

# A New Approach Towards Synthetic Biology Outreach

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Thanks to the 2010 Illinois iGEM Bioware Team Members and Advisers for their contributions!

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## Introduction

The field of Synthetic Biology is growing – and quickly at that! Scientists all over the world are coming together to contribute to this emerging interdisciplinary field, and this generation is lucky enough to bear witness to the beginnings of a practice that will change the way we see “life” on Earth. The iGEM competition has certainly been a part of that growth as more students discover their passions in synthetic biology, and more teams across the world are being formed to take part in the annual iGEM Jamboree. This is a truly exciting time, and we are proud to be a part of a process that will push synthetic biology into the future!

There is, however, an issue that needs to be taken on as fervently as the science itself – and that is the need to educate and inform the public about synthetic biology. There are settings in which casual conversation about synthetic biology can occur regularly and comfortably, but daily life experience can tell you that this is not the norm in our society. A significant portion of the world population is unaware, or even afraid, of advances in synthetic biology. We, the members of the 2010 Illinois Bioware iGEM team, have made it our goal to change an attitude that is enervating and fearful of synthetic biology to one that accepts and embraces it... but we can't do it alone!

We believe that all iGEM teams, present and future, should make it an integral part of their efforts to reach out to the public. Here, we shall detail how you can do that by citing examples of what we've done in the past year:

## **Ways to Publicize**

Creating a face for your iGEM team is important. This is how you represent your team, university, and the iGEM competition. So it is important to reach out to the public professionally. Some ways to do this are outlined into the following topics:

- How to Get Started
- Information Forums and Events
- Media Outlets
- Fundraisers

## **How to Get Started**

### *Team Establishment and Formation*

The best thing we have going for us is a solid foundation as a team on campus, and within the actual structure of our team. However, these guidelines can be varied to suit your team more aptly. How we went about organizing and structuring our team ultimately helped us decide who we are as a team, as well as how we would approach iGEM in general.

In the beginning stages, it was essential for us talk to anybody and everybody who was willing to listen – and even those who were not willing to listen. Starting an iGEM team requires the support of advisors, a space to do labwork in, and money. Establishing solid connections is key if you want to build a good foundation for your team. Get in contact with your professors, fellow students, and even companies who could have an interest in sponsoring your team. At this point, it's all about determination.

Our iGEM team is composed of eight undergraduates and four advisers. Each student on the team has a board position and has responsibilities separate from his/her work done in the lab. These board positions are as follows:

Director - Responsibilities include scheduling and leading team meetings, maintaining contact between students and advisers, overseeing the team's progress over time, making sure other members follow through on all responsibilities, and being the main go-to person in times of trouble.

Secretary - Responsibilities include taking notes at every meeting, writing the monthly newsletter, keeping track of important contacts, being in charge of general meetings when recruiting, and helping with anything outreach related.

Treasurer - Main responsibility is to keep track of iGEM funds and keeping everyone updated on money-related issues.

Lab Director - Responsibilities include training new members in lab techniques, making sure everything in lab goes smoothly, trouble-shooting protocols, and being the main go-to person for anything and everything lab-related. Responsibilities also include making sure research-phase of project goes smoothly, finding new literature related to project topic, and directing the progress of the project.

Publicity Director - Responsibilities include organizing for team to appear at public events, coordinating team participation at events, advertising for iGEM recruitment, being main contact for collaboration with other iGEM teams, taking advantage of any and every opportunity for public outreach.

Funding Director - Main responsibility is to be in contact with potential sponsors for the team, ensuring there is enough support to keep iGEM funded, writing grant proposals, applying for

funding, and networking with other individuals capable of aiding the iGEM team. Also is responsible for planning and coordinating “odds and ends” fundraising events, advertising such events, and thinking of new ways to encourage active fundraising from team members. Technical/Wiki Director - Main responsibilities of this position include being in charge of coordinating organization of lab notes online and overall management of the team’s website. Other responsibilities includes to create and design wiki, training other members of the team to use wiki, updating wiki, and making sure page is finalized before wiki-freeze.

In terms of publicity and outreach to the community, the three positions that play the biggest roles are the Director, Secretary, and Publicity Director. In our case, it is also extremely helpful to have at least one adviser who is especially interested in helping us find new ways to reach out to the community. However, ultimately everyone plays an important role when it comes to reaching out and educating the public about iGEM and synthetic biology. We believe that by having everyone have specific responsibilities that are not necessarily related to the work we do in the lab, we are ensuring iGEM is a strong presence here on campus as well as the larger surrounding community. There is a strong emphasis on the extent to which our iGEM team is student-run. If there is one key thing to take away from the organizational structure of our team, it is the fact that each of us has an indispensable role, and that fuels our motivation and passion for iGEM.

