

DEN5121: Biochemistry, Molecular & Cellular Biology

Fall 2020

Course Description:

Topics including structural biology, cellular organization and communication cell division, regulation of metabolic processes and gene structure and function will introduce students to aspects of advanced molecular and cellular biology and associated biochemical processes. These topics are designed to serve as foundation knowledge for courses to follow in later semesters in tissue and organ structure and function, and general pathology.

I. General Information

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Course Credits:	4
Semester:	Fall

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II. Course Goals

The general goal of this course is to provide advanced knowledge concerning the cellular and molecular biology of the eukaryotic cell, along with selected aspects of biochemistry, in order to understand human physiology, nutrition, chemotherapeutics, and biotechnology. The purpose of this course is to provide fundamental information at an advanced level needed by the dental clinician both to appreciate the state of modern biology as well as to better understand the systemic health of his/her patient and the mechanisms of certain key drugs in common usage.

Information learned in this course is intended to augment or reinforce lectures in human physiology, endocrinology, and neuroscience taken concomitantly and to prepare students for additional coursework in microbiology, immunology, pharmacology, and pathology. Examples of obvious dental relevance involving aspects of cellular and molecular biology and biochemistry will be presented to establish the importance of this knowledge database. Current research in oral biology that employs this database also will be presented as further demonstrations of relevance for the modern dental practitioner.

III. Course Overview

This is a lecture based course with integrated topics in health and disease.

IV. Course Outline

A. Structural Biology

1. Bioenergetics and energy carriers in cells
2. Macromolecules fundamental to cell structure and function
3. Chemistry and structure of building blocks of proteins
4. Protein structure and conformation

5. Protein-protein interactions
6. Subunit cooperativity and protein-ligand interactions
7. Enzymes, vitamins, and coenzymes
8. Drugs as enzyme inhibitors
9. Regulation of enzyme function: post-translational modifications and allosterism
10. Nucleic acids and protein-nucleic acid interactions

B. Introduction to Cell Organization

1. General cell structure of prokaryotes and eukaryotes
2. Membrane structure – pro- and eukaryotic

C. Regulation of Metabolic Processes in Nutrient and Energy Management

1. Carbohydrate metabolism
2. Insulin and glucagon signaling
3. Glucose homeostasis
4. Pyruvate and interorgan homeostasis
5. Mitochondrial energy production
6. Dietary lipid and nutrition

D. Special Topics in Health and Diseases

1. Amino acids and urea cycle
2. Nucleotide metabolism
3. Lipid homeostasis
4. Lipoproteins and disease

5. Specialized lipids

6. Integration of metabolism

E. DNA, RNA, and Protein Synthesis

1. Genome organization

2. DNA replication

3. DNA mutation and repair

4. RNA structure and synthesis (transcription)

5. RNA post-transcriptional processing

6. Protein synthesis (translation)

7. Gene regulation

F. Organization of Cells

1. Membrane transport

2. Cell compartmentalization and protein trafficking

G. Cytoskeleton

H. Cell Communication

1. Cell signaling

I. Cell Division and Regulation

1. Mitosis and meiosis

2. Cell division

3. Cell cycle
4. Cancer and apoptosis

V. Course Material

Suggested, optional, additional reading (i.e., the lecture handouts are the authoritative source of information):

Biochemistry, Eighth Edition by Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto, Jr. and Lupert Stryer. Macmillan Education (2015) ISBN-13: 9781464126109

Lehninger, Principles of Biochemistry, Sixth Edition by David L. Nelson and Michael M. Cox. W. H. Freeman and Company (2013) ISBN-13: 978-1429234146

Molecular Biology of the Cell, Fifth Edition by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science; 6th edition

Dental Lib Guide: <http://guides.uflib.ufl.edu/dental>

VI. Course Objectives

All material will be presented in pre-recorded lectures on Mediasite based on the required handouts, which will be augmented by live question-answer teleconferences and pre-exam review sessions on Zoom. Additional resources include the recommended textbooks, selected internet sources, and self-instruction. There will be no laboratory sessions.

The learning objectives for each lecture are:

A. Structural Biology

1. Bioenergetics and Energy Carriers in Cells.
 - a. Develop a rudimentary understanding of bioenergetics – free energy and entropy.
 - b. Distinguish energy carriers such as ATP from non-energy carriers by their chemistry.

