Interactive Biology Multimedia Courseware

Biology: The Study of Life
Program Supplement

Biology: The Study of Life
TEACHING OBJECTIVES

The following subject areas are illustrated throughout the Interactive Biology Multimedia Courseware program, *Biology: The Study of Life.* Ideally, these areas would be augmented with additional course work outside of this program. *(Click on a subject to jump ahead.)*

- An Examination Of The Signs Of Life: Including organization, growth and development, reproduction, response to stimulus, metabolism, and information systems.

- An Exploration Of The Unifying Themes Found In Biology: Including energy, systems and interactions, stability, evolution, and unity within diversity.

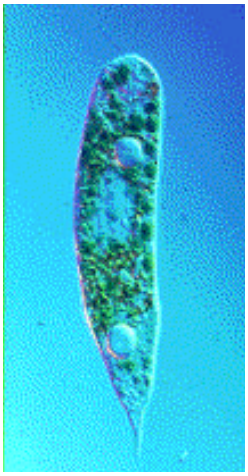
- An Explanation Of Inductive Versus Deductive Reasoning.

- An Extended Look At Scientific Methodology: Including such key processes as defining problems, formation of a hypothesis, controlled experimentation, analysis/ publication of results, and formation of a theory.

Study Guide #1
The Signs of Life

What do all biologists have in common? All biologists are involved in one of the most dynamic and important studies ever undertaken: the study of life.

Since biologists spend much of their time either directly or indirectly studying living organisms such as plants and animals, one of the primary concerns in biology is determining what it means to be alive. Obviously you are alive. But what is it that makes you a living creature? What is the definition of life? Instead of using a precise definition of what it means to be alive, biologists more frequently discuss the basic signs of life. If something possesses all the signs of life, then it is considered to be alive. If, on the other hand, it is missing even a single one of these signs, then it cannot be considered alive.

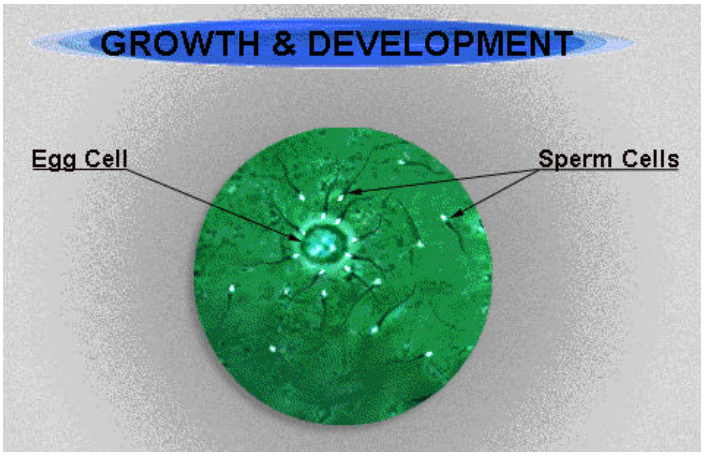


The most basic characteristics of life that biologists recognize are organization, growth and development, reproduction, response to stimulus, metabolism, and an information system.

Organization is one of the first signs of life biologists look for. Life is extremely organized. All living things are made up of cells and, while they are very small, cells are well organized. Inside of cells, all of life's functions must proceed in an organized way. Also, living things almost always have a definite shape. What about an amoeba? This blob-like creature has a very fluid body that isn't limited to one shape. It can take on many forms. But inside, amoebas, like every other organism on earth, are highly organized. Their molecules are assembled in a very precise manner and all of their functions - such as digesting nutrients - work together in an organized manner. Without organization, life would not be possible.

Growth and development is another sign of life biologists look for. To a biologist, growth is simply an increase in living tissue and the formation of new structures. All living things grow and develop. You started out as a single fertilized egg and now you have about 75 trillion cells; that's a lot of growth. But what about a bacterium? A bacterium starts out as a single cell and remains that way. It never gets much larger than it's beginning size. This, however, does not mean a bacterium doesn't grow and develop. Bacteria constantly produce new proteins, which form new structures to replace those that wear out.

Reproduction is important, but why is it a sign of life? Many people choose not to have children, yet these people are definitely alive. When biologists list reproduction as a sign of life, they are referring to the ability to reproduce. All living things - with the fairly rare exception of individuals who are infertile - are able to produce living offspring. Living things must come from other living things. This key sign of life ensures the survival of a species rather than the survival of an individual.

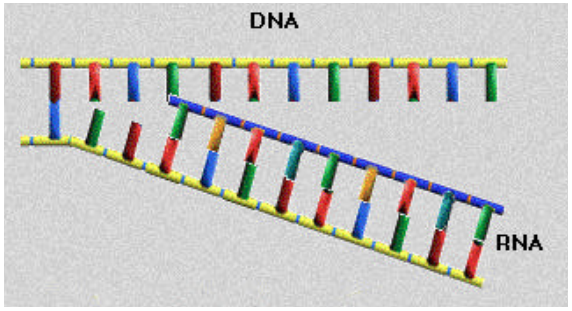


All living things display a response to stimulus. That is, they all adjust to their surroundings. Organisms are in constant contact with the environment, and if the environment changes they need to be able to adjust to the new conditions. Factors such as temperature, wind, water, and predators are constantly fluctuating. Living organisms respond to these changes. When winter comes, some trees drop their leaves to conserve water and some animals change the color of their coat to blend into the background. These and other responses to stimuli are important characteristics of life.

