Florida State University

CHM 5555

Chemical Reactivity

Instructors (Office): **Greg Dudley (5007 CSL), Al Stiegman (3004 CSL), Mike Shatruk (2001 CSL)**

Office hours: Open-door policy, or by appointment

Lecture: MWF 11:15am-12:05pm, HTL 219

Course Materials: Recent reviews and highlight articles in journals such as Chemical Reviews, Angewandte Chemie, Journal of the American Chemical Society, Nature, Science, etc. Other course materials will be provided as appropriate.

Grading: 30% Homework
30% Literature Presentations
40% Module Examinations

Grades will be assigned based on a standard scale (A/A- = 100-90%; B± = 89-80%; C±=79-70%; etc...), normalized as appropriate based on course content and instructor expectations.

Course Description: This course covers fundamental concepts underlying chemical reactivity, including various types of reactions and factors that govern the rate and course of chemical processes. Students will reexamine fundamentals of kinetics and thermodynamics, which will form the basis for the follow-up study of organic, inorganic, and organometallic reactivity.

Course Objective: At the end of the course, the student will be able to explain the thermodynamic and kinetic factors that govern the course of chemical reactions; discuss most important mechanisms of organic and inorganic reactions; elaborate on the role of chemical reactivity as applied to the cutting-edge research examples drawn from the top journals in the field of chemical sciences.

Course Content:

I. Bioorthogonal chemistry: organic reactions in living systems

1. Rationale and design parameters
2. Bio/organic functional group behavior
3. Kinetic v. thermodynamic reactivity considerations
4. *Module exam*

II. Reaction dynamics: kinetics and mechanisms

1. Elementary and complex reactions
2. Rate laws
3. Thermochemical kinetics
4. Gas-phases reactions: transition state theory
5. Photochemistry
6. Heterogeneous catalysis
7. *Module exam*

III. Matter and energy conversion: picking up where nature leaves off

1. Molecular orbital theory for transition metal complexes
2. Organometallic reactivity in small-molecule activation
3. Redox reactions and artificial photosynthesis
4. Molecular design for solar energy conversion
5. *Module exam*

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University Attendance Policy: Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

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Academic Honor Policy: The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout this process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "…be honest and truthful and … [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at http://dof.fsu.edu/honorpolicy.htm).

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Americans with Disabilities Act: Students with disabilities needing academic accommodation shoud:

(1) register with and provide documentation to the Student Disability Resource Center; and

(2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request.

For more information about services available to FSU students with disabilities, contact the Student Disability Resource Center, 874 Traditions Way, 108 Student Services Building, Tallahassee, FL 32306-4167, TEL: 850-644-9566 (voice), 850-644-8504 (TDD); email: sdrc@admin.fsu.edu; Web Site: http://www.disabilitycenter.fsu.edu/.

Syllabus Change Policy: Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

Florida State University

CHM 5555, Part 1

Bioorthogonal Chemistry

Instructors (Office): **Greg Dudley (5007 CSL)**, Al Stiegman (3004 CSL), Mike Shatruk (2001 CSL)

Office hours: Open-door policy, or by appointment

Lecture: MWF 11:15am-12:05pm, HTL 219

Module Materials: The Special Issue of *Acc. Chem. Res.* on Bioorthogonal Chemistry (**2011**, *44*, issue 9) will figure prominently in this module, as will the 2010 Special Issue of *Chem. Soc. Rev.* on Click Chemistry (**2010**, *39*, issue 4). Other content will be distributed as appropriate.

Grading: 30% Homework
30% Literature Presentations
40% Module Examinations

Expectations: I expect everyone to come to class each day on time, well rested, fully prepared (having completed the assigned readings), ready to enhance their understanding of organic reactivity.

Homework: Most homework will take the form of pre-class readings and activities designed to prepare you for the lecture content. Completion of these activities will be evaluated by several measures, including in-class quizzes.

Presentations: Each student will make a brief (10-15 min) presentation on a special topic of relevance to his/her particular interests and the overall module goals. Topic ideas will be provided, and suggestions are welcome.

Content Outline:	**HW and assigned readings**
1. Introduction to bioorthogonal chemistry	video, ACR651, CSR1231
2. Application: in vivo detection of reactive oxygen species (ROS)	ACR793
3. Application: glycobiology and mapping the glycome	video+, CSR1272
4. Introduction: native chemical ligation (NCL) and fluorescent proteins (FPs)	ACR677,752,784
5. Fundamentals: tracking organic reaction mechanisms using electron arrow-pushing	worksheet
6. Tools: “click chemistry”	CSR1231,1252,1355
7. Tools: metal-free click chemistry	ACR666,805,816
8. Tools: light-activated “photo-click” reactions for bioorthogonal coupling	ACR709,828
9. Application: strategic protein modification	ACR654,718,730,742,762,774
10. Application: protein–lipid interactions	ACR686,699
11. Student presentations (through the module)	(student’s choice)
12. Module exam	