2. Macromolecules Fundamental to Cell Structure and Function.
 - a. Describe the role of enzymes as versatile biological catalysts.

 - b. Recognize that a heterogeneous group of proteins are used to transport various metabolites in the cell and in the circulatory system – hemoglobin, lipoprotein, albumin, membrane transporters, and nuclear pores.

- c. Relate the structure of antibody proteins to their function.
- d. Describe how some proteins must be processed before they can function.
- e. Recognize that certain cellular functions require membrane-bound proteins and receptors.

3. Chemistry and Structure of Building Blocks of Proteins.

- a. Recognize the structures and chemical groups of all 20 amino acids.
- b. Describe the significance of chirality and basic chemistry of amino acids such as acid/base, sulfhydryle/disulfide, zwitterion nature, aromaticity, etc.
- c. List unusual amino acids that are important to cell structure and function.
- d. Define buffer, pK_a , pI .
- e. Calculate pH and buffer parameters using the Henderson-Hasselbalch equation.
- f. Describe the significance of physiological buffers.
- g. Describe the peptide bond in terms of structure and conformation.
- h. Define the primary sequence of polypeptides and proteins.
- i. Extrapolate information about primary sequence by end-group analysis, specific enzyme reactions, chemical reactions and sequence analysis.
- j. Describe the significance of naturally occurring peptides as metabolites, antibiotics, hormones and neuropeptides.

4. Protein Structure and Conformation.

- a. Relate the concept of secondary structure to its three principal manifestations: α -helix (amphipathic, electrostatic), β -strands, and "random coil."
- b. Recognize that the arrangement of polypeptides in space is limited by the planarity of the peptide.
- c. Describe α -helix, β -strands, and "random coil" in words and pictures.
- d. Relate the chemistry and energetics of interactions of proteins – H-bonds, covalent, hydrophobic.
- e. Classify the tertiary structure of proteins into a small number of groups.

f. Recognize the folding and unfolding polypeptides in terms of thermodynamic concepts such as the hydrophobic effect.

g. Describe examples of fibrous proteins – keratins and collagen.

5. Protein-Protein Interactions.

a. Explain how the quaternary structure of proteins adds a new dimension to the variety of new proteins and the ability to control their action.

b. Contrast hemoglobin with myoglobin and note the interactions stabilizing hemoglobin.

c. Discuss how local interactions and conformational changes accomplish and change protein/protein interactions.

6. Subunit Cooperativity and Protein-Ligand Interactions.

a. Using hemoglobin as an example, describe how binding of ligands and small effector molecules induce conformational changes in a protein, which in turn change the binding properties of the protein.

b. Create a model for ligand binding.

c. Define cooperativity in terms of ligand binding and conformational changes.

7. Enzymes, Vitamins and Coenzymes.

a. Discuss the theory of enzyme catalysis: activation energy and general rate enhancement.

b. Classify the scheme for enzymes and recognize the logic in these classes.

c. Discuss the chemistry behind the mechanism of action of enzymes.

d. Describe functions of vitamins and coenzymes and that coenzymes are involved in difficult catalysis.

e. Characterize enzyme kinetics using the Michaelis-Menten equation, K_m and V_{max} .

f. Describe and distinguish the active site and the catalytic site of an enzyme.

8. Drugs as Enzyme Inhibitors.

a. Discuss how many useful drugs act by inhibiting specific enzymes.

b. Describe how the effectiveness and mode of action of inhibitors are characterized graphically in categories of competitive inhibition, uncompetitive inhibition and noncompetitive inhibition.

c. Provide some examples of antimetabolites and drugs as inhibitors – penicillinases, protease inhibitors, etc.

9. Regulation of Enzyme Function, Post-Translational Modifications and Allosterism.

a. Describe some of the ways proteins are post-translationally modified – processing, phosphorylation, lipid conjugation, and glycosylation.

b. Relate the concepts of allosterism and cooperativity.

