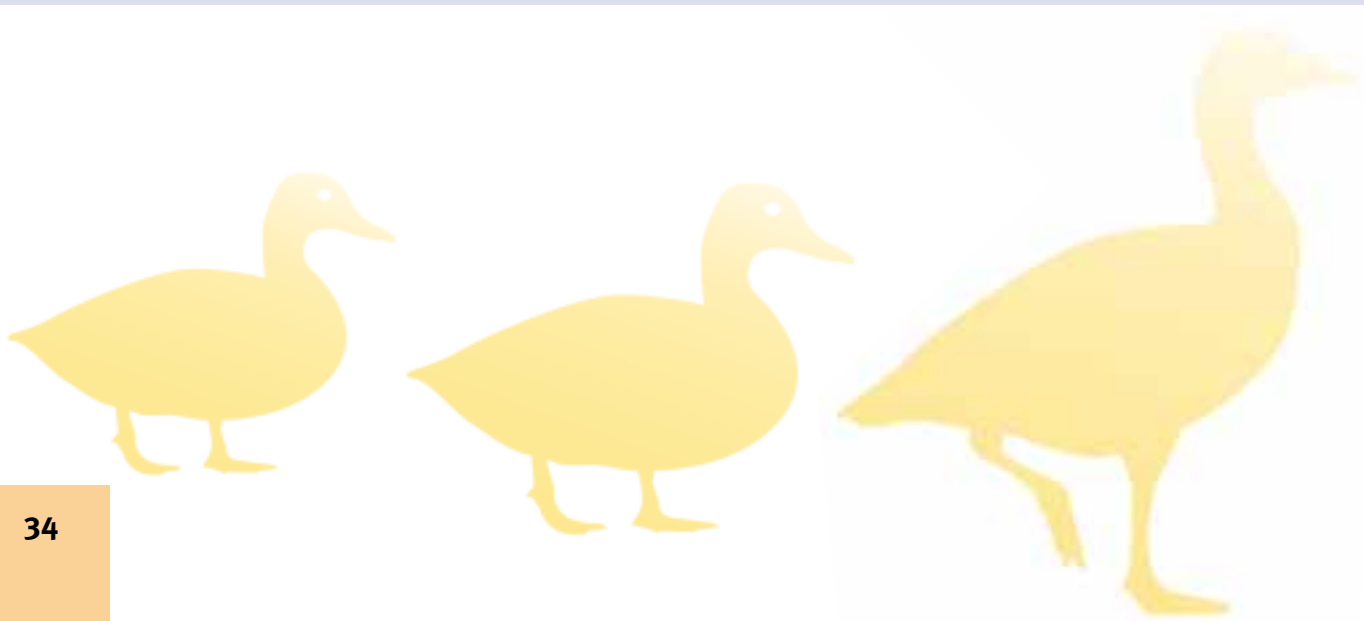
Assessment Rubrics

Teacher's Guide Unit 1–What Is the Nature of Science? *In-depth Investigation Assessment Rubric*

	Excellent	Satisfactory	Needs Improvement
Team Process	Work well together to arrange available evidence (puzzle pieces) • Listen to all team members' ideas before deciding on hypotheses • Collaborate well with other teams, listening to others' hypotheses and reasons before revising their own	Work together to arrange puzzle pieces, but have problems discussing the hypotheses reflected by the evidence • Listen to other teams' hypotheses, but not sure how to use information to refine own hypotheses	Don't work together to arrange puzzle pieces • Don't listen to each other's suggested hypotheses and cannot agree on hypotheses • Don't look at other teams' evidence or listen to other teams' hypotheses and reasons
Team Product	Build their puzzle from all available pieces of evidence • Create several hypotheses and refine final hypothesis based on their evidence and collaboration with other teams • Give reasons for their hypothesis.	Build their puzzle from all available pieces • Create hypotheses, but can't explain how their final hypothesis reflects their evidence and evidence of other teams	Don't use all pieces of evidence in their puzzle • Don't create hypotheses that reflect their evidence • Can't give reasons for their hypotheses
Discussion	Answer all guiding questions • Thoroughly understand how the simulation demonstrates the nature of science and what the limitations of the simulation are	Able to answer some of the guiding questions • Partially understand how the simulation demonstrates the nature of science and what the limitations of the simulation are	Don't answer guiding questions • Don't understand how the simulation demonstrates the nature of science and what the limitations of the simulation are

Teacher's Guide Unit 2–Who Was Charles Darwin? *In-depth Investigation Assessment Rubric*

	Excellent	Satisfactory	Needs Improvement
Team Process	Work well together to design and conduct their experiment • Listen to all team members' ideas • Work well to analyze their data and create a presentation of their results	Work together to design and conduct their experiment • Listen to each other fairly well • Have some problems analyzing their data and creating a presentation of results	Don't work together to design and conduct their experiment • Don't listen to each other's suggestions and cannot agree on a design • Don't understand how to analyze their data and don't work well together to create a presentation of results
Team Product	Team Product Data is well organized • Their conclusions accurately reflect their data • Their visual display and presentation are well done	Data is fairly well organized • Their conclusions don't quite reflect all of their data • Their visual display and presentation are adequate, but not exceptional.	Data is not well organized • They do not know how to use the data to reach a conclusion • Their visual display and presentation are poor
Discussion	Answer all guiding questions • Thoroughly understand how their experiment relates to the colonization of islands by plants • Thoughtfully compare their results with Darwin's	Able to answer some of the guiding questions • Partially understand how their experiment relates to the colonization of islands by plants • They partially understand how their results compare with Darwin's	Don't answer guiding questions • Don't understand how their experiment relates to the colonization of islands by plants • Don't understand how their results compare to Darwin's



