McGill

Department of Anatomy and Cell Biology

Seminar Series

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Hosted by: Hojatollah Vali, Ph.D.

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11:30 am -12:30 pm

“Advances in Digital Healthcare - The Living Heart Project "

Challenges to the safety and cost effectiveness of bringing new treatments to market as well as reliably providing them to the right patients are threatening the sustainability of progress in healthcare. We are at a crossroads. The era of consensus medicine has served us well, but must evolve to include a more powerful medical paradigm that utilizes deep understanding and case specificity as an asset. When faced with similar pressures, other industries turned to the development of virtual twins to systematically reconstruct their most complex systems and reduce risk. Virtual twins, which are digital representations built from real, functioning systems allow unique insights into the observed behavior, predict outcomes and provide tools to anticipate problems and test solutions with increasing confidence over time.

These virtual twins, begin with a general understanding of the structure and function of the object or system, and are then adapted to the unique conditions experienced by the real object. Sensors on the object can deliver real-time updates of these conditions to allow for a high degree of customization. Libraries of behavior can also be generated from accumulated knowledge of the systems, allowing faster and more accurate predictions of future behavior, event determining effective maintenance schedules based on population experience tuned to individual cases.

Suites of physics and biology based computer modeling tools to create these twins have been developed and are now accepted as the foundation of industries from aerospace and automotive at the large scale and drug discovery at the small scale. Building from this platform, patient and laboratory data have been used to develop virtual twins for medical care through the Living Heart and Living Brain Projects.

In 2014, the Living Heart Project (LHP) was conceived as an open, model-centric, application-agnostic, multiscale, multiphysics approach. With unified goals reminiscent of the Human Genome Project, the LHP, if successful could become the first-of-its-kind standardized platform with unquestionable values extending well beyond the research laboratory and into regulatory processes and clinical practice. After 7 years, with over 150 contributing organizations in 24 countries, the project has demonstrated its goals were achievable and the platform effective. The heart model has been used to perform in silico evaluations of cardiovascular devices, screen drug candidates and support clinical decision making. Globally, it has emerged as a reference benchmark for multiscale whole heart simulation. The project ahas partnered with the US FDA to evaluate the merits of virtual twins in creating the evidentiary foundation in regulatory and medical practice.