MAR 11 1994

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Number: _____
Action: _____
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Number: ~~93-80f~~ 94-31
Action: App 3/28/95
Date: App 5/2/95

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. Title/Author of Change

Course/Program Title: BI 105 Cell Biology
Suggested 20 Character Course Title: Cell Biology
Department: Biology
Contact Person: Drs. William Dietrich, Jr. and Jerry Pickering

II. If a course, is it being Proposed for:

X Course Revision/Approval Only
_____ Course Revision/Approval and Liberal Studies Approval
_____ Liberal Studies Approval Only (course previously has been approved by the University Senate)

III. Approvals

Robert P. Gendron
Department Curriculum Committee

Department Chairperson

College Curriculum Committee

College Dean*

Director of Liberal Studies (where applicable)

Provost (where applicable)

*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. Timetable

re-submitted

Date Submitted to LSC: _____
to UWUCC: _____

Semester to be implemented: Fall, ~~1995~~ 1996

Date to be published in Catalog: ~~1995~~ 1996

RECEIVED
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LIBERAL STUDIES

V. DESCRIPTION OF CURRICULUM CHANGE

1. Catalog Description

BI 105 Cell Biology

3 credits
3 lecture hours
0 lab hours
(3c-0l-3sh)

Prerequisites: Non-Biology majors only

Introductory course to provide concepts and applications for understanding human biological function from the point of view of cellular biology.

2. Summary of proposed revisions

It is proposed that BI 105 be revised to accommodate the needs of a more restricted audience of students, specifically majors in Nursing, Respiratory Care, Dietetics and Natural Science. This revision will include the elimination of the laboratory portion of the course. The current BI 105 course serves a more diverse audience which includes Biology majors, Pre-med majors, Natural Science majors and majors of the Department of Nursing and Allied Health Professions. The anticipated curriculum revision for the B.S. in Biology removes biology majors, including pre-meds and pre-veterinarian, and environmental health majors from BI 105 but does not remove other majors presently being served and adds dietetics majors. Hence, the proposed revision will result in a course providing only a service function.

Restriction of the audience, while not changing the principles being taught, will allow use of examples and applications that increase the emphasis on human biology.

3. Justification/rationale for the revision

Rationale of the Course Material: The subject matter of cell biology permeates the life and health sciences. Areas as diverse as biotechnology and ecology all rely on it. There is no sign that it will be less so in future. Since all organisms are composed of cells, understanding cellular properties is an integral part of understanding organisms.

Disease organisms (fungi, bacteria and viruses) interact with organisms at the cellular level. They either parasitize cells or they produce toxins that inhibit cellular processes. Symptoms, such as inflammation or dysfunction, are the result of the cumulative effect of cellular responses to infection.

Chemotherapy for disease is aimed at the cellular level. Therapeutic agents are largely substances with the ability to inhibit pathogen function while allowing the host tissue to remain functional. Part of the difficulty in producing a chemotherapeutic agent for AIDS, for example, is the similarity in function of HIV to that of the cells in which it resides and reproduces.

Diagnosis also relies heavily on cell biological knowledge. For example, prostatic cancer is screened by the presence of a particular form of the enzyme, acid phosphatase; it is normally produced by the prostate and is essential to proper function. This enzyme is not found normally in the bloodstream but cancerous prostate glands leak it into the blood stream where it can be detected.

As can be determined by reading the lay press, nutrition and health are best understood in terms of cellular function. The recent discovery that anti-oxidants can help deter cancer, for example, is based on the recognition of the role played by free radicals in damaging essential cellular molecules.

Finally, and most importantly, our discussions with faculty in the various departments which will be served by this course have convinced us that exposure to cell biology is more necessary now than ever. Their students will benefit from having taken cell biology in their upper level courses, in their internships, and in their prospective professional activities.

Rationale for the Teaching Methods: The use of lecturing as a teaching method is a time-honored pedagogical technique. There is no other was to get across as much material. Much of the literature of science education calls for involving students in the course material to a degree greater than possible by the sole use of lectures. In many courses, the laboratory has been the place where cooperative learning, active learning, practice of critical thinking skills and hands-on activities have occurred. Since this proposed course does not have a laboratory component, such activities must occur during the regular class period and in the regular class setting. The groups activities, described below, are intended to involve the students in their education to a greater extent than by lecture alone, and to have the students learn first hand the application of the course content to their own major.

