



Tuesday March 10, 2009
17:30 to 19:30

Lyon Convention Center
France

SYSTEMS BIOLOGY, A NEW STEP FOR MEDICINE?

Moderator

- **Gaëll Mainguy**, Director, Scientific Publications, Institut Veolia Environnement, France

Speakers

- **Patrick Johnson**, Vice President Research & Technology Strategy, Dassault Systèmes, France
- **Philippe Kourilsky**, Professor, Collège de France
- **Denis Noble**, Professor, Oxford University, UK
- **François Taddei**, Professor, Necker-Enfants Malades Hospital, Research Scientist National Institute for Health and Medical Research (INSERM), France

Summary

- The session's objective was to "unravel the mysteries" of systems biology and try to understand how complex systems in biology should be approached as well as their implication in current issues.
- Systems biology, which can be applied to man-made and natural systems, deals with high number of distinct interactive elements.
- Although considered a relatively new field, systems biology is already an applied science which provides good new replies to unanswered questions such as the elaboration of drugs for heart disorders.
- The extension of the reductionist approach involves a heuristic change in the time at which hypothesis driven approaches are undertaken. Indeed, systems biology forces scientists to emit hypotheses after they get the data, not before.
- Although systems biology can be applied to living organisms of any scale (from cell to entire ecosystems), current usable data is mainly if not only derived from cell models.
- Indeed, massive parallel acquisition of data is only focused on cells and not yet on bigger systems.
- Such complex systems have such highly interacting elements that trying to properly define signalling pathways become arbitrary.



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- The main issues surrounding this field are the issues on data quality and the ability to compare data between the different research facilities.
- But systems biology does not apply only to living organisms but also to complex industrial processes such as building planes or factories...
- In such cases, classic mathematical tools are insufficient to integrate all the proper interactions between the parts, due to the extreme complexity of the products as well as the physical impossibility to test all potential states.
- As such, systems biology is used for the elaboration of models, simulations and formal proving where companies proceed to a virtual test of all the potential states of the construct.
- However, this is not a totally predictive simulation method, only a "simplified one" which nevertheless allows companies to streamline the processes between each department.
- During the session, industrialists recognized the importance of biology but they equally stated that they could bring their know-how to scientists in order to build better hybrid approaches which mix classic and new tools.
- This knowledge sharing can be optimized at the Biovision congress where industrialists and scientists meet.
- Man-made entities are actually becoming so complex that the one of the main distinguishing factor between them and living organisms is that biological entities integrate their own maintenance tools, whereas industrial ones have an outside repair team which limits the amplification (or self replication) of defects.
- Another distinguishing figure is that man-made constructs have direct interactions whereas proteins for example can interact with other unrelated proteins, thus complexifying the already dense studied model.
- Thus, using today's knowledge, systems biology is a necessary and existing step for the evolution of medicine, a step where biologists must more than ever use their insight to select the likeliest probabilities as testing all interactions is becoming virtually impossible.



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Quotes

"Systems Biology is necessarily multi-level integration of data."
Denis Noble

"System Biology aims at speeding up the interactions between the observation, modelling and experiment processes."
François Taddei

"To successfully understand a model, you must look at the simplest of complex systems that has the trend you are looking for."
François Taddei

"After a certain stage, there can be so many interactions between the different elements that defining pathways soon becomes arbitrary."
Philippe Kourilsky