

Semester at Sea, Course Syllabus  
Colorado State University, Academic Sponsor

**Voyage:** Fall 2016

**Discipline:** Chemistry

**Course Number and Title:** CHEM 103 Chemistry in Context (Section 1)

**Division:** Lower

**Faculty Name:** Marc Zimmer

**Semester Credit Hours:** 3

**Prerequisites:** (none)

### **COURSE DESCRIPTION**

CHEM 103 is for non-science majors needing only one semester of chemistry. It is an introduction to important chemistry concepts that underlie topics relevant to our ports of call, as well as global issues directly impacting you and the rest of humanity. Critical thinking skills will be combined with chemical principles, covered on a need-to-know basis, to enable you to make informed decisions about significant science-based issues that are facing all of us.

### **LEARNING OBJECTIVES**

#### **To understand**

- (i) some of the technological problems facing modern society and the chemical contexts of those problems;
- (ii) and be able to implement the process used by scientists to form reliable conclusions about the world we live in;
- (iii) the relations between chemistry and the other scientific disciplines;
- (iv) the important role that mathematics plays as the language for discovering and describing new things about the natural world;
- (v) chemical principles about atoms, molecules, and compounds, and the changes they undergo.

### **REQUIRED TEXTBOOKS**

There is no required textbook. All required materials will be available from the classes' website. You will be asked to read portions of the journal articles referenced in the topical outline of the course given below. In teaching the class I will use my own notes and supplement them with material from

- Catherine Middelcamp, Chemistry in Context: Applying Chemistry to Society, McGraw-Hill Education; 8th edition, 2014.
- Colin Baird, Michael Cann, Environmental Chemistry, W.H. Freeman, 5<sup>th</sup> Edition, 2012.
- Marc Zimmer, Illuminating Disease: An Introduction to Green Fluorescent Proteins, Oxford University Press, 2015.

### **TOPICAL OUTLINE OF COURSE**

Depart Hamburg—September 10

**B1—September 13:** Atomic structure

**B2—September 15:** Nuclear Rxns,  $E=mc^2$ ,

**B3—September 18:** Nuclear Power

Athens—September 19-23

**B4—September 25:** Chernobyl and effects on Greece

**Associated Reading:**

Atwood, C. H. (1988) Chernobyl - What Happened, *Journal of Chemical Education* 65, 1037-1041.

Kritidis, P., and Florou, H. (2001) Radiological impact in Greece of the Chernobyl accident - A 10-Y retrospective synopsis, *Health Physics* 80, 440-446.

Civitavecchia: September 26-38

Livorno: September 29-30

**Field trip September 30: Museo Galileo and the International Laboratory for Plant Neurobiology.**

**B5—October 2:** Water (elements, periodic table, hydrogen bonds)

Barcelona—October 3-7

**B6—October 9:** Why is water so important in Morocco? Drinking Water , Sea Water, Hydrothermal Vents

Casablanca—October 10-14

**B7—October 16:** Toxicology

**B8—October 18:** Persistent organic pollutants - recycling old computers and ships on the African West coast

**Associated Reading:**

Brevik, K., Gioia, R., Chakraborty, P., Zhang, G., and Jones, K. C. (2011) Are Reductions in Industrial Organic Contaminants Emissions in Rich Countries Achieved Partly by Export of Toxic Wastes?, *Environ Sci Technol* 45, 9154-9160.

**B9—October 20: Test**

Dakar—October 21-24

**B10—October 26:** Bonds

**B11—October 29:** Electromagnetic radiation, spectroscopy

**B12—October 31:** Climate change and deforestation in Brazil

Salvador—November 1-6

**B13—November 8:** Climate change and consequences for Panamanian islands

**B14—November 10:** Bioluminescence in the Caribbean

**Associated Reading:**

Widder, E. A., and Falls, B. (2014) Review of Bioluminescence for Engineers and Scientists in Biophotonics, *Ieee Journal of Selected Topics in Quantum Electronics* 20.