The activities proposed in the Tentative Class Schedule are only examples of what could occur during class. These activities will change from semester to semester as the instructors learn new things about the science content and from the reactions of previous classes to individual activities.

The instructors have both gained experience in cooperative learning in the classroom and by participation in workshops. Dr. Dietrich has conducted his Cell Biology laboratory sections solely by cooperative learning for the past four years. Further, during the summer of 1994, lecture material was sacrificed for cooperative reviews by the class in Cell Biology. In May of 1994, he participated in a 3-day NSF-Chautauqua Short Course on Cooperative Learning Workshop given by the IUP Teaching Excellence Center in December, 1994. Dr. Pickering has used cooperative learning exercises in his Bioethics and Global Survival Synthesis Course during the past six years. He participated in the Cooperative Learning Workshop of the IUP Teaching Excellence Center in December, 1994.

Old Course Syllabus

I. CATALOG DESCRIPTION

BI 105 Cell Biology — 3 credits, 3 lecture hours, 2 lab hours (3c-2l-4sh)

An introductory course designed to increase the beginning student's understanding of the structural, functional, developmental, and evolutionary aspects of the cell concept.

II. COURSE OBJECTIVES

1. To develop an appreciation and understanding of the cell as the unit of structure and function of living organisms.
2. To stimulate the student to analyze the important current concepts and hypotheses of biology in terms of cell biology.
3. To make the student aware of the areas of cell biology which are open to investigation.
4. To demonstrate how the development of technology has paralleled the developments of cell biology.
5. To establish an awareness of the contributions of cell biology to both our understanding of basic life processes and its utility in medical sciences, and applied biology.
6. To develop the concept of cell evolution as evidenced by comparative cell morphology and physiology and by the fossil record.
7. To establish the importance of cell biology as a discipline in relation to other biological sciences and human activities.

III. COURSE OUTLINE

Lecture Topic Outline

Orientation
Historical Background of the Cell Concept
Cellular Structure
- microscopy and electron microscopy
- prokaryotic cell structure
- eukaryotic cell structure

The Five Kingdom Concept
Cellular Chemistry
- atoms
- chemical bonds
- carbohydrates
  - sugars
  - isomers
  - polymers: cellulose and starch/glycogen

- importance of 3D structure of molecules
- lipids
  - types: fatty acids, triglycerides, phospho-, sphingo-, and glycolipids, and steroids
  - function of each lipid type
  - amphipathic molecules
- amino acids and proteins
  - amino acids
  - peptide bonds and proteins
  - functions
- nucleic acids
  - mononucleotides
  - polynucleotides: RNA and DNA
- properties of water
- acids and bases: pH and amphoteric substances

Cellular Energetics

- 1st and 2nd laws of thermodynamics
- free energy and equilibrium
- exergonic and endergonic reactions
- steady state
- anabolism/catabolism
- couping reactions: phosporyl transfer, redox, production of electrochemical imbalances
- energetics of coupling
- energy storage by the cell: short term, long term

Enzymes

- protein structure
- catalysis
  - energy of activation
  - importance of conformation
  - specificity
- properties of enzymes
  - environmental parameters
  - inhibitors
  - denaturation
- regulation of cellular chemistry through enzymes
  - self-regulation
  - gene-regulation
- isoenzymes and multi-enzyme complexes

Cellular Membranes

- structure
- transport
  - diffusion
  - facilitated diffusion
  - active transport
    - primary (simple) pumps
    - cotransport (secondary pumps)

Cellular Metabolism

- three stages of catabolism
  - depolymerization
  - glycolysis and fermentation
  - Krebs cycle and electron transport
- oxidative phosphorylation
  - structure of mitochondria

- indirect, chemiosmotic coupling

Photosynthesis
- transduction of light energy to redox energy
- photophosphorylation
- CO_2 fixation