10. Nucleic Acids and Protein-Nucleic Acid Interactions.

a. Describe the structure and basic chemistry of heterocyclic bases and nucleotides.

b. Understand the fundamental chemical structure of DNA

c. Compare the structures of B-DNA, A-DNA and Z-DNA.

d. Discuss the significance of supercoiled DNA and twist.

e. Recognize that although RNA is single stranded, specific and important RNA structures exist.

f. Describe how DNA is organized and condensed by histones into nucleosomes and higher structures.

g. Describe the few structural elements of proteins that interact with nucleic acids: helix-turn-helix motif, leucine zipper, zinc finger, etc.

B. Introduction to Cell Organization

1. General Cell Structure of Prokaryotes and Eukaryotes.

a. Recognize the evolutionary principles that underlie the origin of cells in order to provide a basis for understanding cell organization and function.

b. Recognize the ability of cells to functionally diversify and to spatially and temporally coordinate different functions carried out by different types of cells.

c. Recall microscopic methods that played a pivotal role in the discovery of cells and investigation of cellular and subcellular structure and function.

- d. Demonstrate that eukaryotic cells contain intracellular membrane-bound compartments, termed organelles, that are specialized to carry out individual functions necessary for cell growth and cell division.
- e. Show that eukaryotic cells possess intracellular fibers composed of specific proteins that associate with each other to form long, thin proteinaceous polymers.
- f. Describe the function and processes of the cytoskeleton.
- g. Describe all major components of eukaryotic cells.

2. Membrane Structure: Pro- and Eukaryotic.

- a. Recall the lipid bilayer model for biological membranes.
- b. Describe how proteins may be associated with biological membranes either by direct contact with membrane lipids or indirectly through association with other proteins that directly contact lipids.
- c. Discuss how polypeptide chains of membrane proteins may span the membrane bilayer, or may have a covalently attached non-protein molecule that makes direct contact with membrane lipids.
- d. Identify how membrane lipids are synthesized in the endoplasmic reticulum.

C. Regulation of Metabolic Processes in Nutrient and Energy Management

1. Carbohydrate Metabolism.

- a. Recognize that metabolism represents a "seamless" aggregate of enzymatic and non-enzymatic reactions, not a set of separate pathways.
- b. Describe the role of xylitol as a preventive for caries to illustrate the impact of metabolism on oral bacterial load and dental disease.
- c. Describe and discuss the five major molecular mechanisms used to control individual enzymes and metabolic pathways.
- d. Explain the concept of "division of labor" among specific tissues and cell types and discuss why tissues show specialization with regard to carbohydrate metabolism.

2. Insulin and Glucagon Signaling.

- a. Distinguish hormonal control of carbohydrate metabolism by the pancreatic hormones, insulin and glucagon.
- b. Describe the basis for interorgan glucose metabolism and the tissue specific regulation by pancreatic hormones.

- c. Discuss the molecular mechanism by which cAMP activates a wide variety of serine/threonine kinases through G-protein complexes.
- d. Describe the concept of ADP-ribosylation by cholera and pertussis toxins and the role that it plays in disease.
- e. Contrast serine/threonine phosphorylation control by glucagon with growth factor action, such as insulin, mediated by phosphorylation of protein tyrosine residues.
- f. Illustrate the wide range of cellular events controlled by insulin action.

3. Glucose Homeostasis.

- a. Discuss the concept of the tissue-specific expression of glucokinase versus hexokinase and the relationship to glucose transport into specific tissues.
- b. Describe the cytoplasmic oxidation of carbohydrates and the associated energy production.
- c. Describe the metabolic consequences of aerobic versus anaerobic metabolism.
- d. Distinguish between glucose oxidation and *de novo* glucose synthesis in the liver.
- e. Explain the energetic cost of glucose synthesis from different precursors and the impact on metabolism.

4. Pyruvate and Interorgan Homeostasis.

- a. Describe why pyruvate is a key intermediate that links amino acid, lipid, and carbohydrate metabolism.
- b. Explain the logic and mechanism of inter-tissue glucose and lactate flux from anaerobic muscle during the Cori cycle.
- c. Contrast the anaerobic Cori cycle with the aerobic interorgan flux of glucose and alanine that comprise the Glucose-Alanine cycle.
- d. Describe the oxidation of pyruvate to acetyl CoA, Carbon dioxide, and energy by the pyruvate dehydrogenase complex and outline the regulation of this complex.
- e. Illustrate why excess dietary glucose contributes to fatty acid synthesis and storage.

