AP® Biology
2004 Sample Student Responses
Form B

1R1

BIOLOGY

SECTION II

Time—1 hour and 30 minutes

Directions: Answer all questions.

Answers must be in essay form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write. Write all your answers on the pages following the questions in this booklet.

1. Prokaryotes are found throughout the biosphere. Answer <u>two</u> of the following.
   a) Provide three examples of adaptations found in various prokaryotes. Explain how these three adaptations have ensured the success of prokaryotes.
   b) Discuss how prokaryotes early in Earth's history altered environments on Earth.
   c) Discuss three ways in which prokaryotes continue to have ecological impact today.

c) Archaea bacteria are found in environments with extenely high temperatures. This adaptation helps them by far because in such environment there are no or not many competitors. Sexual reproduction in prokaryotes by conjugation of the ~~type~~ pilli ~~help~~ is a very good adaptation because this increases ~~ratio~~ variation. The rapid reproduction of bacteria by ~~bi~~ binary fission increases differential reproductive success. With the combination of fast reproduction and the ~~transfer~~ exchange in DNA, resistance to antibiotics can spread very fast in a population.

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b) Endosymbiosis is what ~~made~~ the ~~endo~~ eukaryotic cells of today what they are. Chloroplasts and ~~B~~Mitochondria used to be individual cells. Evidence is shown by the organelles having their own DNA. Chloroplasts did photosynthesis in which O_2, needed for cellular respiration, is needed. The ~~mitochon~~ mitochondria moved into the chloroplast cells making cellular respiration of the organism much more efficient. The Eukaryotes then evolved and ~~f~~ began to move onto land.

Earth was originally a reducing atmosphere until photosynthetic ~~prok~~ prokaryotes produced ~~mass~~ mass amounts of O_2, making the atmosphere oxidizing. The Ozone (O_3) layer formed. Obligate anaerobes died. Some molecules of existing organisms denatured causing ~~the~~ ~~organisms~~ some species to lead to a mass extinction.

c) Prokaryotes are excellent samples in which genetic ~~engineering~~ engineering could be done on. ~~Gene expression is the same~~ Prokaryote are of the primary ~~experiments~~ subjects of gene expression. Some prokaryotes even clean up disasters ~~such as~~ oil spills. Prokaryotes also still cause ~~sickness~~ sicknesses such as food poisoning. Speciation and microevolution is also studied from prokaryotes because of things like resistance to antibiotics.

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~~In~~ some prokaryotes, specifically archea bacteria, ~~they~~ can survive very extreme environments, such as ~~E~~xtreme temperatures, or extreme salinity (halophiles). This is a good adaptation because it allows prokaryotes to live in places that no other organisms could live, such as in the hot springs of Yellow Stone National Park. ~~It~~ also allowed prokaryotes to be the first colonizers of earth. Another ~~example~~ is adaptation is that prokaryotes lack double membrane bound organelles ~~and nucle~~ and thus a nucleus. This ~~is~~ can be a good adaptation because ~~as~~ bacteria reproduce by binary fission, thus there ~~is~~ are no Organelles to get in the way as the ~~bacteria~~

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prokaryotes circle. Another adaption is that ~~there~~ prokaryotes have a single circular strand of DNA which contains no introns. This allows for easy replication of the DNA before binary fission. Additionally, since genes that code for a metabolic pathway are side by side; operons are used ~~to~~ as a form of gene control. This means that some genes code for anabolic or catabolic pathways, and those genes are right by one another. Therefore the ~~entire~~ expression of ~~the~~ these genes can be controlled by ~~one thing: the repressor~~ blocking the ~~beginning~~ first gene. by repressing it

Early prokaryotes in Earth's history altered the environments on Earth. ~~The~~ The early atmosphere of earth contained little oxygen. Thus, when autotrophic prokaryotes (such as cyanobacteria) started to produce oxygen as a by product of photosynthesis, the amount of oxygen in the atmosphere greatly increased. Without prokaryotes in Earth's early history that were able to adapt to the harsh environments, such as archea-bacteria, ~~they~~ further life on earth may not

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have evolved.

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In earth's history, one of the first prokaryotes found on the earth's surface was cyanobacteria (blue-green algae) this was one of the earliest photosynthetic organisms that (due to the oxidized atmosphere of the earth) used H_2S (hydrogen sulfide) instead of H_2O ~~for~~ to break down the hydrogen atoms ~~needed~~ needed for photosynthesis. However, the cyanobacteria soon began using ~~oxygen~~ water for photosynthesis since it was a much more abundant molecule. this resulted in the increased rate of oxygen in the primitive earth and also allowed aerobes to sustain on earth's surface. this led to aerobic respiration and helped change the earth from the oxidizing atmosphere (unable to have O_2 in the atmosphere) to the present day reduced atmosphere (O_2 is allowed in the atmosphere).

the theory of endosymbiosis explains how early in the earth's history prokaryotes were engulfed (phagocytized) by heterotrophic eukaryotes and thus were enslaved, the two eventually survival. examples of this are the chloroplast and the mitochondria.

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The early heterotroph endosymbiotic prokaryotes acquired mitochondria for cellular respiration and the chloroplast for photosynthesis, and as a result this adaptation still ensures the success of prokaryotes (they are still found in present day living organisms such as plants) Proofs for this theory of endosymbiosis is that the membranes and cytoplasms of the mitochondria and the chloroplast more closely resemble the membranes and cytoplasms of prokaryotes than of the eukaryotes in which they reside.

Another means of survival in some prokaryotic organisms is parasitism. Some prokaryotic parasites reside in their host cell and do not kill the host cell (as they need a place to live and absorb nutrients from the host) An example of this would be lichens and algae. As a result of living in the host, these prokaryotes ensure their own success.

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