Cellular Information Processing
- introduction
  - structure of nucleic acids
  - proof that DNA is the genetic material
  - roles of genetic material
    - information storage
    - information transfer within the cell
    - information transfer from generation to generation
- what is a gene?
  - gene structure
  - genetic code
- mutations
  - chromosomal
  - gene
- transcription
  - the process
  - control of transcription
  - the operon, enhancers
- messenger RNA
  - prokaryotic vs eukaryotic
- review of the genetic processes

Cellular Packaging
- getting proteins where they belong
- at the rough ER
  - signal sequence
- at the Golgi
  - terminal glycosylation
  - routing of proteins
- proteins of the nucleus and organelles: concept of precursors proteins
- ribosome production

The Cell Nucleus
- nuclear envelope, pore structure and function
- structure of the nuclear matrix
- chromosome structure
- chromosome condensation
- heterochromatin and euchromatin
- polytene chromosomes

Cell Division
- DNA replication
- the cell cycle
- amitosis
- mitosis

Reproduction
- life cycle
  - plant type
  - animal type
- meiosis and gametogenesis
- crossing over
- fertilization

- Patterns of Inheritance
  - Mendel's Laws of Inheritance
  - monohybrid cross
  - dihybrid cross
  - multiple alleles
  - sex linkage
  - linkage and crossing-over
- Intercellular Communication
  - cell junctions
    - tight junction
    - desmosome
    - gap junction
    - plasmodesmata
  - eliciting a response
    - chemical messengers
    - second messengers
- Cellular Evolution
  - early experiments
  - chemical evolution
  - origin of life
  - translation paradox
  - origin of eukaryotes

Laboratory Topical Outline

- Microscopy
  - use of the microscope
  - calculating magnifications
  - staining: positive and negative
  - multicellular organisms
  - prokaryotic and eukaryotic cells
- Preparation of Solutions
  - concentration
  - percent solutions
  - molarity
  - normality
  - dilution
- pH
  - definition
  - strong and weak acids and bases
  - buffers
  - modes of measurement
    - the pH electrode/meter
- Spectrophotometry
  - absorption of light by substances
  - Beer-Lambert Law
  - use to measure concentration
    - the standard curve
    - unknowns
  - absorption spectra used to identify substances
    - A_{max}
- Separation Techniques
  - chromatography
    - principle

- TLC of chloroplast pigments
- R_f
- electrophoresis
  - principle
  - cellulose acetate electrophoresis of serum

Properties of Enzymes
- measurement of an enzymatic reaction
- effect of substrate concentration
- effect of pH
- effect of temperature
- effect of enzyme concentration
- effect of inhibitors
- temperature stability of enzymes

Cell Permeability
- iso-, hyper-, hypotonic solutions
- passive transport
- effects of:
  - molecular size
  - polarity
  - ionization

Respiration
- measurement techniques
- calculation of respiration rate

Isolation of DNA from Bacteria
- use of enzymes as tools
- DNA identification

Genetic Recombination in Bacteria
- bacterial conjugation and plasmids
- antibiotic resistance

Cell Reproduction
- mitosis
  - stages
  - plant vs animal
- meiosis
  - stages
  - crossing-over
  - gametogenesis

Heredity
- laws of probability
- monohybrid cross
- dihybrid cross
- test cross
- solving genetics problems

IV. EVALUATION METHODS

1. Lecture Examinations - 4 one-hour examinations (fourth examination included with a comprehensive final) will constitute 80% of the final grade.

2. Laboratory grade - 20% of the final grade will be provided by the laboratory instructor based upon a combination of quizzes lab hand-ins, and practical exams. The number of each and their respective worth will be determined by the lab instructor.

Notes:

Make-up examinations will be administered at the discretion of the instructor, but only if the student supplies the instructor with an appropriate statement of the reason why an exam must be passed. Such appropriate statements include: notes from practicing physicians, notes from the College Dean.

V. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READINGS

Textbook and Manual:
Becker, W., 1986. The World of the Cell. Benjamin-Cummings, New York.

