

4: 225

Enzyme Catalysis

Fall 2004

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Lecture: 408 CB Thursday 4:30-5:20 PM

Course Outline

Enzymes are the biological catalysts that direct, control and enhance the chemistry in biological systems. Those catalysts are mostly stereo- and regio-selective and specific. Their catalytic power is typically many orders of magnitude at ambient temperature and pressure. The structure and properties of protein and RNA enzymes will be studied. We will deliberate examples of enzymatic mechanisms and compare them to organic and inorganic catalytic processes. We will discuss the chemical and physical basis of their action, and how this understanding is used in the medical and chemical industries. For each topic, a variety of experimental methods and theoretical approaches will be presented. Practical and critical reading of recent literature will be exercised. Several investigators from the University's staff will present advances in their current research. The course material will be developed from text books and from recent journal articles. A list of topics is enclosed. There will be one midterm examination and a term paper in the form of an independent research proposal (in place of a final exam). The proposal will be presented orally to the class.

Principal Text: "Structure and mechanism in protein science" Fersht A.
(W.H. Freeman and Company. 1998.) ISBN 0-7167-3268-8

Recommended Text: "Mechanism in protein chemistry" Kyte, J.
(Garland Publishing, Inc. 1995) ISBN 0-8153-1700-X

"Biochemistry" 4th ed, Stryer, L.
(New York : W.H. Freeman, c1995) ISBN 0-7167-2009-4

"Catalysis in Chemistry and Enzymology" Jencks W.P.
(Dover, 1987)

Course Requirements:

Grading will be divided as follows:

Midterm quiz:	35%
Abstract:	20%
Class presentation:	45%

Course Policies: It's a graduate level course, meaning you are here because you are interested. The more you participate, the more you get out of it. Asking questions and reading the referred literature is highly encouraged.

Topics

- * Chemical and biological catalysis.
 - The absolute rate theory
 - Principles of catalysis in chemistry and biology
 - Catalytic strategies
- * Enzyme kinetics.
 - Introduction to kinetics (Steady state kinetics and pre-steady state kinetics)
 - Inhibition patterns as a mechanistic tool
 - Isotope effects
- * Protein folding, structure and dynamics
 - From amino acids to three dimensional structure of proteins
 - Methods for determination
 - Concise review of protein folding
 - Protein dynamics-activity relationship
- * Special Topics (tentative list):
 - Posttranslational and chemical modifications.
 - Metals and electron transfer
 - RNA catalysis
 - Catalytic antibodies
 - Extremophiles
 - Cofactors
- * Mechanistic examples.
 - Recent examples - the evolution of understanding mechanisms
 - Guests research talks
- * Students presentations.