5. Mitochondrial energy production.

- a. Provide an overview of the aerobic generation of reducing equivalents in the cytoplasm and the mitochondrion.
- b. Explain conversion of reducing equivalents into ATP, CO₂, and H₂O by the pathways of electron transport and oxidative phosphorylation.

- c. Contrast aerobic versus anerobic energy production.
- d. Explain why stored fat, as fatty acids, cannot support blood glucose levels during fasting.
- e. Describe the dynamic complexity of metabolites entering and exiting the citric acid cycle.
- f. Define the single most important regulator of the citric acid cycle.

6. Dietary lipid and nutrition.

- a. Summarize the types of lipids and outline lipid nomenclature.
- b. Describe the mechanisms for digestion and absorption of dietary lipids.
- c. Explain chylomicron synthesis and function.
- d. Discuss disorders affecting absorption of dietary lipid.
- e. Contrast the American diet with the Mediterranean diet.
- f. Contrast omega fatty acids types and their impact on disease.
- g. Explain trans-fats.

D. Special Topics in Health and Disease

1. Amino acids and urea cycle.

- a. Describe protein digestion and amino acid mobilization.
- b. Describe the difference between essential and non-essential amino acids.
- c. Know the pivotal role of amino acids in metabolism.
- d. Describe the urea cycle and the citrulline-nitric oxide cycle.
- e. Describe the general pathways by which excess nitrogen generated from the breakdown of amino acids is converted to urea.
- f. Describe the key regulatory enzymes involved in the regulation of the urea cycle.

2. Nucleotide metabolism.

- a. Outline the general pathways for the biosynthesis of pyrimidine and purine nucleotides.

- b. List key enzymes in the regulation of these pathways particularly in relationship to clinical relevance.
- c. Describe the biochemical basis for the effectiveness of specific antibiotics, anti-tumor, and anti-viral agents in controlling cell growth.

3. Lipid homeostasis.

- a. Describe key reactions and enzymes in fatty acid metabolism.
- b. Outline the types of fatty liver disease.
- c. Describe the synthesis of fat from excess dietary carbohydrate.
- d. Integrate mobilization of stored lipid and contrast oxidation of fatty acids and carbohydrates.
- e. Describe examples of diseases associated with fatty acid oxidation.
- f. Outline the synthesis of cholesterol from basic precursors.

4. Lipoproteins and disease.

- a. Define the different classes of lipoprotein particles, and how they are physically distinguished.
- b. Contrast the organ specific synthesis, life cycle in the blood stream, function, and degradation for each of the major lipoprotein particles.
- c. Describe intracellular cholesterol homeostasis.
- d. Explain the relationship between circulating cholesterol and coronary heart disease.
- e. Describe several ways in which the levels of blood cholesterol can be controlled in patients being treated for high cholesterol and coronary heart disease.

5. Specialized lipids.

- a. Outline the types of membrane-associated lipids.
- b. Describe the determination of blood type.
- c. Describe the pathways, which lead to prostaglandins, leukotrienes, and thromboxanes.
- d. Identify the steps in these pathways that are targets for drug intervention non-steroidal anti-inflammatory drugs (NSAIDS) such as aspirin ibuprofen, and Celebrex.
- e. Outline the function of fat-soluble vitamins and associated diseases.

- f. Define the steroid hormone groups and basic functions.
- g. Describe the biosynthesis of ketone bodies and how they serve as a reserve metabolic fuel.
- h. Discuss the basis for and impact of ketogenic diets.

6. Integration of metabolism.

- a. Describe the three phases of fuel utilization during long-term fasting and explain the tissue interrelationships during fed, fasted, and starved states.
- b. Contrast the hormonal and metabolic changes during long-term starvation and insulin-dependent diabetes (IDDM, Type I).
- c. Summarize the integration of carbohydrate, lipid, and amino acid metabolism using these two metabolic states as contrasting models.

E. DNA, RNA and Protein Synthesis

1. Genome Organization.

- a. Contrast and compare the major features of chromosome organization in eukaryotes and prokaryotes.
- b. Discuss the concept of mobile genetic elements and their roles in infectious disease and generation of antibody diversity.
- c. Discuss the major features of the mitochondrial genome.
- d. Understand the major features of how eukaryotic genomes are packaged into chromatin.

