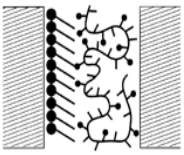


Center on Polymer Interfaces and Macromolecular Assemblies

A Stanford/IBM Almaden/UC Berkeley /UC Davis Partnership

Marni Goldman, Ph.D., Education Director,
Dept. of Chemical Eng., Stanford University, Stanford, CA 94305-5025
TEL: 650-725-3351 FAX: 650-725-5558 mgoldman@stanford.edu

November 2006

Dear Colleague:

Enclosed is an announcement and application for the Summer Undergraduate Research Experiences (SURE) Program, Summer 2007 at the Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA). CPIMA is a partnership of researchers at Stanford University, IBM Almaden Research Center, the University of California at Berkeley, and the University of California at Davis. A total of twenty-four undergraduate research positions will be available within the institutions associated with CPIMA. This program is supported by the National Science Foundation's Materials Research Science and Engineering Center (NSF-MRSEC) program and by a NSF Research Experiences for Undergraduates (NSF-REU) grant.

Please make this flyer available to all interested students and departments. Applications are strongly encouraged to be submitted online (www.stanford.edu/group/CPIMA/education/2007application.htm). The deadline for receipt of all application materials is February 2, 2007. Women, underrepresented minority students, and students with physical disabilities are especially encouraged to apply. Participants must be either US citizens or legal residents of the United States.

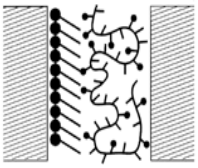
CPIMA SURE research projects focus on the interfacial science of organic materials. Students will have the opportunity to work on research projects at Stanford University, IBM Almaden Research Center, University of California at Berkeley, or University of California at Davis, as well as at international and industrial affiliates. All participants in the CPIMA SURE Program will have the opportunity to attend educational and social events including special seminars on recent scientific advances, sessions on career opportunities in science, and informal meetings with their research group. All participants will present posters of their summer research projects at the annual CPIMA Forum.

Please contact Marni Goldman, CPIMA Education Director (email: mgoldman@stanford.edu, phone: 650-725-3351, fax: 650-725-5558), if you would like to receive additional SURE Program announcements, information, or applications. We look forward to receiving applications from your institution.

Sincerely,

Marni Goldman

Marni Goldman, Ph.D.
CPIMA Education Director



Center on Polymer Interfaces and Macromolecular Assemblies

A Stanford/IBM Almaden/UC Berkeley/UC Davis Partnership

Summer Undergraduate Research Experience Program
June 4 - August 10, 2007*

The Center on Polymer Interfaces and Macromolecular Assemblies seeks qualified undergraduates in chemical engineering, chemistry, materials science, physics, and related fields to participate in a 10-week summer research program. The SURE program allows students to work on independent research projects involving direct interaction with research scientists, post-doctoral scholars, and graduate students at Stanford University, IBM Almaden, University of California - Berkeley, University of California - Davis, or a CPIMA Affiliate. The program is designed to capitalize on the materials science research of Silicon Valley.

Research Topics

- Synthesis and Application of Nanostructured Materials
- Structure and Dynamics of Polymeric and Biomolecular Materials at Interfaces
- Directed Nano-assemblies and Interfaces for Advanced Electronics

Research Locations

- Stanford University, Stanford, CA
- IBM Almaden Research Center, San Jose, CA
- University of California - Berkeley, CA
- University of California - Davis, CA
- Agilent Technology Laboratories, Palo Alto, CA
- Max Planck Institute for Polymer Research, Mainz, Germany

Program Details

- 10-week program: June 4 - August 10, 2007* (Alternate dates are available upon request).
- Open to undergraduates who will be sophomores, juniors, or seniors as of Fall semester/quarter 2007, majoring in an engineering or a science discipline.
- Applicants must have an interest in graduate school in engineering or physical sciences.
- Applicants must be U.S. Citizens or U.S. Legal Permanent Residents.
- Stipend: $4500
- Travel: Some travel is available.
- Housing: Provided or given a housing allowance (dependent on research site)
- Applications are encouraged from students at primarily undergraduate institutions, women, members of underrepresented groups, and students with physical disabilities.
- Participants are required to work full time and may not have outside jobs or enroll in classes that interfere with normal working hours.