## **Information Forums and Events**

### *Outreach to Peers*

One of the easiest ways for iGEM teams to find ways to get in touch with their community is by reaching out to their peers. We were able to participate in events regularly held by the university simply by contacting event coordinators and signing up! iGEM students can participate in similar events that take place at their college or university. For every event, we made sure to have a few essential props:

1. A large poster about iGEM
2. Pamphlets, flyers, other handouts
3. An example from past iGEM projects (we used the scented and colored E. coli biobricks developed by the MIT and Cambridge iGEM teams respectively)
4. Computer for taking survey, playing synbio related videos, etc...
5. A sign-up sheet to get contact information from interested students

We hope that by detailing all the events we took part in, other iGEM teams can learn to look for similar opportunities in their community. Here we’ve described each event separately, and how each of them presented a unique opportunity for us to publicize iGEM and synthetic biology:

### Engineering Open House (EOH)

One of the greatest aspects of UIUC is its large population of engineering students - why? Because it means we get to have one heck of a science fair once a year. During the spring semester, students and organizations affiliated with the College of Engineering participate in Engineering Open House where they showcase cool demos and projects that are related to science. It is open to all students, as well as the general public. iGEM was one of these organizations, and we took this opportunity to talk to current students, prospective students (as well as their parents!), and members of the general Urbana-Champaign

community. This was a unique opportunity because EOH is such a highly publicized event in itself that we got to talk to people of all ages and backgrounds.

### Biology Open House

\_\_The Biology Open House is held during the spring semester every year. Members from a biology related club on campus make posters and advertise the event to the general public as well as students on campus. We took this opportunity to make another appearance to inform the public about synthetic biology, and students about iGEM as an opportunity to gain research experience. Even though typically the only presenters at this open house are from one organization only, we contacted the coordinator for this event and asked to be a part of it. Of course, they were happy to have us work with them and make that year's Biology Open House a different experience than it had been in previous years. This shows that a big part of publicizing is looking for opportunities that are not immediately presented to you, and to assume that other clubs and organizations that are related to biology are willing to collaborate.

### Quad Day

At the beginning of every school year, Quad Day is held at the University of Illinois. The purpose of this event is to give every student organization a chance to recruit new members and foster more interest in their organization. We saw this as a major opportunity to speak to students about iGEM/synthetic biology. Students seemed particularly interested in iGEM when it was described first and foremost as a way to gain valuable undergraduate research experience. Students who were considering medical school or graduate school showed the most interest. However, we emphasized that we were open to any student from any field of study, and actually ended up talking to hundreds of students from all majors about iGEM, accumulating close to 80 different email addresses of students who were interested in iGEM. Overall, it is essential to be on the lookout for events such as Quad Day in which there is ample opportunity to talk to a diversity of students.

### MCB Research Seminar

The MCB Research Seminar is an event held by the Department of Molecular and Cellular Biology at UIUC. This is advertised to students majoring in MCB and its purpose is to give students more information about how to get started in undergraduate research. This was a good opportunity for our team to get in touch with people whose specific interest was to do biological research.

### IGB Fellows Symposium

\_\_The IGB Fellows Symposium was held at the Institute for Genomic Biology, which is the same facility in which the iGEM lab is hosted. The event is an opportunity for anyone affiliated with the IGB to present their work with a poster. Our team decided this was a good way to make connections with professors and other students who work at the IGB, as well as gain valuable experience in presenting our work. We won third place overall in the poster competition, which did a lot to raise our colleagues' awareness of us and our work. This experience reminded us that it is good to keep in mind that we need to try to reach out to those who are also involved in the scientific community as well as the population outside of the scientific community.

We were also able to reach out to other iGEM teams such as the Peking University iGEM team and the Purdue iGEM team. The Purdue and Illinois iGEM teams sought project advice from each other early on via Skype conferences, while Peking and Illinois collaborated more closely due to project similarity primarily over email. The Illinois Software/Tools team also collaborated with us, mainly in putting out a monthly newsletter that described the progress of both teams,

and helping with the modeling component of our project.

### *Outreach to Younger Students*

Children are our future! This well known adage is as important now as it ever was. Informing the next generations of young scientists about new emerging fields in science could yield huge success in the future. Outreach to younger students can impact the way iGEM influences the scientific community, and is important to the longevity and sustainability of the program, competition and field in general.

Outreach to younger students can be done in a variety of ways. Some of which are as easy as implementing demonstrations held at local children's museums and schools. Other venues can be to inform our young students about synthetic biology and iGEM through already established groups that encourage young minds to follow scientific disciplines.