General Text References:

Alberts, B., et.al. Molecular Biology of the Cell. Garland Publishing, Inc., 1983.
Avers, C.J. Molecular Cell Biology. Addison Wesley Publishing Co., 1986.
Becker, W.M. The World of the Cell. Benjamin/Cummings Publishing Co., Inc., 1986.
DeRobertis, E.D.P., and E.M.F. De Robertis Jr. Cell and Molecular Biology. Saunders College Publishing, 1980.
DeRobertis, E.D.P., and E.M.F. DeRobertis Jr. Essentials of Cell and Molecular Biology. Saunders College Publishing, 1981.
Holtzman, E. and A.B. Novikoff. Cells and Organelles 3rd ed. Saunders College Publishing., 1984.
Kimball, J.W. Cell Biology 3rd ed. Addison Wesley Publishing co., 1984.
Prescott, D.M. Cells. Jones and Bartlett Pub., Inc., 1988.
Schwartz, L.M. and M.M. Azar eds. Advanced Cell Biology. Van Nostrand Reinhold Co., 1981.
Thorpe, N.O. Cell Biology. John Wiley and Sons, 1984.

MAIL> extract tt:
From: GROVE::RGENDRON "Rob Gendron" 24-MAR-1995 12:29:36.62
To: DRCHRDSN
CC: RGENDRON
Subj: Bio Curriculum

To UWUCC:
Re: Biology Proposals 4/25/26
Responses to our Questions

Darlene,

I have made the corrections in the BI111 and Program proposals and sent the pages to you via campus mail. (yes, received + placed in proposals)

I have asked Bob Prezant and Bill Dietrich to comment on the question the committee had regarding BI105, BI210 and BI220. What follows are their slightly edited e-mail messages to me. As you can see, the library holdings are not so weak as to preclude the teaching of BI210 and BI220, which are both introductory courses. In their proposals Drs. Prezant and Dietrich have simply reiterated the plea for more support for the library. In this they probably reflect the feelings of the Biology Department, and probably many other faculty.

As Dr. Prezant's reply indicates, we forsee no problem in meeting the need for Cell Biology, even with the reduced class size.

Rob Gendron

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From Bob Prezant:

"Weak library holdings" signifies the current state of the University library for all Biology materials. Having said that: There is sufficient material in our zoology holdings in the IUP library to run the BI220 course as an introductory level majors course. The "weakness" stems from a lack of depth in those holdings. Students wishing to pursue deeper aspects of zoology, as introduced in BI220, will be challenged by our holdings.

BI105: The total number of seats for BI105 has not been reduced. With enrollment management taking effect for Nursing and with our Biology majors and Medical Technology students no longer taking BI105 (but instead taking Principles), the 2-3 sections of 48 students each should suffice. Teaching this course outside of Weyandt Hall is not a requirement; merely a suggestion to keep those students taking the course on their "home base". The course will be scheduled where appropriate rooms are available.

From Bill Dietrich:

Regarding BI210, Botany:
The library holding are weak but not enough so that we are unable to teach the course as described in the proposal. We pressntly supplement the holdings with our personal books and jopurnals.

The reply of the UWCC implies that the Biology department can do something about the woeful state of funding of the IUP library. As near as I know, we can only complain. The real question is: What will the university do to alleviate the problem. The library has been a low priority for funding for quite a while and the Biology department did not make or enforce that decision.

New Course Syllabus

I. CATALOG DESCRIPTION

BI 105 Cell Biology — 3 credits, 3 lecture hours, 0 lab hours, (3c-0l-3sh)

Prerequisites: Non-Biology majors only

Introductory course to provide concepts and applications for understanding human biological function from the point of view of cellular biology.

II. COURSE OBJECTIVES

The Cell Biology Student will:

1. Learn the major principles of cellular biology and how the principles work in specific, relevant examples.
2. Develop an appreciation and understanding of the cell as the unit of structure and function of living organisms.
3. Obtain a conceptual framework which can be used to understand future advances in the life and health sciences.
4. Learn to analyze the important current concepts and hypotheses of biology in terms of cell biology.
5. Learn how the development of cell biology has paralleled the developments of technology.
6. Apply critical thinking to the content material of cell biology viz. to recognize consistencies with the principles, to draw conclusions from relevant data, to distinguish correlation from cause-and-effect and to think quantitatively.
7. Establish an awareness of the contributions of cell biology to both our understanding of basic life processes and its utility in medical sciences, and applied biology.
8. Understand the importance of cell biology as a discipline in relation to other biological sciences and human activities.