Organisms are all able to respond to changes in internal stimuli as well. Homeostasis is the important ability to maintain constant internal conditions. For an example let's look at pH, which is a measure of acidity. A fairly small change in pH could quickly spell death if your body is unable to respond to and correct this change. By constantly regulating its pH level, your body maintains conditions needed for you to live. Organisms are able to efficiently respond to changes brought on by such factors as dehydration, overheating and infection.

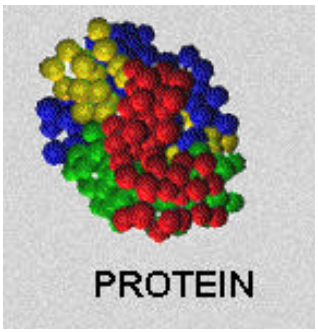
The vital chemical reactions that occur inside of an organism make up its metabolism. Nutrients are broken down to provide energy and smaller molecules are linked together to make more complicated ones needed by an organism. This continuous release and use of energy is so critical that many biologists consider this to be the single most important sign of life. The energy provided by metabolism allows all other signs of life to occur.

The final sign of life looked for by biologists is an information system. Just as a library houses all the information you need to learn about a historical event or learn how a nuclear reactor works, a living organism must house all of the information required to produce an organism and to maintain life. This information system is contained in living organisms in a complex molecule known as deoxyribonucleic acid, or DNA.



DNA carries the instructions needed to direct the production of organisms. It also carries the instructions need to maintain life. But how are DNA's instructions followed? In this process, the information in DNA is first transcribed or copied. The copy has a slightly different chemical composition, being made of ribonucleic acid - or RNA - instead of DNA. The instructions in RNA are then used to produce, molecule by molecule, a new protein. All of the proteins in your body have been made in this fashion, from DNA to RNA to protein. You can think of DNA as being the blueprint of life, RNA as the architect that reads the blueprint, and proteins as the resulting houses that are built.

So, the signs of life then are organization, growth and development, reproduction, response to stimulus, metabolism, and information systems. But must all of these really be present for something to be considered alive? Absolutely, without question, YES! Consider a virus for a moment. A virus is highly organized, has a precise information system based on either DNA or RNA, and can cause an infected cell to produce many hundreds of new viruses. Viruses, however, have no metabolism at all. These biological particles have some very life-like qualities, yet are not considered to be alive.



Study Guide #2
Themes in Biology

Biologist are interested in far more than simply defining what life is. Unifying themes in biology show the large picture of what biology is really about. These themes include energy, systems and interactions, stability, evolution, and unity within diversity. Let's take a closer look at these.

Energy is a central concept in biology. It is what allows you to run, jump, and think. In fact, none of the signs of life would be possible without the energy provided by metabolism. You can learn much about an organism by simply asking how it obtains energy. Does it get energy from the sun? Does it eat plants or even other animals?

Systems and interactions is another important theme in biology. Plants and animals cannot live without one another. Plants get their energy from the sun and rely on animals, such as bees, to pollinate them. Animals in turn need the oxygen plants produce and also eat plants to survive. Groups of organisms in an area that interact with each other form special systems known as ecosystems.

Stability is another theme you'll see examples of while studying biology. Just as it is important for you to maintain a stable environment inside your body, it is important to maintain stability inside an ecosystem. There is a delicate balance between all of the organisms making up an ecosystem. When too many herbivores, or plant eaters, are present, the plant populations decline. When plant populations are low there is little food for the herbivores, which causes some of them to die. The plant populations, in turn, increase, which eventually causes the number of herbivores to increase again and so on.

Evolution is perhaps *the* major unifying theme in biology. In other words, all of the structures and adaptations seen on plants and animals (such as spines for protection and fins for stability in water), all of the ways of obtaining energy (such as photosynthesis or feeding on decaying organisms), and all of the interactions between different organisms (such as bees and flowers) are a result of evolution. Evolution has shaped all life on earth. In doing so, evolution has created the wealth of plants, animals, and bacteria found today, and has tied them together in many intricate ways.

Unity within diversity is the final theme we will look at. This theme emphasizes the similarities between organisms rather than focusing on their differences. Consider an oak tree and a whale for a moment. Obviously, a whale looks very different from an oak tree. Yet DNA, the code of life, is the same in both of these organisms. The only difference between the two is the order in which their DNA molecules are arranged. Similarly, a man looks very different from a dolphin, yet they are comparable in many ways; both breathe air and both have many organs and proteins that are similar in structure and function. Throughout this course, try to look for the ways plants and animals are like each other as well as ways they are different. You will find a great deal of continuity and unity hidden beneath the diversity.

