**University of Minnesota School of Dentistry**

**Course Syllabus**

**BioC 6011 Biochemistry for Dental Students**

**Fall 2017**

**1st Year**

**CONTACT INFORMATION FOR COURSE DIRECTOR:**

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**COURSE PURPOSE**

The purpose of this course is to provide an overview of biochemical pathways and mechanisms. This course also provides preparation for biochemistry sections of dental exams.

**COURSE OBJECTIVES**

* **To understand the molecular components of biochemistry**

Students should understand the building blocks (amino acids, lipids, carbohydrates, and nucleotides) and their assembly into proteins, membranes, RNA and DNA. The shape of a protein determines its function, and variables altering protein structure should be remembered and understood.

* **To understand energy concepts in biochemistry**

Energy in biochemistry can exist as a pH gradient, an electrochemical gradient, a reduced organic molecule or a molecule with high group transfer potential. Students should recognize how these different types of energy can be formed, used and interconverted.

* **To understand catalysis in biochemistry**

Catalysis makes reactions occur more quickly, but does not change whether they are favorable or not. Catalysis involves enzymes and often cofactor, which are usually derived from vitamins. Catalysis is regulated using several strategies.

* **To understand how energy is generated in biochemistry**

Students should understand how biochemistry can use glucose to generate energy both with and without oxygen. Students should recognize that anaerobic fermentation of glucose to lactic acid is the source of acid that causes tooth decay. Students should know the pathways of glycolysis, citric acid cycle and oxidative phosphorylation.

* **To understand how energy can be stored in biochemistry**

Students should understand how energy can be stored as sugars or fats. Students should know the pathways of gluconeogenesis, fatty acid oxidation and synthesis.

* **To understand basic concepts of molecular biology**

Students should know the structure and composition of DNA and RNA. They should be familiar with DNA metabolism (replication, repair, recombination), the genetic code, basic concepts of gene expression and translational control. Students should also understand how defects in DNA metabolism contribute to cancer.

* **To understand the modern ramifications of molecular biology and as they translate into clinical** **technologies used to diagnose and treat human head and neck pathologies**

Students should be familiar with emerging technologies, such as genetic profiling that will likely be part of daily practice in the foreseeable future. They will also be exposed to the basic principles of stem cell technology.

* **To understand basic concepts of signal transduction and their abnormal function in clinical diseases such as cancer**

Students should understand how external stimuli are translated into molecular action. Students will be exposed to examples that are relevant to human health and their profession (e.g., signal transduction in B- and T-cell activation).

**SCHOOL OF DENTISTRY COMPETENCIES ADDRESSED BY COURSE**

**Major competencies addressed in this course:**

1.1 Selecting, obtaining, and interpreting patient/medical data, information and diagnostic images to be able to use these findings to accurately assess and treat patients.

1.2 Formulating a comprehensive diagnosis and treatment and/or referral plan for the management of patients.

1.4 Recognizing the manifestations of systemic disease and how the disease and its management may affect the delivery of oral health care.

1.6 Preventing, diagnosing, and managing odontogenic and non-odontogenic oral diseases and disorders in pediatric, adolescent, and adult patients, geriatric and special needs patients.

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**REQUIRED TEXT AND READINGS**

*Biochemistry,* 7th ed., by Jeremy M. Berg, John L. Tymockzo, Lubert Stryer (Freeman, 2012), *Molecular Cell Biology*, 7th ed., Harvey Lodish et al. (Freeman, 2013)

Course web site:

https://umn.instructure.com/courses/1931

**CREDITS**

4.1 credit hours

**GRADING AND EVALUATION POLICIES**

There are three midterm exams and a final exam. None of the exams are cumulative. Each midterm and the final exam have equal weights of 100 points (400 points is the maximum total). Questions are based on the assigned chapters in the textbook, lecture and handouts. The "things to know” sheets highlight the key concepts for each exam. The writing assignment (worth 80 points) is a 500-word report describing original research in dental biochemistry or molecular biology.

The final course grade will be a letter grade without pluses or minuses based on the total number of points on the four exams and on the writing assignment.

>90% = A

80-89%= B

70-79%= C

<70% = F

**STUDENT EXPECTATIONS**

Students’ evaluation of the course and the participating faculty are considered to be a mandatory requirement for the successful completion of this course and are used to help improve the course each year. Students will be required to complete evaluations on line (using CoursEval) before a grade will be given in this course.