Teacher's Guide Unit 3–What Is the Evidence for Evolution? *In-depth Investigation Assessment Rubric*

	Excellent	Satisfactory	Needs Improvement
Team Process	Work well together, dividing the job of counting amino acid differences in the different animals • Do backup counts and check with each other to confirm counting accuracy, re-counting if there is not a match • Help each other with any questions of understanding or procedure	Work together to divide the job of counting amino acid differences • Do not double check each other • Do not often take the initiative of asking questions or checking each other's understanding	Do not divide the counting task • One or two do the counting, while the others are not engaged • Little or no effort by anyone to get everyone involved or to offer or seek help in understanding
Team Product	Record their counts in the proper spaces on the cladogram • Find that their results are consistent with the counts by other teams	Find and record the differences for all requested animals, but they may not all be confident of the accuracy of all counts, or there may be errors • Do not check this with other teams	Do not get total counts for every animal requested • Cladogram spaces are not all completed
Discussion	Discuss each question before arriving at a consensus response for each question • Any student at random can explain any given answer, and can accurately explain the main points of the objective • All analysis questions are accurately answered	Do not always initiate discussion or seek help when needed • Some students may not be involved in the process • May not be able to explain all answers or the main points of the objective • Able to answer most of the analysis questions	Do not understand the questions • Cannot explain any of the objective items • Do not answer most of the analysis questions

Teacher's Guide Unit 4–How Does Evolution Work? *In-depth Investigation Assessment Rubric*

	Excellent	Satisfactory	Needs Improvement
Team Process	Work well together to create beaks and conduct their simulation • Work well to analyze their data	Work together to create beaks and conduct their simulation • Have some problems analyzing their data	Don't work together to create their beaks and conduct their simulation • Don't understand how to analyze their data
Team Product	Data is well organized • Their conclusions accurately reflect their data	Data is fairly well organized • Their conclusions don't quite reflect all of their data	Data is not well organized • They do not know how to use the data to reach a conclusion
Discussion	Thoroughly understand how their simulation relates to natural selection and how it is similar and different than the real world	Partially understand how their simulation relates to natural selection and how it is similar and different than the real world	Don't understand how their simulation relates to natural selection and how it is similar and different than the real world

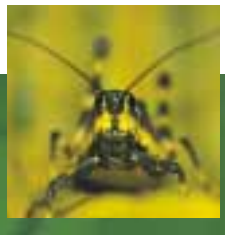
Teacher's Guide Unit 5–How Did Humans Evolve? *In-depth Investigation Assessment Rubric*

	Excellent	Satisfactory	Needs Improvement
Team Process	Work well together to map the data • Work well to analyze the data and answer discussion questions • Listen to all team members' ideas	Work together fairly well to map the data • Have some problems analyzing the data and answering discussion questions • Listen to each other fairly well	Don't work together to map the data • Don't understand how to analyze the data and answer the discussion questions • Don't listen to each other's suggestions
Team Product	Data is mapped accurately • Their conclusions accurately reflect the data	Data is mapped fairly accurately • Their conclusions don't quite reflect the data	Data is not mapped accurately • They do not understand how to interpret the data
Discussion	Answer all discussion questions • Thoroughly understand how to interpret hominid migration from the fossil data	Able to answer some of the discussion questions • Partially understand how to interpret hominid migration from the fossil data	Don't answer discussion questions • Don't understand how to interpret hominid migration from the fossil data

Teacher's Guide Unit 6–Why Does Evolution Matter Now? *In-depth Investigation Assessment Rubric*

	Excellent	Satisfactory	Needs Improvement
Team Process	Excellent research using many reliable resources	Research includes a few good resources	Poor research, relying on few sources whose reliability is questionable
Team Product	Provide excellent information from assigned point of view • Do excellent job staging and running Town Meeting • Article is well written and offers conclusions based on the variety of information presented	Provide adequate information from assigned point of view • Do fairly good job staging and running Town Meeting • Article is fairly well done and is mostly based on information presented	Doesn't provide information from assigned point of view • Do poor job staging and running Town Meeting • Article is poorly written and does not reflect information in class presentations
Discussion	Thoroughly understand different points of view about the topic and can discuss the pros and cons of each position	Partially understand different points of view and can discuss the pros and cons of some positions	Don't understand the different points of views and cannot intelligently discuss the pros and cons of different positions

Glossary



adaptation
any heritable characteristic of an organism that improves its ability to survive and reproduce in its environment; also used to describe the process of genetic change within a population, as influenced by natural selection

amino acid sequence
a series of amino acids, the building blocks of proteins, usually coded for by DNA (exceptions are those coded for by the RNA of certain viruses, such as HIV)

antibiotic resistance
a heritable trait in microorganisms that enables them to survive in the presence of an antibiotic

artifact
an object made by humans that has been preserved and can be studied to learn about a particular time period

artificial selection
the process by which humans breed animals and cultivate crops to ensure that future generations have specific desirable characteristics; in artificial selection, breeders select the most desirable variants in a plant or animal population, and selectively breed them with other desirable individuals

australopithecine
a group of bipedal hominid species belonging to the genus *Australopithecus* that lived between 4.2 and 1.4 mya