Study Guide #3
Reasoning

Biologists, like everyone else on earth, use two types of reasoning when approaching a problem. These are inductive and deductive reasoning. Let's take a look at inductive reasoning first.

When you use *inductive reasoning*, you begin with a known set of observations and turn them into a general rule. For instance, let's assume you just moved to a new town. If every day for the first month, the mailman arrives at your house around 3 o'clock, then you can make the general rule that the mailman will show up every day around 3 o'clock. That's inductive reasoning.

With *deductive reasoning*, the process is reversed. This type of reasoning suggests a specific event may occur based on a known general rule. For instance, if you are expecting a package from a friend and your doorbell rings at three o'clock, then you may reason that it is the mailman with your package. How did you come to this conclusion? You started with the general rule that "the mailman arrives around three" and applied to a specific fact - "it's around 3 o'clock and my doorbell just rang". That is deductive reasoning. Of course, reasoning doesn't actually prove anything. You still have to answer the door to be sure.

So, you think you understand the difference between inductive and deductive reasoning? Here is a quick test.

A) Every day, your mother gets home close to 5:30. It's 5:45 and you hear a car pull into your driveway, but you can't see outside. You say to yourself, "Ah, that must be mom". What type of reasoning did you just use?

B) It's the beginning of the school year, and every Friday your new biology teacher gives you a pop quiz. After a month, you say to yourself, "Ah, I bet she is going to give us a quiz every Friday this semester". What type of reasoning did you just use?

C) Yesterday, a doctor examined three patients who felt ill. They complained of fever, body aches, and being very tired. The doctor diagnosed them as having the flu. This morning, four more patients came in with the same symptoms and the doctor once more diagnosed them as having the flu. The doctor says to himself, "Ah, there must be a flu epidemic". What type of reasoning did he just use?

D) You are in Los Angeles and decide to go see the Dodgers play. You know that every time a member of the Dodgers hits a home run, fireworks go off. While at the snack bar getting a Dodger-dog, you hear fireworks. You say to yourself, "Ah, that one's outta here". What type of reasoning did you just use?

Answers:

A) This is an example of deductive reasoning. You started with the general rule the "your mother gets home about 5:30" and applied it to the fact that someone pulled into your driveway at 5:45.

B) This is an example of inductive reasoning. You are making a general rule "we will have a quiz every Friday" out of specific facts (every Friday so far you have had a quiz in class).

C) This is an example of inductive reasoning. The doctor has made a general rule "we must be having a flu epidemic" from specific facts (he has seen several patients with the flu in the past few days).

D) This is an example of deductive reasoning. You started with the general rule that "fireworks go off when a member of the Dodgers hits a home run" and applied it to the fact that fireworks just started going off.

Study Guide #4
Scientific Methodology

Biologists often ask different questions than other scientists. A biologist may wonder how much light, if any, a seed needs to sprout. A physicist may wonder how much energy is required to produce a certain type of subatomic particle. While biologists have different questions than other scientists, the method they use to find answers is the same. All fields of science use what is known as scientific methodology to find answers to questions.

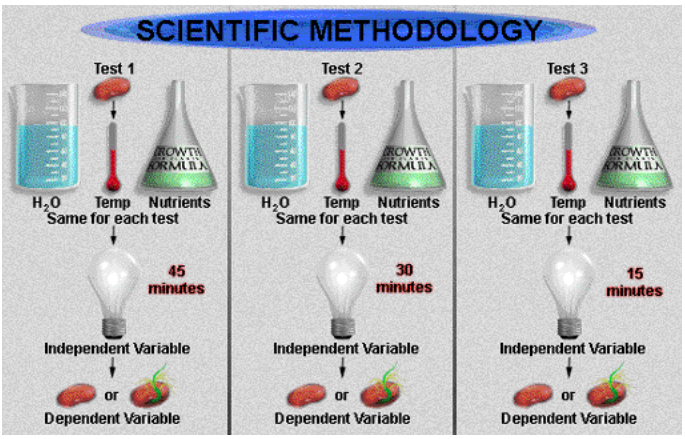
Scientific methodology is basically just a very precise means of approaching a problem. Let's take a closer look.

To successfully answer a question, a biologist must go through a series of critical steps. If any step is not carried out properly the biologist may get no answer at all, or, even worse, an incorrect answer. To illustrate the steps involved, we'll use the example of a biologist investigating a handful of seeds she collected while doing some field research.

This biologist collected seeds from a new plant species she identified recently, and wants to learn about how they germinate (or how they sprout). She knows that there are many factors involved in germination - such as light, water, depth of soil, and nutrients - so she has to make the question she wants answered as specific as possible. In other words, she has to carry out the first step in scientific methodology and define the problem. The problem she chooses to look at involves light. She asks, "how much light, if any, do seeds from this species need to start growing?" That being done, she moves on to step two.

