08 Training Guide for Cell Biology
prepared by Karen L. Lancour

Process Skills and Tasks Which Might Be Tested

Methods   * Understanding techniques used in studying cells as electrophoresis, DNA probes cell fractionation, radioactive tracers, spectrophotometry, centrifugation, computer imaging, photography of cells.

Lab Safety   * Distinguishing "safe" behaviors vs. "unsafe" behaviors, identifying safety symbols related to experiments , evaluating situations -- what to do "if" or what's wrong.

Microscopy   * Understanding of parts of microscope & their function, magnification, appearance of images, resolution, changes in field with magnification, types of microscopes and their uses.
* Understanding the different types of microscopes, their uses, and their differences.
* Using types of light microscopes to perform a requested task.
* Determining the three dimensions of a cell
* Determining length, width, depth, area, and volume of cells.
* Interpreting electron micrographs

Lab Equipment   * Identifying pieces of lab equipment and their functions.
* Identifying appropriate pieces of equipment to perform a specific task.

Measurement   * Identifying the capacity, range, and increments of measuring devices used to study cells .
* Converting units within the metric system.

Calculations   * Using measurements to determine area, volume, percentages, probabilities.
* Using area and sample number to determine density of a sample.
* Understanding and using statistics to analyze data.

Chemical Analysis   * Using reagents for chemical analysis.

Observations   * Using senses to notice specific features.
* Identifying similarities and differences in features.
* Identifying qualitative and quantitative changes in conditions.
* Using observable properties to classify objects, organisms or events.

Inferences   * Formulating assumptions based upon observations.
* Distinguishing between observations and inferences.

Problem   * Using observations to propose a testable question.

Hypothesis
* Proposing a hypothesis for a given problem.
* Identifying statements presented along with a set of data as.
    1. logical hypothesis
    2. illogical hypothesis of contrary to data
    3. not a hypothesis, but a restatement of data
    4. reasonable hypothesis, but not based on data

Predictions
* Predicting the results for a proposed lab test or setup.
* Selecting predictions based upon previously observed patterns.

Design Analysis
* Analyzing designs for experiments relative to problem, identifying variables & constants, procedure analysis , proper control of variables, types of data collected, basic assumptions used, time period for the test.

Procedures
* Analyzing procedures for flaws in design.
* Arranging steps of procedures in the appropriate order.
* Determining the repeatability of a procedure.
* Identifying an appropriate procedure to test a problem.

Graphing
* Interpreting line, bar, and pie graphs.
* Identifying the title, source, independent variable & dependent variables, and the legend.
* Predicting data points not included in a given graph.
* Preparing a line, bar or pie graph to represent a set of data.
* Scaling each axis for a line graph.
* Making predictions or inferences based upon the data on a graph.

Analysis of Data
* Identifying data which supports or rejects a hypothesis.
* Identifying discrepancies between stated hypothesis and actual data.
* Identifying types of error in the data as experimental and random.
* Determining the validity of experimental data.
* Interpreting charts and diagrams.

Conclusions
* Selecting the most logical conclusion for given experimental data.
* Accepting or rejecting hypotheses based upon data analysis.
* Proposing a new hypothesis for rejected hypotheses.
* Proposing a future test for inconclusive results.

Cell Biology

Sample Stations Within Content Areas

EUKARYOTIC & PROCARYOTIC CELL STRUCTURES

*   Using models, photographs, or illustrations of structures such as organic molecules and cell organelles, identify the structure and describe its function or role in life processes.
*   Identifying differences between prokaryotic & eukaryotic cells.
*   Analyzing studies used to determine key pieces of current knowledge.
*   Identifying types of microscopes -light vs. electron - uses, capacities, limits
*   Identifying cell types and their functions

*   Identifying electron micrographs of organelles - function, identification of parts, and chemical mechanisms.
*   Understanding and interpreting the role of cell membranes structures and surface specialization.