Australopithecus afarensis
an early australopithecine species that was bipedal; known fossils date between 3.6 and 2.9 mya (for example, Lucy)

big bang theory
theory that states that the universe began in a state of compression to infinite density and that in one instant all matter and energy began expanding and they have continued expanding ever since

bioengineered food
food that has been produced through genetic modification using techniques of genetic engineering

biogeography
the study of patterns of geographical distribution of plants and animals across the Earth, and of the changes in those distributions over time

biosphere
the part of the Earth and its atmosphere capable of sustaining life

Cenozoic
the era of geologic time from 65 mya to the present, a time when the modern continents formed and modern animals and plants evolved

centromere
a point on a chromosome that is involved in separating the copies of the chromosome produced during cell division; during this division, paired chromosomes look somewhat like an X, and the centromere is the constriction in the center

cladogram
a branching diagram that illustrates hypotheses about the evolutionary relationships among groups of organisms; cladograms can be considered as a special type of phylogenetic tree that concentrates on the order in which different groups branched off from their common ancestors

coevolution
evolution in two or more species, such as a predator and its prey, or a parasite and its host, in which evolutionary changes in one species influence the evolution of the other species

contrivance
an object or characteristics used or modified to do something clearly different from its usual use

creationism
the religious doctrine that all living things on Earth were each created separately, in more or less their present form, by a supernatural creator, as stated in the Bible; the precise beliefs of different creationist groups vary widely

"creation science"
an assortment of many different, non-scientific attempts to disprove evolutionary theory, and efforts to prove that the complexity of living things can be explained only by the action of an "intelligent designer"

DNA base sequence
a chain of repeating units of deoxyribonucleotides (adenine, guanine, cytosine, thymine) arranged in a particular pattern

enzyme
a protein that acts as a catalyst for chemical reactions

Eocene
from 54 to 38 mya, the second oldest of the five major epochs of the Tertiary Period; it is often known for the rise of mammals

evolution
in general terms, biological evolution is the process of change by which new species develop from preexisting species over time; in genetic terms, evolution can be defined as any change in the frequency of alleles in populations of organisms from generation to generation

fact
a natural phenomenon repeatedly confirmed by observation

fossil
most commonly, an organism, a physical part of an organism, or an imprint of an organism that has been preserved from ancient times in rock, amber, or by some other means; new techniques have also revealed the existence of cellular and molecular fossils

founder effect
the loss of genetic variation when a new colony is formed by a very small number of individuals from a larger population

genetic drift
changes in the frequencies of alleles in a population that occur by chance, rather than because of natural selection

genetic engineering
removing genes from the DNA of one species and splicing them into the DNA of another species, using the techniques of molecular biology

half-life
the amount of time it takes for one half of the atoms in a radioactive isotope to decay to a stable form

hominids
members of the family Hominidae, which includes only modern humans and their ancestors

Homo erectus
a species of hominid that lived between 1.8 mya and 300,000 years ago; the first *Homo* species to migrate beyond Africa

Homo habilis
a species of hominid that lived between 1.9 and 1.8 mya, the first species in genus *Homo*, and the first hominid associated with clear evidence of tool manufacture and use

Homo neanderthalensis
a species of hominid that lived between 150,000 and 30,000 years ago in Europe and Western Asia, originally thought to be a geographic variant of *Homo sapiens*, now generally accepted to be a distinct species

Homo sapiens
modern humans, evolved to present form about 100,000 years ago

homologous structures
structures shared by a set of related species because they have been inherited, with or without modification, from their common ancestor (for example, the bones that support a bat's wing are similar to that of a human arm)

hypothesis
an explanation of one or more phenomena in nature that can be tested by observations, experiments, or both; in order to be considered scientific, a hypothesis must be falsifiable—which means that it can be proven to be incorrect

intelligent design
the non-scientific argument that complex biological structures have been designed by an unidentified supernatural or extra-terrestrial intelligence

inversion
a segment of a chromosome that has been turned around so that the order of the nucleotides in the DNA is reversed (specifically, where a small portion of a chromosome is upside down compared to the same region of an otherwise identical chromosome)

isotope
an atom that shares the same atomic number and position as other atoms in an element but has a different number of neutrons and thus a different atomic mass

law
a description of how a natural phenomenon will occur under certain circumstances

meiosis
a type of cell division that occurs only in the reproductive cells of organisms, during which paired chromosomes are separated into different daughter cells, reducing the number of chromosomes in those daughter cells by half

mitochondrial DNA
DNA found in the mitochondrion, a small round body found in most cells, that produces enzymes to convert food to energy; because mitochondria are generally carried in egg cells but not in sperm, mitochondrial DNA is passed to offspring from mothers, but not fathers

mutation
a change in genetic material that results from an error in replication of DNA; mutations can be beneficial, harmful, or neutral

natural selection
a process by which the forms of organisms in a population that are better adapted to their local environment increase in frequency relative to less well-adapted forms over one or more generations

