Brainstorming Session Notes

RoSBNet Workshop
14-16 September 2009

On the second day of our first year workshop, on the 15th September 2009, we organized three "brainstorming" sessions on:

- The importance of modelling for design (coordinated by Prof Hana El Samad from UCSF and Prof Declan Bates from the University of Leicester)

- The importance of modularity and standardization (coordinated by Prof Domitilla Del Vecchio from UMich/MIT and Dr George Wadhams from the University of Oxford)

- The Ethical, Legal, Philosophical and Societal Issues that Synthetic Biology research raises (coordinated by Dr Annamaria Carusi and Dr Mark Sheehan, both from the University of Oxford).

The remaining participants were split into 3 groups, and rotated every 20 minutes between these stations – this offered all participants the opportunity to discuss the various challenges that Synthetic Biology faces today but also to overcome language barriers. At the end of the brainstorming sessions, the station coordinators led a discussion between all participants about these three topics.

The purpose of this note is to summarize the main points that were discussed. We hope that this will provide material for future discussion within RoSBNet and beyond.

Modelling for Design

The main question raised was whether appropriate mathematical modelling should be a prerequisite for design in synthetic biology or whether design can be done based on intuition and trial-and-error – is this acceptable? The impression is that many times, Synthetic Biology models are built after these designs are implemented in the laboratory, aiming to explain the observation rather than guide the design. It was found that a fundamental limitation in Synthetic Biology was the lack of reliable systems biology models; several questions relevant to implementation and construction are still unanswered, which impose further constraints on model-based design.

Modularity and Standardization

The main question in this station was whether modularity was essential for scalable design in Synthetic Biology. 'Orthogonality' of paths is commonly used to get modularization and scalability but it is still unclear what are the correct building blocks in this framework and what are the interconnection properties if and when these parts were assembled together. Is it possible to establish a systematic manufacturing process based on modularity and could standardization be used to that end? Could modules be viewed as 'digital' devices? What is the trade-off between imposing modularity in design and not, e.g., could modular design use more parts than a non-modular one? Does biology use modules in natural systems – is there an "optimal design" principle? What is the importance of localization/encapsulation and scaffolding? How can these components be connected together?

Ethical, Legal, Philosophical and Societal Issues

The main questions raised were regulation and the role of ELSI in Synthetic Biology. What are the kinds of synthetic biology constructs/parts that should be regulated and how? Should researchers be regulating on their own ('self-regulation')? This may not be optimal and is it desirable given the danger to over-regulate? If a global regulation mechanism is introduced, all stakeholders need to be included. How does the public get engaged in this effort? Could a lack of public understanding bring Synthetic Biology research to a halt? Who should we engage with? The issue of social justice was also brought up, and safety patenting issues were discussed. What is the broader impact of Synthetic Biology and how should ELSI support and justify investigations in this area?