Biochemistry 2B03 (2009/10)

Nucleic Acid Structure and Function

Note: The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

Instructors:
Dr. Yingfu Li, Course Coordinator
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Dr. Justin Nodwell, Course Instructor
HSC 4H27C, Ext. 27335, please send email to nodwellj@mcmaster.ca

TAs:
Refat Khan (khanrs@univmail.cis.mcmaster.ca) in charge of topic 1 inquiry
Aisha Shamas-Din (shamasa@mcmaster.ca) in charge of topic 2 inquiry
Bobbijo Sawchyn (sawchybl@mcmaster.ca) in charge of topic 3 inquiry
Iwona Wenderska (wenderi@mcmaster.ca) in charge of topic 4 inquiry
Wendy Mok (mokwk@mcmaster.ca) in charge of logistics, marking tests and exam

Lectures:
Mon., Wed. 8:30 - 9:20 am
Fri. 10:30-11:20 am

Location:
BSB/B136

Course Textbook:
Biochemistry, Garrett & Grisham, 4th Edition or (required).

Course objectives:
Nucleic acids are imperative to the storage and transmission of genetic information within cells. Accurate and detailed knowledge of their structure and function is of prime importance for molecular scientists of all description. Equally importantly, nucleic acids research has been a rich source of discovery and invention that is drastically enhancing our understanding of cells and diseases. In this course, we will examine the structure of nucleic acids, genes, the manner in which DNA is replicated and how its information content is utilized by cells. In addition to conveying the prevailing paradigms in this field, we will discuss how nucleic acids are studied experimentally and how we know what we know about them today. Finally, students will be given opportunities, through examination of very recent primary literature, to learn how our human creativity and imagination has led to numerous important scientific findings in nucleic acids research.
Evaluation:

Test 1: 25%
Wed. Oct. 14, 2009, 8:30-9:20 am. This test will be on the materials covered in lectures 1-12.

Test 2: 25%
Friday, Nov. 13, 2009, 10:30-11:20 am. This test will be on the materials covered in lectures 14-24.

Group Project: 20%
5% will be on attendance and participation, 10% on your answers to the questions, and 5% on presentation. Additional 5% will be awarded for a group selected for class presentation for each topic (upon successful completion of class presentation).

Final Exam: 30%
5% will be the materials covered by Drs. Li and Nodwell, 20% will be on the project assigned, 5% will be on other projects.

Detailed schedule:

Lecture 1, Friday, Sept. 11
Opening of class and general discussion. (Drs. Li & Nodwell).

Lecture 2, Monday, Sept. 14
Nucleotides and nucleic acids 1 (Dr. Li). Ch 10-11

Lecture 3, Wednesday, Sept. 16
Nucleotides and nucleic acids 2. (Dr. Li). Ch 10-11.

Lecture 4, Friday, Sept. 18
Nucleotides and nucleic acids 3. (Dr. Li). Ch 10-11.

Lecture 5, Monday, Sept. 21
DNA replication, recombination and repair 1. (Dr. Nodwell). Ch 28

Lecture 6, Wednesday, Sept. 23
DNA replication, recombination and repair 2. (Dr. Nodwell). Ch 28

Lecture 7, Friday, Sept. 25
DNA replication, recombination and repair 3. (Dr. Nodwell). Ch 28

Lecture 8, Monday, Sept. 28
DNA replication, recombination and repair 4. (Dr. Nodwell). Ch 28

Lecture 9, Wednesday, Sept. 30
DNA replication, recombination and repair 5. (Dr. Nodwell). Ch 28

Lecture 10, Friday, Oct. 2
DNA replication, recombination and repair 6. (Dr. Nodwell). Ch 28

Lecture 11, Monday, Oct. 5
Molecular cloning 1. (Dr. Li). Ch 12.

Lecture 12, Wednesday, Oct. 7
Molecular cloning 2. (Dr. Li). Ch 12.

Lecture 13, Friday, Oct. 9
Transcription 1. (Dr. Li). Ch 29

Lecture 14, Wednesday, Oct. 14, 2009, 8:30-9:20 am
TEST #1.

Lecture 15, Friday, Oct. 16
Transcription 2. (Dr. Li). Ch 29

Lecture 16, Monday, Oct. 19
Lecture 17, Wednesday, Oct. 21
   Transcription 4. (Dr. Li). Ch 29

Lecture 18, Friday, Oct. 23
   Transcription 5. (Dr. Li). Ch 29

Lecture 19, Monday, Oct. 26
   Translation 1 (Dr. Nodwell). Ch 30

Lecture 20, Wednesday, Oct. 28
   Translation 2 (Dr. Nodwell). Ch 30

Lecture 21, Friday, Oct. 30
   Translation 3 (Dr. Nodwell). Ch 30

Lecture 22, Monday, Nov. 2
   Translation 4 (Dr. Nodwell). Ch 30

Lecture 23, Wednesday, Nov. 4
   Translation 5 (Dr. Nodwell). Ch 30

Lecture 24, Friday, Nov. 6
   Translation 6 (Dr. Nodwell). Ch 30.

Lecture 25, Monday, Nov. 9
   Group project time.

Lecture 26, Wednesday, Nov. 11
   Group project time.

