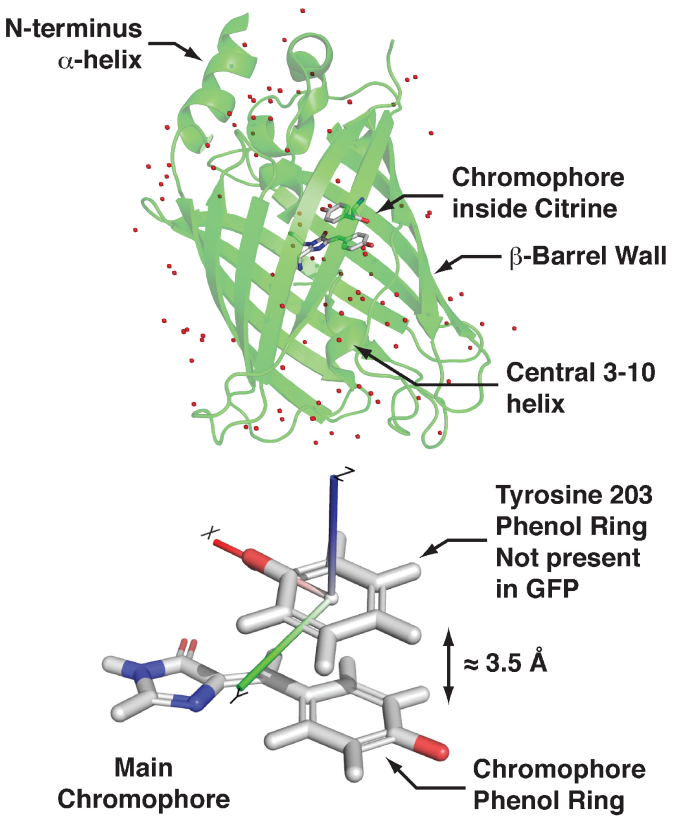
Sol M. Gruner

Argonne NATIONAL LABORATORY

Putting the Squeeze on Biology:
Biomolecules Under Pressure

Modest pressures encountered in the biosphere (i.e., at the bottom of the oceans) have extraordinary effects on biological molecules and assemblies. These include pressure denaturation of proteins, as well as dramatic changes in protein monomer-multimer association, substrate binding, membrane ion transport, transcription/translation of DNA and RNA, virus infectivity, enzyme kinetics, and conformational states of proteins. Yet practically all the biomolecules involved are highly incompressible. The challenge is to understand how pressure affects structure and to elucidate the relevant physical mechanisms for the observed effects even though the volume changes are very small. X-ray diffraction studies of membranes and proteins under pressure will be described. It is seen that the key point is not the magnitude of the structural changes, but rather the differential compressibility of different parts of the structure. Examples will be given of pressure studies on biomembranes and proteins.



Sol M. Gruner (Physics Ph.D., Princeton University, 1977) is the John L. Wetherill Professor of Physics at Cornell University and, until recently, Director of CHESS, the Cornell High Energy Synchrotron Source. Gruner's research interests are in the study of soft condensed matter, biological physics, self-assembled materials, and x-ray instrumentation and techniques. Gruner has led development of much of the technology that underpins x-ray detectors used at synchrotron sources. He is presently working on silicon-based pixel array detectors as a next-synchrotron-source technology, methods of microcrystallography, block copolymer-based materials, and the effects of pressure on macromolecules.

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