INTRODUCTION

I. OVERVIEW

LIFE ON EARTH is a self-paced course based on a series of 13 video episodes produced by the BBC and narrated by David Attenborough. This study guide has been written to guide you through the class.

LIFE ON EARTH is an evolutionary approach to studying the many life forms on this planet. Beginning with the simplest forms of life, David Attenborough takes you around the world as he examines different living organisms. He explores the different characteristics of living creatures, especially as their bodies become more complex. Throughout the video episodes, he examines many organisms on an individual basis; however, their relationships with other life forms are also noted. As described in his companion book, *Life on Earth*, Attenborough presents the "history of nature" by surveying the changes that occur to major plant and animal groups as they evolve into more complex life forms.

II. CHANGING NATURE OF SCIENCE

Science is an ever-changing field, particularly with respect to our understanding of evolutionary history. While Attenborough presented the most current evolutionary information available at the time these videos were made, many more discoveries have been made since then. There has been a full-blown Renaissance period of new fossil findings coupled with new information from molecular biology that has shed new light on evolutionary relationships of living things.

In some cases (and sometimes with much argument and figurative blood-shedding), our view of relationships has been radically altered. The "war of birds as living dinosaurs" is still being fought today, with new fossils and interpretations shaking the conventional world of ornithology. This is an on-going process. Even as we revise this edition of the study guide, it is with the knowledge that some of the dates and interpretations may change before you even read this. However, this is the nature of science: change based on new evidence.

So, if the videos contain information that is out of date, why are we still using them in this class? Well, there are a number of good reasons. First, the basic information in the videos is still valid. The organisms have not changed radically; our interpretation of "who is related to whom" has changed. Secondly, the photography is fantastic and the videos illustrate many of the major issues of evolutionary biology. In some cases, scenes were filmed for the first time and, unfortunately in some cases, for the last time because the organisms are now extinct. Finally, we still feel that, short of going on a trip around the world, this is a great way to see global diversity and put it into its evolutionary context.

III. COURSE STRUCTURE

The material in this study guide is divided into six units; each unit usually has two video episodes and the corresponding material in the study guide. (The only exception is Unit 5; it contains three video episodes. Be sure and allow extra time for the completion of Unit 5.) Check your syllabus to see what material is covered on each exam.

Read the material in the study guide (**Concepts**) before watching the video episode. There is additional information on certain issues that will be discussed in the video. As you watch the tape, look for examples of these concepts.

You should then view the video episode and answer the **Questions** in the study guide. Students who have successfully completed this course in the past have told us they typically watch the videos twice. The exam questions are based on **all** material covered in this study guide.

WEB LINKS IN THE STUDY GUIDE

The web links in this study guide were correct when the study guide was revised. Since web links change faster than the study guide, please check the ACC Life on Earth web site for updated links. Go to: http://www.austincc.edu/bspeer and click on the Life on Earth link.

ADDITIONAL REFERENCES

If you need or want additional information about topics covered in this course, don't forget to use the ACC Library. Biology textbooks will have information about characteristics of different groups: bacteria, plants, animals, etc. These books will also contain information about evolution, fossils and related topics.

On reserve at many ACC Libraries, you will find David Attenborough's companion book, *Life on Earth*. His book can be a very valuable resource for students. Ask for help from the instructor or a reference librarian. Used copies are often available at on-line book sources and used bookstores.

IV. COMMON TERMINOLOGY USED THROUGHOUT THE COURSE

Cells: smallest complex unit of life. Most cells are complex, with internal subdivisions (called organelles or "small organs") that carry out biochemical reactions, such as breaking down food particles or transporting substances from one part of the cell to another.

Tissues: groups of cells that function together in a multicellular organism to carry out a specific task, such as muscle tissue or nervous tissue or tissue that covers or tissue that connects (such as bone).

Organs: complex structures made of two or more tissues that carry out a specific function. One example is the human stomach that contains tissue for secretion, tissue for absorption, muscle tissue for movement, nervous tissue, etc.

Unicellular: organisms that consist of only one cell. In some cases, several unicellular organisms group together to form a colony. However, each cell still retains its separate identity and the colony cannot be considered to be a true multicellular organism.

Multicellular: an organism that consists of more than one cell. In most multi-cellular organisms, the cells have become specialized for different functions, such as digestion or reproduction. The cells in the organism cannot live in isolation.

Heterotrophs: organisms that rely upon other organisms for their supply of food.

Autotrophs: organisms that produce their own food from raw materials and an energy source. The most common type of autotrophic production of food on the surface of the earth is **photosynthesis**, the means by which organisms (such as plants) convert water and carbon dioxide into sugars and oxygen, using energy from sunlight. There is mounting evidence that **chemoautotrophs**, organisms that produce food from carbon dioxide and water using inorganic chemical energy (such as sulfides, methane, etc.), may be equally important underground and in the deep sea.