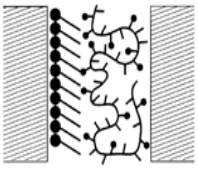
For more information regarding research project descriptions, mentors, participant requirements, and application materials, please visit our website: http://www.stanford.edu/group/CPIMA/education
Online application form: http://www.stanford.edu/group/CPIMA/education/2007application.htm

CPIMA SURE Program Director:
Dr. Marni Goldman
Department of Chemical Engineering
Stanford, CA 94305-5025
Phone: (650) 725-3351
Email: mgoldman@stanford.edu

Application Deadline: February 2, 2007

The program is funded by NSF-REU and MRSEC grants.

*Program dates are subject to pending housing availability and may change by a week or two.



Center on Polymer Interfaces and Macromolecular Assemblies
A Stanford/IBM Almaden/UC Berkeley/UC Davis Partnership

SUMMER UNDERGRADUATE RESEARCH EXPERIENCE PROGRAM

The Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA) seeks qualified undergraduates in chemical engineering, chemistry, materials science, physics or related fields to participate in a 10-week summer undergraduate research experience (SURE) program. Applications are especially encouraged from women, students at primarily undergraduate institutions, students who are members of underrepresented groups, and students with physical disabilities. The SURE program allows students to work on independent research projects involving direct interactions with research scientists, post-doctoral scholars, and graduate students at Stanford University, IBM Almaden Research Center, University of California – Berkeley, University of California - Davis or a CPIMA Affiliate. The program is designed to capitalize on the materials science research of high-tech Silicon Valley.

This program is made possible through grants from the National Science Foundation – Materials Research Science and Engineering Center (NSF-MRSEC) and the National Science Foundation – Research Experience for Undergraduates (NSF-REU) programs. Participants will receive a stipend of $4500 for the 10-week program and some travel reimbursement. Housing will be provided or participants will be given a housing allowance depending upon their research site. All participants will be required to work full-time and may not have outside jobs or enroll in classes that interfere with normal working hours. The CPIMA SURE program will run from June 4 through August 10, although later start dates are available for those whose school schedules conflict.

Eligibility:

Internships are offered on a competitive basis to United States citizens or U. S. Legal Permanent Residents who will be sophomores, juniors or seniors (as of Fall semester/quarter 2007) enrolled at a college or university. The CPIMA SURE program is a research-intensive program aimed at students who are interested in graduate school in engineering and/or physical sciences.

Instructions for Applying to the CPIMA SURE Program:

1. Official Transcript. Request an official transcript from your undergraduate institution to be sent directly to the CPIMA Education Director (see address below). **Deadline for transcripts is February 2, 2007.**

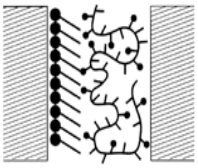
2. Three Letters of Reference. Request three letters of reference to be sent directly to the CPIMA Education Director (e-mail is preferred, but fax and postal mail are also acceptable - see contact info below). At least one letter must come from a faculty member who can evaluate your laboratory skills. **Deadline for letters is February 2, 2007.**

3. Application. Complete parts 1-24 of the application form. Submit the form either electronically (www.stanford.edu/group/CPIMA/education) or mail a hard copy to the CPIMA Education Director (see address below). We prefer application forms to be submitted electronically, unless you do not have access to this website. **Applications must be postmarked or submitted electronically on or before February 2, 2007 to be considered in the selection process.**

Please send any postal mail to the following address:

CPIMA SURE Program, Summer 2007
Dr. Marni Goldman
Department of Chemical Engineering
381 North-South Mall
Stanford University
Stanford, CA 94305-5025
e-mail: mgoldman@stanford.edu
fax: 650-725-5558

*** Application Deadline is Friday, February 2, 2007 ***



Center on Polymer Interfaces and Macromolecular Assemblies

A Stanford/IBM Almaden/UC Berkeley/UC Davis Partnership

APPLICATION, SUMMER 2007
Summer Undergraduate Research Experiences (SURE) Program
Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA)
• A Stanford University/IBM Almaden/UC Berkeley/UC Davis Partnership •

1. Full Name (first, last) _____
2. Social Security Number_____
3. I am a: US Citizen _____ or a US Legal Permanent Resident_____ (check one)
4. Email Address_____
5. Current Mailing Address at School_____
   City_____State_____Zip Code_____
   Phone Number _____
6. Permanent/Home Address_____
   City_____State_____Zip Code_____
   Phone Number _____
   Alternate Email Address_____

Questions 7, 8, 9 are **Optional** (The following information is used by the NSF for statistical purposes only.)