2. DNA Replication.

- a. Understand the macromolecular structure and chemical mechanism of DNA replication.
- b. Describe the basic replication machinery, including its enzymology, directionality, and discontinuous nature on the lagging strand.
- c. Recognize the essential properties of the origin of DNA replication.
- d. Discuss the biological role of telomerase.
- e. Understand the mechanism and therapeutic role of DNA synthesis inhibitors.

3. DNA Mutation and Repair.

- a. Contrast the causes of different types of mutations.
- b. Understand the correlation between mutations and carcinogenesis.
- c. Describe pathways for DNA repair and models of recombination.

4. RNA Structure and Synthesis (Transcription).

- a. Contrast the chemical and macromolecular structure of RNA with DNA.
- b. Discuss the transcription cycle.
- c. Compare genomic organization with regard to prokaryotic and eukaryotic transcription.
- d. Understand the therapeutic role of RNA synthesis inhibitors.

5. RNA Post-Transcriptional Processing.

- a. Compare the general features of RNA structure in prokaryotes and eukaryotes.
- b. Discuss the three post-transcriptional processing steps, as well as their regulation during eukaryotic mRNA biogenesis.
- c. Distinguish the mechanisms of post-transcriptional control including RNA editing, cytoplasmic sequestration, half-life, and antisense RNA.
- d. Describe the role of alternative mRNA splicing in eukaryotic cell function.
- e. Recognize the role of aberrant splicing in disease.
- f. Contrast the post-transcriptional processing of mRNA with ribosomal and transfer RNA.

6. Protein Synthesis (Translation).

- a. Define the three roles of RNA in protein synthesis.
- b. Describe the stepwise formation of proteins on ribosomes.

- c. Recognize how this information defines the concepts of advanced molecular biology.
- d. Understand the therapeutic role of protein synthesis inhibitors.

7. Gene Regulation.

- a. Examine general models for gene regulation in prokaryotes.
- b. Describe features of prokaryotic genome structure in regulating transcription initiation.
- c. Discuss the importance of specific protein – nucleic acid interactions in regulating gene expression.
- d. Contrast the complexity of transcription events in prokaryotes and eukaryotes.
- e. Discuss the regulation of gene expression by hormones in eukaryotes.
- f. Describe methods to analyze gene expression in eukaryotes.
- g. Describe the major features of post-translational processing.
- h. Discuss how post-translational processing is required for compartmentalization of nascent proteins in eukaryotes.

F. Organization of Cells

1. Membrane Transport I.

- a. Distinguish between simple diffusion, passive and active transport, channel and transporter, and primary and secondary active transport.
- b. Compare basic membrane transport characteristics of channels, transporters (carriers, permeases), and ATP-driven pumps.
- c. Contrast uniport, symport, antiport (passive and active mechanisms).
- d. Describe basic properties of the GLUT family of glucose uniporters.
- e. Review insulin regulated GLUT4 function in adipose, striated muscle.
- f. Describe basic properties of SGLT family of Na⁺ glucose symporters.
- g. Review pathway for epithelial glucose transport (GI track and kidney).
- h. Explain basic properties of anion exchange in RBC plasma membrane.
- i. Discuss basic properties of ion channels, including states and gating.

- j. Review functions of channels during skeletal muscle contraction.
- k. Recall regulation of water transport by ADH and aquaporins in kidney.

2. Membrane Transport II.

- a. Recall three classes of membrane ATPases and shared and distinguishing properties.
- b. Explain functions of conformational change and ATP hydrolysis in membrane ATPases.
- c. Explain energy storage in the plasma membrane Na^+ gradient and its use (e.g., symport).
- d. Compare structure and function of F- and V-type ATPases, and give examples of each.
- e. Describe ABC transporter structure and function, including MDR and CFTR transporters.
- f. Relate the cell biology by which cholera toxin induces severe diarrhea and dehydration.
- g. Outline the principles of resting plasma membrane potential and role of K^+ leak channels.
- h. Recount steps, including roles of channels, in regulated insulin secretion from beta cells.
- i. Explain significance of Na^+ channel inactivation in directional action potential propagation.