**DISTANCE DELIVERY OF COURSE MATERIAL**

This course offers a comprehensive distance delivery of all course materials discussed in class. All lectures can be viewed as power point presentations, lecture summaries and all additional handouts are available as pfd files. All materials can be found at: <https://ay15.moodle.umn.edu/course/view.php?id=4241>

**GRADE DISPUTES**

Only request for grade changes in writing will be considered (e-mail is ok). State the reason that your grade should be changed. I will consider your request, its fairness to the other members in the class, and give an answer in a few days.

Grade disputes will follow University and SOD policies listed in the student handbook. All grade disputes must first be addressed to the course director.

**REMEDIATION POLICIES**

If you do not take all four exams, you will get an Incomplete. Incompletes are not given because a student is earning a low grade. Before an I grade is given, the instructor and student must fill out an Incomplete Contract, which outlines the conditions for making up the exam. I grades automatically lapse to Fs at the end of the next semester of a student’s registration, unless an instructor submits a grade change. All student failures are reviewed by the Scholastic Standing Committee and the ultimate decision for remediation for students in academic difficulty lies with that committee.

**MAKE-UP EXAM POLICIES**

You must take all four exams. If you miss an exam and have an excused absence from the School of Dentistry Registrar’s Office, then you must make arrangements with the instructor to take a make up exam. Alternately, for an excused absence you may be able to take the midterm exam early. Final exams may not be taken early. All exam time/date changes must be in writing (e-mail is ok) and will be copied to the registrar.

**ATTENDANCE**

**There is a new school attendance policy. Students who are absent from class for a reason other than the 9 Excused Absence categories are responsible for making up any missed class content. Instructors will not offer make-up work (e.g. exams, quizzes, practicals, etc) if a student’s absence is not excused.**

**Class attendance is expected**. Students are responsible for all material discussed in class and all class announcements made in class.

Excused Absence Policy

Student absences from class or clinic may be excused for the following reasons:

1. Illness of the student or his or her dependent\*

2. Subpoenas

3. Jury duty

4. Military service

5. Recognized religious holidays

6. Family emergency

7. Death in the family

8. Participation in School of Dentistry student groups, as approved by a faculty advisor

9. Official school business

Students who plan to be absent due to circumstances identified above must submit a

planned absence request, if possible, to the Office of Student Affairs. Students must

submit requests and notify instructors as far in advance as possible so that instructor have adequate time to make alternative arrangements.

\*In the case of illness, students are required to submit a physician’s note if they are

absent on the day of any graded course component to the Director of Academic Services

& Registrar (Lucy Hartel). Students must also follow the same day absence notification

process for illness. Clinical faculty and administration also reserve the right to request a

doctor’s note for any clinical session absence due to illness.

**If a student is absent on the day of a graded exam or for any of the submission deadlines for the writing assignment for any other reason than the nine listed above, make-up exams/deadlines will not be provided.**

If you are unable to attend class due to a medical or family emergency, you should contact Lucy Hartel, coordinator of Academic Services, Registrar, in the Academic Affairs attendance office at 612-624-3300 or [lhartel@umn.edu](mailto:lhartel@umn.edu).

**STUDENT INTEGRITY**

Per the School of Dentistry Code of Conduct, “academic misconduct is any unauthorized act that may (1) give a student an unfair advantage over other students, (2) interfere with the educational pursuits of others, (3) jeopardize the good name and reputation of the School of Dentistry, (4) involve attempts to mislead, misrepresent, and/or falsify documents, papers, charts, and/or any information given to faculty or administrative officials or (5) place patients under unnecessary risk.” Additional information about acts considered infractions of the code can be found in the School of Dentistry Code of Conduct in the student handbook.

**Academic misconduct is a violation of the School of Dentistry Code of Conduct and will be resolved following the procedures in the code.**

Scholastic misconduct is broadly defined as “any act that violates the right of another student in academic work or that involves misrepresentation of your own work. Scholastic dishonesty includes, (but is not necessarily limited to), cheating on assignments or examinations; plagiarizing, which means misrepresenting as your own work any part of work done by another; submitting the same paper, or substantially similar papers, to meet the requirements of more than one course without the approval and consent of all instructors concerned; depriving another student of necessary course materials; or interfering with another student’s work.”

**Any misconduct may result in failing the course.**

**COMMUNICATION**

All individual and full class communication will be through your University of Minnesota e-mail account. Announcements intended for the whole class may be sent by e-mail. It is a requirement of the course to check your e-mail daily. **While in class, please turn off all pagers and cellular phones.**

**STUDENT ON-LINE PRIVACY AND SECURITY**

Online learning components of this course are password-protected with your U of M internet ID. Moodle technology will sometimes make students' names and U of M Internet IDs visible within the course website, but only to other students in the same class. Since we are using a secure, password-protected course website, this will not increase the risk of identity theft or spamming for anyone in the class. If you have concerns about the visibility of your Internet ID, please contact your instructor for further information.

