Engaging Audiences in Science through Building with Biology Public Forums

Welcome!
Thursday, April 28th – Today’s presenters are:

Caroline Lowenthal, Kayla Berry and Elizabeth Kollman, Museum of Science, Boston

As we wait to get started with today’s discussion, please:

Introduce yourself! Type your name and institution into the Chat Box
Call into the phone line (optional) at (877) 898-0037 (if using the phone line please make sure to mute your phone when not talking and also your computer’s microphone)
Questions? Feel free to type your questions into the Question pod at any time throughout the webinar
Today’s discussion will be recorded and shared on www.buildingwithbiology.org at:
http://www.buildingwithbiology.org/blog/online-project-orientations-and-workshops

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Building with Biology

Activities and Conversations about Synthetic Biology

Forums Webinar
April 28, 2016

This project is funded by the Advancing Informal STEM Learning (AISL) program in the Education and Human Resources Directorate of the National Science Foundation through award no. DRL-1421179
Presenters

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Forums

Kayla Berry
Stipends

Liz Kollmann
Evaluation

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Agenda

• What is a forum?
• Why should you hold a forum?
• How this fits into BWB project goals
• Your options for forums
• Stipend details
• Evaluation requirements
• Resources
• What to think about now
• Q&A and how to get in touch with questions
Poll #1
What is a forum?

• Event for groups of 2-100+ where participants:
  – Learn about an emerging technology
  – Engage in a guided conversation
  – Share their views
  – Make a plan of action

• A longer, more in-depth conversation targeted at ages 16+

• Scientists are participants, rather than facilitators
What is a forum?

• A forum has 4 main parts:
  – Welcome and introduction
  – Speaker or video presentation
  – Participant conversation
  – Report out and wrap up

• A forum usually takes around an hour and a half
Why should you hold a forum?

For your institution

• Attract and engage adult audiences with various backgrounds and ages in in-depth learning experiences
• Develop your ability to engage the public in conversations about societal issues raised by emerging technologies
• Start to define a new role for your museum in your community, as a neutral place to talk about controversial science and technology issues

For your participants

• Share their perspectives with scientists and policy-makers who want public input on their work
• Increase scientist and public understanding of diverse points of view
• Gain confidence in making decisions about new technologies
• Practice considering different perspectives and sources of information for problem-solving
• Learn about a new technology and get the chance to discuss its impacts
How this fits into BWB project goals

• The aim of this project is to foster activities in science museums through which public audiences can engage with scientists and in conversations about what synthetic biology is, how research in the field is carried out, and the potential products, outcomes, and implications for society of this work.

• Researchers and publics will explore personal and societal values and priorities as well as research outcomes so that both groups can learn from each other.
Your options for forums

• **Should We Engineer the Mosquito?**
  – The materials for this forum are provided in your kit and you can print more from the Building with Biology website if needed

• **Editing the Genome: Now We Can. Should We?**
  – You will need to print all of the materials for this forum yourself from the Building with Biology website, available by the end of May
Should we engineer the mosquito?
Your group is going to decide whether to release genetically engineered (GE) mosquitoes in Mombasa, Kenya, and how to go about it. Follow the steps below to learn about options, then draft your proposal on the back of this sheet. You can find more in-depth information about the mosquito life cycle, malaria and traditional control methods, and engineered mosquitoes in the Supplemental Information Sheets.

**STEP 1: INTRODUCTIONS AND MALARIA PROFILE**
1 card, 5 minutes
Introduce yourselves. Share your name and your connection to the topic. Then read the malaria profile card aloud to the group.

**STEP 2: ENGINEERED MOSQUITO PROFILE**
1 card, 5 minutes
The technology card provides information on one genetic engineering method that could be used to engineer mosquitoes so they would not transmit malaria as well. Engineers are working on other methods but this is one of the more promising options. Read the technology profile card aloud to the group.

**STEP 3: GENE DRIVE PROFILES**
2 cards, 8 minutes
The gene drive cards provide information about a technology that can be added to GE mosquitoes. Gene drives raise ethical considerations, but can improve the success of the GE mosquito strategy. Take turns reading the gene drive profile cards.

**STEP 4: RELEASE OPTIONS**
1 card, 2 minutes
The release options card provides some possible options for how your group can choose to release genetically engineered mosquitoes. As part of your conversation, you can choose one of these options or make up your own. Read the release options card aloud to the group.

**STEP 5: PERSONAL PROFILES**
5 cards, 10 minutes
Take turns reading the personal profile cards. You don’t need to play the roles of these people, but rather, consider their perspectives as you make decisions.

**STEP 6: DISCUSS AND MAKE A PLAN**
30 minutes
Discuss whether your group would like to release the GE mosquitoes in Mombasa. As you discuss, consider the personal profiles. How might each of these people feel about Introducing GE mosquitoes to help control malaria? For more background information on mosquitoes, refer to the Supplemental Information Sheets. Flip to the other side of this paper to write your plan as a group. Your group will need to decide:
1. Will you release GE mosquitoes in Mombasa? Why or why not?
2. If you choose to release GE mosquitoes, will you use a gene drive? If so, which type?
3. If you choose to release GE mosquitoes, who should handle the release? At what scale?
4. What were the reasons behind your group’s decision?
5. If the population in Mombasa cannot agree about whether to release the GE mosquitoes, who should have the power to decide?

**STEP 7: REPORT OUT**
10 minutes
Each group presents their plan in 2 minutes or less. Then participants can comment on each other’s plans.