Neanderthal
a hominid, similar to but distinct from, modern humans, that lived in Europe and Western Asia about 150,000 to 30,000 years ago

paleoanthropologist
someone who uses fossil evidence to study early human ancestors

paleontologist
a scientist who studies fossils to better understand life in prehistoric times

pathogen
a microorganism that causes disease

pesticide-resistant insects
insects with the ability to survive and reproduce in the presence of pesticides; these resistant variants increase in frequency over time

phylogeny
the study of ancestral relations among species, often illustrated with a "tree of life" branching diagram, which is also known as a phylogenetic tree

postulate
a basic principle

radiometric dating
a dating technique that uses the decay rate of radioactive isotopes to estimate the age of an object

recombination
the appearance in offspring of different gene combinations than are present in either parent; in most organisms whose cells have a nucleus, recombination occurs because of two processes that occur during the production of eggs and sperm; one process involves the random sorting of chromosomes into eggs and sperm; the other process, called crossing-over, involves exchange of DNA between chromosomes

relative dating
the process of ordering fossils, rocks, and geologic events from oldest to youngest; because of the way sedimentary rocks form, lower layers in most series are older than higher layers, making it possible to determine which fossils found in those layers are oldest, and which are youngest; by itself, relative dating cannot assign any absolute age to rocks or fossils

science
a way of knowing about the natural world based on observations and experiments that can be confirmed or disproved by other scientists using accepted scientific techniques

species
usually defined as a group of organisms capable of mating and producing fertile offspring with one another

supernatural
relating to phenomena that cannot be described by natural laws, cannot be tested by scientific methodology, and are therefore outside the realm of science

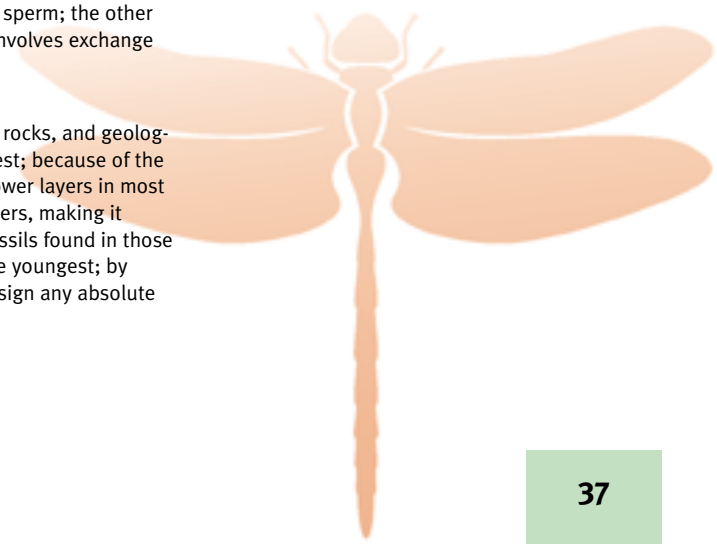
symbiosis
a relationship of mutual benefit between two organisms that live together

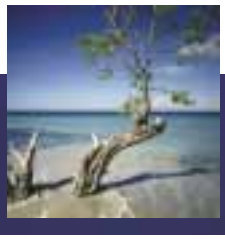
taxon
a group in biological classification such as species, genus, family, order, class, and phylum

theory
a well-substantiated explanation of some aspect of the natural world that typically incorporates many confirmed observations, laws, and successfully verified hypotheses

transitional fossil
a fossil, or group of fossils, representing a series of similar species, genera, or families, that link an older group of organisms to a younger group; often, transitional fossils combine some traits of older, ancestral species with traits of more recent species (for instance, a series of transitional fossils documents the evolution of fully aquatic whales from terrestrial ancestors)

vestigial
structures that have been greatly reduced in size and function over evolutionary time to the extent that they now appear to have little or no current function





Evolution Series Index

The entire *Evolution* TV series is available on home video on seven videocasettes, with a total viewing time of eight hours. For your convenience, we have described the series by program segments. You may want to use specific segments to focus classroom discussions and activities. To find a segment, queue up to the approximate starting time and look for the starting image.

Show One: Darwin's Dangerous Idea (two hours)

Summary: Introduction to Charles Darwin and his theory of evolution by natural selection.

Segment 1
Length: 4 min.
Starting image: Darwin and Fitzroy lead horses
Ending image: portrait of Darwin
Commentary from Daniel Dennet, Stephen Jay Gould, and James Moore.

Segment 2
Approximate starting time: 4 min.
Length: 6 min.
Starting image: London, ships at dock
Ending image: Darwin talking to Fitzroy
Darwin returns from voyage; tries to piece together data; discovers he has 13 species of finches.

Segment 3
Approximate starting time: 10 min.
Length: 7 min., 30 sec.
Starting image: Darwin and Erasmus at Geological Society
Ending image: Darwin drawing tree of life
Darwin encounters controversy at the Geological Society; Owen speaks of divine will.

Segment 4
Approximate starting time: 17 min., 30 sec.
Length: 3 min.
Starting image: river in Ecuador
Ending image: hummingbird
Biologist Chris Schneider studies rainforest biodiversity; ornithologist Tom Smith studies the beaks of hummingbirds.

Segment 5
Approximate starting time: 20 min., 30 sec.
Length: 1 min., 30 sec.
Starting image: tree of finches
Ending image: James Moore
Stephen Jay Gould and James Moore emphasize the importance of Darwin's idea that all finches are related to a common ancestor finch.