The next step is to make a guess as to what the answer will be. Although a guess doesn't sound very scientific, if it is based on some reasoning it can be very useful. A scientific guess or prediction based on reasoning is called a hypothesis. This biologist knows that most seeds require light to germinate, so her hypothesis may be "these seeds need some light to germinate". Information about other plants could help shape the hypothesis. These new seeds appear very similar to seeds from another species of plant our biologist is quite familiar with. She could use this information to narrow down her hypothesis. Perhaps she could reason that "since the seeds from this similar plant species require at least 30 minutes of light to germinate, then seeds from my new plant species will require at least 30 minutes of light as well". Let's assume she settles on "these seeds need at least 30 minutes of light to germinate" as her hypothesis.

A hypothesis is very helpful, but it doesn't answer any questions. These seeds may need 30 minutes of light to germinate, but it is just as possible that they need a different amount of light. To find the answer to her question, this biologist will have to take another step and test the hypothesis. That is, she will have to design and carry out an experiment. In biology, we run what are called controlled experiments. We'll cover how to conduct one of these later.



After the experiment has been completed, the biologist then completes another important step and analyzes the results. Several things can occur at this point. If the seeds

required more or less than 30 minutes of light to germinate, then the biologist may revise the hypothesis. Perhaps her next hypothesis would be "these seeds require at least 60 minutes of light to germinate."

If seeds germinated without any light at all, then she could reject the hypothesis. Her next hypothesis would be "these seeds do not require any light to germinate".

If the seeds did in fact require 30 minutes of light to germinate, the biologist would accept the hypothesis. Perhaps she would even publish her results. Often, biologists publish results even if these results have shown their hypothesis to be incorrect. This important step allows other biologist to find out what research has been tried in the past. Many times, discovering the way a process work is made easier by first knowing the ways it doesn't work.

For other researchers to check her findings, not only must the experiments be run the same, but the results must also be measured in the same way. To ensure that scientists around the globe measure such things as length and temperature in the same units, all results are reported in what is referred to as the international system of measurement, or SI for short. You should be familiar with many of these units already. They are:

Measurement	Units
Length	Meters
Volume	Liters
Mass	Grams
Time	Seconds
Temperature	Degrees Celsius or Kelvin

Now that you know about scientific methodology, it's time to take a close look at just how biological experiments are set up and run.

Study Guide #5
Controlled Experiments

The design of an experiment is crucial. Only a well thought out experiment can accurately answer a question. In biology, we use what are known as controlled experiments.

In a controlled experiment, more than one version of the same experiment is run. All conditions are kept equal except for the one being tested, in our case it was the amount of light needed for seeds to germinate.

Since the amount of light needed is being tested, it is called the independent variable. If the previous experiment had been looking at the temperature these seeds needed to germinate, then temperature would have been the independent variable.

As stated earlier, several different versions of the experiment are run under similar conditions. The independent variable changes from one experiment to the next. For instance, our biologist may have set up four different experiments. In the first, she may give the seeds only fifteen minutes of light. Of course since her hypothesis was that at least 30 minutes of light was required, she would set up one experiment in which the seeds are exposed to 30 minutes of light. The other two experiments may give the seeds one-hour of light and five hours of light respectively.

All other conditions are kept the same. These seeds would be kept at the same temperature, would be given the same nutrients and receive the same amount of water. Keeping other conditions the same ensures that the differences she sees between the experiments is due to the one variable that changes... the independent variable. If all experiments had different amounts of water as well as light, she would not be sure whether water or light was causing the differences she was seeing.

There is also a dependent variable in controlled experiments. The dependent variable is the condition that is being tested for or observed. In this case, germination is the dependent variable. If she had been investigating light's affects on roots, her dependent variable may have been the length of roots. If she had been investigating light's effects on leaf growth, her dependent variable may have been the size of leaves. In each of these examples, light is still the independent variable.

There is one more very important part of the biologist's experiment. In addition to the four groups she already set up (15 minutes, 30 minutes, 1 hour, and 5 hours of light), she also sets up what is known as a control group. In her control group, the independent variable is left out. That means the seeds in this group received no light at all.

The control group determines if the independent variable has any effect at all. For example, if she ran only the four groups receiving light and all four groups germinated, what conclusion could she draw? Could she claim that these seeds need light to germinate? No. Just because all of these groups germinated doesn't mean they all needed light to do so. To really see if light was involved in germination, she would have to set up one group that gets no light. That is, one group that does not receive the independent variable.

Now, lets assume she does set up a control group and her results are as follows:

Group	Results
Control	No germination
15 minutes	No germination
30 minutes	45% Germination
1 Hour	100% Germination
5 Hours	100% Germination

Can our biologist conclude that seeds from this species require light to germinate? Yes, because the control group received no light and didn't germinate. Can she conclude that seeds from this species need more than 15 minutes of light to germinate? Yes, because seeds in her experiment receiving 15 minutes of light did not germinate. Can she conclude that some seeds in this species will germinate given 30 minutes of light? Yes, because 45% of the seeds in her experiment receiving 30 minutes of light germinated. Can she conclude that seeds in this species need at least 30 minutes of light to germinate? This is a little trickier, but no. Maybe they need 20 minutes. She'll have to run another experiment with times between 15 minutes and 30 minutes to discover the minimum amount of light required.

