

CHEMISTRY 5694, Winter 2006

Special Topics in Organic Chemistry: Essentials of Carbohydrate Chemistry

Instructor: Professor Alexei V. Demchenko

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Lecture: MW, 6:55-8:10 PM; B451 Benton Hall

Office Hours: MW, 5:30-6:45 PM or by appointment

Textbook/Supplies: Thisbe K. Lindhorst "Essentials of Carbohydrate Chemistry and Biochemistry", 2nd Ed., Wiley-VCH, 2003.

Credit: 3.0

Ref#: 46606

CHEMISTRY 5694 is the lecture course that welcomes you to the exciting world of carbohydrate chemistry, the chemistry of living tissue, the science that covers multiple aspects of modern organic, synthetic, medicinal, pharmaceutical, biological, and computational chemistry.

For many years, carbohydrates had been ignored by both pharmaceutical industry and academia most likely due to underestimation of the biological activity of this class of natural compounds. Many of you are familiar with the role of carbohydrates as energy sources (sugar, cereal, potato, celery for nutrition or wood as a source of heat) or structural components (elasticity of joints, cell wall constituents). These early considerations have been slowly refocused to the fact that carbohydrates have other vital biological functions, as well as tremendous therapeutic and diagnostic potential!

It appears that complex carbohydrates (oligosaccharides, glycoconjugates) are involved in most cell functions: they give shape to cells and, therefore, organs, they identify cells by providing unique chemicals (antigens) on cell surfaces. Carbohydrates act both as receptors for signals from outside the cell and as signals for themselves, they also provide the energy reserves and currency of cells. As these processes are understood and mastered, and the structures of complex carbohydrates are elucidated, some diseases will be conquered and clinical therapies invented or improved (examples: outer shell of the AIDS virus is covered with carbohydrates, many types of tumor cells produce unusual carbohydrate sequences, skin disorders, various infections *etc, etc, etc*).

During the lecture course, you will not only learn major tools that allow chemists to synthesize or modify carbohydrate molecules, but also design the multi-step syntheses of complex natural carbohydrates. You will also have an opportunity to define novel carbohydrate structures responsible for some kind of a biological/medical process/disorder, plan their synthesis, tell your colleagues about your findings, as well as defend your work in a real world atmosphere.

Syllabus - CHEMISTRY 5694, WINTER 2006

(subject to modification)

Lecture #1-3. Jan 18, 23, 25
Introductory aspects of the subject (occurrence, nomenclature, biological roles, therapeutic potential)

Lecture #4-6. Jan 30, Feb 1, 6
Protecting groups (classes, strategies, applications)

Test #1 Feb 8

Lecture #7. Feb 13
Reactions at the anomeric center, an overview

Lecture #8-12. Feb 15, 20, 22, 27, Mar 1
Formation of a glycosidic linkage (methods, approaches, principles)

Test #2 Mar 8

Lecture #13-15 Mar 13, 15, 20
Oligosaccharide synthesis (strategies, conditions, applications)

Lecture #16 Mar 22
Enzymatic synthesis

Lecture #17,18 Apr 3, 5
Carbohydrates as chiral synthons

Lecture #19 Apr, 10
Methods for carbohydrate analysis (NMR, mass-spectrometry, polarimetry, Dionex)

Lecture #20, 21 Apr 12, 17
Glycoconjugates (types, classes, properties, synthesis)

Test #3 Apr 19

Lecture # 23-26 Apr 24, 26, May 1, 3
Student presentations (three per section: 20 min + 5 min for questions each)

(please note that there is no class on Mar 6, 27, and 29)

Grades: Your final grade will be based on your accumulated point total on 700 point scale as follows: Exam 1-3 – 150 p each (450 total), student presentation 125 p, attendance 125 p.