3. Cell Compartmentalization & Protein Trafficking I.

- a. Demonstrate how proteins contain information within special stretches of amino acid sequence, called signal sequences, that determine which cellular membrane the protein is capable of crossing.
- b. Describe how signal-containing proteins can be transported across a membrane or integrated into the membrane.
- c. Discuss how signal sequences are recognized by specialized protein machinery that are unique to each organelle and that transport polypeptide chains across the organellar membrane.
- d. Outline how specific signals lead to protein targeting to the endoplasmic reticulum, mitochondrion and peroxisome.
- e. Recognize proteins without signals remain in the cytosol.

4. Cell Compartmentalization & Protein Trafficking II.

- a. Outline how nuclear localization and export signals lead to protein targeting to within and outside the nucleus, respectively.

b. Recognize how proteins secreted by cells are transported across the endoplasmic reticulum membrane into the luminal space, which is topologically equivalent to the cell exterior.

c. Describe how proteins in the endoplasmic reticulum lumen are conveyed to the Golgi apparatus.

5. Cell Compartmentalization & Protein Trafficking III and IV.

a. Describe how proteins in the Golgi apparatus are delivered to the plasma membrane by transport vesicles.

b. Describe how plasma membrane form transport vesicles that are internalized by cells.

c. Discuss why the pathway from endoplasmic reticulum to plasma membrane is termed the secretory pathway, whereas the pathway from the plasma membrane to internal cellular compartments is termed the endocytic pathway.

G. Cytoskeleton

1. Cytoskeleton I.

a. Describe the composition and function of microtubules.

b. Recognize that microtubules are polar with "minus" ends associated with the centrosome and "plus" ends positioned near the plasma membrane.

c. Discuss how motor proteins associate with microtubules and hydrolyze ATP in order to generate movement toward the minus or plus end.

d. Describe the composition of cilia and flagella.

2. Cytoskeleton II.

a. Describe the types and arrangements of intermediate filaments.

b. Infer how actin filaments are composed of actin protein monomers that assemble into polar polymers.

c. Recognize that actin filaments associate with proteins that cross-link filaments or anchor them to other cellular structures.

d. Describe how myosin proteins associate with actin filaments and are capable of hydrolyzing ATP to generate movement.

H. Cell Communication

1. Cell Signaling I.

- a. Describe how cells communicate by means of small diffusible molecules that convey information from one cell to another.
- b. Discuss how signaling molecules bind to signal-molecule-specific protein receptors located on the plasma membrane of, or within, target cells.
- c. Identify how receptors occupied by signaling molecules trigger specific intracellular events that affect cell physiology and/or gene expression in a specific manner.
- d. Describe how intracellular signals are propagated by second messengers.

2. Cell Signaling II.

- a. Identify the three main families of cell receptors that are responsible for most cell communication.
- b. Describe how most intracellular signals are amplified and propagated by a serial cascade of enzymatic events.
- c. Discuss how alterations in intracellular signaling pathways can result in pathogenesis.

I. Cell Division and Regulation

1. Mitosis and Meiosis.

- a. Illustrate the cell cycle process whereby cells grow in a stepwise process which separates duplication of genetic material from separation of genetic material into progeny cells.
- b. Describe how mitosis separates cellular components and duplicated genetic material into two progeny cells.
- c. Describe how meiosis produces germ cells with a haploid genetic content for the purpose of sexual reproduction.

2. Cell Cycle Control.

- a. Discuss how progression through the cell cycle is regulated.
- b. Illustrate how progression through cell cycle checkpoints requires the action of a special class of protein kinases that are dependent on cyclin proteins for their enzymatic activity.

c. Describe how the activity of cyclin-dependent kinases is subject to regulatory modulation by a number of kinases, phosphatases, inhibitors, and other metabolic inputs.

3. Control of Cell Number in Multicellular Organisms.

a. Describe how cell growth and number in metazoans is controlled.

b. Discuss how cell growth and number is also controlled by endogenous cellular mechanisms that control cell differentiation, cell senescence, and programmed cell death (apoptosis).

c. Describe how the failure to regulate cell growth and number by exogenous and endogenous mechanisms can lead to cell growth aberrations such as cancer.

VII. Course Competencies

This course contributes to teaching to the following competencies.

