

HST 2354
Humanities, Technology, and the Physical Sciences
Creating Chemistry and Chemists, from Alchemy to the Buckyball

Spring 2002
MWF 10:10-11:00
McBryde 210

Instructor: Jody A Roberts
Office: 334 Lane Hall
Contact Info: jody@vt.edu; 231-6547
Office Hours: M 11:00-1:00, T 9:00-11:00, by appointment

In this course, we will investigate the role of the physical sciences in society through the example of chemistry. Where did chemistry come from, why did people create it, how have they studied it, and what have they done with it? Historically, the *practice* of chemistry has been called an art, a craft, and a science, while being blamed for seeking mystical solutions to ancient concerns and tampering with nature. However, this course is not just a class in the history of chemistry--it is an exploration of the *ideas* and the *people* that have defined chemistry as art, science, and industrially applicable technology. Such an approach will force us to consider *philosophical*, *religious*, and *social* issues. Therefore, **the goal of the course is to provide students with the ability to consider the lessons of the past for the purpose of applying them to critical thinking today.**

In pursuing this goal, we will focus our attention on three central questions:

- 1) What is a chemist?
- 2) What is chemistry?
- 3) What is science?

Throughout the semester, we will return to these questions to see how individuals and institutions attempted to answer these questions—in different countries, different disciplines, and different time periods. From this undertaking, we will begin to understand how chemists and chemistry were created in different contexts—thus opening the doors for a more critical analysis of our own contemporary context.

Our analysis will focus on three major themes: **theories, experimentation, and discipline formation**. Before starting our inquiry, however, we will create a common base from which we will be able to ground ourselves in our studies. This base will be provided by Trevor Levere's book, *Transforming Matter: A History of Chemistry from Alchemy to the Buckyball*. By reading Levere's book first, we will all have the opportunity to familiarize ourselves with many of the names, places, institutions, and events associated with chemistry—from the 16th century alchemical lab to the industrial chemical laboratory. From this base, we will begin our exploration of the first of the three themes of this course—theories.

In the first section of this course, we will explore theories of basic constituents (sometimes called atoms or elements), theories about how these parts come together, and notions of acidity/basicity. We will look at the role national context played in the theory formation and adoption as we explore the “chemical revolution” of the 18th century. Finally, we will look at how language and representation are tied to theories. Here we will ask the questions: What were these “things” called? How were they represented? Answers to these questions will help us to understand current theory development in chemistry.

We will use our study of language and representation as a transition into our second theme—experimentation. Beginning with the writings of Francis Bacon and the works and writings of Robert Boyle, we will explore how the nature and tools of experimentation have changed over the past four centuries. We will ask questions such as: What does it mean to experiment? How does experiment relate to theory? What role do instruments play in experimentation? How did the idea and tools of experimentation vary from one place to another? This will help us in the evaluation of today's modern chemical laboratory.

Our final theme will focus on discipline formation. We will use our understanding of shifts in theory and experimentation to tackle the question: When did chemists become chemists? To help us answer this question, we will look at variety of material from different national contexts to answer such questions as: What were chemists before they were chemists? When were the first chemical societies formed? What role did the publishing of journals play in discipline formation? When/why did chemistry begin to splinter into other disciplines? Answering these questions will help us to gain perspective on what a chemist—in the professional sense—is today.

Now that we are well versed in three important dimensions of the development of chemistry (theory, experimentation, and discipline formation), we will apply our knowledge to a series of case studies taken from the history of chemistry, and we will attempt a contextual analysis of the topics. These topics will include (but are not limited to): the French Academy in the 18th century, English chemistry in the 19th century, and American industrial chemistry in the 20th century. We will also use this time to explore topics suggested by other members of the class.

The class assignments will focus on each theme, individually, and will ask us to relate what has been learned in each section back to our guiding questions: What is a chemist? What is chemistry? What is science? (For more on the assignments, see below.)

Required Texts for the course:

Brock, W. H. (2000). *The Chemical Tree*. New York, W. W. Norton & Company.
Levere, T. (2001). *Transforming Matter: A History of Chemistry from Alchemy to the Buckyball*. Baltimore, Johns Hopkins University Press.

Additional readings will be made available either in class or on the course website.

Course Schedule:

Week 1 Overview

Reading: Levere, Introduction and Chapters 1-7

Week 2 Overview

Reading: Levere, Chapters 8-14

Week 3 Theories of science; Theories of chemistry

Reading: TBA

Assignment #1 due Monday, 28 January

Week 4 Theories of chemistry; language and representation

Reading: TBA

Week 5 Theories of chemistry; national context

Reading: TBA

Week 6 Experimenting in science; Experimenting with Chemistry

Reading: TBA

Assignment #2 due Monday, 18 February

Week 7 Experimenting with Chemistry

Reading: TBA

Week 8 Experimenting with Chemistry; national context

Reading: TBA

Assignment #5 due Friday, 15 March

Week 9 Discipline formation in the sciences; early disciplines in chemistry

Reading: TBA

Assignment #3 due Monday, 18 March

Week 10 Disciplines in chemistry

Reading: TBA

Week 11 Disciplines in chemistry; specialization

Reading: TBA

Outline for Assignment #6 due Monday, 1 April

Week 12 Case Studies in chemistry: social history, industrial history

Reading: TBA

Assignment #4 due Monday, 8 April

Week 13 Case Studies in chemistry: students' choice

Reading: TBA

Draft of Assignment #6 due Monday, 15 April

Week 14 Case Studies in chemistry: students' choice

Reading: TBA

Week 15 Research presentations

Reading: TBA

Assignment #6 due Wednesday, 1 May (last day of class)

Assignments:

#1,2,3,4: Write a brief (500 words) essay discussing the current theme in class (i.e. Levere's overview, theory, experimentation, discipline formation). Your essay should demonstrate how specific individuals, institutions, or groups sought to answer the questions: What is a chemist? What is chemistry? What is science?

#5: Your group will be asked to conduct an interview with a professor in one of the chemical (chemistry, biochemistry, chemical engineering) departments here at Virginia

Tech. You are free to conduct the interview however you choose, but you must relate the interview to topics and ideas discussed in class (e.g. How has the chemistry profession changed? How has the laboratory changed? What role have professional societies played in their personal career?) Your group will do a brief (10 minute) presentation (last week of class) to the class and will hand in a brief (500 words) summary of your interview. Your summary should attempt to relate your interviewee's comments back to the core questions of this course: What is a chemist? What is chemistry? What is science?

#6: Reflecting on ideas and questions brought up in class, research a topic that interests you. This can be any topic that relates to the history of chemistry from any time period. The paper should be between 1500-2000 words. Make sure to tie your paper back into the main themes of the class.

Teaching Philosophy:

Learning is best facilitated by group discussion. For this reason, there will be few "lectures" in this class. Instead, we hope to facilitate discussion on the reading materials. This set-up, however, places certain demands on all of us. Because we are learning from one another, it is imperative that you are not only **present** to take part in discussion, but also **prepared** for class. This means that we have all read the material and that we have highlighted some potential points for discussion or wish to raise some questions to our fellow classmates. These points (attendance and active participation) will comprise your participation grade.

Calculation of Grade:

Your final grade will be based upon the following formula:

Assignments 1-4:	30%
Assignment 5:	15%
Assignment 6:	30%
Participation:	25%

Note: this syllabus is a draft, and will be adjusted throughout the course of the semester to fit the goals and needs of the class as seen fit.