

**SPECIAL TOPICS IN ORGANIC CHEMISTRY  
(CHM 9221-030, CRN 12097)  
CARBOHYDRATE CHEMISTRY  
Summer 2013**

**Time and Location:** Mondays and Wednesdays 6:00 - 8:00  
Room 260 Mendel Science Center

**Instructor:** Dr. Robert M. Giuliano, robert.giuliano@villanova.edu, 300D Mendel

text: Robert V. Stick and Spencer J. Williams, *Carbohydrates: The Essential Molecules of Life*, Elsevier, 2009

<u>Class Dates</u>	<u>Topics</u>	<u>Text Chapters</u>
5/29	<b>Introduction and overview.</b> Course content and objectives. Carbohydrates in chemistry, biology, and medicine.	1, 9 (handout)
6/3, 6/5	<b>Carbohydrate structure.</b> Definitions and structural representations, nomenclature, configurational relationships, cyclic and acyclic forms, mutarotation, conformation, the anomeric effect. Physical measurements, NMR spectroscopy.	1
6/10, 6/12, 6/17, 6/19, 6/24, 7/1, 7/3	<b>Synthetic organic chemistry of carbohydrates</b> <b>Part I. Monosaccharide functionalization.</b> Protecting groups, acetal formation and cleavage, methyl glycosides, oxidation/reduction, halogenation, unsaturated sugars, glycals, amino sugar and other carbohydrate components of antibiotics, branched-chain sugars, chain extension.	2,3
6/26	In-class exam	
7/8, 7/10, 7/15	<b>Synthetic organic chemistry of carbohydrates</b> <b>Part II. Formation of the glycosidic linkage and oligosaccharide synthesis.</b> General principles, glycosyl donors, orthogonality, neighboring group participation, solid phase methods, C-glycosides, glycosyl radicals.	4,5
7/15	<b>Disribute take-home assignment. Due 7/22</b>	

7/17, 7/22	<b>Asymmetric synthesis. Glycobiology.</b> Carbohydrate reagents and starting materials, Glycomimetics, enzymatic reactions, cell-surface carbohydrates,	7,12 (handout)
7/24, 7/29	<b>In-class presentations</b>	

Course Coverage and Objectives: This course emphasizes the organic chemistry of carbohydrates. Students will gain an appreciation and working knowledge of the structure and reactivity of carbohydrates, with exposure to current synthetic methodology. Many reactions that you are familiar with will be covered in the context of carbohydrates, as well as reactions that are little known outside the carbohydrate field. Topics will include structure and stereochemistry of carbohydrates, synthetic organic chemistry of carbohydrates, oligosaccharide synthesis, carbohydrates in asymmetric synthesis, methods of structure determination, and other topics. Examples of research papers from the broad literature of carbohydrate chemistry will be included.

Prerequisites: A year of undergraduate organic chemistry is necessary, in particular the chapters on the chemistry of alcohols, aldehydes and ketones, and carbohydrates. A semester of organic chemistry at the graduate level is recommended but not required.

<u>Grading:</u>	In-class exam	50 points
	Take-home exam	50 points
	Presentation	50 points

### **Guidelines for Research Paper Presentation (50 points total)**

#### **I. In-Class Presentation (35 points)**

This assignment requires you to present a paper at the board during class. The paper will be given to you; however, you may use one of your own if you have your instructor's approval. The topic will be some facet of carbohydrate chemistry. You may use a few overhead transparencies if you like, or just use the board. The presentation should be informal, typical of what you would give at a research group meeting, so we won't use PowerPoint. If you decide to use transparencies, please make a copy and distribute them before class.

In preparing your talk, consider the following:

Be sure to list the title of the paper and authors at the start of your presentation.

What was the goal of the authors' research? If their main goal was the synthesis of a specific target, what is the significance of the target? If the goal was more related to

methods development, what is the importance of the method? It's scope and limitations?

Include appropriate background information. If a key starting compound in a synthesis is cited without further details as to its origins, you may need to look up the paper that describes its preparation. Other background information should be included to the extent that you feel it is necessary to understand the paper.

How does the authors' work fit into a context established by prior and current work in the area? It's important to acknowledge prior work that may have had a large influence on the study you are presenting. Were any problems or difficulties in the authors' approach, and if so, how were they resolved?

The overall talk should be about 20 -25 minutes in length, to leave time for questions at the end.

## **II. Written Summary (15 points)**

Prepare a two-page summary of the research, highlighting some of the key points mentioned above. The purpose of this is to describe the essence of the paper in a clear, succinct way. Use ChemDraw or similar software to prepare any figures.