Segment 6
Approximate starting time: 22 min.
Length: 7 min., 30 sec.
Starting image: rainforest
Ending image: fog over mountains
Chris Schneider and Tom Smith compare animals in the mountains to those found in lowland rainforest; hummingbirds hibernate at night and have different beak lengths.

Segment 7
Approximate starting time: 29 min., 30 sec.
Length: 9 min.
Starting image: arrow hitting target
Ending image: Darwin in chair
Darwin courts Emma; talks about artificial and natural selection; reads Malthus' essay about population.

Segment 8
Approximate starting time: 38 min., 30 sec.
Length: 1 min., 30 sec.
Starting image: James Moore
Ending image: beetles
Discusses beetles' protective coloring as example of natural selection.

Segment 9
Approximate starting time: 40 min.
Length: 11 min., 30 sec.
Starting image: HIV cells
Ending image: man swimming
Jeff Gustavson and Clarence Johnson have been battling HIV for years; virus evolves drug-resistance; Dr. Veronica Miller found that if patient went off drugs, virus returned to wild-type, then she could attack the virus with drugs.

Segment 10
Approximate starting time: 51 min., 30 sec.
Length: 6 min., 30 sec.
Starting image: man pushing wheelbarrow
Ending image: Emma looking down
Erasmus tries to convince Darwin to publish; Owen has assembled sloth and thinks divine creator made blueprint.

Segment 11
Approximate starting time: 58 min.
Length: 11 min.
Starting image: James Moore
Ending image: trees outside cottage
Kenneth Miller discusses how the intricacy of the eye was considered proof of God; Dan-Eric Nilsson studies eye evolution, models different types of eyes.

Segment 12
Approximate starting time: 69 min.
Length: 12 min.
Starting image: Darwin looking through microscope
Ending image: Annie's gravestone
Darwin studying barnacles, assembling evidence for theory; Annie becomes ill and dies; Darwin refuses to enter church, cannot believe a God could exist that would kill an innocent child.

Segment 13
Approximate starting time: 81 min.
Length: 5 min.
Starting image: children singing
Ending image: James Moore
Kenneth Miller, author of *Finding Darwin's God*, believes religion compatible with evolution.

Segment 14
Approximate starting time: 86 min.
Length: 13 min.
Starting image: Darwin at party
Ending image: Darwin with Erasmus
Owen presents views on human superiority; Huxley champions Darwin's ideas; Darwin publishes a joint paper with Wallace; Darwin publishes *On the Origin of Species*.

Segment 15
Approximate starting time: 99 min.
Length: 4 min., 30 sec.
Starting image: man with beard
Ending image: DNA from different animals
Creationists against evolution because believe human soul at stake; DNA now used to show comparisons between animals.

Segment 16
Approximate starting time: 103 min., 30 sec.
Length: 4 min.
Starting image: Chimp Dr. license plate
Ending image: river
Psychologist Sally Boysen compares developmental milestones in chimps and humans.

Segment 17
Approximate starting time: 107 min. 30 sec.
Length: 2 min.
Starting image: church in England
Ending image: Darwin's face
Darwin died in 1882 and was interred at Westminster Abbey.

Show Two: Great Transformations (one hour)

Summary: Examines the history of life on Earth, including the role of transitional fossils in deciphering the fossil record.

Segment 1
Length: 2 min., 30 sec.
Starting image: pole vaulter
Ending image: dolphin
How did each creature alive today evolve so differently?

Segment 2
Approximate starting time: 2 min. 30 sec.
Length: 11 min., 30 sec.
Starting image: sunrise on mountains
Ending image: whale bones
Paleontologist Phil Gingerich found a fossil in Pakistan that looked like part of a wolf-like creature but had the inner ear of a whale; some skeletons have been found of whales with legs.

Segment 3
Approximate starting time: 14 min.
Length: 3 min.
Starting image: dolphins
Ending image: river bank
Frank Fish studies how mammals swim—fish flex their spine from side to side and mammals move it up and down.

Segment 4
Approximate starting time: 17 min.
Length: 6 min.
Starting image: Volvo on road
Ending image: fish fossil
Limbs developed first on aquatic creatures; Jenny Clack found a fish with fingers.

Segment 5
Approximate starting time: 23 min.
Length: 3 min.
Starting image: Neil Shubin
Ending image: fossil
Evolution is not a goal-directed process; it's a tinkering.

Segment 6
Approximate starting time: 26 min.
Length: 5 min.
Starting image: fossil
Ending image: fossil
During the Cambrian explosion, many diverse animals suddenly appear on Earth; in 1913, Charles Walcott found 540 million-year-old sea creatures in the Burgess Shale.

Segment 7
Approximate starting time: 31 min.
Length: 13 min., 30 sec.
Starting image: Shubin
Ending image: Levine
Bill McGinnis and Mike Levine found the "master switch," a gene turned on in a band in an early embryo.

Segment 8
Approximate starting time: 44 min., 30 sec.
Length: 10 min.
Starting image: people at café
Ending image: Shubin
Liza Shapiro studies the movement of living primates; chimpanzees share 99% of their DNA with humans; a series of chance coincidences led to human bipedalism.

Show Three: Extinction! (one hour)

Summary: Traditionally, extinction and evolution have been in balance. Today, extinction far outpaces the evolution of new species.

Segment 1
Length: 2 min.
Starting image: forest
Ending image: debris
Extinction is the termination of a species; an average lifetime for a species is 4 million years.