**DISABILITIES**

The University of Minnesota is committed to providing all students equal access to learning opportunities. Disability Services is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations. Students registered with Disability Services, who have a letter requesting accommodations, are encouraged to contact the instructor early in the semester. Students who have, or think they may have, a disability (e.g. psychiatric, attentional, learning, vision, hearing, physical, or systemic), are invited to contact Disability Services for a confidential discussion at 612-626-1333 (V/TTY) or at [*ds@umn.edu*](mailto:ds@umn.edu). Additional information is available at the DS website [*http://ds.umn.edu*](http://ds.umn.edu).

**MENTAL HEALTH RESOURCES**

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation.  These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities.  University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via www.mentalhealth.umn.edu.  
*Developed and endorsed by the Provost’s Committee on Student Mental Health, June 2006*

**WELLNESS PROGRAM FOR DENTAL STUDENTS**

The Minnesota Dentist Wellness Program offers a consulting and counseling service to help Minnesota dentists and dental student members with the many stressors that impact their lives and their practice of dentistry. Sand Creek is a service offered free of charge to dental students. Help is available by phone 24 hours a day, 7 days a week by call 1-800-632-7643. Face-to-face help is also offered through a counseling and consulting network with over 500 offices in Minnesota.

**APPROPRIATE STUDENT USE OF CLASS NOTES**

Students may not distribute, via internet or other means, instructor-provided lecture notes or other instructor provided materials except to other members of the same class without the express consent of instructor.

**CHANGES MADE IN RESPONSE TO STUDENT FEEDBACK**All lecture materials have been updated. **Lecture notes will only be provided online and no longer as handouts at the beginning of each class.**  Although the writing assignment means considerable extra work for the students, the vast majority enjoyed the assignment and gave us very positive feedback. Thus, this year’s course will have a writing component as well. *Last year, we introduced quizzes and these were extremely well received by the students. We will therefore increase the number of quizzes this year. The quizzes will allow students to collect points that count toward their final grade. Quizzes will be administered through iClickers. 20 quizzes will be offered for a total of 40 points – 20 points will be counted toward your final grade and the remaining 20 points will be counted toward* ***extra credit****. This is a great opportunity to make up for a “bad exam”.*

**FACULTY INFORMATION**

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Professor

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Robert Roon, Ph.D.