Herbivore: an organism that eats autotrophs. One example is a zebra.

Carnivore: an organism that eats other heterotrophs, such as a lion.

Let's look at a specific example of the last few terms. A grass plant is an autotroph, using sunlight to produce food. A zebra is an herbivore that eats grass (autotrophs). A lion is a carnivore that eats the herbivore (zebra) that eats the autotrophs (grasses).

Species: generally used to represent a collection of similar organisms that are capable of interbreeding and producing fertile offspring. One example is the familiar fox squirrel (*Sciurus niger*). Fox squirrels can breed with each other but do not breed with gray squirrels (*Sciurus carolinensis*).

Scientific Nomenclature: this is a system used in science to group organisms into categories based on similar characteristics.

There are different levels of categories. The following scheme begins with the largest category (based on very broad characteristics) and goes toward the smallest category (based on very specific characteristics). We will use the fox squirrel to illustrate the concept of scientific nomenclature.

Kingdom – Animalia
Phylum – Chordata
Class – Mammalia
Order – Rodentia
Family – Sciuridae
Genus – *Sciurus*
Species – *Sciurus niger*

Each species has its own scientific name. The name is made of two Latin words. All fox squirrels have the scientific name of *Sciurus niger*. All gray squirrels have the scientific name of *Sciurus carolinensis*. Since fox squirrels and gray squirrels are members of the same genus, they are thought to be closely related. Since the second word is different (*niger* versus *carolinensis*), the two types of squirrels belong to different species. They cannot mate and produce fertile offspring.

Population: a group of individuals of the same species found in one geographic area. For example, all of the blue catfish found in Town Lake would represent a population.

Community: composed of all living organisms found in one geographic area. All fish, plants, plankton, algae, turtles and other organisms in Town Lake would be a community.

Ecosystem: all living organisms plus all physical characteristics of the environment (rainfall, climate, temperate, etc.)

V. METRIC SYSTEM

Measurements and distances in the videos are given in both metric and English units. Here are some of the conversion factors.

1 mile = 1.6 kilometers	1 kilometer = 0.6 mile
1 mile = 5,280 feet	1 kilometer = 1,000 meters
1 inch = 2.54 centimeters	1 meter = 39 inches or 1.094 yards
1 kilogram = 2.2 pounds	1 meter = 100 centimeters
1 pound = 0.454 kilograms	1 meter = 1,000 millimeters

Geologic Timescale for Life on Earth

Glacial/Interglacial periods	2 mya to present
Land bridge between North America and South America	5 mya
Spread of grasslands	25 mya
Oldest ape fossil	33 mya
Oldest fossils of monkeys	38 mya
Global Climate Cooling and Drying	45 mya to present
First appearance of primates, hoofed mammals, rodents	54 mya
1st whale fossils	56 mya
1st bat fossils (teeth)	57 mya
Rapid diversification of mammals (origin of most modern orders)	65-54 mya (if not earlier)
Mass Extinction (dinosaurs, large marine reptiles, ammonites)	65 mya
Oldest monotreme fossil (relative of duck-billed platypus and echidna)	100 mya (poor record)
1st land snail (pulmonate snails) fossils	110 mya
Oldest placental/marsupial mammals	125 mya
1st flowering plants	130 mya
Archaeopteryx	157 mya
Oldest true mammal fossils	170+ mya
1st turtle fossils	180 mya
Oldest frog fossil	190 mya
1st dinosaurs	225 mya
Mass Extinction (including trilobites, primitive corals)	245 mya
Protomammals (synapsids) abundant	300-210 mya
1st flying insect fossils	310? mya
1st amniote fossils (reptiles and protomammals)	330 mya
1st land vertebrate fossils	360 mya
1st seed plant fossils	370 mya
1st insect fossils (springtails)	385 mya
1st centipede and arachnid fossils (and good plants, Rhynie chert)	415 mya
1st jawed fish fossils	425 mya
1st plant fossils	430 mya
1st land plants (based on spores)	470 mya
1st vertebrates	515 mya
Cambrian "explosion" (low diversity to high diversity)	525-510 mya
Most modern phyla appear in fossil record (molluscs, brachiopods, arthropods, echinoderms, annelids, chordates)	544-510 mya
Diverse (but unusual) metazoans (Vendian biota, including sponges and jellyfish)	600-544 mya
Oldest multicellular fossils (sponges?)	700 mya
Diverse single celled Eukaryotic fossils	1.1 bya
Oldest Eukaryotic fossils	1.7 bya
Stromatolites abundant	2.8-1.3 bya
Accumulation of O_2 in atmosphere	2.6-1.7 bya
Oldest Prokaryotic fossils (Australia)	3.5 bya
1st evidence of biologic activity (based on stable isotopes)	3.8 bya
Earth Forms	4.5-4.6 bya

mya = millions of years ago **bya = billions of years ago**