So why do biologist publish their results? Making results known to other researchers is critical in science. Only after several experiments independently confirm a hypothesis is it accepted as being accurate. Hypotheses that cover a broad range of topics and are supported by massive amounts of research may become a theory. For instance, evolution has become a theory based on supporting evidence from a wide range of fields. Information from such diverse areas as biology, geology, and chemistry has all been incorporated into the larger theory of evolution.

Biology: The Study of Life
QUIZ PAC

The following quizzes are meant to test student understanding of specific topic areas covered in the Interactive Biology Multimedia Courseware program, *Biology: The Study of Life.* Many, but not all, of these questions have been addressed directly in the study guides designed to strengthen student understanding of these topics. All questions have been addressed in the program.

QUIZ #1	The Signs of Life
QUIZ #2	Themes in Biology
QUIZ #3	Reasoning
QUIZ #4	Scientific Methodology
QUIZ #5	Controlled Experiments
EXAM	Comprehensive Exam

Quiz #1
The Signs of Life

1. Rather than using a precise definition of life, biologists look for several basic signs of life.

   A. True
   B. False

2. Something must posses most of the signs of life to be considered alive.

   A. True
   B. False

3. The sign of life dealing with living things being composed of cells, organisms tending to have a definite shape, and the way functions such as digestion work in a coordinated manner is _____.

   A. coordination
   B. regulation
   C. functional coordination
   D. organization

4. The sign of life dealing with an increase of living tissue or formation of new structures is _____.

   A. growth
   B. development
   C. growth and development
   D. regeneration

5. The sign of life stating that living things must come from other living things is ___.

   A. reproduction
   B. spontaneous generation
   C. abiogenesis
   D. offspring

6. The sign of life dealing with an organism's ability to adapt to routine fluctuations in its environment is _____.

   A. adaptive response
   B. stimulation
   C. response to stimulus
   D. adaptability

7. _____ is the ability to maintain constant internal conditions.

   A. Regulation
   B. Homeopathic
   C. Homeostasis
   D. Adaptability

8. The sign of life dealing with the vital chemical reactions that occur inside of an organism is _____.

   A. metabolism
   B. biochemistry
   C. steady state
   D. cellular biology

9. One sign of life is that all known organisms possess DNA. That is, all living things have _____.

   A. replication
   B. the chromosome theory of inheritance
   C. an information system
   D. heredity

10. To carry out the instructions held in DNA, DNA is _____ or copied.

    A. transformed
    B. translated
    C. transplanted
    D. transcribed

11. The copy that is made in question #10 has a slightly different chemical composition. Instead of DNA, it is composed of _____. The information in this new molecule is used to make _____.

    A. DNB, proteins
    B. RNA, carbohydrates
    C. protein, RNA
    D. RNA, proteins

Quiz #2
Themes in Biology

1. There are unifying themes in biology that show the larger picture of what biology is really about.

   A. True
   B. False

2. This theme deals with what allows you to think, plants to grow, and bacteria to move.

   A. Stability
   B. Systems
   C. Interactions
   D. Energy

3. This theme deals with the ways in which plants and animals rely upon and influence each other (such as bees pollinating flowers and flowers providing the oxygen needed by animals).

   A. Environmentalism
   B. Interactions
   C. Conservation
   D. Systems and Interactions

4. Groups of organisms that interact with each other and their environment make up special systems known as _____.

   A. ecosystems
   B. ecological niches
   C. biospheres
   D. habitats

5. This theme deals with the delicate balance that exists in the environment as well as within a single organism. That is, it deals with the tendency of conditions to remain fairly constant.

   A. Stasis
   B. Predictability
   C. Stability
   D. Maintenance

6. This theme deals with the emergence of structures or adaptations (such as spines for protection on a cactus) and the emergence of interactions between different organism (such as bees and flowers) over very long periods of time.

   A. Diversity
   B. Evolution
   C. Adaptive Radiation
   D. Ecology

7. This theme deals with focusing on the ways different organisms are like one another rather than simply focusing on the ways they are unlike one another.

   A. Unity Within Diversity
   B. Symmetry
   C. The Study of Life
   D. Biology

Quiz #3
Reasoning

1. Biologist use different types of reasoning than other people.

   A. True
   B. False

2. The type of reasoning in which you begin with a known set of observations and use them to form a general rule is _____.

   A. inductive reasoning
   B. deductive reasoning
   C. general reasoning
   D. specific reasoning

3. The type of reasoning in which you predict a certain even may occur or has occurred based upon a known general rule is _____.