- **Domain IV:** Health Rehabilitation – Using universal infection control guidelines and managing the patient’s anxiety and pain, perform procedures and restore the patient to oral health or refer appropriately.
 - **13.:** Prescribe and/or apply clinical and/or home therapies for the management of dental caries and monitor their effect on the patient’s oral health.
 - **16.:** Manage conditions requiring surgical procedures of the hard and soft tissues.
 - **18.:** Diagnosis and manage limited developmental or acquired occlusal abnormalities.
 - **20.:** Manage oral mucosal and osseous diseases or disorders, including oral cancer.

This course teaches to the following competencies in the [*"Competencies for the New Dental Graduate"*](#).

3: Apply biomedical science knowledge in the delivery of patient care.

12: Patient Assessment, Diagnosis, Treatment Planning and Informed Consent: Provide oral health care within the scope of general dentistry to include patient assessment, diagnosis, comprehensive treatment planning, prognosis, and informed consent.

VIII. Evaluation

Missed exams:

Students who are absent from any examinations in this course for reasons other than an emergency (for additional information refer to the Administrative Practices tab in section IX below, A. Attendance), which requires documentation as requested by the course director, will incur a 7% reduction in their grade for that examination. Such students will be required to take the missed examination as soon as possible but no later than 2 business days after their return to class.

Exam #Lectures %Weight

1	11	25
2	12	25
3	14	25
4	14	25

Remediation:

There is no remediation of individual exams.

Students that do not achieve a cumulative percentile score of at least 63.5% (taking into account the 0.5% tolerance, 63.5% is rounded up to a passing grade of 64%) will be awarded an "E" grade, referred to the Student Performance Evaluation Committee (SPEC), and automatically placed on academic probation. The student must meet with the course director to develop a remediation plan within one week of receiving the failing final grade. The remediation activities are at the discretion of the course director and commonly have consisted of an examination that focuses on the area (or areas) in which the student did not achieve a grade of "C" or better during the semester. Faculty are available to assist students preparing for this examination, but the responsibility for learning the material resides with the student. The remedial activity will include no formal instruction. The time and place of the remediation examination will be arranged individually. Please note that if the course director determines that the student failed the coursework to such an extent that remedial activities would be inadequate to attain an acceptable level of academic achievement in the course material, the course director can recommend that the student repeat the course as the remedial activity.

In order to remediate successfully the score of the remediation examination, averaged with the three top regular examination scores, must achieve a cumulative percentile score of at least 63.5%, i.e., a passing grade in the remediation program of "C"; however, the highest grade attainable in a remediated course is a "D." Students failing to satisfactorily complete the remediation program will maintain the "E" grade and be referred to SPEC for consideration for dismissal or retracking. Re-enrollment will be as soon as deemed feasible by the course director in concert with the Associate Dean for Education and the SPEC. The highest final grade attainable when repeating a course in its entirety is an "A." Students failing to satisfactorily complete a course at the second offering will be referred to SPEC for further evaluation and possible action. A failing grade awarded in any course will remain on the permanent record. Any grade achieved after re-enrollment will be listed separately.

"Students are encouraged to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://ufl.bluera.com/ufl/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under

GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.”

IX. Administrative Practices

Administrative practices for all UFCD courses are universally applied. Exceptions to or deviations from these practices are stated in the individual syllabi by the course director. When not individually stated in the syllabus, course administrative practices default to those identified under "Course Policies" on the DMD Student Website:

<https://dental.ufl.edu/education/dmd-program/course-policies/>

X. Grade Scale

DEN5121 Grade Scale

Method	Letter Grade
Scale	100
Tolerance	0.5 (Final letter grades within this range will be rounded up.)
A	93 - 100
A-	89 - 93
B+	84 - 89
B	79 - 84
B-	74 - 79
C+	69 - 74
C	64 - 69
E	0 - 64

XI. Americans with Disabilities Act (ADA)

AMERICANS WITH DISABILITIES ACT (ADA) – STUDENT ACCOMMODATIONS

Students with disabilities requesting accommodations should first register with the Disability Resource Center by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the Assistant Dean of Student and Multicultural Affairs when requesting accommodations. Students with disabilities should follow this procedure as early as possible in the semester.

XII. Privacy Statement

Our class sessions held by live Zoom (question-answer and pre-exam review sessions) will be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.