7. Gender: Male_____ Female _____ (check one)
8. Ethnicity:_____
9. Physical Challenges or Special Needs, etc._____
   _____

---

10. Have you previously applied to the CPIMA SURE program? No_____ Yes _____ year:_____
11. Undergraduate Institution You Currently Attend_____
12. Major(s)_____
13. GPA (2 decimal points) _____
14. Expected Graduation Date (month and year) _____
15. Awards and Honors _____
    _____
    _____

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16. What are the dates for Spring Break at your school?_____

CPIMA SURE APPLICATION FORM CONTINUED, SUMMER 2007

17. Relevant Coursework and Grades. Please list all college level science, engineering, and math courses you have taken or are planning to complete before June 30, 2007 along with the corresponding grade you received.

18. Describe your previous work experience (including any research experience other than laboratory coursework).

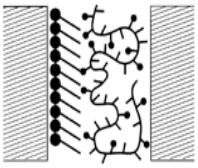
19. Briefly explain how an internship with CPIMA would influence your plans following graduation and your professional goals.

20. Please refer to the CPIMA SURE project descriptions (http://www.stanford.edu/group/cpima//education/projects2007.htm) and list your top three choices of the senior investigators you are interested in working with. Please note that project descriptions/mentors are subject to change.

    1st choice_____

    2nd choice_____

    3rd choice_____



Center on Polymer Interfaces and Macromolecular Assemblies

A Stanford/IBM Almaden/UC Berkeley/UC Davis Partnership

CPIMA SURE APPLICATION FORM CONTINUED, SUMMER 2007

21. List three references who can provide information about your academic standing and your interest in science. At least one reference should be able to comment on your laboratory skills. Please arrange to have these references send letters of recommendation to the address below by February 2, 2007.

A. Name & Title_____

Company/Institution_____

Address_____

City_____State_____Zip Code_____

Phone_____Email Address_____

B. Name & Title_____

Company/Institution_____

Address_____

City_____State_____Zip Code_____

Phone_____Email Address_____

C. Name & Title_____

Company/Institution_____

Address_____

City_____State_____Zip Code_____

Phone_____Email Address_____

22. I hereby certify that all information provided on this application is true and complete to the best of my knowledge. If accepted, I understand that providing false information is grounds for dismissal from the CPIMA SURE program.

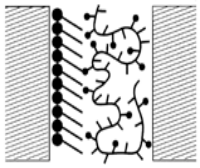
Signature_____Date_____

Print name_____

23. CPIMA has my permission to copy all parts of my application (application, letters of reference, transcripts) for internal distribution to members affiliated with CPIMA during the SURE selection process.

☐ I agree ☐ I do not agree

24. How did you learn about the SURE Program?



Center on Polymer Interfaces and Macromolecular Assemblies

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Please send all postal mail to the following address:

CPIMA SURE Program
Dr. Marni Goldman
Department of Chemical Engineering
381 North-South Mall
Stanford University
Stanford, CA 94305-5025

The Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA) Summer Undergraduate Research Experiences (SURE) Summer 2007 PROJECT DESCRIPTIONS

The following research project descriptions are intended to give applicants to the CPIMA SURE program a feeling for the research opportunities within the four CPIMA partners - Stanford University, IBM Almaden Research Center, University of California at Berkeley and University of California at Davis – and its affiliates. The projects are grouped according to the corresponding research site. Each mentor's name is listed before the title of the project.

PLEASE NOTE: Projects and mentors are subject to change. While we do not guarantee each participant will be matched with one of her or his top three choices, project choice is a factor in the SURE selection process. Please read through each project carefully and pick three that interest you the most.

Stanford

1) (S. Boxer) *Membrane Architectures and Compositions for Imaging.*
The structures of many components associated with biological membranes are known to atomic resolution. The organization of these components into more complex structures is less well known. We are involved in developing optical and mass spectrometry methods to probe this organization and dynamic changes in this organization. Summer projects involve a variety of strategies for labeling membrane-associated components for imaging applications.

2) (R. Dauskardt) *Adhesion in Thin-Film Structures for Nanoscience Technologies.*
The intent of this project is to study the adhesive and cohesive properties of thin-film structures containing nanostructured layers that have applications in a wide range of emerging nanoscience technologies. The goal of the work is to develop a fundamental understanding of how the adhesive and cohesive properties of the film structures are related to their nanostructure and processing conditions. We are particularly interested in the role of complex aqueous chemical environments on the evolution of defects in nanomaterial films. The student will gain familiarity and experience with a number of experimental techniques, including thin-film sample preparation and adhesion testing, and the use of atomic force microscopy, X-ray photoelectron spectroscopy, and possibly scanning electron microscopy for analyzing fracture surface composition and morphology.