III. COURSE OUTLINE

Lecture Topic Outline

Orientation:

course requirements and regulations

importance of cell biology in the modern world

examples: AIDS, bioethical issues, careers

Cellular Structure:
Statement of Principle: all livings things are composed of cells; there are two cell types encompassing all living matters.
light microscopy
- resolution and magnification
- sample preparation
- staining
  - positive vs negative
  - simple vs differential
  - immunological staining
- application: diagnosis of tuberculosis during the Nazi occupation of France

electron microscopy
- sample preparation
- major discoveries
  - prokaryotic and eukaryotic cells
  - substructure of organelles
  - cytoskeleton

structure of organisms
- multicellular vs unicellular
- hierarchical structure of multicellular organisms
  - organs > tissue > cells

cellular structure
- description of prokaryotic cell structure - structure & function
- description of eukaryotic cell structure - structure & function

the five kingdom concept
- characteristics of each kingdom
  - prokaryotic vs eukaryotic
  - unicellular vs multicellular
  - modes of nutrition

viruses
- discovery
- composition and structure
- reproduction cycle
- why viruses are considered not to be alive
- examples of important disease-causing viruses
- application: HIV/AIDS virus

A Primer of Cellular Chemistry I - Structural Chemistry
Statement of Principle: living organisms have a unique chemical composition and the chemical nature of living things is important to life functions.
atoms, ions and isotopes
chemical bonds
- weak vs strong

chemical groupings
the molecules of the cell
properties of water
- physical properties consistent with life - hydrogen bonds
- solvent
- acids and bases
  - pH
  - amphoteric substances
  - buffers
- application: definition of "physiological conditions"

carbohydrates

- sugars
- polymers: cellulose and starch/glycogen
- importance of 3D structure of molecules to function

lipids
- type
  - storage lipids: fatty acids, triglycerides, membrane lipids (amphipathic lipids): phospholipids, sphingolipids, glycolipids
  - steroids: hormones and membrane lipids
- application: the lipid vitamins; role of steroid hormones in physiological changes of menopause

amino acids and proteins
- amino acids
- peptide bond and proteins
- protein structure
  - role of weak bonds
  - functions
- application: essential amino acids and vegetarianism, serum proteins and diagnosis

nucleic acids
- mononucleotides
  - structure and functions
- polynucleotides: RNA & DNA
  - structure and functions
- application: nucleic acid is the active portion of viruses

A Primer of Cellular Chemistry II - Cellular Chemical Reactions

Statement of Principle: The major work of cells is chemical work which is catalyzed largely by enzymes and which uses the coupling of certain exergonic reactions to drive equilibria.

reaction types
- condensation/hydrolysis
- polymerization/depolymerization
- group transfer
- redox
- isomerization

bioenergetics
- chemical equilibrium
  - law of mass action
  - 2nd laws of thermodynamics
- free energy and equilibrium
  - exergonic and endergonic reactions
- cellular energetics
  - anabolism/catabolism
  - coupling reactions:
    - phosporyl transfer
    - redox
    - electrochemical gradients
  - energetics of coupling
  - steady state
- energy storage by the cell: short term vs long term
- application: energetics of obesity

enzymes
- review of protein structure
- enzyme function

- catalysis
  - energy of activation
- specificity
  - importance of conformation

property of enzymes
- effects of environmental parameters
- inhibitors
- denaturation

regulation of cellular chemistry through enzymes
- self-regulation
- isoenzymes
- multi-enyme complexes
- gene-regulation

application: diagnosis by elevated enzyme levels and enzymes that are found where they shouldn't be, action of antibiotics

Cellular Membranes

State of Principle: Cells are separated from their environment and are internally compartmentalized by membranes which function to control the chemical composition of the space which they contain.

composition and structure
- lipids
- proteins
- Fluid Mosaic membrane model

cellular locations

transport
- passive
  - diffusion
  - facilitated diffusion
- active
  - primary (simple) pumps and ATP
  - cotransport (secondary pumps) and electrical gradients
- endo- and exocytosis

application: excitable cells; intestinal absorption

Cellular Metabolism

Statement of Principle: The cell uses nutrients to both provide metabolically available energy for doing cell work and to provide precursors for synthesis of cellular components.

