

CHEM 529

Enzyme and Coenzyme Mechanisms
Instructor: Professor Anthony S. Serianni
Fall 2014
October 13 - November 10
8:00 – 9:15 AM MWF
322 Jordan

Course Topics

This course focuses largely on fundamental principles of chemical reactivity as applied to biological systems. Functional group reactivity, reaction stereochemistry, core biochemical transformations, the structure/chemistry/biochemistry of the major coenzymes, coenzyme reactivity exploited by specific enzymes, and general enzyme mechanisms are treated in molecular detail. Course emphasis lies in the discovery of underlying chemical themes that underpin the behaviors of living systems, with the expectation that this knowledge will inform studies in other subfields of biochemistry, such as macromolecular structure/function and molecular metabolism.

Supporting Text

Perry A. Frey and Adrian D. Hegeman, *Enzymatic Reaction Mechanisms*, Oxford University Press, 2007. ([see Handout 1](#))

Supplemental Texts

D. Voet and J. G. Voet, *Biochemistry*, 4th Edition, Wiley, 2011.

T. D. H. Bugg, *Introduction to Enzyme and Coenzyme Chemistry*, 2nd Edition, Blackwell Publishing, 2004.

R. B. Silverman, *The Organic Chemistry of Enzyme-Catalyzed Reactions*, Academic Press, 2002.

J. McMurry and T. Begley, *The Organic Chemistry of Biological Pathways*, Roberts and Company Publishers, 2005.

H. Dugas, *Bioorganic Chemistry - A Chemical Approach to Enzyme Action*, 3rd Edition, Springer, 1996.

M. H. Saier, Jr., *Enzymes in Metabolic Pathways*, Harper & Row, 1987.

Syllabus (10 lectures)

Power Point slides will be sent by email on an as-needed basis to students enrolled in the course. These slides contain essentially all of the material you will need in the course. If you wish, you can supplement this in-class material by reading appropriate sections of the texts listed above. It may also be helpful to review basic organic chemistry, since the discussions of coenzyme reactivity and mechanisms of enzyme-

catalyzed reactions focus heavily on the reactivity of organic functional groups in the enzyme and the coenzyme.

The general sequence of topics to be discussed is as follows (the indicated dates are only approximate – we will move at whatever pace circumstances dictate):

October 13: reactive/functional groups in organic and biochemistry; hydrolysis of biological phosphates; classes of biochemical reaction intermediates and transition states

October 15: nicotinamide coenzymes

October 17: flavin coenzymes

October 27: biotin and vitamin B₁₂

October 29: pantothenic acid/acetyl CoA and lipoic acid

October 31: pyridoxal phosphate

November 3: tetrahydrofolate coenzymes

November 5: thiamine pyrophosphate

November 7 & 10: Overflow; possibly discussion of additional enzyme mechanisms if time permits (representative aldolases, proteases, glycosidases, kinases)

Testing and Grading

1. Assignment 1 – Take Home (Collaborative, Open-Book), Friday, October 17, 2014. Due Date: Tuesday, October 28, 2014. **(10 points)**
2. Assignment 2 – Take Home (Collaborative, Open Book), Wednesday, October 29, 2014. Due Date: Thursday, November 6, 2014. **(20 points)**
3. In-Class Quiz: Monday, November 3, 2014. **(10 points)**
4. Assignment 3 – Take Home (Non-Collaborative, Closed Book), Friday, November 7, 2014. Due Date: Tuesday, November 11, 2014. **(40 points)**
5. Assignment 4 – Take Home (Non-Collaborative, Open Book), Wednesday, November 12, 2014. Due Date: Monday, November 17, 2014. **(20 points)**