ORANGE COAST COLLEGE COURSE OUTLINE OF RECORD

Course developer: Farah Sogo Course static ID: _____
TOP No. 0401.00 CIP No. _____ Course adoption: _____
Date revised: _____ Revised by: _____
Semester(s) offered: Fall Distance education alternative _____

COURSE MASTER DICTIONARY DATA

Title 5 credit status: Associate degree credit course X Nondegree credit course _____ Noncredit course

Course name/number: Biology 230 Division: Math and Science

Course title: Structure and Function of Cells Department: Biology

Units: 3 Total course hours: 54 Course length: 16 weeks

Weekly hours configuration: 3.0 hours lecture

Grading method: Graded X CR/NC _____ Student option _____ Noncredit

Method of Instruction: 10 (2 digit no.) Basic skills status: N (P, B or N)

Materials fee: No X Yes _____ $ _____

Justification:

COURSE PREREQUISITE:
Biology 181, Chemistry 180

CATALOG DESCRIPTION:
The molecular basis of cellular processes will be explored including organellar functions, biogenesis, and organization; the cytoskeleton; cell/cell communication; and the regulation and coordination of these processes. Special attention will be given to current scientific literature.

SCHEDULE DESCRIPTION:
The molecular bases of cellular structure, communication, and function are explored.

COURSE CLASSIFICATION:

A	Liberal arts/AA	X	D-H	Community course	
B	Remedial		I	Occupational required	
C	Remedial		I	Occupational elective	

COURSE TRANSFER:

0	Non-transfer/Non-AA		2	Transfer CSU	X
1	Non-transfer AA		3	Transfer UC	

JUSTIFICATION FOR THE COURSE:
Required for certification
Advisory committee recommendation

COURSE CONTENT AND SCOPE/TOPIC OUTLINE:

1) Techniques to study cells
    a) Light Microscopy
    b) Phase-Contrast
    c) Immunofluorescence
    d) Electron Microscopy
2) Biological membranes
    a) Functions
    b) Properties
    c) Lipid organization in membranes
        i) Gorter & Grendel
        ii) Models of arrangement with lipid bilayer and protein
            (1) Davson-Danielli Model
            (2) Singer-Nicolson Fluid Mosaic Model
    d) Lipid composition in biological membranes
    e) Ways to study bilayers
        i) Liposomes
        ii) Black lipid membranes
    f) Dynamic Properties of membranes
        i) Fluidity Experiments
            (1) Electron Spin Resonance Microscopy (ESR)
            (2) Fluorescence Recovery after Photobleaching (FRAP)
            (3) Mouse /human hybrid cells
        ii) What affects membrane fluidity
        iii) Keeping membranes fluid under various conditions
3) Lipid synthesis and distribution
4) Protein Association with membranes
    a) Peripheral membrane proteins (Extrinsic)
    b) Integral Membrane proteins (Intrinsic)
        i) Phospholipid attachments
        ii) Transmembrane Proteins
            (1) Transport proteins
                (a) Passive transport
                (b) Active transport
                    (i) Electrochemical gradients
                    (ii) Membrane potentials
                    (iii) Antiport
                        1. Na+/K+ ATPase
                    (iv) Uniport
                        1. Ca2+ ATPase
                        2. H+ ATPase
                (c) Secondary active transport
                    (i) Na+/H+ exchanger
                    (ii) Na+/HCO3- symporter
                    (iii) Na+ driven Cl-/HCO3- exchanger
                    (iv) Glucose Transporter (symport)
            (2) Gated Channels
                (a) Ligand-gated channel
                (b) Voltage gated

(c) Mechanical gated
(d) Model of integration- The Nerve cell in action and the neuromuscular junction

5) Membrane internalization
   a) Phagocytosis
   b) Pinocytosis
   c) Receptor mediated endocytosis
      i) General process
         (1) Process
         (2) Receptor structure
         (3) Clathrin cage structure
      ii) LDL- Receptor
      iii) Transferrin receptor
      iv) Fates of ligands
6) Cell Compartmentalization
7) Sorting (signal) sequences
8) Endoplasmic Reticulum (ER)
   a) Properties
   b) Protein import into the E.R.
      i) Blobel and Walsh experiments
      ii) Mechanics of ER import
      iii) Secreted vs. membrane proteins
9) Secretory pathway
   a) Paladi experiments
   b) Flow
      i) ER Function (biochemical)
      ii) Golgi Function (Biochemical)
      iii) Vesicle trafficking through the secretory pathway
         (1) Biochemical approach (Jim Rothman)
         (2) Vesicle formation
         (3) Vesicle targeting
         (4) Membrane fusion
         (5) The genetic approach (Randy Scheckman)
10) KDEL and protein recycling
11) Lysosome
   a) Function
   b) Lysosomal sorting
   c) Lysosomal Targetting sequence
   d) Hydrolase scavenging pathway
12) Mitochondria
   a) Functions
   b) Structure
   c) ATP synthetase (F0F1 ATPase)
      i) Experiments to define function of subunits
      ii) Racker and Stoeckenius experiments
   d) Monogenetic system
   e) Mitochondrial protein import
13) Chloroplasts
   a) Function]
   b) Structure
   c) Protein import
14) Peroxisome
   a) Function