**B15—November 12:** DNA, Proteins, Enzymes

Port of Spain—November 13-14

**B16—November 16:** Dengue and Zika in the tropics

**Associated Reading:**

Harris, A. F., Nimmo, D., McKemey, A. R., Kelly, N., Scaife, S., Donnelly, C. A., Beech, C., Petrie, W. D., and Alphey, L. (2011) Field performance of engineered male mosquitoes, *Nature Biotechnology* 29, 1034-U1109.

**B17—November 19:** Test

**B18—November 21:** Biofluorescence, Green Fluorescent Proteins

Callao—November 22-26

**B19—November 28:** Bioinorganic chemistry, hemoglobin

**B20—November 30:** Malaria and Central America

**Associated Reading:**

Greenwalt, D. E., Goreva, Y. S., Siljestroem, S. M., Rose, T., and Harbach, R. E. (2013) Hemoglobin-derived porphyrins preserved in a Middle Eocene blood-engorged mosquito, *Proceedings of the National Academy of Sciences* 110, 18496-18500.

Guayaquil—December 1-4

**B21—December 6:** Chagas Disease in Central America

**Associated Reading:**

Hotez, P. J., Dumonteil, E., Woc-Colburn, L., Serpa, J. A., Bezek, S., Edwards, M. S., Hallmark, C. J., Musselwhite, L. W., Flink, B. J., and Bottazzi, M. E. (2012) Chagas Disease: The New HIV/AIDS of the Americas, *PLoS Negl Trop Dis* 6, e1498.

**B22—December 8:** Calcium imaging, heart disease

Puntarenas—December 9-13

**B23—December 15:** Mining in Peru, brain disease

**B24—December 17:** Action Potentials, Optogenetics

**Associated Reading:**

Hegemann, P., and Nagel, G. (2013) From channelrhodopsins to optogenetics, *Embo Mol Med* 5, 173-176.

No Classes—December 18

**A25—December 20; A Day Finals**

San Diego—December 22

**FIELD WORK**

**Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class.** Field Classes constitute at least 20% of the contact hours for each course, and will be developed and led by the instructor.

The field class, September 30th in Florence, Italy, will have two components, the Museo Galileo and the International Laboratory for Plant Neurobiology.

Chemistry in Context is a global comparative course. However, at the Museo Galileo we will not be travelling across the globe, but back in time. We will discover where many of our scientific theories have come from and what scientific instrumentation was available during the Renaissance.

While at the International Laboratory for Plant Neurobiology (LINV) we will learn to think about plants in a new way and see how new fields of study are born. At LINV they think of plants as highly sensitive organisms that actively and competitively forage for limited resources, both above and below ground; plants accurately compute their circumstances, use sophisticated cost-benefit analysis, and take defined actions to mitigate and control diverse environmental insults. They believe plants are capable of a refined recognition of self and non-self and are territorial in behavior.

This new view sees plants as information processing organisms with complex communication throughout the individual plant.

### **Field Class and Independent Field Assignments**

You will be required to write two short reactions/reflection papers. The papers should be ~600 words in length. The goals of these reflection papers are to encourage you to reflect upon experiences that you had during your field trips to the different ports and most importantly to integrate the material studied in class with the on-shore experiences in the countries visited.

Field Assignment I is due October 8th and it is a report on the field trip to the Museo Galileo and the International Laboratory for Plant Neurobiology.

Field Assignment II is due December 10th and it's a report of your voyage to date. Think about how the countries you have visited are affected by the materials we have learnt in class to date.

The reports should also answer the following three questions; a) What did you learn on the trip? (A summary of knowledge and insight acquired); b) How did you learn it? (A detailed description of what was accomplished); c) Why is this important? (An informed discussion about how this experience fits into the context of the course and any other courses you are taking this semester).

The reports will be evaluated according to the criteria

40% of the report grade will be based on the chemistry in the report (is it correct and is there sufficient chemistry in the report),

40% content/integration

10% grammar, spelling etc.