Segment 2
Approximate starting time: 2 min.
Length: 4 min., 30 sec.
Starting image: bird flying
Ending image: animation sequence
There have been five mass extinctions; geologist Peter Wards studies mass extinctions.

Segment 3
Approximate starting time: 6 min., 30 sec.
Length: 11 min.
Starting image: open plain
Ending image: wheat in sunset
End of Permian, all but a few species became extinct; Mike Novacek studies small mammals that lived alongside dinosaurs and survived the mass extinction.

Segment 4
Approximate starting time: 17 min., 30 sec.
Length: 3 min., 30 sec.
Starting image: asteroid
Ending image: footprints in ash
In the K-T event, an asteroid crashed on earth and dinosaurs became extinct but mammals survived.

Segment 5
Approximate starting time: 21 min.
Length: 1 minute
Starting image: people boarding boat
Ending image: barges on river
6 billion people inhabit the earth; current rate of extinction now 100 times greater than normal.

Segment 6
Approximate starting time: 22 min.
Length: 2 min., 30 sec.
Starting image: fog over trees
Ending image: raft down river
Alan Rabinowitz of the Wildlife Conservation Society studies total number of species in Kaeng Krachan National Park in Thailand.

Segment 7
Approximate starting time: 24 min., 30 sec.
Length: 10 min.
Starting image: animated sun
Ending image: men walking through woods
The presence of healthy carnivores, at the top of the food chain, indicates a healthy forest; number one cause of extinction is habitat destruction by humans.

Segment 8
Approximate starting time: 34 min., 30 sec.
Length: 5 min.
Starting image: shoreline of Hawaii
Ending image: tree close-up
Number two cause of extinction is invasive species; paleontologist David Burney studies the biological invaders brought to Hawaii by the Polynesians.

Segment 9
Approximate starting time: 39 min., 30 sec.
Length: 3 min., 30 sec.
Starting image: plane
Ending image: sky over water
Modern transportation has increased rate of species invasion.

Segment 10
Approximate starting time: 43 min.
Length: 2 min., 15 sec.
Starting image: sky
Ending image: face of scientist
Weed species are mobile, adaptive, flexible; humans are the most successful weeds of all time.

Segment 11
Approximate starting time: 45 min., 15 sec.
Length: 5 min., 15 sec.
Starting image: North Dakota farm
Ending image: truck driving away
Sy Kittleston has introduced the flea beetle, a non-native species, to his farm to keep an invading weed in check.

Segment 12
Approximate starting time: 50 min., 30 sec.
Length: 4 min.
Starting image: fog over trees
Ending image: room of animal skulls
Rabinowitz's team found photos of carnivores; maybe it's still possible to avoid a mass extinction.

Show Four: Evolutionary Arms Race (one hour)

Summary: Predators and their prey evolve alongside one another in an escalating arms race.

Segment 1
Length: 1 min., 50 sec.
Starting image: Moscow traffic
Ending image: crowd
Idea of evolutionary arms race; disease in Russian prisons released to population at large.

Segment 2
Approximate starting time: 1 min., 50 sec.
Length: 6 min., 30 sec.
Starting image: Oregon landscape
Ending image: newt in tank
Edmund Brodie, Jr. and his son study a poisonous newt in an arms race against a garter snake.

Segment 3
Approximate starting time: 8 min., 20 sec.
Length: 3 min.
Starting image: E.O. Wilson
Ending image: pills on conveyor belt
Predator and prey relationship drives evolution; humans' only predator since civilization is infectious disease.

Segment 4
Approximate starting time: 11 min., 20 sec.
Length: 14 min., 30 sec.
Starting image: cell door
Ending image: multiplying microbes
Antibiotic-resistant strains of tuberculosis reign in crowded Russian prisons; microbiologist Alex Goldfarb trying to change the way TB treated.

Segment 5
Approximate starting time: 25 min., 50 sec.
Length: 5 min., 30 sec.
Starting image: man walking dog
Ending image: man walking away from camera
Evolution can domesticate a disease.

Segment 6
Approximate starting time: 31 min., 20 sec.
Length: 7 min.
Starting image: cheetah fur
Ending image: lion's face
Geneticist Stephen O'Brien studies feline resistance to immunodeficiency virus; O'Brien found mutation in humans that protects against HIV infection.

Segment 7
Approximate starting time: 38 min., 20 sec.
Length: 3 min.
Starting image: E.O. Wilson
Ending image: girl wearing glasses
Introduces mutualistic symbiosis.

Segment 8
Approximate starting time: 41 min., 20 sec.
Length: 9 min.
Starting image: tropical forest
Ending image: "antibacterial" label
Ted Schultz and Ulrich Mueller studying leafcutter ants in the Amazon rainforest; grad student Cameron Currie found alliance of four organisms.

Segment 9
Approximate starting time: 50 min., 20 sec.
Length: 4 min.
Starting image: doctor in hospital
Ending image: boy leading cows
Pediatrician Erika Von Mutius treats allergies and asthma; compares children of farmers and non-farmers.

Segment 10
Approximate starting time: 54 min., 20 sec.
Length: 1 minute, 30 sec.
Starting image: crowd
Ending image: crowd
E.O. Wilson: mistake for us to separate ourselves from all other organisms.

Show Five: Why Sex? (one hour)

Summary: Examines how sex evolved as the means of reproduction.

