GRANDE PRAIRIE REGIONAL COLLEGE

BI 1070
INTRODUCTION TO CELL BIOLOGY

Instructor:

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Description: All life functions are based on cells, and this course will provide an introduction to cell structure and function. Major topics will include the origin of life, the development of procaryotic and eucaryotic cell lineages, energy conversions, the compartmentation of biochemical functions within a cell and communication from cell to cell. The genetic control of cell activities is examined through methods of molecular genetic analysis and their application in genetic engineering and biotechnology.

Text-books: "Biology" (3rd edition) 1993
Neil A. Campbell
Benjamin Cummings Pub. Co., California

Biology 1070 Lab Manual

Requirements: Since participation in lectures and completion of assignments are important components of this course, students will serve their best interests by regular attendance. Those who choose not to attend must assume whatever risks are involved. In this regard, your attention is directed to the Academic Guidelines of Grande Prairie Regional College.

During the course, both class and laboratory quizzes will be given, some without advance notice.

All assignments must be completed and handed to the instructor by the date specified. Late assignments will not be marked.

Students must attend the laboratory session and complete the exercise in order to recieve credit for lab reports.

Evaluation:

Mid-term exam.....	20%
Lab. assignments.....	15%
Lab. quizzes.....	10%
Final lab. exam.....	15%
Final exam.....	40%
TOTAL	100%

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TOPIC OUTLINE

lecture	topics	text
1	Macromolecules and inorganic constituents.	64-90
2	Origins of living systems:	
	- organic molecules.	64-90
	- early heterotrophs and cyanobacteria.	504-512
		525-526
	- endosymbiosis.	535
3	Taxonomy:	
	- 3 kingdoms.	522-524
	- 5 kingdoms.	512-513
	- nomenclature.	
4	Membrane structure and function:	151-172
	- fluid mosaic model.	
	- permeability and transport.	
	- procaryotic and eucaryotic differences.	
5	Procaryotic cell structure:	516-519
	- cell walls. (Gram +ve, Gram -ve, Archaebacterial)	
	- flagella, pili, fimbriae, capsules.	
6	Procaryotic cell structure:	
	- nucleoid and plasmids.	519-520
	- conjugation (F-plasmids).	357-361
7	Procaryotic growth:	
	- endospores.	520-521
	- binary fission.	222-223
	- colonial growth, growth curve.	
8	Viruses:	345-350
	- structure and replication.	
	- bacteriophage, 'one-step growth curve'.	
	- lytic and lysogenic cycles.	
9	Animal viruses:	350-354
	- budding (enveloped viruses).	
	- host recognition.	
	- viruses and oncogenes.	
	- viroids and prions.	
10	Eucaryotic cell structure:	127-134
	- nucleus, ribosomes, endoplasmic reticulum, lysosomes, vacuoles.	
	- cell wall synthesis.	143

lecture	topics	text
11	Eucaryotic cell structure: - cytoskeleton. - contractility.	136-142
12	Eucaryotic cell structure: - mitochondria, structure and function. - chloroplasts, structure and function.	134-136
13	Energy flow.	173-178
14	Chloroplasts and photosynthesis.	199-212
15	Carbon reduction and photosynthesis.	212-220
16	Aerobic respiration: - Glycolysis. - Kreb's Cycle. - Oxidative phosphorylation.	178-190
17	Eucaryotic anaerobic respiration: - energy utilization. - anaerobiasis. - carbohydrate metabolism.	190-198
18	Procaryotic anaerobic metabolism: - fermentations. - anaerobic respiration. - facultative anaerobes.	190-192
19	Nucleic acids: - composition. - complementary base pairing.	83-90
20	DNA: - transformation. - RNA as a genome.	301-302 357,521
21	Information in DNA: - base pair sequences, genes, proteins. - biosynthetic pathways.	
22	Recombinant DNA - Restriction: - restriction endonucleases. - mapping restriction fragments.	390-415
23	Recombinant DNA - Cloning: - splicing genes into vectors. - expression of cloned genes (selection).	390-415

lecture	topics	text
24	Handling and identifying DNA sequences: - cDNA. - deduction from amino-acid sequences. - PCR, forensic uses.	390-415
25	DNA in the eucaryotic cell: - chromosome organization (histones). - semi-conservative replication.	306-308,373-376
26	Eucaryotic chromosomes in growth: - mitosis. - cell division.	221-239
27	Procaryotic chromosomes and plasmids: - chromosome replication and segregation. - extrachromosomal DNA (plasmids). - consequences of extrachromosomal genes: antibiotic resistance (R-factors), phage-encoded exotoxins.	355-361
28	Transcription: - RNA-polymerase. - processing of mRNA.	316-325 333-335
29	Control in transcription: - positive and negative control sequences.	316-324
30	Genetic code / Protein synthesis: - codon recognition (triplets) - base pair sequence changes (mutations).	316-324
31	Translation: - tRNA and codon recognition. - translation at ribosomal level. - processing of polypeptide chains.	325-331
32	Protein trafficking: - peptide signal sequences, membrane insertion. - post-translation modification and sorting. (rough ER and Golgi) - protein secretion.	331-333
33	Signal transduction: - bacterial chemotaxis. - epidermal growth factor.	519,910
34	Signal transduction: - oncogenes. - second messenger systems: kinase pathway from EGF to nucleus.	354,384-386 912-915

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LABAORATORY OUTLINE

1. INTRODUCTION:
   - laboratory regulations and safety.
   - microscopy using prepared slides to compare procaryotes and eucaryotes.

2. MEMBRANE STRUCTURE AND FUNCTION:
   - effect of temperature and solvent treatment on beet root cores.

3. CELL STRUCTURE:
   - use of prepared slides and live organisms to examine the cellular structure of procaryotes and eucaryotes.
   - bacterial staining: Gram stain, endospore, capsules.
   - isolation of organelles by differential centrifugation.

4. PHOTOSYNTHESIS:
   - measurement and comparison of rates of photosynthesis between spinach chloroplasts and cyanobacteria using different wavelengths of light and DCPIP as an electron acceptor.

5. FERMENTATION AND CELLULAR RESPIRATION:
   - measurement of CO_2 production by *Saccharomyces cerevisiae* (yeast) using different concentrations of sugar and different temperatures.

6. ENUMERATION AND GROWTH CURVES:
   - direct count of yeast cells.
   - plate count of yeast cells.
   - turbidity measurement of yeast cells.
   - growth curves of *Escherichia coli*.

7. DNA EXTRACTION:
   - extraction of high molecular weight sperm DNA.
   - extraction of *E. coli* plasmid DNA.

8. INFORMATION IN DNA:

9. SEQUENCE ANALYSIS AND TRANSLATION:
- detection of ORF's and their translation to proteins.
- crime solving scenarios.

10. TRANSFORMATION AND RESTRICTION:
- transformation of *E. coli* from ampicillin-sensitive to ampicillin-resistant using plasmid DNA from previous week.
- restrict both high molecular weight DNA and plasmid DNA, and visualize it on agarose gel.
- construct a map of the plasmid.

11. LAB. EXAM

BIOCHEMICAL PATHWAYS:
- characterization of *E. coli* strains which carry gene mutations coding for enzymes of the methionine biochemical pathway.