biomedical and health informatics

Biomedical and Health Informatics Lecture Series

Tuesday, January 6, 2009
Room T-531, 12:00-12:50 p.m.

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"Bridging Biological Ontologies and Biosimulation: SemSim Ontologies and the Ontology of Physics for Biology"

Dr. Cook will review and motivate outstanding problems in the bioinformatic representation and analysis of multiscale/multidomain biologic systems. He draws on a long history of engineering analysis that he is now applying to the physics-based analysis of biological systems. He will introduce and define the Ontology of Physics for Biology (OPB), a reference ontology of physical principles that bridges the gap between bioinformatics modeling of biological structures and the bio-simulation modeling of biological processes. Whereas modeling anatomical entities is relatively well-studied, representing the physics-based semantics of biosimulation and biological processes remains an open research challenge. The OPB bridges this semantic gap—linking the semantics of biosimulation mathematics to structural bio-ontologies. Our design of the OPB is driven both by theory and pragmatics: we have applied systems dynamics theory to build an ontology with pragmatic use for annotating biosimulation models.

Dr. Cook has been developing tools for the representation and analysis of complex dynamic systems for 40 years. He earned a BSME in mechanical engineering from the University of Michigan and spent 4 years as a Boeing while earning his Masters degree in Mechanical Engineering from the UW. To follow-up his Master's thesis project on the simulation of glucose-induced insulin secretion, he entered the UW's Medical Scientist Training Program to earn his MD and a PhD in Physiology & Biophysics. After making seminal discoveries in the electrophysiology of insulin secretion, Dr. Cook returned to his interests in the computational representation and analysis of complex systems. He authored two graphics-based applications for diagramming and analyzing cell networks and based one program, Chalkboard, on a linguistic metaphor of entity interactions using noun/verb constructs. He then connected with Dr. Cornelius Rosse and the FMA project to learn state-of-the-art knowledge representation and query methods as part of the DARPA-sponsored Virtual Soldier Project. In subsequent collaborations with Drs. John Gennari, James Brinkley, and others, he is developing informatics methods for the declarative representation of physics-based biosimulation models as needed by, for example, the European Virtual Physiological Human and IUPS Physiome projects. The major contributions to this effort are an ontology of classical physics, the Ontology of Physics for Biology (OPB), and light-weight OWL representations (SemSim models) that map the biological and mathematical content of individual simulation models to the FMA and OPB.