

# Find out how to prove — and improve — the effectiveness of your Biology program with the *ETS*® Major Field Tests.

## Content Validity

The **Major Field Test (MFT) in Biology**, first administered in 1989, assesses mastery of concepts, principles and knowledge by graduating Biology students. To ensure fairness and content relevance, the test is revised approximately every four to five years.

## Developed by Leading Educators in the Field

Experienced faculty members representing all the relevant areas of the discipline determine test specifications, questions and types of scores reported. ETS assessment experts subject each question to rigorous tests of sensitivity and reliability. Every effort is made to include questions that assess the most common and important topics and skills.

In addition to factual knowledge, the test evaluates students' abilities to analyze and solve problems, understand relationships and interpret material. Questions that require interpretation of graphs, diagrams and charts are included. Academic departments may add up to two subgroups and as many as 50 additional locally written questions to test areas of the discipline that may be unique to the department or institution.

## National Comparative Data

A *Comparative Data Guide*, published each year, contains tables of scaled scores and percentiles for individual student scores, departmental mean scores and any subscores or group assessment indicators that the test may support. The tables of data are drawn from senior-level test takers at a large number of diverse institutions. Nearly 1,500 colleges and universities employ one or more of the Major Field Tests for student achievement and curriculum evaluation each year.

### Who Develops the MFT in Biology?

Individuals who serve or recently have served on the Committee for the MFT in Biology are faculty members from the following institutions:

**Rutgers, The State University of New Jersey**  
**University of Puerto Rico**  
**University of Pennsylvania**  
**University of Virginia**  
**Westminster College**  
**University of Texas at Austin**  
**Purdue University North Central**  
**For more information about the MFT in Biology:**

Phone: **1-800-745-0269**  
Email: **higherred@ets.org**  
Visit: **www.ets.org/mft**

Educational Testing Service  
Rosedale Road  
Princeton, NJ 08541

# Test Content — Biology

The Major Field Test in Biology contains about 150 multiple-choice questions, a number of which are grouped in sets and based on descriptions of laboratory and field situations, diagrams or experimental results. The subject matter is organized into four major areas: cell biology; molecular biology and genetics; organismal biology; and population biology, evolution and ecology. Some of the questions within each of the major areas are designed to test examinees' analytical skills. Programs can choose when and where to administer the tests. It is designed to take two hours and may be split into two sessions. This test must be given by a proctor. Mathematical operations do not require the use of a calculator.

## The Test Outline

### I. Cell Biology (~20%)

- A. Biochemistry and cell energetics (~10%): biochemical compounds and macromolecules; first and second laws of thermodynamics; enzyme activity and regulation; ATP and energy-producing pathways; post-translational modification, transmembrane insertion and sorting of proteins; cell-cell communication
- B. Cellular structure, organization and function (~10%): organelles and other cellular components; cytoskeleton and cell motility; cell surfaces and membrane function; extracellular space; cell theory and germ theory; distinctions among archaeobacteria, eubacteria and eukaryotic cells; cell growth, cell cycle, mitosis and cytokinesis

### II. Molecular Biology and Genetics (~20%)

- A. Molecular Genetics (~14%): DNA replication and mutation; gene structure, introns and exons; regulation of gene expression; RNA transcription and modification; translation of mRNA; bacteriophages and viruses; control of normal development; cancer; molecular aspects of immunology; genetic engineering
- B. Heredity (~6%): meiosis and chromosomal alterations; modes of inheritance; probability and pedigree analysis; segregation, recombination and chromosome mapping; polyploidy and aneuploidy; sex determination; non-Mendelian inheritance; prokaryote genetics

### III. Organismal Biology (~33%)

- A. Diversity of organisms (~9%): phylogenetic relationships, classification, morphology, life histories and general biology of bacteria and archaea, protists, fungi, plants and animals; origin of life and endosymbiont theory; fossil record and human evolution; systematic and molecular phylogeny; adaptations of organisms to habitats
- B. Animal organ systems (vertebrates and invertebrates) – comparative structure, function and organization (~9%): digestion and nutrition, excretion and osmoregulation, gas exchange and ventilation, circulatory systems, support and movement, nervous and endocrine systems, integument, immune system, metabolic rates and energy

- C. Animal reproduction, growth and development (~5%): reproductive structures and gametogenesis; fertilization, cleavage and gastrulation; comparative embryology; reproduction in nonchordate animals
- D. Plant organ systems (seed plants and nonseed plants) – comparative structures, function and organization (~7%): roots, stems and leaves; plant energetics; water relations; mineral nutrition; translocation and storage; hormones, photoperiods and tropisms; nonphotosynthetic strategies
- E. Plant reproduction, development and growth (~3%): reproductive structures, gametogenesis and sporogenesis; fertilization and alternation of generations; embryogeny and germination; meristems and growth

### IV. Population Biology, Evolution and Ecology (~29%)

- A. Population genetics and natural selection (~7%): genetic variability and polyploidy; distributions of genetic variability; Hardy-Weinberg equilibrium and genetic drift; heritability, fitness and adaptation; natural selection
- B. Patterns of evolution (~7%): modes of speciation; isolating mechanisms; convergence, divergence and adaptive radiation; extinction; evidence for evolution; evolution of higher taxa; evolutionary rates and punctuated equilibrium; molecular evolution; neutral mutations; coevolution
- C. Environmental Factors (~2%): biogeographic and temporal patterns, biomes and climates
- D. Population ecology (~5%): habitat selection, tolerances, limiting factors and resource acquisition; demography and population dynamics; animal behavior
- E. Community Ecology (~4%): competition, predation, parasitism and symbiosis; community structure and niche; species richness and species diversity; change and succession; introduced species
- F. Ecosystems (~3%): energy flow, biochemical cycling and decomposition; productivity; food webs
- G. Human Impacts (~1%): human demography; resource depletion and pollution; economic

botany; habitat modification and effects on organisms; emerging diseases and endemic diseases

### V. Analytical Skills (~35%)

- A. Science as a way of knowing: understanding quantitative aspects and limitations of science; understanding the place of hypotheses and theories in biology; identification and testing of hypotheses
- B. Experimental design: identification of variables and establishing experimental controls; ensuring that measured parameters are affected by phenomenon being studied
- C. Interpretation, data analysis, inductive reasoning and drawing conclusions from data: application of information to solve a problem or make a prediction; demonstration of proficiency with quantitative concepts and familiarity with units of measure; demonstration of an understanding of probability theory and statistics; interpretation of data, graphs, tables and statistical analyses

#### How scores for the Major Field Test in Biology are reported:

**Total Score** — Reported for each student and summarized for the group

**Subscores** — Reported for each student and summarized for the group

- Cell Biology (28)
- Molecular Biology and Genetics (29)
- Organismal Biology (50)
- Population Biology, Evolution and Ecology (43)

**Assessment Indicators** — Reported for the group\* only

- Biochemistry and Cell Energetics (10)
- Cellular Structure, Organization, Function (18)
- Molecular Biology and Molecular Genetics (29)
- Diversity of Organisms (14)
- Organismal-Animals (22)
- Organismal-Plants (14)
- Population Genetics and Evolution (20)
- Ecology (23)
- Analytical Skills (65 based on package subscore report)

Numbers in parentheses are the approximate number of questions in each category.

\* A minimum of five (5) students is required for assessment indicators to be reported.