b) Protein import
15) Nucleus
a) Structure and Function
b) Mitotic assembly and disassembly
c) Nuclear Pores
d) Nuclear Protein Import
e) RNA export
16) Cell division cycle
a) Overview
b) Timing
c) Checkpoints
d) G1 to S phase transition
e) G2 to M phase transition
f) M to G1 transition
17) Ubiquitin proteolytic system
18) Influences on cell division
a) Nutrients
b) Growth factors
c) Cell/cell contact
d) Cell adhesion
19) Tumor promoting viruses
a) History (RSV virus)
b) Proto-oncogenes
i) C-src vs v-src
ii) C-sis vs. v-sis
iii) C-erb-b vs. v-erb-b
iv) C-ras vs v-ras
v) C-myc vs. v-myc
c) Tumor suppressor genes
i) Rb
ii) P53
20) Cytoskeleton
a) Types of cytoskeletal elements
b) Microtubules
i) Function
ii) Assembly
iii) Treadmilling vs fixed Microtubules
iv) Dynamic instability
v) Associated proteins (MAPs)
vi) Mitotic function
(1) Mitosis
(2) Microtubule changes
vii) Cilia and Flagella
viii)Centrioles and Basal Bodies
21) Intermediate filaments
a) Structure
b) Dynamics
c) Functional types
22) Actin
a) Structure
b) Dynamics
c) Listeria monocytogenes

   d) Structural role in the cell
   e) Cellular contraction
      i) Myosin
      ii) Muscle contraction
23) Cell signaling
   a) Blood glucose regulation
   b) Types of signaling
   c) Types of signals
   d) Types of receptors
24) G protein linked receptors
   a) β-adrenergic receptor
   b) Sutherland experiments
   c) Adenyslyl cyclase
   d) Heterotrimeric G-proteins
   e) PKA
   f) General structure of
25) Cell adhesion
   a) Overview
   b) CID system
   c) CAD system
   d) Catenins
26) Cell Junctions
   a) Anchoring Junctions
   b) Tight Junctions
   c) Gap Junctions
27) Extra Cellular Matrix (ECM)
   a) Function
   b) Components
   c) Linking proteins and integrins

INSTRUCTIONAL OBJECTIVES:

The students will be able to:

1) Describe the structure and function of biological membranes
2) Explain the process of and the components of protein transport systems.
3) Explain the process of and the components of membrane internalization and compartmentalization.
4) Discuss the structure, function, and the flow of vesicles through all the organelles in the secretory pathway.
5) Explain the process and function of protein import in all the organelles outside of the secretory pathway.
6) Discuss the process of, and what influences, the cell division cycle.
7) Explain how viruses can promote tumors and give specific examples.
8) Identify the components of the 3 types of cytoskeletal elements and discuss their function, assembly and dynamics.
9) Explain the process of cell signaling and give examples of G-protein linked receptors.
10) Describe and identify the components of and structure of the matrix outside the cell and between cells.
11) Analyze the experimental evidence for the processes listed in objectives 1-10.
12) To assemble their knowledge of all the subjects listed in objectives 1-10 to predict outcomes of hypothetical situations and experiments.
13) Give an oral presentation on a current peer reviewed article in cell biology.

METHOD OF STUDENT EVALUATION:
Student written exams, problem sets, and a paper summarizing their oral presentation.

INSTRUCTIONAL METHODOLOGIES:
Lecture on concepts emphasizing the experimental process that led to our current knowledge on each subject area. Give problem sets that are application based which require the student to use concepts in lecture and apply those concepts to new hypothetical situation. Student oral presentations on current literature in cell biology.

WRITING ASSIGNMENTS/PROFICIENCY DEMONSTRATION:
The students will complete written problem sets and a summary paper on a current peer reviewed article in the field of cell biology.

REPEATABILITY:

N/A

FEASIBILITY:

Faculty: This course will be taught using existing faculty.
Classroom: This course will be taught in existing classroom facilities.
Library Learning Resources: The library has an interlibrary loan program and Internet access that will be sufficient for student research of assigned topics.

EDUCATIONAL MATERIALS:

Essential Cell Biology: An Introduction to the Molecular Biology of the Cell, Alberts, B., Bray, D., Johnson, A., Lewis, J., Raff, M., Walter, P., and Roberts, K., Garland Publishing, Inc.