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**COURSE TIMES, ROOMS AND LECTURE TITLES FOR EACH SESSION**

**Class time: 10:10 am-12:05 pm in Moos Tower 2-530 Tuesdays and Thursdays**

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| **Day/Date (\* quiz)** | **Lecturer** | **Topic** |
| Thu.  Aug. 31, 2017\* | Bielinsky/Roon | Introduction, Chemical Bonds, Water & pH |
| Thu.  Sept. 7, 2017\* | Roon | Protein Structure and Function |
| Tue.  Sept. 12, 2017\* | Roon | Protein Purification and Characterization |
| Thu.  Sept. 14, 2017 | Dr. J. Rudney | Saliva Proteins (material will be on exam 1) |
| Tue.  Sept. 19, 2017\* | Roon | Enzyme Basic Concepts & Kinetics |
| Thu.  Sept. 21, 2017\* | Roon | Catalytic Strategies |
| Tue.  Sept. 26, 2017\* | Roon | Regulatory Strategies and Blood Clotting |
| Thu.  Sept. 28, 2017\* | Roon | Lipids & Cell Membranes, Channels & Pumps |
| Tue.  Oct. 3, 2017 | Roon | **Exam 1** |
| Thu.  Oct. 5, 2017 | Roon | Carbohydrates |
| Tue.  Oct. 10, 2017\* | Roon/Bielinsky | Metabolism Concepts & Design  **(discussion of writing assignment)** |
| Thu.  Oct. 12, 2017\* | Roon | Glycolysis & Gluconeogenesis |
| Tue.  Oct. 17, 2017\* | Roon | Glycogen Metabolism, Pentose Phosphate Pathway and the Citric Acid Cycle |
| Thu.  Oct. 19, 2017\* | Roon | Electron Transport and Oxidative Phosphorylation |
| Tue.  Oct. 24, 2017\* | Roon | Fatty Acid Metabolism |
| Thu.  Oct. 26, 2017\* | Roon | Biosynthesis of Membrane Lipids and Steroids Nitrogen Metabolism |
| Tue.  Oct. 31, 2017 | Dr. T. Griffin | SPECIAL SEMINAR ON SALIVA PROTEOMICS & DIAGNOSTICS (material will be on exam 3) |
| Thu.  Nov. 2, 2017 | Roon | **Exam 2** |
| Tue.  Nov. 7, 2017 | Bielinsky | Biosynthesis of Nucleotides |
| Thu.  Nov. 9, 2017\* | Bielinsky | DNA Structure & Chromatin  **(first draft writing assignment due)** |
| Tue.  Nov. 14, 2017\* | Bielinsky | DNA Replication, Repair & Recombination  **(peer evaluation of draft writing assignment due)** |
| Thu.  Nov. 16, 2017\* | Bielinsky | Cell Cycle, Oncogenes, Tumor Suppressors & Cancer |
| Tue.  Nov. 21, 2017 | Bielinsky | **Exam 3** |
| Thu.  Nov. 23, 2017 | Bielinsky | **HOLIDAY** |
| Tue.  Nov. 28, 2017 | Bielinsky | RNA Synthesis & Processing |
| Thu.  Nov.30, 2017 | Bielinsky/ Dr. R. Gopalakrishnan | SPECIAL SEMINAR ON BISPHOSPHONATE-INDUCED OSTEONECROSIS (material will not be on exam 4) |
| Tue.  Dec. 5, 2017\* | Bielinsky | Gene Expression in Prokaryotes and Eukaryotes  **(writing assignment due)** |
| Thu.  Dec. 7, 2017\* | Bielinsky | Genetic Code & Protein Synthesis |
| Tue.  Dec. 12, 2017\* | Bielinsky | Stem Cell Biology  Introduction to the Immune System |
| Thu.  Dec. 14, 2017\* | Bielinsky | Membrane Receptors & Signaling |
| Thu.  Dec. 21, 2017 | Bielinsky | **Final exam** |

***Writing Assignment Fall 2017 Bielinsky/Roon***

In addition to providing a foundation for other courses, biochemistry is also essential for understanding dentistry on a molecular level. This writing assignment is to help you see this connection.

**How to complete your report**

1. Find a recent (published in 2016 or later), high quality original research article on a molecular aspect of dentistry. It is required that the article covers molecular aspects of biochemistry and that it is original research, not a review. A good way to find an article is to go the web site of a basic science journal (e.g., Biochemistry, Journal of Biological Chemistry, EMBO Journal, PLoS Biology, PLoS ONE, Proceedings of the National Academy of Sciences) and search with dental keywords. You can check with the instructors (not with the teaching assistant) to make sure your article is suitable. This is required if you want to choose a paper that is not listed as one of the examples that will be presented in class. Alternatively, you can choose a paper that we provide on the course web site.

2. Read the article and identify the hypothesis being tested, its importance, biochemical methods used, and conclusion. You will need to read in textbooks, reviews and other original research articles to reach this understanding.

3. You will write a **500-word** essay in layman terms directed toward your (imaginary) patients. This assay should convey: 1) the central question (hypothesis) of the paper (who did the research? what did they set out to do?), 2) a brief introduction (why is this important?), 3) a brief description of how the research was done (what model system was used? what general methods were used?), 4) what is/are the key finding(s) of the study? and 5) how will the results affect your patients’ life in the future? You will get a maximum of **80 points** (20 for the correct hypothesis and introduction, 20 for methods, 20 for key findings, 20 for future applications). Please avoid technical terms like “citric acid cycle” and use instead “energy metabolism” etc.

4. Write your report and upload your draft online on **Thursday, 9 November 2017 by 10 AM**. DO NOT write your name on the draft. You will evaluate each other’s essays (peer-review) and will provide written comments for your fellow students. The peer-reviewed draft is due **Tuesday, 14 November 2017 by 10 AM**. The final version is due on **Tuesday, 5 December 2017**. **Reports must be submitted before 5 pm to receive credit. Failure to meet the above mentioned deadlines will result in a 10-point score reduction of your final writing assignment. Failure to submit the peer-reviewed draft of a fellow student will also result in a 10-point score reduction of your final writing assignment.**

5. The individual whose name appears on the report must prepare the entire report. No reuse of reports for other classes or of reports from previous years’ students will be accepted. Also, please make yourself familiar with properly citing other people's work (and words). **To adopt wording that is not your own and presenting it as your original work constitutes plagiarism and is a violation of the university's ethic code** (see University of Minnesota Code of Ethics if you are unsure).