3) (R. Dauskardt) *Biomechanical Study of Human Stratum Corneum.*
The structure and function of the outermost layer of the skin, the stratum corneum (SC), are critical in maintaining bodily well being. Modifications to the SC such as by surfactants (e.g. soaps and detergents) can be detrimental to the lipids and proteins in the skin. By changing the SC microstructure, the mechanical properties of the SC are affected. This project seeks to connect the structure and mechanical properties of SC which are important for understanding SC function and for a range of emerging technologies such as transdermal drug delivery. Mechanical properties of SC will be explored by examining the affect of different treatments which cause specific changes to the tissue. Using a mechanics approach developed in our research group, the debond energy of the SC will be measured. Tissue will be treated with enzymes and other chemically active treatments to affect both the underlying cellular and intercellular structure and resulting mechanical function. Additional characterization will be conducted using scanning electron and optical microscopy.

4) (C. Frank) *Interpenetrating Polymer Hydrogels for an Artificial Cornea.*
We are part of a large interdisciplinary collaboration with the Department of Ophthalmology in the Stanford School of Medicine whose goal is to create an artificial cornea. This SURE project will involve the synthesis and characterization of hydrogel networks that are candidate materials for the cornea.

5) (C. Frank) *Lipid Vesicles and Bilayers for Biodiagnostic Applications.*
This study will be directed toward the development of a diagnostic assay to monitor protein-lipid interactions. We will use the quartz crystal microbalance with dissipation to follow the kinetics of vesicle adsorption and subsequent vesicle fusion to form a planar supported lipid bilayer.

6) (B. Pruitt) *Testing Mechanical Properties of Cells with Microdevices.*
The study of cellular response to mechanical stimuli (mechanotransduction) has important applications in tissue engineering and cell biology. The goal of the research is to employ controllable micro-devices to interface mechanically with cells for the study of biomechanics. This involves observing effects of mechanical stimuli on the cytoskeleton with fluorescent markers, applying forces/strains to cell-cell interfaces to study the adhesion properties and measuring elastic properties of certain cells. Some key steps in the project would be patterning cells onto microscale devices, sustaining cells in suitable condition, controlled actuation of device, sensors from device, data collection and analysis.

7) (R. Waymouth) *Organic Catalysts for Polymerization Reactions.*
We have recently discovered a family of novel organic catalysts for the ring-opening polymerization of cyclic esters to generate biodegradable and biocompatible polyesters. The most active catalysts are derived from stable N-heterocyclic carbenes. This project will involve the synthesis of new classes of organic catalysts and the evaluation of their behavior in the synthesis of novel polymer architectures.
Prerequisite: Prior lab experience (either in coursework or in research) a plus.

University of California – Berkeley

8) (N. Balsara) *Nanostructured Polymer Electrolyte Membranes.*
We are developing novel polymer electrolyte membranes (PEM) for high temperature fuel cells. The function of the PEM is to allow the transport of protons while keeping the fuels separated. Current state-of-the-art PEMs based on Nafion® operate at temperatures below 80°C. Above this temperature, water cannot be maintained within the membrane and proton conductivity is lost. The structure of the proton conducting channels in Nafion® is not well-defined because the membrane is made from a random copolymer. We propose to use block copolymers to create membranes with well-defined proton conducting channels. The structure of the membranes will be studied by electron microscopy and proton conductivity will be measured using an apparatus where the humidity of the environment surrounding the membrane is controlled.

9) (S. Muller) *Development of Sequence-Specific Probes for DNA Hybridization and Sequencing Studies.*
The study of individual DNA molecules in microfluidic devices is of interest for both biological sequencing and detection applications and for the study of polymer conformation under hydrodynamic stresses. One project of current interest to our group is the development of multiple sequence-specific probes for dsDNA using restriction enzymes. This will require the identification of enzymes that bind sequence-specifically to dsDNA and determination of which conditions promote binding and prevent cleavage. The student researcher will gain experience in microfluidic device fabrication by soft lithography, biological solution preparation, and single molecule visualization and characterization using fluorescence microscopy.
Prerequisite: Must be a chemistry, chemical engineering, or mechanical engineering major.