   A. inductive reasoning
   B. deductive reasoning
   C. general reasoning
   D. specific reasoning

4. It's the beginning of the school year, and every Friday your new biology teacher gives you a pop quiz. After a month of this pattern, you say to yourself, "Ah, I bet she gives us a quiz every Friday". What type of reasoning did you just use?

   A. Inductive reasoning
   B. Deductive reasoning
   C. General reasoning
   D. Specific reasoning

5. You are in Los Angeles and decide to see the Dodgers play. You know that every time a member of the Dodgers hits a home run, fireworks go off. While you are at the snack bar getting yourself a Dodger-Dog, you hear fireworks and say to yourself, "Ah, that one's outta here". What type of reasoning did you just use?

   A. Inductive reasoning
   B. Deductive reasoning
   C. General reasoning
   D. Specific reasoning

6. Every day, your mother gets home close to 5:30. It's 5:45 and you hear a car pull into your driveway, but you can't see outside. You say to yourself, "Ah, that must be mom". What type of reasoning did you use?

   A. Inductive reasoning
   B. Deductive reasoning
   C. General reasoning
   D. Specific reasoning

Quiz #4
Scientific Methodology

1. Of all fields of science, only biology uses scientific methodology to find answers to its questions.

   A. True
   B. False

2. Scientific methodology is basically a very precise means of approaching problems.

   A. True
   B. False

3. A scientific guess or prediction based upon reasoning, intuition, or research is known as a theory.

   A. True
   B. False

4. The first step to answering a question using scientific methodology is to make this question as specific as possible. In this step, scientists _____.

   A. test the theory
   B. define the problem
   C. analyze results
   D. test the hypothesis
   E. form a theory
   F. form a hypothesis

5. The next step to answering a question using scientific methodology is to make a guess or prediction of the answer based upon reasoning, research, or intuition. In this step, scientists _____.

   A. test the theory
   B. define the problem
   C. analyze results
   D. test the hypothesis
   E. form a theory
   F. form a hypothesis

6. While the step in question #4 is helpful, it doesn't answer any questions. To continue with the search for answers, scientists move on to the next step in scientific methodology, which is _____

   A. test the theory
   B. define the problem
   C. analyze results
   D. test the hypothesis
   E. form a theory
   F. form a hypothesis

7. After the step in question #5 is completed, scientists then _____.

   A. test the theory
   B. define the problem
   C. analyze results
   D. test the hypothesis
   E. form a theory
   F. form a hypothesis

8. After a scientist completes the step in question #6, he or she is then ready to _____.

   A. accept or revise the problem
   B. accept or revise the results
   C. accept or revise the hypothesis
   D. accept or revise the theory

9. In the sciences, all results are collected and reported in the same units. These units are collectively referred to as the _____.

   A. System of English Measure
   B. International System of Measurement
   C. Dewy Decimal System
   D. U.C.R. (Units of Collection and Report)

Quiz #5
Controlled Experiments

1. As long as it is run properly, the design of an experiment is not very crucial in answering questions.

   A. True
   B. False

2. Biologist run controlled experiments to help answer their questions.

   A. True
   B. False

3. In controlled experimentation, only one version of an experiment is run (as opposed to running several slightly different versions of the same experiment).

   A. True
   B. False

4. If experimentation shows their predictions to be incorrect, scientist never make these results known to other researchers (that is, they do not publish any results of these experiments).

   A. True
   B. False

5. In controlled experiments, the condition that is changed or varied (such as the amount of light a seed receives) is known as the _____.

   A. variable condition
   B. variable
   C. dependent variable
   D. independent variable

6. In controlled experiments, all variables except for the one in question #4 _____.

   A. are unimportant and not controlled for
   B. are important but not controlled for
   C. are kept the same
   D. are not taken into consideration

7. In controlled experiments, the condition that is being tested for or observed (such as germination of a seed) is known as the _____.

   A. variable condition
   B. variable
   C. dependent variable
   D. independent variable

8. An important part of controlled experiments is the control group. In the control group, the _____ is not made available.

   A. variable condition
   B. variable
   C. dependent variable
   D. independent variable

Biology: the Study of Life
Comprehensive Exam

The following exam is based on the Interactive Biology Multimedia Courseware program, *Biology: The Study of Life.* Most, but not all, of these questions have been addressed directly in the study guides. All of the questions on this exam, however, are based on information put forth in the program.

Please determine if the following statements are true or false.

1. Rather than using a precise definition of life, biologists look for several basic signs of life.

   A. True
   B. False

2. Something must posses most of the signs of life to be considered alive.

   A. True
   B. False

3. There are unifying themes in biology that show the larger picture of what biology is really about, and what biologists are really interested in.

   A. True
   B. False

4. Biologist use different types of reasoning than other people.

   A. True
   B. False

5. Of all fields of science, only biology uses scientific methodology to find answers to its questions.

   A. True
   B. False

6. Scientific methodology is basically a very precise means of approaching problems.

   A. True
   B. False

7. As long as it is run properly, the design of an experiment is not very crucial in answering questions.

   A. True
   B. False

8. Biologist run controlled experiments to help answer their questions.

   A. True
   B. False

9. In controlled experimentation, only one version of an experiment is run (as opposed to running several slightly different versions of the same experiment).

