Biomolecular Imaging – A possible guide for strategic development of research infrastructure at Rice

George N. Phillips, Jr.

Preface

Imaging plays a central role in all of science, here defined as representation or reproduction of an object's form, especially a visual representation. The practice of science, a humanist endeavor, is driven by our experiences, and humans are very visual creatures. Our highest bandwidth sensory organ is our eyes, and visual input often dominates our thinking. Hence clichés like "seeing is believing" or "a picture is worth a thousand words." The process of imaging the world around us permeates science, whether subatomic imaging of particles on detectors or deep space imaging of radiation from the origins of the universe. Yet imaging beyond simple direct observation of visible light via the retina, has common themes that require careful application of sound scientific principles to be faithful representations of the objects we study.

The physics of imaging biological objects using electromagnetic radiation are understood in general terms. These modes might include optical and super resolution microscopy, X-ray diffraction, nuclear magnetic resonance imaging, and so on. Other modalities of imaging include the manifestation of the wave properties of neutrons, electrons and other particles or atomic force microscopies that perhaps are better described as metaphors involving touch rather than sight.

Proposal

Rice University, like other research institutions, depends strongly on imaging technologies to advance its research mission, and is in a unique position to develop a strong set of capabilities to support its own mission and to advance imaging capabilities for the greater Houston community. By managing the deployment of new resources and perhaps developing a virtual "Center for Biomolecular Imaging" at Rice, a strategic packaging and enhancement of capabilities could lead to a coherent perception of Rice as providing leadership in this important area of science. It would build on Rice's expertise in the quantitative aspects of science. Rice has undergraduate, graduate and high level research programs in biosciences, bioengineering, chemistry, structural biology, applied mathematics, statistics, computer graphics and so on that form the basis for modern imaging applications as they relate to basic biological and medical fields.

We propose that Rice make significant investments in the infrastructure for imaging research and its applications. First one would inventory the set of imaging modalities that exist at Rice, then identify targets of opportunity to enhance them either by simple improvements in instrumentation or by new coordinated efforts in hiring new researchers, whether faculty members or other research scientists. CryoEM or video two photon optical microscopies are but two examples. We could imagine that this activity could not only guide internal decisions on resource allocation, but also serve as excellent focal points for the development of external sponsors. Visual representations can be very compelling to everyone from the K-12 level to state-of-the-art researchers.