### Science Olympiad National Tournament

\_\_The Science Olympiad National Tournament was held at the University of Illinois over the summer of 2010, and the College of Engineering took this as an opportunity to host a Majors Fair in the days before the competition. Most of the participants in the Majors Fair were the different departments under the College of Engineering. The iGEM team was also invited to host their own booth next to the Department of Bioengineering. The main demographic we reached out to were middle school and high school aged children who were interested in science.

### G.A.M.E.S. Camp

The G.A.M.E.S. camp is also hosted at the University of Illinois every summer, and is geared towards girls in middle school and high school who are interested in math and science. We got in contact with the G.A.M.E.S. camp coordinators, and scheduled a date on which we could give a talk to high school school students about synthetic biology, and a separate date on which we could give a talk to middle school students. This involved making a 45 minute long presentation in which we introduced the basic ideas of synthetic biology, as well as some information on the iGEM competition as well. We incorporated an activity that involved paper "plasmids" with which the girls could simulate what happens in DNA recombination by cutting restriction sites on the paper plasmid with scissors, and "ligating" the plasmid with another paper DNA fragment using scotch tape. This was an especially rewarding experience because we got to introduce the girls to something they had never been exposed to before and guide them through the learning process.

### *Outreach to the General Public*

\_\_Typically, outreach can be difficult do to the lack of information accessible to the general public. The general stigma associated with science is that it is too complicated to comprehend, and an associated disinterest is formed. Yet, presenting information to the public is essential, and one effective way to inform them is through a public forum or event. This is a great way to have human interaction with the public and be able to present structured information in a way they would understand. Also, this is an easy way to field any questions that may arise and address them then and in future situations. These forums can take place via public libraries, general meeting places, community sponsored events and other various occasions that would be appropriate to inform the public about iGEM.

### Public Engagement Symposium

\_\_This open house, of sorts, was to engage the local community through the breadth of of

different actions being done by students on the UIUC campus. This event we were able to reach out to not only members of the community but also leaders and supervisors of the university. We engaged people to what was iGEM, synthetic biology and the pros and cons of the ethical treatment of the projects. Held just off campus at the iHotel in Champaign, Illinois, we found it to be rewarding to present such information via a venue that attracted less of our peers.

## **Media Outlets**

Due to the fast paced world we live in and the 24 hour news cycle impacting the way we obtain our information, media is an effective and vital implementation to your team's successes in publicity. As discussed previously, reaching the general public through community forums and events is important; however, a more effective way to reach them is through mass/local media outlets in and throughout the community. To encourage thought and discussion on a larger scale information can be sent through the following outlets:

- Newspapers
- Internets - Blogs
- Television

### *Newspapers*

An easy way to reach your peers is by submitting information your your school's newspaper. Also, your local newspaper might also want to cover your team's successes. By being able to reach out your information in this way is terrific considering how many people you will be able to reach in your community.

### *Internet - Blogs*

\_\_This is an easy way to get published. This option also allows you to send people to a link online so they can find out more information about you and your team. You may have links up to other sources of information that may be relevant to your team's project as well as some helpful tools to inform the public about synthetic biology.

### iGEM Documentary Filmed by Francis Lee (2009-2010 iGEM participant)

Francis Lee (team member of the 2009 and 2010 Illinois Bioware teams) put together a documentary about iGEM

"Art of the Real 2 0" <http://www.youtube.com/watch?v=Ktr9OQQPRb8>

### *Television*

This is by far the best way to inform the public by far as many people watch television. Just by being mentioned in a piece on a local news network would produce a lot of publicity and contacts. Some other options is contacting your school's media department and seeing if they wont host your team on the university's channel.

### Surrounded by Science

Surrounded by Science is a local TV program that focuses on the science in our everyday lives. iGEM had the opportunity to work with the SbS crew and be featured in one of their episodes. Filming took place a week before the Jamboree once we had a lot of the final details of our project worked out, and the episode will air sometime in the near future. This is probably one of the most unique ways the Illinois iGEM team was able to reach out to the community.

## **Fundraisers**

Fundraisers are an excellent way to complete multiple goals through a single event. Through these specific venues you can raise money while informing the public about iGEM and synthetic biology.

### iGEM Dots and iGEM Oktoberfest BBQ

\_\_Our team made and sold what we called “iGEM dots” which was our home-made version of the popular Dippin’ Dots ice cream. While selling the ice cream, many passers-by were curious as to how we were able to make the dots on our own. Eventually this led to our talking a lot with people about our research. The BBQ was also a big hit. The key thing with fundraisers is that people want to know what they are supporting when they buy from you, and that opens a lot of opportunities to inform the public about what iGEM is all about.

