THE VIRTUAL PHYSIOLOGICAL HUMAN NETWORK OF EXCELLENCE (VPH-NoE)

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INTRODUCTION

The paradigm behind the Physiome includes a "framework for modeling the human body using computational methods that incorporate biomechanical, biophysical and anatomical information on cells, tissues and organs. The main project goals are to use computational modeling to analyze integrative biological function and to provide a system for hypothesis testing" [1]. Such a structure should allow a particular problem related to human organs to be tackled using integrative approaches that enable researchers to fuse data characterized by different spatial scales (from genes: 10^{-10}m to organs: 10^{-1}m), and different temporal scales (from a DNA mutation: 10^{-14} sec. to a human lifetime: 2.6×10^{9} sec).

The consortium of the project *STEP: A Strategy for the EuroPhysiome* worked on a coordination action to define the requirements that was needed to put in place a technological structure similar to that described above. This new structure, called the Virtual Physiological Human (VPH), will allow us to undertake truly integrative research in which multidisciplinary collaborative efforts would be facilitated [2-4]. The main deliverable of the STEP effort is a Roadmap outlining how the VPH should be created.

METHODS

The consensus around the content of the STEP roadmap was achieved in various steps during a 13-month effort.

The first step included the organization of 6 working groups totaling about 120 experts from various fields (fundamental and applied research, clinicians, industry). Each group was asked to work an aspect of VPH related to a particular topic (hard tissue, soft tissue, fluid, anatomy & physiology, multiscale modeling, ICT infrastructure). Each group produced a consensus paper. All 6 consensus papers were bundled into a single consensus document.

During the second step of the consensus procedure, this document was used to extend the discussion to a larger group of experts (about 300) to discuss and improve the first draft of the consensus document. Consensus steering took place over BiomedTown an Internet community (www.BiomedTown.org) dedicated to integrative biomedical research. This led to the creation of the final STEP roadmap [5], a 107 page document describing the VPH paradigm, the need to achieve a clinically useful EuroPhysiome, the technological requirements to answer these needs and to gather advice on implementation issues (this document is available from BiomedTown, STEP building, see reference [5] for download address).

RESULTS AND DISCUSSION

The roadmap outlines a key problem - many pathologies are currently badly understood because their etiology produces a large amount of inhomogeneous data. Such amount of data could only be produced and processed with an efficient technological frame (TF) in place (Figure 1). Also, the current clinical approach is often too fragmented to fully understand a clinical pathology. Collaborative research and integrative methods is the answer to that problem.

The above TF should include tools like, e.g. information flow control (ontology, database access, data mining), data processing/modeling and community building. Challenges are: inhomogeneous data integration, visualization of physiological processes, clinical model validation, better model communication, distributed computing. Once in place the VPH should enable our research community to create predictive modeling systems that could be used to improve our understanding of complex pathologies (e.g., cerebral palsy, fracture in osteoporosis patients, etc) and predicting the related medical actions. To achieve these ambitious goals several VPH-related EC-funded projects have been launched recently, including a Network-of-Excellence whose goal is to connect the diverse VPH projects, including not only those funded as part of the VPH initiative but also those of previous EC and national funding schemes, together with industry, healthcare providers, and international organizations, thereby ensuring that the above impacts will be realized.

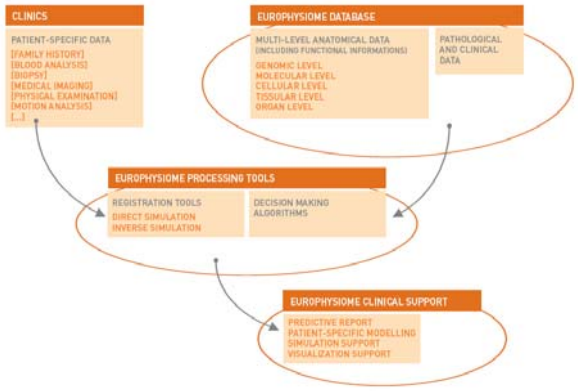

Figure 1: The VPH ICT infrastructure has it should be developed to achieve the EuroPhysiome goals (from [5]).

CONCLUSIONS

The VPH is a long-term vision that requires, from our research community, a paradigm shift in the way our biomedical research is performed. It will involve the sharing our data and methods while acknowledging the constraints related to a large multidisciplinary effort (e.g., respect of standards and formats). When such integrative research framework is in place, the VPH could become a reality.

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