AP® Biology
2003 Sample Student Responses
Form B

The materials included in these files are intended for use by AP teachers for course and exam preparation; permission for any other use must be sought from the Advanced Placement Program®. Teachers may reproduce them, in whole or in part, in limited quantities for noncommercial, face-to-face teaching purposes. This permission does not apply to any third-party copyrights contained herein. This material may not be mass distributed, electronically or otherwise. These materials and any copies made of them may not be resold, and the copyright notices must be retained as they appear here.

These materials were produced by Educational Testing Service® (ETS®), which develops and administers the examinations of the Advanced Placement Program for the College Board. The College Board and Educational Testing Service (ETS) are dedicated to the principle of equal opportunity, and their programs, services, and employment policies are guided by that principle.

The College Board is a national nonprofit membership association whose mission is to prepare, inspire, and connect students to college and opportunity. Founded in 1900, the association is composed of more than 4,300 schools, colleges, universities, and other educational organizations. Each year, the College Board serves over three million students and their parents, 22,000 high schools, and 3,500 colleges through major programs and services in college admissions, guidance, assessment, financial aid, enrollment, and teaching and learning. Among its best-known programs are the SAT®, the PSAT/NMSQT®, and the Advanced Placement Program® (AP®). The College Board is committed to the principles of equity and excellence, and that commitment is embodied in all of its programs, services, activities, and concerns.

For further information, visit www.collegeboard.com

Copyright © 2003 College Entrance Examination Board. All rights reserved. College Board, Advanced Placement Program, AP, AP Vertical Teams, APCD, Pacesetter, Pre-AP, SAT, Student Search Service, and the acorn logo are registered trademarks of the College Entrance Examination Board. AP Central is a trademark owned by the College Entrance Examination Board. PSAT/NMSQT is a registered trademark jointly owned by the College Entrance Examination Board and the National Merit Scholarship Corporation. Educational Testing Service and ETS are registered trademarks of Educational Testing Service. Other products and services may be trademarks of their respective owners.

For the College Board's online home for AP professionals, visit AP Central at apcentral.collegeboard.com.

BIOLOGY
SECTION II
Time—1 hour and 30 minutes

FORM B 3ZPB3
1A1

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. A difference between prokaryotes and eukaryotes is seen in the organization of their genetic material.
   (a) **Discuss** the organization of the genetic material in prokaryotes and eukaryotes.
   (b) **Contrast** the following activities in prokaryotes and eukaryotes:
      - Replication of DNA
      - Transcription or translation
      - Gene regulation
      - Cell division

1a.) Eukaryots have an organell, called the nucleus, where all the genetic material is situated. The genetic material, called DNA is made up out of nucleotides that again exist out of amino acids. Three nucleotides form the structure of a double helix.

In prokaryots do not have organells, so they don't have a nucleus. The genetic material is in the cytoplasm of the cell and is not as well protected as in the eukaryots

b.) In eukaryots DNA replication is subdivided into 2 steps. First the DNA, that exists of 2 strands is denaturated and seperated. Then, with the help of DNA polymerase and a primer, one strand is replicated. New amino acids are put on the old strand by complementary base pairing
There is the same DNA replication in prokaryots
Cell division in eukaryots is done by meiosis or by mitosis

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).

1A2

In mitosis out of one diploid cell, by the processes of prophase, anaphase, metephase and telophase a new cell develops with genetically identical.

In meiosis out of 2 diploid cells four haploid cells develop, which assort randomly to a new cell.

In eukaryots transcription is done with the help of RNA. That takes a special piece of the DNA and replicats that to produce new proteins

In prokaryots only mitosis can take place The process of mitosis is explained in the top ↑ (briefly). There is only one cell that can divide.

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).

BIOLOGY
SECTION II
Time—1 hour and 30 minutes

1B1

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. A difference between prokaryotes and eukaryotes is seen in the organization of their genetic material.
   (a) **Discuss** the organization of the genetic material in prokaryotes and eukaryotes.
   (b) **Contrast** the following activities in prokaryotes and eukaryotes:
      - Replication of DNA
      - Transcription or translation
      - Gene regulation
      - Cell division

a) The form in which the genetic information of a prokaryotic cell is kept differs from a eukaryotic cell. In prokaryotes, the DNA isn't in a nucleus, while the eukaryotes has their nucleus to keep the DNA inside it.

b) In prokaryotes, it's easier to make DNA replication because of the lack of a nucleus, but to do DNA replication in a eukaryotic cell is harder. DNA of an eukaryotic cell is in chromatin form to fit into the small nucleus for the replication to occur, first the DNA should open. Because of this reason, it's harder for eukaryotes to make DNA synthesis.
In prokaryotes, the gene regulation is determined with the position of a repressor. To make proteins, the RNA polymerase should attach to the promoter of the DNA. If there is an active repressor, this repressor prevents the RNA polymerase from binding to the promoter. In prokaryotes,

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).