10) (S. Muller) *Development of an Automated Microfluidic Trap for DNA Studies.*
Our group is interested in measuring how DNA hybridization rates vary with molecular extension in planar extensional flow. This involves trapping a single DNA molecule for up to several hours at a time. These experiments require the presence of an operator to keep the DNA molecule within the field-of-view for extended period. Automating this process and eliminating the need for the operator would be of great value. The proposed project involves developing a LabVIEW application for real-time video monitoring and position control of a bead or a single DNA molecule. The student researcher will gain experience with LabView, microfluidics, and single molecule visualization and characterization using fluorescence microscopy.
Prerequisite: Must be a chemistry, chemical engineering, or mechanical engineering major.

University of California – Davis

11) (A. Knoesen) *Sum-frequency Spectroscopy and Second Harmonic Generation of Collagen.*
Sum-frequency and second harmonic imaging techniques, which are based on nonlinear optical effects, will be used to image the spatial distribution of collagen macromolecular assemblies. The research involves the design and testing of new experimental concepts, as well as being participating in the nonlinear optical measurements.

12) (G. Liu) *Microfabrication of Organic and Polymeric Materials.*
The Liu group has focused on using advanced nanofabrication methodologies to mimic the complexity of biomembranes. Using nanografting, an atomic force microscopy (AFM)-based nanofabrication method developed in the group, various nanostructures are produced to mimic cell membranes. These engineered surfaces can be used as supports for the formation of our biomimetic membrances to investigate if and how the underlying surface energy and functionality at nanoscal impact the resulting rafts size, structure, density, and dynamics. The concept of introducing nanoscale heterogeneity to supports is inspired by the complex structures at cytoskeleton of membrane and formation of functional complex within cell membranes. The ability to produce complex nanostructures is the first and critical step in the construction of useful nanoplatforms for the mimicking of membranes and the development of nanobiotechnology such as arrays of nanostructures of proteins and DNA molecules. .
Prerequisite: Must be a chemistry or chemical engineering major.

13) (M. Longo) *Biomembrane Materials.*
The major components of biological membranes (lipids) make biomedically useful nanometer-scale structures which will be explored in this project. For example, lipids self-assemble into: monolayers at an air-water interface, bilayers/vesicles in water, and supported bilayers on surfaces. The student will learn how to make the structure (e.g. supported lipid bilayer or microbubble), perform physical measurements (e.g. characterize microstructure) on the structure, and relate the measurements to a biomedically useful property (e.g. physiological function of a cell membrane or potential for use in drug delivery). These will be part of the ongoing effort in the Longo laboratory: http://www.chms.ucdavis.edu/research/web/longo/.

14) (S. Risbud) *Aerogel and Xerogel Platforms for Biomembrane Assembly.*
We are creating structures that mimic cell membranes using inorganic and organic materials for each sub-section of the assembly. The aerogel/xerogel surface characterized by a high porosity (70 to 98% pores) is used to first absorb water and then form lipid bilayers. Subsequently, proteins can be inserted in the lipd layers.
Prerequisite: A chemistry, materials science, or chemical engineering major is preferred.

IBM Almaden Research Center

15) (J. Cha) *DNA-Mediated Assembly of Aligned Carbon Nanotube Arrays on Nanopatterned Surfaces.*
The focus of this project will be to study the self-assemblying properties of DNA wrapped single walled carbon nanotubes on patterned substrates. While carbon nanotubes have attracted much attention due to their some of their remarkable electronic properties, one of the major challenges that still exist is the ability to direct their assembly and orientation on specific substrates. We have deveopled methods of using long, genomic single stranded DNA to disperse carbon nanotubes in water and we have furthermore discovered that DNA can wrap around the nanotubes as helices. This project will investigate the assembly properties of such DNA wrapped carbon nanotubes on surfaces by synthesizing, using conventional molecular biology techniques, a variety of lengths of dual-end modified strands of single stranded DNA. Methods of labeling the DNA wrapped carbon nanotubes with fluorophores or nanoparticles may also be investigated for other applications.
Prerequisite: A chemical engineering or materials science major is preferred. Some knowledge of biology is also preferred.

16) (J. Frommer) *The Creation and Control of Nanostructures.*
Molecular constructs with dimensions below a micrometer now appear frequently in research labs and in product applications, yet the properties of objects on this scale are not well understood. The departure from the bulk is due to the limited number of molecules involved and their non-homogeneous environment. We study the behavior and control of organic interfaces as they are confined within submicron feature sizes. The methods we use include lithographic and surface derivatization techniques to create small domains and structures, atomic force microscopy and other surface analytical techniques to probe localized features and properties, and interaction with synthetic chemists to customize surfaces and materials.
Prerequisite: Must be adept at instrumentation and comfortable with chemicals.

