HUMMOD – INTEGRATED MULTILEVEL MATHEMATICAL MODELING OF PHYSIOLOGY FOR RESEARCH AND EDUCATION

R. Iliescu, R. L. Hester, T. Coleman

Thursday, 24 November 2011, 9.15–10.30, Hall A

D1.1 PLENARY SESSION I

Multilevel, integrated mathematical modeling of physiology allows examination of a multitude of variables which may not be amenable to direct experimental testing or measurement. We have developed HumMod, a model composed of~ 4,500 equations describing human physiology, which includes cardiovascular, neural, renal, endocrine, metabolic, and respiratory physiology. Variables are described by differential and / or algebraic equations and numerical solutions are computed simultaneously for increments of the independent variable, time. All variables and equations are organized in XML files, which can be opened by any text editor and are directly readable and interpretable by users as the local names are self-descriptive. The model structure is parsed, equations are solved and results are displayed graphically by a compiled executable file. In addition, by way of XML files, users can add or modify existing content (variables and relationships), making HumMod a user-friendly, interactive modeling platform. The major advantage of the HumMod, besides its complexity, is that it allows evaluation of dynamic changes in physiological variables in response to perturbations. Such an approach is currently used for conveying complex physiological processes in medical education and also for research hypothesis generation and testing. We present mathematical simulations using HumMod describing normal and pathophysiological behaviors in both steady state and dynamic conditions.