10% style and readability

### **METHODS OF EVALUATION / GRADING SCALE**

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework.

Two class tests	30%
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Two integrated field trip reports	10%
Field Class	20%
Class participation, Home works	10%
Final exam	30%

Grades will be assigned according to:

(A > 92.5%); (A- > 90.0%); (B+ > 87.5%); (B > 82.5%); (B- > 80.0%)

(C+ > 78.5%); (C > 72.5%); (C- > 70.0%); (D+ > 67.5%); (D > 62.5%); (D- > 60%)

(F < 60%)

### **ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM**

Attendance in all Semester at Sea classes is mandatory, but it is at the instructor's discretion to assign a grade to the participation and attendance requirement. Remember to include information concerning the evaluation of Field Assignments and the Field Classes, which must constitute at least 20% of the total grade in a course.

Students must do their best to inform me prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion. I will make reasonable efforts to enable students to make up work which must be accomplished under my supervision (e.g., examinations).

### **LEARNING ACCOMMODATIONS**

Semester at Sea provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation. A memo from the student's home institution verifying the accommodations received on their home campus is required before any accommodation is provided on the ship. Students must submit this verification of accommodations pre-voyage as soon as possible, but no later than July 19, 2016 to [academic@isevoyages.org](mailto:academic@isevoyages.org).

### **STUDENT CONDUCT CODE**

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative

commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

Depending on the nature of the assignment or exam, the faculty member may require a written declaration of the following honor pledge: "I have not given, received, or used any unauthorized assistance on this exam/assignment."

## ELECTRONIC COURSE MATERIALS

All course materials will be in the Chem 103 electronic course folder housed on the ship's intranet. (1-10)

### References

1. Kritidis, P., and Florou, H. (2001) Radiological impact in Greece of the Chernobyl accident - A 10-Y retrospective synopsis, *Health Physics* 80, 440-446.
2. Atwood, C. H. (1988) Chernobyl - What Happened, *Journal of Chemical Education* 65, 1037-1041.
3. Breivik, K., Gioia, R., Chakraborty, P., Zhang, G., and Jones, K. C. (2011) Are Reductions in Industrial Organic Contaminants Emissions in Rich Countries Achieved Partly by Export of Toxic Wastes?, *Environ Sci Technol* 45, 9154-9160.
4. Widder, E. A., and Falls, B. (2014) Review of Bioluminescence for Engineers and Scientists in Biophotonics, *Ieee Journal of Selected Topics in Quantum Electronics* 20.
5. Harris, A. F., Nimmo, D., McKemey, A. R., Kelly, N., Scaife, S., Donnelly, C. A., Beech, C., Petrie, W. D., and Alphey, L. (2011) Field performance of engineered male mosquitoes, *Nature Biotechnology* 29, 1034-U1109.
6. Greenwalt, D. E., Goreva, Y. S., Siljestroem, S. M., Rose, T., and Harbach, R. E. (2013) Hemoglobin-derived porphyrins preserved in a Middle Eocene blood-engorged mosquito, *Proceedings of the National Academy of Sciences* 110, 18496-18500.
7. Leandro-Reguillo, P., Thomson-Luque, R., Monteiro, W. M., and de Lacerda, M. V. G. (2015) Urban and architectural risk factors for malaria in indigenous Amazonian settlements in Brazil: a typological analysis, *Malaria Journal* 14.
8. Hotez, P. J., Dumonteil, E., Woc-Colburn, L., Serpa, J. A., Bezek, S., Edwards, M. S., Hallmark, C. J., Musselwhite, L. W., Flink, B. J., and Bottazzi, M. E. (2012) Chagas Disease: The New HIV/AIDS of the Americas, *PLoS Negl Trop Dis* 6, e1498.
10. Hegemann, P., and Nagel, G. (2013) From channelrhodopsins to optogenetics, *Embo Mol Med* 5, 173-176.