Martin Gruebele, James R. Eiszner Endowed Chair in Chemistry and Professor of Physics,

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Martin Gruebele is a professor in Center for Advanced Studies at the University of Illinois. He obtained his B.S. in 1984 and his Ph.D. in 1988 at UC Berkeley, did a postdoc with Ahmed Zewail at Caltech, and then joined the faculty at the University of Illinois in 1992. His research interests include protein and RNA folding, fast dynamics in live cells, vibrational energy flow in molecules, quantum computing and measurement, nanoscale imaging of excited states, glass dynamics, and locomotion and sensing dynamics. The work is published in over 280 papers and reviews. He is a Fellow of the American Physical, Chemical and Biophysical Societies, the American Academy of Arts and Sciences, as well as a member of the National Academy of Sciences and the German National Academy of Sciences.

Current availability: In accordance with requests, including (with confirmation):
Aug 31-Sep 4
Sep 14-15
Sep 21-22
Sep 28- Oct 2
Oct 5-6
Mar 8-9
Mar 15-19

Lecture topics:
1) "**The long-term prospects of science**" (suitable for any undergraduate major)
When Einstein's paper on general relativity came, who would have thought the equation would be programmed into our cell phones 100 years later so they can accurately guide us to our dinner restaurant? When Berzelius discovered the new element silicon in 1823, who would have thought it was critical to the chips in the same cell phones? When Ivanovsky in 1892 discovered the first virus that infected tobacco plants, who would have thought in 2006 the FDA would approve a vaccine against a human cancer in 2006. And when Picasso painted Nude, Green Leaves and Bust, who would have thought it would sell for over $100 million 85 years later? Scientific discovery, like art, often takes time to show its full value. The strange things we

find out about Nature, whether it is the 14+ billion-year age of the universe, the odd little ways in which fish go about swimming around, or the fact that fat, protein and genes absorb infrared light from a toaster oven in slightly different ways, could all lead to the next cure or billion-dollar industry, but not likely in just a couple of years!

2) "**The simple motion of complex systems: from rockets to swimming fish**" (suitable for a general science-interested audience at the *Scientific American* level)
The talk will discuss levels of dynamics from guiding molecules like we now guide spacecraft, to animal behavior. We will see how restricted chaotic motion enables control of molecules; how we can image excited states of quantum dots and carbon nanotubes with sub-nanometer spatial resolution to visualize how electrons move around; and how physics principles can be used to show how fish swimming is really much simpler than one might think.

3) "**Protein and nucleic acid dynamics: from the test tube into the cell**" (suitable for a general science-interested audience at the *Scientific American* level)
Protein and nucleic acid folding and binding reactions are generally quite fast at room temperature compared to, say, combustion of gasoline. Why is that so? As a result, protein reactions can be sensitive to the environment that biases protein energy landscapes. I will discuss molecular dynamics simulations, test-tube experiments, in-cell measurements, and measurements in single cell of living animals that highlight the sensitivity of biomolecules to their solvation environment.

4) "**How does glass flow?**" (suitable for a general science-interested audience at the *Scientific American* level)
Glass is an ancient material that humans shape into anything from Erlenmeyer flask to vases to Christmas ornaments. Instead of melting suddenly, like ice, glass softens gradually at the so-called "glass transition." Amazingly, exactly how glass moves and flows at the microscopic level is still somewhat of a mystery. This talk will highlight nanometer-resolution experiments that image the hopping of tiny regions of. A simple theory nicely explains how glass motion becomes increasingly more collective as the glass transition temperature is approached, eventually freezing out any motion before equilibrium is reached.

These lectures can include some demonstrations with models or locally available materials, per prior arrangement.