MACROMOLECULAR STRUCTURE

INSTRUCTOR: Nadrian C. Seeman, 1066 Waverly, ned.seeman@nyu.edu

TIME: 5:15 pm - 6:30 pm T, Th

PLACE: Room Silver 512


DESCRIPTION--This is a course on the 3-dimensional molecular structures of biological macromolecules, particularly nucleic acids. The course will emphasize an understanding of the principles involved in the description, elucidation and determination of 3-D structure, and the use of those principles for nanotechnological design.

GRADING--Students will be graded on a written paper based on The Eighth Day of Creation by Horace F. Judson, 1 exam, on an oral presentation of a paper on an assigned topic from the recent literature, and on their contributions to the discussions of the presentations by other students. The relative weights are: Paper, 2; Exam, 3; Presentation, 2; Discussion 1.

Exam Date and Due Dates chosen in consultations with the class.

For the paper, in each of the 3 sections of the book, choose a major example of the prevailing wisdom that was incorrect before the work described was performed. Show the basis of the fallacies and explain the experiments that eventually overturned them. Read the entire book first. Papers that are late or are not spell-checked and grammar-checked will not be accepted. The paper should be about 10 pages double-spaced, not longer. Note that all submissions will be run through turnitin.

LECTURE TOPICS--The following topics will be covered, in the following order as time permits; The first 3 topics will be emphasized and quantitatively tested:

The Description of Structure: Coordinates, coordinate systems, transformations of coordinates, and quantities derived from coordinates, such as distances, angles, torsion angles.

Symmetry: Symmetry of biological molecules, viruses, and crystals, helices, point groups and space groups.

Introduction to X-ray Crystallography: Scattering, Fourier transforms, reciprocal space and resolution. A lot of time will be devoted to this topic.

Components of Macromolecular Structure: Hydrogen bonding, base stacking and hydrophobic interactions, paired interactions, solvent interactions, secondary structures.

Details of Observed Structures: Chemical synthesis of nucleic acids, B, A, Z-DNA helices, RNA helices, tRNA structure, DNA supercoiling, topology, and intercalation.

Introduction to Structural DNA Nanotechnology: Derivation of motifs, sequence design, objects, devices, periodic arrays, relationship to DNA-based computation.