Segment 1
Length: 2 min.
Starting image: molting peacock
Ending image: walrus couple in sunset
Prologue outlines topic of sexual selection.

Segment 2
Approximate starting time: 2 min.
Length: 5 min.
Starting image: Texas landscape
Ending image: Meredith Small
Jerry Johnson studies a type of lizard that clones itself.

Segment 3
Approximate starting time: 7 min.
Length: 7 min., 15 sec.
Starting image: Mexican village
Ending image: men playing basketball
Robert Vrijenhoek studies a minnow that uses both sexual and asexual reproduction; sex generates variability among offspring and is the best defense against evolving enemies.

Segment 4
Approximate starting time: 14 min., 15 sec.
Length: 3 min.
Starting image: single-celled organisms
Ending image: flying peacock
Sex evolved from a random encounter of two single-celled creatures; males and females evolved with sperm and eggs.

Segment 5
Approximate starting time: 17 min., 15 sec.
Length: 8 min.
Starting image: Marion Petrie
Ending image: Katharine Hepburn
Males compete for the right to mate with females and females choose the mate with the best genes; Petrie has found that peahens choose peacocks with the largest tails.

Segment 6
Approximate starting time: 25 min., 15 sec.
Length: 5 min., 30 sec.
Starting image: man walking in woods
Ending image: jacana chick
Stephen Emlen studies songbirds; 40% of chicks do not belong to the father raising them; female Wattled Jacanas have taken on a male role.

Segment 7
Approximate starting time: 30 min., 45 sec.
Length: 8 min., 30 sec.
Starting image: Tree of Life animation
Ending image: animation of early humans
Chimpanzees and bonobos have evolved very different social systems due to an ancient drought; chimps make war and bonobos make love.

Segment 8
Approximate starting time: 39 min., 15 sec.
Length: 7 min.
Starting image: Meredith Small
Ending image: masculine computer image
Evolutionary psychologists study how human evolutionary history affects the way we think today; Victor Johnston studies the correlation between beauty and fertility.

Segment 9
Approximate starting time: 46 min., 15 sec.
Length: 5 min., 30 sec.
Starting image: men walking on campus
Ending image: Picasso painting
Geoffrey Miller believes that artistic expression comes from a drive to impress the opposite sex.

Segment 10
Approximate starting time: 51 min., 45 sec.
Length: 2 min., 30 sec.
Starting image: cranes courting
Ending image: family
The ancestors who had the most surviving offspring were those who found sex to be fun and parenting rewarding.

Show Six: The Mind's Big Bang (one hour)

Summary: Examines the evolution of the human mind.

Segment 1
Length: 2 min., 30 sec.
Starting image: flashlight beam in cave
Ending image: people running past sunset
Archaeologist Randy White studies cave paintings; modern humans developed communication and culture.

Segment 2
Approximate starting time: 2 min., 30 sec.
Length: 1 minute
Starting image: skull
Ending image: Rick Potts
Rick Potts studies stone tools from the Great Rift Valley in East Africa; hominids made the same stone axes for about 1 million years.

Segment 3
Approximate starting time: 4 min., 15 sec.
Length: 2 min.
Starting image: large rocks and trees
Ending image: group of modern humans
The humans of about 40,000 years ago would be recognizable to us, in terms of both behavior and physical appearance.

Segment 4
Approximate starting time: 6 min., 15 sec.
Length: 30 sec.
Starting image: Steven Pinker
Ending image: world map showing migration routes
Mary Stiner and Steve Kuhn have found shell beads from 43,000 years ago; the beads show the path of migration.

Segment 5
Approximate starting time: 6 min., 45 sec.
Length: 3 min.
Starting image: person sitting at table with laptop
Ending image: beads
Randy White demonstrates the bead-making techniques used 35,000 years ago.

Segment 6
Approximate starting time: 9 min., 45 sec.
Length: 2 min., 15 sec.
Starting image: fire
Ending image: modern human skeleton decorated with beads
Modern humans in ancient Europe encountered Neanderthals, a species that shared many characteristics but were more massive and less sophisticated.

Segment 7
Approximate starting time: 12 min.
Length: 4 min., 30 sec.
Starting image: modern human skull
Ending image: John Shea pulling spear out of ground
John Shea is trying to understand the differences between Neanderthals and modern humans by recreating some of their activities.

Segment 8
Approximate starting time: 16 min., 30 sec.
Length: 1 minute, 30 sec.
Starting image: ancient arrowheads
Ending image: shell necklace
Neanderthals lived in isolated pockets, while modern humans lived in larger groups and used portable art as a means of communication.

Segment 9
Approximate starting time: 18 min.
Length: 1 min.
Starting image: fire in cave
Ending image: stalactites in cave
Michel Lorblanchet studies the technique of cave painting; he can reproduce "spit painting."

Segment 10
Approximate starting time: 19 min.
Length: 1 minute, 30 sec.
Starting image: trees
Ending image: Steven Pinker
Richard Klein thinks modern humans became innovative because of a change in the brain; Stephen Pinker thinks there were many changes over a long period of time.

Segment 11
Approximate starting time: 20 min., 30 sec.
Length: 13 min.
Starting image: Richard Wrangham walking in forest
Ending image: boy signing
Chimpanzees use the threat of physical force for social climbing; with humans, language is the key to complex relationships; in 1980, deaf village children developed their own sign language in Managua.

