

BASIC INFO AND SYLLABUS (2014)

LECTURER: Tim S. Baker, Natural Sciences NSB 4-105, 4-5845, tsb@ucsd.edu

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WHERE & WHEN: Center Hall 113; Tue/Thu 8:00-9:20 am; April 1 through June 12, 2014.

COURSE GOALS

This course gives a broad introduction to the structural biology of viral pathogens. Viruses (sometimes called 'infection machines') are the subject of intense interest in large part owing to their direct impact on human health, the food supply, and environment, but also because they provide an outstanding means to explore and understand fundamental biological processes.

Virus structure has evolved to facilitate all stages of the viral life cycle, beginning with recognition and binding to host cell receptors, uptake, genome release, replication, assembly and maturation of progeny viruses, budding/lysis/release, transmission from host to host, and host defense mechanisms (e.g. immune recognition). Hence, structure lies at the heart of understanding the mechanisms by which viral nano-machines infect cells.

The composition and basic structures of viruses will be discussed. This will include viruses that are deemed simple (i.e. spherically or helically symmetric) to those that are complex or pleomorphic. Overviews of some of the primary methods by which structural information on viruses is derived will be given and include transmission electron cryo-microscopy, three-dimensional image reconstruction, electron cryo-tomography, and X-ray crystallography. Other structural methods such as solution X-ray scattering, X-ray fiber diffraction, NMR, mass spectroscopy, and hydrogen-deuterium exchange may also be mentioned as time permits.

GRADING

The course includes one midterm (150 points), a comprehensive final exam (300 points), and an undetermined number of brief, in-class quizzes (based generally on the previous class lecture or assigned reading for that class). The quizzes might contribute as much as 100 total points towards the final grade. Most quizzes include the potential to earn bonus points.

Students in CHEM 264 or BGGN 264 have the option of giving a 25-30 minute oral presentation in place of or in addition to the final exam. These talks will be scheduled during the last four or five lecture periods of the course. Hence, there are a limited number of slots (≤ 10) for these talks, which are by invitation only (based on performance on the midterm exam). Every student in the class is expected to attend each presentation and fill out an evaluation sheet. You will receive 10 points credit for each evaluation form you complete. Bonus points will likely be awarded to those who complete a critique for every talk given. More details about the oral presentations will be given after the midterm exam.

There are **NO MAKE-UP QUIZZES or EXAMS** in this class. At least one and possibly two of your worst scoring quizzes may be omitted in determining your grade.

CLASS HANDOUTS AND OTHER MATERIALS

Pre-lecture PowerPoint presentations will be posted as PDF files on the UCSD TED website at least 12-15 hours before class and a final version will be posted within a few hours after each class. This should reduce the need to take copious notes during lecture and allow you to listen carefully and concentrate on understanding the principles being presented. Most announcements, including any required reading assignments, will be included in the PowerPoint presentations.

In addition to the PowerPoint slides, reading materials (some required and some optional) will be posted as PDF documents on the class TED web site. These provide important supplements to the lectures and are intended to provide a deeper understanding of the topics covered and discussed in lecture. Material presented in class lectures and in the assigned reading will be the primary sources for formulating midterm and final exam questions.

SYLLABUS (Tentative Topics and Schedule)

| Date(s) | Lec # | Topic(s) |
|---------------|-------|---|
| Apr 1 | 1 | Course introduction and overview; The virus life cycle; Classifications of viruses; Principles of protein primary (1°), secondary (2°), super-secondary, tertiary (3°), and quaternary (4°) structure |
| Apr 3 | 2 | Virus structure: Composition; Principles of icosahedral and helical symmetries; |
| Apr 8 | 3 | Triangulation symmetry; Quasi-equivalence |
| Apr 10 | 4 | Virus structure: Viruses with mixed symmetries; Pleiomorphic viruses |
| Apr 15 | 5 | Virus structure: Naked (non-enveloped) versus enveloped viruses; DNA versus RNA viruses |
| Apr 17 | 6 | Virus structure determination: Basics of transmission electron microscopy (TEM) |
| Apr 22 | 7 | Virus structure determination: Specimen preparation and TEM of viruses |
| Apr 24 | 8 | Virus structure determination: 3D image reconstruction |
| Apr 29 | 9 | Virus structure determination: X-ray crystallography of whole viruses and viral components; VIPER database |
| May 1 | 10 | Virus structure determination: Cryo-electron tomography of viruses; other structural methods for examining viruses |
| May 2 | | Optional help session in preparation for midterm exam |
| May 6 | | Midterm Exam (150 pts) – Covers material through lecture #10 (May 1) |
| May 8 | 11 | Virus assembly and maturation |
| May 13 | 12 | |
| May 15 | 13 | Virus attachment, entry, and genome delivery |
| May 20 | 14 | Virus budding, exit, and transmission |
| May 22 | 15 | <i>Oral presentations by CHEM 264 or BGGN 264 students</i> |
| May 27 | 16 | <i>Oral presentations by CHEM 264 or BGGN 264 students</i> |
| May 29 | 17 | <i>Oral presentations by CHEM 264 or BGGN 264 students</i> |
| Jun 3 | 18 | <i>Oral presentations by CHEM 264 or BGGN 264 students</i> |
| Jun 5 | 19 | <i>Oral presentations by CHEM 264 or BGGN 264 students</i> |
| Jun 9 | | Optional help session in preparation for final exam |
| Jun 12 | | Comprehensive final exam (300 pts) |

OFFICE HOURS: Tuesday and Thursday 9:45-10:45 am in NSB 4-105

Contact Tim Baker or Kristen Walker for appointments at different times.

READ THIS PART VERY CAREFULLY

- Lectures begin **promptly** at 8:00 a.m. and end as close to 9:20 a.m. as possible to maximize the learning experience of all participants. The time allotted to cover concepts that are likely new to many students is very limited. Being seated and ready to proceed at 8:00 a.m. sharp will minimize disruptions and be appreciated by all. As an added incentive for “early birds”, classes will often be preceded by one or more short answer questions (e.g. T/F, or multiple choice, or fill-in blank, etc.) that may be included verbatim or in slightly modified form on a quiz, midterm, or final exam. You may freely discuss these questions amongst yourselves or with the instructor prior to class. They may or may not be posted with the other lecture material on the TED website.
- As obvious as it sounds, come to class well prepared. For example, complete any assigned reading and be ready with questions, especially if something from a previous lecture or in the class notes needs clarification.
- Please turn off all electronic devices (e.g. cell phones, iPhones, iPods, iPads, cameras, etc.) that are **NOT** used for note taking during class. **THANKS !!!**