three stages of catabolism
- depolymerization: digestion
- glycolysis and fermentation
- Krebs cycle and electron transport (respiration)
  - structure of mitochondria
  - oxidative phosphorylation
    - indirect, chemiosmotic coupling

energetics of the living world - the "big picture"

application: energizing muscle activity, inborn metabolic errors

Receptors

Statement of Principle: Communication within and among cells is accomplished by the recognition of certain chemical messages by specific receptors.

functio and cellular localization

specificity - cellular identification

intercellular communication

cell junctions
tight junction
desmosome
gap junction
eliciting a response
chemical messengers
second messengers
application: flight or fight response, communication across a synapse, "selfness," transplants and the immune system

Cellular Information Processing I - Heredity
Statement of Principle: Cells contain an instruction set in the form of DNA that is passed to succeeding generations.
review of structure of nucleic acids
roles of genetic material
information storage
information transfer within the cell
information transfer from generation to generation
the cell nucleus
genomic structure of viruses and bacteria
nuclear envelope, pore structure and function
structure of the nuclear matrix
chromatic structure
chromosome condensation
heterochromatin and euchromatin
chromosome structure
polytene chromosomes
application: sex determination in amniotic fluid
information transfer from generation to generation
cell division
DNA replication
the cell cycle
amitosis
mitosis
sexual reproduction
meiosis
crossing over - genetic recombination is a way of introducing genetic variation
gametogenesis
fertilization
patterns of inheritance
Mendel's Laws of Inheritance
segregation
independent assortment - leads to genetic variation
alleles and their interaction
dominance/recesive
blending
monohybrid cross
dihybrid cross
sex linkage
linkage and crossing-over
non-Mendelian inheritance
application: genetic diseases

Cellular Information Processing II - Gene Expression

Statement of Principle: The genetic complement of a cell/organism contains genes for the encoding of functional proteins and RNA's, for the control of gene expression and for enzyme placement.

information storage
- what is a gene?
- one gene-one polypeptide concept
  - genes code for the amino acid sequence of proteins
- gene structure
  - genetic code
- application: sickle cell anemia

information transfer within the cell (gene expression_
- transcription
  - the process - RNA polymerase(s)
  - cellular RNA's: prokaryotic vs eukaryotic
    - transfer RNA
    - ribosomal RNA
    - messenger RNA
- post-transcriptional processes
  - excision of introns
  - capping
  - tailing
- translation
  - role of ribosomes and tRNA's (adaptor)
  - amino acyl-tRNA synthesis
  - peptide synthesis
- post-translational processes
  - protein folding
  - protein alteration
    - excision
    - additions
- application: cystic fibrosis: alteration of primary structure of a regulatory protein
- getting proteins where they belong - the endomembrane system
  - at the rough ER
    - signal sequence
  - at the Golgi
    - terminal glycosylation
    - routing of proteins
  - proteins of the nucleus and organelles: concept of precursor proteins
  - ribosome production
- application: Hurler's disease - an enzyme out of place

control of gene expression
- transcriptional control
  - the operon
  - enhancers
  - chromatin and gene expression

review of the genetic processes

mutations
- chromosomal
- gene

application: molecular diseases, DNA fingerprinting

Development

Statement of Principle: Morphogenesis of multicellular organisms involves the specific and programmed control of gene expression in response to both internal and external cues.
definition of development
    embryonic development
        animal embryogenesis
cellular differentiation
    definition
    cell types
    selective expression of genes
    mechanism of differentiation
        cell lineage
        sources of developmental information
            environment
            positional info
            induction by neighboring cells
    transplantation experiments
        determination
application: cancer as aberrant development; the production of antibodies by the immune system as an example of differentiation

Tentative Lecture Schedule (lectures of 60 or 90 minutes duration)
Week # Lecture Topic
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1. Orientation & selection of learning groups
   Explanation of group activities and projects
   Microscopy, Cellular and Tissue Structure of Organisms

2. Cellular Structure of Prokaryotes & Eukaryotes
   Virus Structure

   Class Activity: cell structure drawing - identifying cell parts, function and functional analogs of different cell types; identifying common cellular structures from photos and drawings of various specialized cells.

