Course Home Page

- **Password:** pc3267
- Please familiarize yourselves with the information there, especially with respect to the tutorials and other matters
Why is biophysics important?

- Many breakthroughs in biology are based on biophysical principles and techniques. Biophysical techniques continue to play an important role in biological and biomedical science:
  - X-ray, NMR images, Electron microscopy, AFM,
  - Scanning probe microscopy, ...
- To explore physical principles and underlying mechanisms of many phenomena and problems associated with life sciences.
- To assist you to construct the overall picture that at first sight appears to consist of many disconnected facts.
- To establish “physics” thinking - “Does this hypothesis make sense, given what is known about the dynamics of this biological system?”, “Can I obtain a better understanding based on exact physical principles?”
Virus and cell

HIV, SARS
Case: Viral protein

(A)

Target Membrane

HA1

HA2

Fusion Peptide

Viral Membrane

(B)

Target Membrane

HA1

HA2

Fusion Peptide

Viral Membrane

Low pH
Case: SNARE protein

- The protein works like a nanomachine.
- The mechanism is pH, the process is driven by a hydrophilic/hydrophobic force
Fusion peptide

Physics can be applied to examine membrane fusion
Aim of this course

- By delivering general knowledge concerning the basic principles and importance of physics in life sciences, the aim is to establish the interconnectedness of knowledge between human life and activity and basic physics.
- To establish the essential knowledge and practical skills in modern life sciences.
Course Outline

- **Bio-molecular thermodynamics/statistics**
  - First law of thermodynamics; molecular interpretation of thermodynamic quantities;
  - Second law of thermodynamics in biological systems;
  - Statistical complications in modeling macromolecular structure;
  - Molecular mechanics; bonding and non-bonding potentials; stabilizing interactions in macromolecules.
Course Outline

- Biophysical description of Macromolecules
- Physical and structural characteristics of proteins and amino acids
- Physical environment in the cell
- Physical and symmetry relationships between molecules
- Molecular physical interactions and macromolecular structures
What is to be gained at the end of the Course?

- You would be able to obtain essential knowledge of bio-physical principles which play a very important part in many fields of life sciences.
- It will help you take other advanced modules in life sciences related subjects.
- You should be equipped with the basic knowledge/skills to carry out life sciences related research.
Reference Texts: *Compulsory*

- **Biological Physics**, Philip Nelson, W.H. Freeman and Company
  ISBN: 0-7167-4372-8
Reference Texts: *Supplementary*

To Explore...the Underlying Mechanisms of Life Sciences

- Fascinating Modules
- Attractive Experiments
- Exciting Research Opportunities

Biophysics Teaching Web: http://www.physics.nus.edu.sg/%7EBiophysics/
Module Structure/Assessment

Biophysics II (PC3267)

~ 26 Lectures, (2.5 hrs/wk)

~5 Tutorials (10%)

1 Test (10%)

Final Exam (50%)

Short project (10%)

15 hours Experiments (20%)
Term paper/presentation

- To provide the opportunity for you to get in touch with some frontiers in biophysics.
- **Team spirit:** Several (~3) students to work together as a Team
- **Active-learning**
- **Presentation skill**
Project/presentation (cont.)

- Topic:
  - To be chosen by yourself from the list provided in the web.
  - See the web for more details

- Group size: 3 students
- Choose a topic and submit an abstract (~100 words) to me by Feb. 8, 2008
- Carry out readings on this topic, and write a 10-15 page essay and prepare the presentation.
- Deadline of submission: April 11, 2008
Expt Arrangements

- 3 experiments.
- Start at the end of Jan (to be announced).
Term Test & Final Exam

Test: Test – Tue, Mar 4, 2008
  • Venue: S1A-0212

  • Duration: 1 hour (8:15-9:15am).

EXAM
Official Lecture Time

- 1.5 times a week
- Tue, Fri., 8:00-9:30 am, S1A-0212
- Format: Lecturing, and misc/video
Learn Actively During Lectures

- Try to understand the key concepts during the lecture itself, as details can be filled in afterwards.

- Please do not hesitate to stop me to ask questions if things are not clear to you, or if I am going too fast.
Taking Notes

- Just jot down key points, or something that strikes you
- Slides will be made available on the web a few days before each lecture (which you may want to print out beforehand)
Expectations

• Please be punctual for lectures, as missing even a small portion might make it harder to follow at a later stage

• Attendance is very important, as slides will deliberately be kept brief, and only elaborated upon in the lectures

• Students should take the initiative to read up further on the lecture material to enhance their understanding
Contact Information

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