17) (J. Hedrick) *Novel Macromolecular Architectures Based on Biocompatible Aliphatic Polyesters.*
Macromolecular engineering has assumed increasing importance in polymer science. One approach to complex molecular architectures is through the preparation of block copolymers or two distinctive homopolymers covalently bound at one point. Another approach to complex molecular architectures is the introduction of controlled branching. The use of ring-opening polymerization (ROP) methods to develop such new architectures has been much less pervasive than other synthetic techniques. Our interest is in the ROP of lactones, lactides, etc. and other related monomers. This project will involve the synthesis of new biocompatible polymers with the object of tailoring elastomeric mechanical properties with new molecular architectures.
Prerequisite: Must be a chemistry major.

18) (J. Hedrick) *Organic Catalysis: A New and Broadly Useful Strategy for Living Polymerization.*
Advances in organometallic chemistry in the design and synthesis of single-site metal catalysts for olefin, ring-opening metathesis, and ring-opening polymerization techniques have enabled the preparation of well-defined functional polymeric materials with predictable molecular weights and narrow polydispersities. Surprisingly, relatively few polymerization reactions have been reported which employ simple organic molecules as reaction catalyst, despite the widespread availability of organic chemicals in enantiopure form. The ring-opening polymerization (ROP) of lactides, lactones and epoxides using nucleophilic organic catalysts such as amines, thiophenes, phosphines and imidizolidine carbenes has been investigated. The strategy employed for the ROP using organic catalysts is as follows. First, a nucleophile such as an alcohol must be used to initiate the polymerization of the cyclic monomer in the presence of the catalyst, which provides a means of molecular weight and end-group functionality control. Secondly, the ROP does not evolve a co-product and since the equilibrium is enthalpically driven, the equilibrium is prejudiced towards polymerization. Mild and highly selective polymerization conditions either in bulk or solution produced polymers with predictable molecular weights and extremely narrow polydispersities. New strategies for chiral and "planar-chiral" organocatalysts that enable the formation of highly enantioselective poly(lactides) and polyethers from racemic monomer mixtures will also be developed.
Prerequisite: Must be a chemistry major.

19) (R. Miller) *Functionalized and Interactive Star Polymers.*
Dendrimers are polymers with controlled sizes and shapes with abundant functionality on the periphery. Although the synthetic control is often excellent, the synthethesis and purification is tedious and time consuming. We have developed a synthetic procedure for the preparation of multiarm star polymer with excellent control of molecular weights, arm lengths and number, polydispersity and arm functionality. This anionic procedure is essential a simple one step procedure where the arm end functionality is introduced via the initiator. Various types of block copolymers can be generated by coupling the anionic with controlled radical procedures such as nitroxide mediated, atom transfer radical polymerization, RAFT etc to generate core-shell materials. The respective layers can be selectived crossinked if so desired. The project involves primarily synthesis and characterization of monomers and functional polymers for various applications such as nanoparticle synthesis, preparation of multiarm fluorophores, controlled reagent delivery, nanoscale reactors, photovoltaic systems, polymer crosslinking additives, etc.
Prerequisite: Prefer a chemistry or chemical engineering major with some interest/experience with polymers.

20) (R. Miller) *Block Copolymer Synthesis and Self Assembly.*
Block copolymers self assemble into a bewildering array of regular structures such as spheres, cylinders, lamellae, gyroids, diamond structures etc depending on the volumer percentage of the block copolymer and the respective interaction parameters between the blocks. Such structures can have very small features because of the molecular size of the respective phase separating blocks. This has provided the opportunity for sublithographic self assembly where the orientation of the features can be controlled by the surface energy of the substrate, the temperature, atmospheric composition etc. These features may be selectively reacted, metalized or removed to make a variety of nanostructures. The majority of physical studies on block copolymers have been done on a small number of readily available materials. Using synthetic controlled polymerization methods developed in the laboratory, access to a wide variety of functionalized block copolymer of unusual structure and morphologies can be envisioned. These in turn can be expected to spontaneously assembly into a variety of nanostructures for potential applications.
Prerequisite: Prefer a chemistry or chemical engineering major with some interest/experience with polymers.