CELL FUNCTION AND CELL CLASSIFICATION

*   Comparing surface area to volume ratio of various cells.
*   Using a light microscope, estimate cell size and determine the 3-dimensional shape of cells. Relate the size and shape of a cell to its function.
*   Making measurements to calculate surface area to volume relationships. Relate SA/VOL relationships to cell structure and function.
*   Analyzing or making predictions concerning osmosis, diffusion and cell transport.
*   Using mechanisms that control of cell size to explain shapes modifications in cells
*   Analyzing cell cultures
*   Using photographs or microscope slides, identify various types of cells such as muscle, nerve, epithelial, and leaf epidermis and relate the structure of the cell to its function.
*   Identifying tissue types - structure, function, chemical mechanisms

CHEMICAL REACTIONS AND BONDING

*   Using the protocol and data derived from an experiment such as one on the effect of pH on enzyme activity, determine (1) the independent and dependent variables, (2) variables that must be kept constant, (3) a control, (4) the most appropriate measure of central tendency to use in analyzing the data, (5) if the data are quantitative or qualitative, (6) the type of graph to use and how to label the X and Y axes, and (7) an appropriate conclusion.

ORGANIC MOLECULES

*   Determining the most appropriate reagent test for identifying substances such as gelatin, vitamin C, glucose, butter, and cornstarch.
*   Identifying key organic chemicals and their role in cell operation.

PHOTOSYNTHESIS AND CELLULAR RESPIRATION

* Calculating the energy content of food from data obtained from calorimeters. Relating the energy content of food molecules to the flow of energy and the cycling of matter that occur during photosynthesis and cellular respiration in ecosystems.
* Drawing conclusions about the relationship between photosynthesis and cellular respiration from data collected on the production/uptake of oxygen and carbon dioxide by green plants and animals. Predict how changing the environment of a plant or animal might affect the rate of photosynthesis or respiration.
* Interpreting photosynthesis & cellular respiration experiments or their data.
* Understanding and interpreting data concerning enzymes and their role in cell activities
* Analyzing and comparing the ATP production in aerobic and anaerobic respiration

CELL REPRODUCTION

* Using photographs or illustrations of mitosis and meiosis, identify major events that occur in these processes and relate these events to cell and organism continuity.
* Comparing & analyzing data - stages of mitosis & meiosis their similarities and differences
* Analyzing cell cycle data–timing for normal vs. abnormal cells
* Understanding and interpreting information on prokaryotic cell reproduction and DNA operation

CELL DIFFERENTIATION

* Interpreting and analyzing cell differentiation processes and data relative to their study.

DNA REPLICATION, TRANSCRIPTION, AND TRANSLATION

* Using a mRNA codon chart, determine amino acid sequences when given DNA nucleotide base sequences.
  Relating base sequences to protein structure, genotype, and phenotype and recognize that changes in DNA base sequences (mutations) may alter genotype and phenotype.
* Interpreting DNA structure & replication diagrams or sequences as well as Okazaki fragments
* Comparing the kinds of RNA – their production and processing
* Interpreting Translation data and amino sequences

IMMUNOLOGY

* Analyzing immunology mechanisms and studies related to their operation.

VIRUSES

* Understanding and interpreting mechanisms of viruses – their structure, reproduction, genetics, and retroviruses
* Analyzing the effects of viruses on other cells

PROTEIN PROFILES AND EVOLUTIONARY RELATIONSHIPS

* Using the results of gel electrophoresis, compare the protein profiles of different species to infer evolutionary relationships

Internet Resources: Cell Biology

Cell Biology Textbooks and Resources Online
http://www.teleport.com/~amobb/biology/cellbio.html

Online Biology Book
http://gened.emc.maricopa.edu/bio/bio181/BIOBK/BioBookTOC.html

Cell Biology Lab Manual Outline plus Online links

http://www.gac.edu/cgi-bin/user/~cellab/phpl?index-1.html

http://www.gac.edu/cgi-bin/user/~cellab/phpl?links.html

Cell and Molecular Biology On-line
http://www.cellbio.com/

Teaching Science   BioChemLinks
http://biochemlinks.com/bclinks/teaching.cfm

MIT Cell Biology Hypertextbook
http://esg-www.mit.edu:8001/esgbio/chapters.html

Harvard University, Dept. of Molecular & Cell Biology – Biology Links
http://golgi.harvard.edu/BioLinks.html

Resources for Biology Courses
http://www.bio.davidson.edu/Biology/courses/courses.html

Cell Structure and Function: Excellent resource with notes, charts and animated diagrams
http://www.biology.eku.edu/RITCHISO/301notes1.htm