## **What Information to Present**

It is important that you cover as much information as possible. However, it is just as important to make the information as easy to understand as possible. This is because the general public lacks the knowledge much of you have. So it is important to demonstrate information about synthetic biology, iGEM and who you are in a fashion that can be easily explained to the youngest of minds. However, it is vital to include the appropriate information. The more important facts that you should include when presenting information to your selected community are:

- Who You Are
- iGEM
- Synthetic Biology
- Your Current and Future Projects
- Effects of the Field

## **Who You Are**

It may come as common sense, but it is important to say who you are, what you are a part of and what you are doing. This is necessary to introduce whatever you want to convey to your audience. Also, it allows you to be a working individual that is the making of something larger. You want to demonstrate clearly who you are and what are you doing in that particular venue. To encourage dialogue, introduce yourself in a warm and inviting manner. Try not to appear intimidating or overtly detailed in the information you want to demonstrate. Remember, you are just trying to have a conversation with your audience. Whether you are speaking to a single high

school student or to a room full of professors, the information you want to provide is a simple conversation between you and them.

In addition, we also included a few props to help people visually learn more about our team. These items helped us guide our audience through some information and let them have a chance to understand what we were trying to do. As mentioned from before, we made sure to have a few essential props:

- A large poster about iGEM
- Pamphlets, flyers, other handouts
- An example from past iGEM projects (we used the scented and colored E. coli biobricks developed by the MIT and Cambridge iGEM teams respectively)
- Computer for taking survey, playing synbio related videos, etc...
- A sign-up sheet to get contact information from interested students

## **iGEM**

During your introduction you will probably mention how you are a part of the International Genetically Engineered Machines team at your university (make sure you say the whole name). You can mention also that iGEM is an international synthetic biology competition that is held at MIT every year. When crunched for time, this can be enough to describe to the public. However, you can continue to explain more in depth about what iGEM is. Additional information can be how old iGEM is, who established it, who attends and more about what makes iGEM... iGEM!

However, a large part of iGEM are the biobricks. Having a visual aid usually helps in explaining how we create them and make them work, but creating a similarity between biobricks and something your audience can relate to is the most effective way. Usually drawing the similarity to lego blocks is the widely accepted metaphor. How you can use the pieces and continue to build with them is a great and essential feature that needs to be highlighted. Biobricks are essentially what makes this a synthetic biology competition. Keep in mind your audience and do not overwhelm them with information!

## **Synthetic Biology**

You do not necessarily have to mention biobricks in order to explain synthetic biology in terms for the general public to understand, but it is important to at least mention the over-reaching field. When describing the field of synthetic biology, as a team we like to convey that it is genetic engineering that is abstracted. This “abstraction” we are talking about is of course the biobricks. We simply say that abstracting genetic engineering allows us to use the genetically modified material in a universal, standardized and extremely accessible fashion. Further, we would explain how the field is relatively new and interdisciplinary, as well as being on the cutting edge of biotechnology. However, you must mind your audience and know exactly how you can convey the field in a simple way so that anyone could understand.

## **Your Current and Future Projects**

Remember who is your audience. Know who you are talking to and gauge the complexity of your information and how you can present it to your audience so they will understand. Usually, when describing your current and future projects to the public at large you can mention your

goals or your mission statement. The overall picture should be outlined to your audience and applications for your project are a must! Due to the lack of expertise your audience will have about your project, it is important to have examples that they can relate to. Usually, something that has happened recently in the news or just topical information that many people already know are good uses to help relate your project.

## **Effects of the Field**

\_\_The last point you have to cover, and the final effect of your publicity, should be covering the benefits and detriments of what you are doing. This is the area that is the most talked about and is up for discussion via many ethics committees. This is one of the more variable areas as well. It is hard to define and receive the information you are looking for. Essentially, it is area that should not present similar data and should be individual from other teams. However some basic questions are inherent and would help answer the more overreaching questions.

### *Bioethics Survey*

It is important to find your own way to determine how to go about gathering information and informing the public about the endeavors in synthetic biology. However, the most common way to perform both of these tasks is by conducting a bioethics survey.

In the spring semester, our team released a survey meant to be taken by members of our community. Methods of distribution included Facebook and public events such as Engineering Open House and Biology Open House. The idea was to familiarize ourselves with how students and other members of the community thought of synthetic biology.

Through these survey results, we were able to gain a better understanding of what our friends and family thought about synthetic biology. Since the survey was also anonymous, people were more inclined to be honest with their answers. Overall, conducting this short, but informative, survey helped us refine our approach when it comes to reaching to our peers.

Questions and results from the survey are all available on our wiki:

<http://2010.igem.org/Team:UIUC-Illinois/Bioethics>