

My current research involves work in science, humanities, and chemical education. These brief summaries provide a broad overview. More specific projects can be developed based on your interests and background.

## **STATISTICAL MECHANICS AND THERMODYNAMICS**

Statistical mechanics provides the bridge between the molecular description of matter provided by quantum and classical mechanics and macroscopic theories such as thermodynamics and hydrodynamics. My research program employs both pencil and paper theoretical calculations and the more modern technique of computer simulation. Most of my work has been in the area of polymer dynamics, but I am interested in a variety of other areas. Some specific projects are listed below, but it might be possible to design a research problem in an area of interest to you.

### *Computer Simulation of Polymer Dynamics*

We have written a number of computer codes to simulate the dynamics of polymers using a Monte Carlo method. Currently we are using the codes to study the dynamics of polymers near attractive solid interfaces, but there are a variety of other important applications of this method. Some problems of interest include the dynamics of polymers at liquid-gas interfaces, the collapse transition, the inclusion of hydrodynamic interactions in Monte Carlo simulations, and the conformation and dynamics of polyelectrolytes.

### *The Liquid-Glass Transition*

Glasses are metastable non-equilibrium systems which cannot be treated by the usual methods of equilibrium statistical mechanics and thermodynamics. We are exploring the use of a theoretical formalism originated by Mazo by applying it to a variety of simple models for glass formation, particularly cell models.

### *Non-Equilibrium Thermodynamics*

I am interested in the application of this formalism to a number of problems including the origin of hydrodynamic boundary conditions and the liquid-glass transition.

## **CHEMICAL EDUCATION**

I am involved in a number of projects in chemical education including the use of

cooperative learning in undergraduate courses, development of context-rich challenge problems and projects, inquiry-based laboratories, use of writing in chemistry education, particularly laboratory reports. Finally, I am interested in the definition of the scholarship of teaching and learning in chemistry.

### **HISTORY AND PHILOSOPHY OF CHEMISTRY**

I am interested in developing a philosophy of chemistry as a profession. This project includes both history and philosophy. Historical projects would include tracing the development of professionalism in the American Chemical Society and the history of the ACS Committee on Professional Training. Current projects involve the influence of profit and commercialization on science and the ethical implications of the development of large research groups. I am also interested in the role of tacit knowledge, as developed by Michael Polanyi, and practical reasoning in chemistry. Some of my work in ethics involves the relationship between science and law. Finally, I am interested in the rhetoric of science, understanding the role of writing in the process of science, particularly the role of metaphor in the development and communication of scientific knowledge.

### **HISTORY AND PHILOSOPHY OF PACIFISM AND CONSCIENTIOUS OBJECTION**

I am currently writing a book on the history of Civilian Public Service Camp #21 at Cascade Locks, Oregon. This camp was part of the system of alternative service for conscientious objectors during World War II and is part of a larger effort to better understand the history and philosophy of non-violence and its role in American society.