   A. True
   B. False

10. If experimentation shows their predictions to be incorrect, scientist never make these results known to other researchers (that is, they do not publish the results of these experiments).

    A. True
    B. False

In the following portion of the exam, please choose the letter beside the word, words, or phrase that best completes each sentence.

11. The sign of life dealing with living things being composed of cells, organisms tending to have a definite shape, and the way functions such as digestion work in a coordinated manner is _____.

    A. coordination
    B. regulation
    C. functional coordination
    D. organization

12. The sign of life dealing with an increase of living tissue or formation of new structures is _____.

    A. growth
    B. development
    C. growth and development
    D. regeneration

13. The sign of life stating that living things must come from other living things is _____.

A. reproduction
B. spontaneous generation
C. abiogenesis
D. offspring

14. The sign of life dealing with an organism's ability to adapt to routine fluctuations in its environment is _____.

A. adaptive response
B. stimulation
C. response to stimulus
D. adaptability

15. _____ is the ability to maintain constant internal conditions.

A. Regulation
B. Homeopathic
C. Homeostasis
D. Adaptability

16. The sign of life dealing with the vital chemical reactions that occur inside of an organism is _____.

A. metabolism
B. biochemistry
C. steady state
D. cellular biology

17. One sign of life is that all known organisms possess DNA. That is, all living things have _____.

A. replication
B. the chromosome theory of inheritance
C. an information system
D. heredity

18. To carry out the instructions held in DNA, DNA is _____ or copied.

A. transformed
B. translated
C. transplanted
D. transcribed

19. The copy that is made in question #18 has a slightly different chemical composition. Instead of DNA, it is composed of _____. The information in this new molecule is used to make _____.

    A. DNB, proteins
    B. RNA, carbohydrates
    C. protein, RNA
    D. RNA, proteins

20. This theme deals with what allows you to think, plants to grow, and bacteria to move.

    A. Stability
    B. Systems
    C. Interactions
    D. Energy

21. This theme deals with the ways in which plants and animals rely upon and influence each other (such as bees pollinating flowers and flowers providing the oxygen needed by animals).

    A. Environmentalism
    B. Interactions
    C. Conservation
    D. Systems and Interactions

22. Groups of organisms that interact with each other and their environment make up special systems known as _____.

    A. ecosystems
    B. ecological niches
    C. biospheres
    D. habitats

23. This theme deals with the delicate balance that exists in the environment as well as within a single organism. That is, it deals with the tendency of conditions to remain fairly constant.

    A. Stasis
    B. Predictability
    C. Stability
    D. Maintenance

24. This theme deals with the emergence of structures or adaptations (such as spines for protection on a cactus) and the emergence of interactions between different organism (such as bees and flowers) over very long periods of time.

    A. Diversity
    B. Evolution
    C. Adaptive Radiation

D. Ecology

25. The type of reasoning in which you begin with a known set of observations and use them to form a general rule is _____.

A. inductive reasoning
B. deductive reasoning
C. general reasoning
D. specific reasoning

26. The type of reasoning in which you predict a certain even may occur or has occurred based upon a known general rule is _____.

A. inductive reasoning
B. deductive reasoning
C. general reasoning
D. specific reasoning

27. It's the beginning of the school year, and every Friday your new biology teacher gives you a pop quiz. After a month of this pattern, you say to yourself, "Ah, I bet she gives us a quiz every Friday". What type of reasoning did you just use?

A. Inductive reasoning
B. Deductive reasoning
C. General reasoning
D. Specific reasoning

28. You are in Los Angeles and decide to see the Dodgers play. You know that every time a member of the Dodgers hits a home run, fireworks go off. While you are at the snack bar getting yourself a Dodger-Dog, you hear fireworks and say to yourself, "Ah, that one's outta here". What type of reasoning did you just use?

A. Inductive reasoning
B. Deductive reasoning
C. General reasoning
D. Specific reasoning

29. You recently moved to a new town. During the first week, you notice that the mail arrives at your house between 2:45 and 3:15. From this information, you decide that the mail will usually be delivered around three o'clock. What type of reasoning did you use?

A. Inductive reasoning
B. Deductive reasoning
C. General reasoning
D. Specific reasoning

30. Every day, your mother gets home close to 5:30. It's 5:45 and you hear a car pull into your driveway, but you can't see outside. You say to yourself, "Ah, that must be mom". What type of reasoning did you use?

A. Inductive reasoning
B. Deductive reasoning
C. General reasoning
D. Specific reasoning

31. The first step to answering a question using scientific methodology is to make this question as specific as possible. In this step, scientists _____.

A. test the theory
B. define the problem
C. analyze results
D. test the hypothesis
E. form a theory
F. form a hypothesis

32. The next step to answering a question using scientific methodology is to make a guess or prediction based on reasoning, research, or intuition. In this step, scientists _____.

