Ethics and Collaboration Workshop

Sweden iGEM Meet-Up
25 – 27 July 2014
Linköping

Linköping University
INSTITUTE OF TECHNOLOGY

UPPSALA
UNIVERSITET

CHALMERS

From the 25th to the 27th July 2014 three Swedish university iGEM teams (Linköping, Uppsala, and Chalmers) gathered at Linköping University for a joint Meet-Up. The teams officially presented their projects for each other and participated in an Ethics and Collaboration Workshop. The workshop was divided into three parts:

- A discussion about Collaboration and how the current Swedish iGEM Teams can jointly create a support network to aid in the establishment of new Swedish iGEM teams
- A discussion about what direction the field of Synthetic Biology will take in the next 10 and 20 years, and how to foster an interest for Synthetic Biology amongst young people and the general public
- A discussion about the more problematic sides of Synthetic Biology, namely accidental release into the environment, patenting of synthetic organisms, and how these issues should be approached

The Meet-Up Weekend was deemed successful and all participating teams look forward to many years of future collaboration!

As of 2014 the Swedish iGEM teams currently in existence do not have any collaboration projects in place, thus the first step is to establish routines for contact. It was unanimously agreed that collaboration between the teams should start in an earlier stage of the project.
To ensure that collaboration is maintained every year, each team should have a contact person that transfers the information to the project leader of next year's iGEM team. It is important to properly document everything in order to facilitate communication. Seeing as there is a significant geographical distance between the teams it would probably be best if the project leaders communicated through e-mail. Other suggestions were Skype calls once a week and that we could create a common Facebook Group, however, it was also pointed out that it is difficult to have Skype calls since video-calls with more than two participants requires a paid subscription.

If each university started their work with next year's project at an earlier stage (around Winter Break) then it would be possible to have more than one meet up per year. Meet ups are both a great way for team members to get to know each other, but also a good opportunity to share project ideas. Meet ups are also a useful opportunity to invite other universities who are not participating in iGEM but have students who are interested in Synthetic Biology.

Introducing Synthetic Biology and iGEM to other universities could also be a part of a Human Practice project. Another suggestion for a Human Practice project was to visit other universities and inform their biology, chemistry, data, and design students about iGEM and Synthetic Biology. There might be students who are interested in participating in iGEM even if their universities do not currently have a team. If this was the case then an already existing team could recruit them.

One major hurdle for most iGEM teams is to finance their project. It is difficult for new teams to establish themselves in the iGEM competition because they usually do not get any or very few sponsors. A solution to the financial problem could be to establish a national committee for Synthetic Biology that sponsored Swedish iGEM teams in order to ensure that they have the possibility to participate in iGEM each year.

During our Ethics and Collaboration workshop with Chalmers and Uppsala Universities we also discussed the potential future for the field of Synthetic Biology 10 and 20 years from now. Furthermore, it was also debated how recruitment for this industry should be approached and educationally what means we should take to awaken an interest in this field amongst young people – the future workforce.

What are the opportunities for Synthetic Biology and where is it headed? Today the focus lies in developing methods for treatment of different diseases (e.g. Malaria) and to synthesize bacteria that can produce fuel and so on. However, this just the beginning of things to come, so where do you think that the area of Synthetic Biology is in 10 or 20 years? Will it continue to expand and develop or is it just a flash in the pan?

The general opinion is that Synthetic Biology will spread and be utilized to a greater extent in the future years to come. However, how quickly and efficiently this is done depends entirely

on if the field can become more widely accepted by society. This is dependent upon on how information about Synthetic Biology is spread to the public. Furthermore, it would be advantageous for the field if some sort of “leader” takes a public stand for Synthetic Biology.

One opinion was that it is ethically acceptable to make modifications in order to ensure that, for example, a plant is optimized in order to produce as much food as possible from it. There was also a discussion about the fact that a widespread and prevalent disease that affects a large part of the world’s population, and can only be cured with the help of Synthetic Biology, is both highly possible but might also be important for the progress of Synthetic Biology.

Another opinion is that we will be able to optimize products and methods with Synthetic Biology in the future years to come. Synthetic Biology could help to deal with current problems like environmental issues. Generally it is agreed that negative image that Synthetic Biology has acquired throughout the years has to be changed in order for it to be more accepted in the future.

It was also brought up and discussed that the thin line separating biotechnology and Synthetic Biology will disappear in the near future and that the two fields will be become one. The main focus of Synthetic Biology will be on creating synthetic proteins to be able to synthesize products from scratch and a lot more efficiently than today. The engineer-part will be used to speed up processes that are fairly slow for today’s standards, ex. transcription. Synthetic Biology will be used as a tool in other fields, ex. chemical synthesis and possibly to make less hazardous chemicals.

To ensure that Synthetic Biology progresses, there must be a continued recruitment of new people wanting to work in the industry of Synthetic Biology. So how do we make sure that this recruitment takes place? Can you try to implement Synthetic Biology earlier in education? Now you get your exposure to the subject when you study at university level, should the foundations of Synthetic Biology be taught earlier?