3. Cellular Chemistry: Atoms and Molecules, Water, Vitamins, Minerals

   Class Activity: Drawing chemical structures, reading the contents labels of common foods and dietary supplements, identifying vitamin deficiencies and therapies from their symptoms.

4. Cellular Chemistry: Lipids, Carbohydrates, Proteins and Nucleic Acids

   Class Activity: Tracking where different important cellular substances occur and function within the cell; discussion of what we actually eat.

   Group Pre-Exam Review Activity: Each group composes exam questions and discusses the correct answers; groups trade question sheets and determine the correct answers.

Exam #1

5. Biological Energetics & Enzymes

Class Activity: Discussion of articles on the therapeutic and industrial use of enzymes.

6. Cellular Membranes and Transport: Membrane Properties, Diffusion & Active Transport

   Class Activity: Understanding neuron function & electrolyte balance. Why is sweat salty?

7. Inter- and Intra-cellular Communication: Cell Junctions and Receptors

   Class Activity: Understanding the role of hormones by explaining reading assignments to each other. Communication across the synapse. Therapeutic use of hormones - what do they do? Why do some cells respond and others do not?

8. Cell Metabolism: Digestion, Glycolysis, Fermentation and Respiration

   Class Activity: Discussion of the role of metabolism in athletic training and obesity and what "oxygen debt" refers to.

   Group Pre-Exam Review Activity: Each group composes exam questions and discusses the correct answers; groups trade question sheets and determine the correct answers.

Exam #2

9. Cell Information Processing: Nucleus Cell Cycle and DNA Replication

   Class Activity: Discussion of nature of cancer, cancer diagnosis and therapy.

10. Cell Information Processing: Meiosis and Mendelian Genetics

    Class Activity: Genetics problems, determination of blood types from pedigree of family blood types. Role playing of genetic counseling.

11. Cell Information Processing: Gene Expression, Post Translational Processes, Regulation of Gene Expression and Mutations

    Class Activity: Genetic diseases and the ethics of gene therapy. Discussion of articles on forensic uses of DNA testing.

    Group Pre-Exam Review Activity: Each group discusses and presents a list of the important concepts; discussion of what questions would address each concept; groups trade questions and determine the correct answers.

Exam #3

12. Developmental Processes: Differential Gene Expression, Germ Layers, Morphological Development

    Group Activity: discussion of teratogenesis; scientific basis of "nature vs. nurture" debate.

13. Immune System: Basic Definitions, B Cell and T Cell Immunity, Development of Immunity, Actions of the Immune System

    Group Activity: Discussion of allergy, examples of immunochemicals in diagnosis and treatment of disease.

14. Modern Medical Practice: Role of Cell Biology Concepts

    Group Activity: Examples of disease diagnosis and treatment - identification of the relevant cell biology concepts, public health practices and disease prevention - cell biological basis.

    Pre-Exam Review: Problems which relate immunity and development with concepts learned early in the course.

Exam #4 and Comprehensive Final

* **Reading assignments** will consist of pages in the text and of non-text material put on reserve in the university library. Each assignment specifically will be indicated on the lecture schedule.

IV. EVALUATION METHODS

1. Lecture Examinations: Four (4) one-hour examinations and a one-hour comprehensive final (fourth examination included with a comprehensive final) will constitute 80% of the final grade. These exams will consist of objective questions and short answer thought questions. Exams in this course are intended to test not only the students retention of material but also the ability to use it to solve problems and to connect concepts.

Note: Make-up examinations will be administered at a time and in a format that is at the discretion of the instructor, but only if the student supplies beforehand an appropriate statement of the reason why an exam must be missed. Such appropriate statements include: notes from practicing physicians and notes from a College Dean.