A. test the theory
B. define the problem
C. analyze results
D. test the hypothesis
E. form a theory
F. form a hypothesis

33. While the step in question #32 is helpful, it doesn't answer any questions. To continue with the search for answers, scientists move on to the next step in scientific methodology, which is _____

A. test the theory
B. define the problem
C. analyze results
D. test the hypothesis
E. form a theory
F. form a hypothesis

34. After the step in question #33 is completed, scientists then _____.

A. test the theory
B. define the problem
C. analyze results
D. test the hypothesis
E. form a theory
F. form a hypothesis

35. After a scientist completes the step in question #34, he or she is then ready to _____.

A. accept or revise the problem
B. accept or revise the results
C. accept or revise the hypothesis
D. accept or revise the theory

36. In the sciences, all results are collected and reported in the same units. These units are collectively referred to as the _____.

A. System of English Measure
B. International System of Measurement
C. Dewy Decimal System
D. U.C.R. (Units of Collection and Report)

37. In controlled experiments, the condition that is changed or varied (such as the amount of light a seed receives) is known as the _____.

A. variable condition
B. variable
C. dependent variable
D. independent variable

38. In controlled experiments, all variables except for the one in question #37 _____.

A. are unimportant and not controlled for
B. are important but not controlled for
C. are kept the same
D. are not taken into consideration

39. In controlled experiments, the condition that is being tested for or observed (such as germination of a seed) is known as the _____.

A. variable condition
B. variable
C. dependent variable
D. independent variable

In the following portion of the exam, please fill in the word or words that best completes each sentence.

40. An important part of controlled experiments is the control group. In the control group, the _____ is not made available.

41. A scientific guess or prediction based upon reasoning, intuition, or research is known as a _____.

42. The theme that deals with focusing on the ways different organisms are like one another rather than simply focusing on the ways they are unlike one another is _____.

43. A _____ covers a broad range of topics and is supported by a massive amount of research, often from very diverse fields of science.

Biology: The Study of Life
Answer Guide

QUIZ PAC

QUIZ #1	QUIZ #2	QUIZ #3	QUIZ #4	QUIZ #5
1. A	1. A	1. B	1. B	1. B
2. B	2. D	2. A	2. A	2. B
3. D	3. D	3. B	3. B	3. B
4. C	4. A	4. A	4. B	4. B
5. A	5. C	5. B	5. F	5. D
6. C	6. B	6. B	6. D	6. C
7. C	7. A		7. C	7. C
8. A			8. C	8. D
9. C			9. B	
10. D				
11. D				

COMPREHENSIVE EXAM

1. A	11. D	21. D	31. B	41. hypothesis
2. B	12. C	22. A	32. F	42. unity within diversity
3. A	13. A	23. C	33. D	43. theory
4. B	14. C	24. B	34. C	
5. B	15. C	25. A	35. C	
6. A	16. A	26. B	36. B	
7. B	17. C	27. A	37. D	
8. A	18. D	28. B	38. C	
9. B	19. D	29. A	39. C	
10. B	20. D	30. B	40. independent variable	

Biology: the Study of Life
Glossary

bacteria: single-celled organisms from the kingdom Monera.

biologist: one who studies or who is skilled in biology.

biology: the study of life.

cell wall: rigid outer structure surrounding the cells of plants and microorganisms.

community: the sum total of organisms in given region or population.

control group: group in which conditions are identical to the experimental group except for the presence of the independent variable.

controlled experiment: an experiment set up in duplicate so that a single factor, or variable, is changed in one group but not in another.

deductive reasoning: suggesting a specific event may occur or has occurred based upon an established general rule.

dependent variable: the condition in an experiment that is being observed.

DNA (deoxyribonucleic acid): the molecule directing function of a cell. The hereditary molecule.

ecosystem: a community of organisms and the physical environment that makes up their habitat.

environment: all the living and non-living factors that combine to make up an organisms surroundings (such as climate, geography, and other organisms).

germinate: to begin to develop or the start of growth.

herbivores: plant eating organisms.

homeostasis: maintenance of stable conditions (such as temperature) inside of an organism.

hypothesis: a scientific prediction based on reasoning, intuition, and research.

independent variable: the one condition in an experiment that is changed.
inductive reasoning: using a set of observations to establish a general rule.

international system of measurement (SI): system used by scientists to measure length, time, temperature, mass, and volume.

metabolism: sum total of the chemical reactions occurring inside of an organism.

organism: a living thing.

photosynthesis: the conversion of solar energy into chemical energy.

scientific method: standardized procedure for moving from observation to hypothesis and possibly to theory.

signs of life: the properties of organization, growth and development, reproduction, response to stimulus, and metabolism.

stimuli: plural of stimulus.

stimulus: any factor that results in a response or change in activity.

theory: general condition that is accepted as being accurate only after a tremendous amount of confirmation.