The general opinion was that the key is to get young people interested in Synthetic Biology at an early age. They need to know what Synthetic Biology is in order to develop an interest and possibly wanting to study it at a higher level. The subject needs to be introduced earlier in the educational system but at a basic level. Another example is to spread the information to teachers in chemistry and biology and that they in turn can relate it to their students. The foundations in the subject need to be taught because if you don´t know what an atom is how can you understand what Synthetic Biology is? The focus should however not be on what is taught but how it is taught.

Information available to the public about Synthetic Biology needs to be more accessible and easier to understand, ex. articles written in layman´s terms and the work we do with iGEM. The negative label associated with Synthetic Biology needs to be removed. The negative image and the fact that Synthetic Biology is considered to be very dangerous could probably be helped by regulations and laws ensuring that the public knows that governments and other organisations control what is being done.

During our Ethics and Collaboration workshop with Chalmers and Uppsala Universities we also touched upon the more problematic sides of Synthetic Biology, namely accidental release into the environment and patenting of synthetic organisms. One of the first questions discussed was how accidental release of synthetic organisms into the environment could be prevented.

A major concern raised by the critics of Synthetic Biology is that by their very nature biological machines are evolutionary machines. This means that mutations in the genome of the synthetic organisms could produce unexpected and unwanted interactions with the environment that they are exposed to. How could their accidental release into the environment be prevented?

A major point brought up and discussed was about governmental regulation. Many agreed that international regulation of the Synthetic Biology Community would aid in reducing the risk of GMO release into an environment where they do not belong. The regulating organ would have to be an organization which is widely recognized by the world; the organization which best matched this criteria was The United Nations. However, it was also pointed out that not all the countries represented in the UN have similar interests when it comes to scientific development. An example was drawn between Sweden and India, where the former does not have the same social burden on it as the latter caused by diseases like Malaria, Tuberculosis, and Diarrhoeal diseases. This means that a country like India might be more intent on developing regulation for research and development within these areas while a country like Sweden might have other targets. These differences would have to be taken into consideration when developing an international policy governing the entire Synthetic Biology Community.

A more practical method discussed which could be used to address the aforementioned issue were forms of kill switches. It was argued that organisms in nature, even dangerous ones, evolve alongside organisms belonging to the same ecosystem. Organisms which are completely synthetic do not evolve alongside natural organisms, making them more dangerous for the homeostasis of the environment they are released into. They can be compared to an invasive species which have the ability to upset the fine balance of ecosystems, making some form of kill switch paramount. Sterile synthetic organisms which cannot reproduce in nature were a possible option, along with organisms which have kill switches programmed into processes which are otherwise required for survival. It was agreed that the Synthetic Biology Community must be able to prove that the synthetic constructs being released or produced are inherently unstable or unfit compared to organisms around them. Another option discussed were hosts which are entirely synthetic and depend on laboratory “nutrients” in order to survive, like the organism recently built using PNA (peptide nucleic acid) instead of DNA. Finally, it was argued that host organisms like bacteria and viruses could be skipped entirely in many projects. A cell-free system of production would eliminate hosts and alleviate the issue associated with accidental release of these hosts.

Should patents on synthetic life forms and processes be avoided? And if so, how should intellectual rights otherwise be protected within Synthetic Biology? Should they be protected at all? How can policy be developed to balance the claims of inventors and broader public interests to promote scientific research and affordable access to new technology?

The second question examined by the group during the Ethics and Collaboration Workshop had to do with concerns about the intellectual property puzzle of Synthetic Biology, namely patents. It was agreed that intellectual information within Synthetic Biology must be protected in some manner; a completely Open-Source movement in today's market would deter monetary investments from outside partners since investments would have no protection. The definition of how broad or how narrow a patent should be allowed to be was discussed along with monetary concerns. It was pointed out that applying for a patent in the EU is time-consuming and very expensive. Patents should be made cheaper so that companies other than the largest (i.e. Roche, Novo Nordisk, AstraZeneca) can afford to take patents on their products. Furthermore, everyone agreed that the length of time that a patent is in effect should be reduced; this way smaller companies and research groups are not discouraged to research within a specific area simply because a patent has been taken by another company. Patents within Synthetic Biology were compared to patents within the Software sector, and it was suggested that SynBio patents should work on the same principle, namely that "coding languages" cannot be patented but the final product based on the language can. It was agreed that basic and broad ideas like "creating synthetic genomes", "inserting a synthetic genome into a host", or even a gene in itself should not be allowed to be patented. Giving patents for broad and basic areas will stifle research and give monopoly to the patent-owner. An idea for reducing the paperwork and patent lawyer involvement and thus in turn reducing the cost for patents was to create different categories of Synthetic Biology product patents that are standardized. However, it was also agreed that due to the nature of the beast, namely the fact that research within the field of Synthetic Biology is continuously evolving, standardized patents might quickly become obsolete.

As a final point, it was agreed that a system which was based on both conscientious and fair patents as well as the Open-Source movement (i.e. BioBricks) would be optimal. This system would encourage young companies without the same financial capital as large SynBio conglomerates to protect their intellectual property as well as supporting the culture of sharing and collaboration between all research groups.