21) (A. Nelson) *Synthesis and Investigation of Supramolecular Polymers.*
Many biological processes, such as DNA transcription and protein-protein interactions, are driven by self-assembly of smaller components into larger assemblies by employing molecular recognition. As the current trend of creating smaller electronic devices continues, there is an increasing need to develop the materials and methods required to continue this trend. Emulating the assembly processes, as they occur in Nature, is one route to generating new materials for devices and other applications that require particular attention to events as they occur at the nanoscale. Our group focuses upon using and understanding molecular recognition to control the self assembly of polymeric materials. This includes synthesizing molecular recognition elements, employing controlled polymerization techniques, and investigating the functional properties of the polymers both in solution and solid states.
Prerequisite: Prefer a chemistry major who is currently a junior.

22) (C. Scott) *Characterization of Self-Assembled Polydiacetylenes Films and Electronic Devices.*
The integration of electrical function with the chemical principles of self-assembly is one of the most challenging problems in molecular electronics. Polydiacetylenes are a class of polymer which comprises a conjugated backbone with versatile side-group chemistry. By exploiting the molecular recognition principles of hydrogen bonding and hydrophobic-hydrophilic interactions in the substituents, diacetylene monomers can be synthesized and processed to form highly ordered monomolecular films, and subsequently polymerized topotactically by UV exposure. The resulting sheet of aligned polymer chains is then suitable to create the channel of a field-effect transistor. This project will involve the preparation of such polymer monolayers from monomers synthesized in the group of collaborator Robert Miller. Characterization of the morphology of films will be carried out using primarily optical and scanning-probe techniques. Electrical measurements of charge injection and transport will be made on field-effect transistor structures.
Prerequisite: Must have laboratory experience in the electrical and optical characterization of materials. 3rd and 4th year students will be given preference.

23) (W. Swope) *Computer Simulations and Modeling of Protein and Peptide Folding Kinetics and Thermodynamics.*
Understanding the underlying mechanisms of protein folding will have major impacts not just on biology and the life sciences but also on our ability to design similar nanostructured polymers. One simple model of the folding process is that it proceeds through the gradual accumulation of native-like intramolecular contacts until the native, fully folded conformation is reached. Simple statistical mechanical models based on this idea have been used to describe the observed folding behavior of several different proteins. This project will analyze some of the large protein simulation data sets from the Blue Gene project to see if atomistic simulations of the protein folding process can be used to produce Markov models. If such models accurately describe the behavior observed in the simulations, long time folding behavior can be deduced that conveys the rates of folding as well as the number and nature of the many folding pathways. In particular, we will look for characteristic patterns of secondary structure formation, as well as look to see if non-native contacts play any role in the folding process.
Prerequisite: Must have an interest in life sciences, physical chemistry or chemical engineering, computer simulation of biological molecules, or statistical mechanics. Student should have completed a course in physical chemistry. Must have some basic computer programming skills, and experience with Unix and Windows.

24) (W. Swope) *Modeling of Organo-Catalytic Polymerization Reactions in Solution.*
Understanding the mechanisms of organo-catalytic polymerization reactions is an important aspect of polymer chemistry, and for many of these reactions there is no clear picture of the mechanism: Does it involve a radical intermediate? Is it a concerted reaction? What is the function of the catalyst? Does the solvent play an important role? The project uses computational chemistry methods to study these problems. A computational study of many possible reaction mechanisms helps elucidate the ones that may actually occur and to compare where possible with experimental data in the literature. In particular, we will investigate use of a variety of quantum mechanical methods and predict reactant/product structures, transition states and spectroscopic properties of the species involved. The intern's work will involve some computer programming, quantum chemical calculation, molecular simulation, data analysis and statistics.
Prerequisite: Must be a chemistry or chemical engineering major and should have completed a course in physical chemistry. Student should be familiar with basic concepts of quantum mechanics. Must have some basic computer programming skills, and experience with Unix and Windows.

25) (W. Swope) *Computer Simulations of Polymeric Systems.*
Thin films of block copolymers containing nanoscopic domains have merged as a promising patterning method for the creation of sub-optical lithographic features. This project involves computational molecular modeling of single molecule self-assembly, as well as the modeling of molecular systems of many small polymeric molecules to understand the phenomena of phase formation, defect formation, migration, and annealing. Student intern will be involved in performing molecular simulations and the analysis of resulting data sets. The intern's work will also involve some computer programming, data analysis and statistics.
Prerequisite: Must be a chemistry or chemical engineering major and should have completed a course in physical chemistry. Student should be familiar with basic concepts of thermodynamics and statistical mechanics. Must have some basic computer programming skills, and experience with Unix and Windows.