2. Learning Group Activities: During the first class students will be asked to form themselves into groups of four. These learning groups will carry out several class activities, a semester group project and, we hope, will study together. While these activities will be carried out during class time, they may require some out-of-class preparation. There will be three types of in-class learning group activities.

a. *Lecture Extension Activities*: These are intended to enhance learning of the concepts taught in the lecture portion of the course. Such learning activities include: problem solving, explanation of specific examples to other groups and graphic presentation of concepts. It is intended that such activities will be incorporated into class activities on a weekly basis as the subject matter demands.

b. *Exam Review Activities*: These will take place during the class prior to a major course exam. These activities are intended to draw together all of the concepts and factual material in a particular exam. This will be carried out by within-group activities, interactions among groups and interaction between groups and the instructor.

c. *Applications Activities*: These will take place during the semester as appropriate to the material being taught. The purpose is to reinforce conceps presently being considered with activities related to the applications of the course material to the medical or nutrition fields. The following are examples of activities to be used: reading and discussion of materials from the news media, problems based on medical diagnois and discussion to the ethics of certain medical problems and practices.

Learning groups activities will be graded by both the instructor and the students of a learning group. Twice during the semester, at mid-term and during the last class, each student will be asked to submit a confidential evaluation of the participation of the other members of the group; each student to be graded on a scale of 0 (worst) to 5 (best). The instructor will, at the same time, evaluate the work of each group in a similar manner. The grade of each individual student will be a sum of the grade of the instructor and the average grade of each individual. This group activity grade will constitute 10% of the course grade.

3. Learning Group Project: Each learning group will make a 5 minute presentation to the class concerning an application of a course concept to an area of importance to the students major. This project will constitute 10% of the course grade.

A lottery will be held during the first class to determine the date of each group's presentation; none will be held sooner than four weeks into the semester. The instructor will give the instructions on how to proceed on the group project at this time. Groups will discuss topics of interest among themselves and with the instructor. Task assignments will be negotiated among group members with the advice of the instructor. It is expected that the preparation for each presentation will be composed of the following tasks:

initial feasibility research
preparation of an initial story board
library research
final story boarding
writing the script
preparation of the graphics
actual presentation by one or two group members.

Each presentation will be graded by the entire class on a 0 to 5 scale and by the instructor on the same scale. The grade of each individual student will be the sum of the grade of the instructor and the average of the grades by the class.

4. The course grading scale is expected to be as follows:

90% and above ..... A
80% to 89.9% .....B
70% to 79.9% C
60% to 69.9% ..... D
59.9% and below.....F

This grading scale will be communicated to all students in the course in the course schedule. It is subject to modification based on statistical analysis of actual student performance. Any modifications will be communicated to the students.

Summary of Graded Activities:

Exam #1	16%
Exam #2	16%
Exam #3	16%
Exam #4 (taken at same time as final)	16%
Comprehensive Final	16%
Group Activities	10%
Group Project	10%

REGULATIONS:

. Normal classroom etiquette is required during lectures. Thus, during lectures:

1. There will be no eating or drinking.
2. There will be no wearing of hats.
3. Please try to be on time.
4. If you must leave early or come late, please be seated at the back of the room so as not to disturb your classmates.

V. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READING

Required Textbook:

Curtis, H. and N.S. Barnes. 1989. *Biology, Part I Biology of Cells*. 5th ed. Worth Publishers, Inc., New York.

(There is no text currently available which would exactly serve the needs of this course. Thus this is a tentative choice and will be used only if a more appropriate text does not become available. Other texts which are being considered are:

Mader, S.S. 1992. *Human Biology*, 3rd ed. Wm. C. Brown Publishers, Dubuque, IA. Lewis, R. 1992. *Beginnings of Life*. Wm. C. Brown Publishers, Dubuque, IA.)

VI. SPECIAL RESOURCE REQUIREMENTS

The inclusion of group activities, see above, into the structure of this course will be greatly enhanced by the limitation of the size of each section to 48 students - twelve groups fo four. This, we believe, is the upper limit of class size to allow the instructor time to interact effectively with each individual group. A larger class size will be inhibitory to this interaction by the instructor.

The students of this course are students only of the College of Health and Human Services. Our experience over the last twenty years with the present Cell Biology has led us to conclude that non-Biology majors do not regard this as a course of <u>their</u> major, but a "science requirement" only. But, as stated above, the content of this course is <u>central</u> to their major and will supply a foundation for the life-long learning students will undertake as practitioners. We believe that students taking possession of a course is essential to committed learning. And this is fostered not only by "saying it is so" but also by faculty actions. Thus, we propose that this course be taught outside of Weyandt Hall, on the students' "turf" as it were, in Ackerman, Johnson or Zink Halls.

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