Segment 12
Approximate starting time: 33 min., 30 sec.
Length: 4 min., 30 sec.
Starting image: Richard Dawkins watering flowers
Ending image: two girls talking
Dawkins thinks that those who could use language left the most offspring; Robin Dunbar has found that 2/3 of all conversations are gossip about social relationships.

Segment 13
Approximate starting time: 38 min.
Length: 5 min., 30 sec.
Starting image: Richard Dawkins
Ending image: Susan Blackmore
Susan Blackmore studies memes; today cultural evolution more likely than genetic evolution.

Segment 14
Approximate starting time: 43 min., 30 sec.
Length: 1 min.
Starting image: two people running on plain
Ending image: cave painting of hand
The mind's "Big Bang" led to a new era of the evolution of ideas.

Show Seven: What About God? (one hour)

Summary: Examines the controversy surrounding evolution.

Segment 1
Length: 1 min., 30 sec.
Starting image: blue sky behind cliff
Ending image: skull outside classroom
Christian fundamentalists debate with scientists and teachers over the future of religion, science, and science education.

Segment 2
Approximate starting time: 1 min., 30 sec.
Length: 4 min.
Starting image: church exterior
Ending image: Ken Ham
Ken Ham, a fundamentalist, argues that if the Bible is wrong in regards to science, why trust it for morality?

Segment 3
Approximate starting time: 5 min., 30 sec.
Length: 2 min., 15 sec.
Starting image: speaker in front of crowd
Ending image: folk singer
Since the Scopes Monkey Trial in 1925, 37 anti-evolution bills have been passed in 20 states.

Segment 4
Approximate starting time: 7 min., 45 sec.
Length: 12 min.
Starting image: light coming through crevice
Ending image: Nathan Bard at counter
Rachel Benton, an anthropologist, discusses with students from Wheaton College how scientists determine the age of a watering hole; Nathan Bard tries to reconcile God with science.

Segment 5
Approximate starting time: 19 min., 45 sec.
Length: 3 min., 30 sec.
Starting image: students exiting building
Ending image: professor talking to students
Emi Hayashi, a student at Wheaton, is comfortable with both science and religion.

Segment 6
Approximate starting time: 23 min., 15 sec.
Length: 7 min.
Starting image: Wheaton College sign
Ending image: professor's face
Faculty at Wheaton sign a statement of faith; Kansas State University geologist Keith Miller said in a lecture at Wheaton that he sees no conflict between evolution and religion.

Segment 7
Approximate starting time: 30 min., 15 sec.
Length: 4 min., 30 sec.
Starting image: group of boys on stage
Ending image: discussion group
Peter Slayton, an anthropology major and young Earth creationist, says you can't pick sides because then you're doing bad science or bad theology.

Segment 8
Approximate starting time: 34 min., 45 sec.
Length: 1 minute
Starting image: Ken Ham in hallway
Ending image: Students at lockers
Ham thinks people will develop a sense of purposelessness if they're just a mixture of chemicals.

Segment 9
Approximate starting time: 35 min., 45 sec.
Length: 3 min., 30 sec.
Starting image: classroom
Ending image: science teacher Stephen Randak
Claire McKinney is both a Christian and a science teacher; over half the students and 35 faculty members at Jefferson High petitioned for special creation to be taught alongside evolution.

Segment 10
Approximate starting time: 39 min., 15 sec.
Length: 4 min., 15 sec.
Starting image: Eugenie Scott
Ending image: school board meeting
Eugenie Scott, of the National Center for Science Education, said, "All evolution as a science can tell us is *what* happened. Can't tell us who done it."

Segment 11
Approximate starting time: 43 min., 30 sec.
Length: 2 min.
Starting image: open book
Ending image: Eugenie Scott
In 1961, Henry Morris and John Whitcomb published a book called *The Genesis Flood* in which they selected scientific evidence to demonstrate that the Earth was created as described in Genesis.

Segment 12
Approximate starting time: 45 min., 30 sec.
Length: 6 min.
Starting image: students at podium
Ending image: Claire McKinney
Students at Jefferson High asked for the teaching of special creation alongside evolution; the school board decided that they could address the students' concerns through a humanities class.

Segment 13
Approximate starting time: 51 min., 30 sec.
Length: 3 min.
Starting image: a Christian a capella group at Wheaton
Ending image: a sunset
Stan Jones agrees that Wheaton is placing students' faith at risk by helping them examine difficult questions, but in the real world their faith is always at risk.

National Science Education Standards: Grades 9–12

Unit 6	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Science As Inquiry - Content Standard A					
Abilities Necessary to do Scientific Inquiry					
Identify Questions and Concepts That Guide Scientific Investigations	√	√			
Design and Conduct Scientific Investigations	√	√			
Formulate and Revise Scientific Explanation and Models Using Logic and Evidence √		√	√		
Recognize and Analyze Alternative Explanations and Models	√	√		√	√
Communicate and Defend a Scientific Argument √		√	√		
Understandings about Scientific Inquiry √	√	√	√	√	√
Life Science - Content Standard C					
The Molecular Basis of Heredity				√	√
Biological Evolution			√	√	√
The Interdependence of Organisms √				√	
The Behavior of Organisms					√
Earth and Space Science - Content Standard D					
The Origin and Evolution of the Earth System			√		√
Science in Personal and Social Perspective - Content Standard F					
Personal and Community Health √					
Natural and Human-Induced Hazards √					

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