1B2

substances like lactose involve in gene regulation, because they bind to the repressor and stop its function. When the repressor becomes inactive, RNA polymerase can bind to the promoter and make proteins. In eukaryotes, it's a little different. There are transcription factors, which bind to the enhancers of the DNA. If they bind to the enhancers, some other proteins bind both to the transcription factors and to the genes of interest. If this occurs, the RNA polymerase can start making protein. So, in prokaryotes repressors are responsible for gene regulation, while in eukaryotes activators do the same job

Prokaryotes divide by binary fission, in which two identical cells are formed. First, the components of the cell are duplicated and then the cell breaks into two parts. In eukaryotes, another technic is used; mitosis and meiosis. They also duplicate their cytoplasmic components during interphase, but they divide in a different way. Especially, Meiosis is very different from the dividing technic of prokaryotes. In meiosis, the newly formed cells don't have to be identical to the parent cell, there is genetic variability.

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).

FORM B3EPB3

IC1

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. A difference between prokaryotes and eukaryotes is seen in the organization of their genetic material.
   (a) **Discuss** the organization of the genetic material in prokaryotes and eukaryotes.
   (b) **Contrast** the following activities in prokaryotes and eukaryotes:
      - Replication of DNA
      - Transcription or translation
      - Gene regulation
      - Cell division

a) In prokaryotes, the genetic material, DNA, is not [redacted] clearly packed in a nucleus. It is not in a membrane covered part. However, DNA is still clustered in the center forming nucleus-like area, without any membranes. In Eukaryotes, DNA is in the nucleus; in other words DNA is covered by a membrane. In Prokaryotes, DNA can be also found as plasmids, circular DNA, and the DNA is not supercoiled around proteins or itself. [redacted] In eukaryotes, there are no plasmids, DNA is wrapped around proteins histones, and supercoils to form cromatin fibers.

b) In prokaryotes and eukaryotes DNA replication is done by certain enzymes; RNA polymerase, DNA polymerase, DNA ligase. In eukaryotes DNA has to uncoil first and should be apart from histones for DNA replication to take place. In both types of cells, DNA is replicated according to semi-conservative model. In prokaryotes, transcription and translation both occur in cytoplasm. In

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).

IC2

transcription, a part of DNA, a gene starting with a promoter and finishing at a terminator, is transcribed. The result is an mRNA. No other editing is done to mRNA and whole mRNA is translated into amino-acid sequences, ending up as a polypeptide chain. In eukaryotes transcription occurs as in prokaryotes, but in the nucleus. The mRNA is spliced afterwards. First a cap and tail is added to protect it from hydrolytic enzymes in the cytoplasm and to make it easier to recognise by ribosomes. Also mRNA is edited by taking off introns (meaningless parts of DNA transcribed into mRNA), and combining extrons (meaningfull parts). Therefore, mRNA in eukaryotes that leave the nucleus is shorter than the DNA piece. Translation occurs in cytoplasm as in prokaryotes.
In Prokaryotes, related genes are adjacent to each other forming operons. At the beginning of operons, there are operators that control gene expression. For example, if lactose isn't available to the organism a protein attaches to lac operon and inhibits the expression of lactase. In some other cases, a protein with the certain material on it attaches to the operon, inhibiting further synthesis of that material. In eukaryotes gene regulation occur in many steps: histones and supercoiling of DNA, RNA splicing, complex protein assemblies for transcription, activators or inhibitors for translation, protein breakdown.

In eukaryotes cell division can occur in two ways: meiosis or mitosis. In meiosis, four haploid daughter cells are produced, (these're gametes) and in mitosis two diploid genetically identical daughter cells are produced (this is mainly for growth) or can be for asexual reproduction.

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).

1C3

In prokaryotes there is one way of cell division: binary fission. A prokaryote cell divides producing two genetically identical cells.

There is also one important difference of DNA replication in prokaryotes and eukaryotes. In eukaryotes, there's a proof reading that recognizes mistakes that occured during replication. No such process is done in prokaryotes.

GO ON TO THE NEXT PAGE.

Copyright © 2003 by College Entrance Examination Board. All rights reserved.
Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).