Agilent Technology Laboratories, Santa Clara, CA

26) (M. Bynum) *Methods and Applications Development of Biomolecular Analysis for Microfluidic Platform.*
Agilent Technologies has commercialized a microfluidic gel electrophoresis platform. Current applications include electrophoretic separation to determine size distribution and concentration of DNA, RNA and proteins. We are expanding the platform and developing new applications for the analysis of other molecules relevant to the fields of diagnostics and pharmaceutical development. A key to the successful development of new applications with be the development of biocompatible surfaces for the microfluidic channels. Surface properties play a critical role in the interaction between the microfluidic structure and the molecules of interest. These interfacial interactions are characterized with various techniques such as fluorescence microscopy, surface plasmon resonance (SPR), and x-ray photo emission spectroscopy (XPS), among others. The goals of this project are for the CPIMA student to gain an understanding of the properties of interactions and characterize these interactions between biomolecules and microfluidic structures composed of different materials and coatings.
Prerequisite: Must have a background in bioengineering, biochemistry, biophysics, or other related fields.

Max Planck Institute for Polymer Research, Mainz, Germany

27) (I. Köper) *Tethered Bilayer Lipid Membranes as Model Systems.*
Tethered bilayer lipid membranes (tBLMs) are novel model architectures that mimic structure and function of natural biomembranes. The can be used to incorporate and study membrane proteins in a quasi natural, but well controlled environment. During this project, the student will learn to prepare tethered membrane with newly synthesized molecules on gold substrates using various assembly techniques. He/she will characterize the optical (by Surface Plasmon Resonance Spectroscopy) and electrical parameters (by Impedance Spectroscopy) of the system. In a second step, we will investigate the incorporation and function of membrane proteins, e.g. ion channels of pore forming proteins.
Prerequisite: Must have curiosity.

28) (R. Naumann) *Proteins in Biomimetic Membrane Systems.*
We can offer a position for a summer student during 2007 connected with the following research work: organic supramolecular architectures at interfaces, in particular biomimetic systems comprising planar solid-supported lipid bilayers and the incorporation of transmembrane proteins; the study of the formation and structure of these systems by various surface analytical methods such as surface plasmon resonance spectroscopy, impedance spectroscopy, surface-enhanced IR and Raman spectroscopy and atomic force microscopy (AFM); and the investigation of the function and activity (in particular ion transport) of the incorporated proteins in particular of the cytochrome c oxidase, bacteriorhodopsin and the bacterial reaction center by impedance spectroscopy and other electrochemical techniques in combination with the above mentioned spectroscopy techniques. We would like to welcome anyone who is interested in the physics and physicochemistry of biomimetic systems as well as some application aspects of our work (sensors, drug screening) and would like to join our active international research team.
Prerequisite: Physical chemistry interest and background preferred.

Letter of Recommendation for the Summer Undergraduate Research Experience (SURE) at the Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA)

☛ Due by Friday February 2, 2007☚

(Applicant):_____ ☐ waives ☐ does not waive

their right to view this recommendation. Applicant signature: _____

This student is applying to the CPIMA SURE Program, Summer 2007. CPIMA, an NSF Materials Research Science and Engineering Center partnership between Stanford University, IBM Almaden Research Center, University of California at Berkeley, and University of California at Davis, offers a competitive, 10-week summer undergraduate research program in the area of interfacial science of organic materials for outstanding undergraduates in science. The SURE program allows students to work on independent research projects with direct interaction with research scientists.

Please assist in the selection process by completing this form and evaluating the applicant.

Your Name_____

Company/Institution _____

Phone Number_____ Email Address_____

1. Relationship to Student (please check all that apply).

Instructor	_____	Laboratory Instructor	_____
Academic Advisor	_____	Teaching Assistant	_____
Research Advisor	_____	Other (please specify)	_____

2. Please rank the applicant with regard to the following attributes:

	Excellent (top 5%)	Very Good (6-15%)	Good (16-30%	Average (31-50%)	Below Average (<50%)	No Basis for Judgment
A. General science knowledge						
B. Laboratory skills						
C. Communication skills						
D. Ability to work in a group setting						
E. Motivation						
F. Perseverance						
G. Independence						
H. Overall						

3. Evaluation. Please attach a separate letter describing why this student should be a participant in the CPIMA SURE program. This is the most important part of the evaluation.

4. Signature of Evaluator_____Date_____

Please return by February 2, 2007 to:

CPIMA SURE Program, Summer 2007
Dr. Marni Goldman, CPIMA Education Director
Department of Chemical Engineering
381 North-South Mall
Stanford University
Stanford, CA 94305-5025
Fax: 650-725-5558; email: mgoldman@stanford.edu