Lecture 27: Friday, Nov. 13, 2009, 10:30-11:20 am.
   TEST #2.

Lecture 28, Monday, Nov. 16
   Group project time.

Lecture 29, Wednesday, Nov. 18
   Group project time.

Lecture 30: Friday, Nov. 20 (10 groups, whole day)
   Individual group presentation.

Lecture 31: Monday, Nov. 23 (10 groups, whole day)
   Individual group presentation.
   It is possible that some of you may have scheduling conflicts with other courses. This may
   mean that you may have to skip the other class in order to give your presentation.

Lecture 32, Wednesday, Nov. 25
   Student lecture 1

Lecture 33, Friday, Nov. 27
   Student lecture 2

Lecture 34, Monday, Nov. 30
   Student lecture 3

Lecture 35: Wednesday, Dec. 2
   Student lecture 4
Group project—Self-directed learning:

1. Papers: We have selected four recent research articles that cover a broad range of nucleic acids related topics and techniques as the basis for our group projects. The topics are:

**Paper 1.** Kapil Tahlan, Sang Kyun Ahn, Anson Sing, Tetyana D. Bodnaruk, Andrew R. Willems, Alan R. Davidson and Justin R. Nodwell. Initiation of actinorhodin export in Streptomyces Coelicolor. Molecular Microbiology (2007) 63(4), 951–961. **Five groups (1A through 1E) will be selected for this paper.**

**Paper 2.** Jeffrey M. Skerker, Barrett S. Perchuk, Albert Siryaporn, Emma A. Lubin, Orr Ashenberg, Mark Goulian and Michael T. Laub. Rewiring the Specificity of Two-Component Signal Transduction Systems. Cell 2008, 133, 1043–1054. **Five groups (2A through 2E) will be selected for this paper.**

**Paper 3.** Wendy W. K. Mok, Naveen K. Navani, Courtney Barker, Bobbijo L. Sawchyn, Jimmy Gu, Ranjana Pathania, Rebecca D. Zhu, Eric D. Brown, and Yingfu Li. Identification of a Toxic Peptide through Bidirectional Expression of Small RNAs. ChemBioChem 2009, 10, 238 – 241. **Five groups (3A through 3E) will be selected for this paper.**

**Paper 4.** Tracey A. Lincoln and Gerald F. Joyce. Self-Sustained Replication of an RNA Enzyme. Science 2009, 323, 1229-1232. **Five groups (4A through 4E) will be selected for this paper.**

2. Responsibilities of students

   Each student should sign up for one of the 20 groups. Each student can sign up in ELM and on Sept. 18 at 9 pm sharp (the group sign-up sheets will be released to you at that time). You must sign up by Sept. 23 at 10 pm because the sheets will be closed then and you will be assessed a 5% penalty. You can sign up for a group according to your interest; however, only five groups can select a given paper and each group can only have maximal 8 students. Therefore, you should be prepared to have a second or third choice (please list the 20 groups in order of preference, such as 1A, 2C, 2D, etc., when signing up).

   Each group must select a group leader who will be in charge of group activities, otherwise the instructors will arbitrarily select a group leader. Please e-mail the name and contact information of the group leader (name, email and phone – for emergency use only) to the course coordinator living@mcmaster.ca by Sept 28. A teaching assistant is available to work with students on a given paper and the TA will function as a resource person for guidance.

   Each group needs to work together to answer some questions related to the paper. Some of the questions are technique oriented and others are of problem solving in nature. The answer to many of these questions can only be found from inquiry. Be aware that your written answers will be screened for plagiarism using computer software. Each group should e-mail the course coordinator the written answers to the questions given by Monday, Nov. 30 at 4 pm. Late submissions will be assessed a 5% penalty.

   Each group also needs to put together a 30-minute (± 5 minutes) PowerPoint presentation and present to the TAs and the instructors on Nov. 20/23 at a specific time to be provided later. The presentation will be followed by a short question and answer period to all the members of the group. Each group must hand in a PowerPoint presentation file by 5PM Thursday, Nov. 19 (Electronic files please). Please note that the presentation time to the
instructors and TAs cannot be changed, so when you sign up for a particular group, consider any conflicts with your own schedule. Absolutely no re-scheduling will be given once the groups are set and all members of the groups must attend their presentations.

**Each group must contact their TA to set up two mandatory meetings**, one in October and one in November. These two meetings are required as part of 5% marks on attendance and participation.

Each presentation will be evaluated by two TAs and one instructor on the basis of **clarity**, **creativity**, **accuracy** and **quality** of the presentation. One group will be selected to present each topic to the entire class. The winning group will receive an extra 5% to their final mark. However, each group has to be prepared to give a presentation in a scheduled class during which the competition results will be announced. Everybody must attend all the presentations to the class, even if they are not the presenters. Attendance will be randomly checked, please bring your ID to class.

A significant portion of your final marks (45%) relates to the group project, speaking to its importance. The group project needs a term-long effort and each group should start to work on its project as early as possible. It is everyone’s responsibility to be an active member of your group and to make sure that **YOU ABSOLUTELY UNDERSTAND THE PAPER ASSIGNED AND KNOWS CRUCIAL DETAILS**, in order to do well in the final exam.
Group leaders:

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