**YOUR PLAN**
Write down your group’s proposal for managing mosquitoes that transmit malaria.

If your group chooses to release GE mosquitoes in Mombasa, decide:
Whether you will use a gene drive and if so, which one? (Targeting the malaria parasite or targeting mosquitoes), and

A method for release from the options below, or make your own:
A. Local/Mombasa government
B. Governmental authorities such as the Kenyan Ministry of Health
C. Companies who developed the mosquitoes
D. A nonprofit/NGO that developed the mosquitoes in collaboration with academics and government.
E. Other

At what scale?
A. Group releasing the mosquitoes determines the scale
B. Limited local release followed by a one-year study period of using gene drives, this is only possible for the technique targeting mosquitoes
C. Large-scale release
D. Other

1. Will you release GE mosquitoes in Mombasa? Why or why not?

2. If you choose to release GE mosquitoes, will you use a gene drive? If so, which type?

3. If you choose to release GE mosquitoes, who should handle the release? At what scale?

4. What were the reasons behind your group’s decision?

5. If the community in Mombasa cannot agree about whether to release the GE mosquitoes, who should have the power to decide?

If you have time, consider this: How would your answers change if this were in your own city?

Be ready to present your plan in a 2-minute summary!
Release Options

Who should release the GE mosquitoes?

A. Local Mombasa government
B. Governmental authorities such as the Kenyan Ministry of Health
C. Companies who developed the mosquitoes
D. A nonprofit/NGO that developed the mosquitoes in collaboration with academics and government
E. Other

At what scale?

A. Group releasing the mosquitoes determines the scale
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C. Large scale release
D. Other

Gene Drive

Part 1: Overview

Some genes found in nature are more likely to be passed on to offspring. By using elements of these genes, engineers have developed gene drive systems. Genes with gene drives spread through a population quickly over just a few generations.

Engineered Mosquito

These engineered mosquitoes have genes that make them more likely to cause gene drive. The engineered mosquitoes initially produce offspring that inherit the gene drive and are released into the wild. The engineered mosquitoes that do not inherit the gene drive are killed with a drug. This process continues, causing the gene drive to spread through the mosquito population.

Gene Drive

Part 2: Targets

Target: Malaria Parasite
- The gene drive targeting the malaria parasite makes mosquitoes unable to carry the malaria parasite.
- The mosquitoes are sterilized.

Target: Mosquito
- The gene drive targeting mosquitoes causes sterilization to spread through the mosquito population, which reduces the number of mosquitoes.

Matthew Bioengineer

My name is Matthew. I'm a bioengineer at the company producing these mosquitoes. I truly believe our company is doing great work for the greater good. The mosquitoes we engineer combat diseases which kill and harm many people every year. Our product means that people no longer need to rely on dangerous chemicals in insect repellent or insecticides to stay safe from mosquito-borne diseases. With strict guidelines, plenty of rigorous testing, and the best scientists on our team, this is a sound product for reducing a public health issue. I want to get public input because I know that there are social and ethical questions about their release. We also know that our mosquitoes won't be as good at mating as wild ones, which is why we're considering gene drives.
Editing the Genome: Now We Can. Should We?
You are a group of citizens brought together to advise the city council on a research project at a local university. Scientists at the university have developed a new application using CRISPR, and local biotech companies are showing interest. The city council is interested in what local citizens think about the future use of this technology.

**Application:**

1. **Would you like this technology to be used? If so, how? If not, why not?**
   - Restricted to research use? Commercialized? Used in clinical applications, if applicable?
   - What benefits do you hope will result from the use of this technology?
   - What concerns do you have about its use?

2. **Should the university should bring this technology to market/world? If so, how?**
   - Generally, filing a patent is the first step whether an inventor wants to charge for the use of their discovery or allow people to use it freely.
   - Charge people who want to use it? If so, should the price be low or high?
   - Or allow people to use it freely? If so, should they insist on some restrictions on profits for companies who make products that use it?

3. **What restrictions, if any, would you like to see implemented to maximize benefits and safety? Who should regulate/oversee the use of this technology?**
   - The scientists themselves? The city council? The state government? The federal government or a federal agency (e.g. FDA)?

If you have time, consider this: How would your answers change if it were a company developing this technology rather than a university?
Background Information

Throughout history, humans have strived to create better versions of existing plants and animals through selective breeding. Since the 1970s, scientists have been able to genetically modify living things by "cutting and pasting" DNA. In 2013, scientists developed a new technique for genetic modification that uses repeating patterns in the DNA of many species. This new technique is called the CRISPR/Cas9 system (called CRISPR, pronounced "crisper," for short). CRISPR works like a search-and-replace function in a word processor and allows scientists to edit genomes with much more precision, efficiency, and flexibility than they had with prior techniques. It is also faster, lower cost, and easier to use.

The CRISPR technique is only useful where the connection between genes and the desired or undesired characteristic is well understood. For example, scientists have identified the mutated gene that causes the deadly disease cystic fibrosis. On the other hand, a mosquito's ability to find humans has not been mapped to specific genes and likely involves a combination of genes. Using CRISPR to remove the mutated cystic fibrosis gene and replace it with an unempted one should be much simpler than changing the mosquito's sense of smell.
Application Card: Bees

Problem
Bees are an important part of ecosystems all over the world. They play a critical role in agriculture, with 35% of global crops depending on pollinators like bees. Over the last 10 years, more and more bees have been lost. In February 2016, the UN released a report that included bees on a list of pollinator species that are at risk of global extinction.

Possible Solution
It is not clear yet what is causing so many bees to die, but possibilities include disease, parasites, and pesticides. Scientists have been studying the genomes of 'hygienic' bees, which obsessively clean their hives and remove sick and infested bee larvae. Hygienic colonies are less likely to die out from disease or parasites. If scientists can identify the hygienic genes, they can use CRISPR to copy them to other types of bees to help the bees survive.

Pros
- Many people, including scientists, the Environmental Protection Agency, and the Department of Agriculture, as well as their counterparts all over the world, have been trying for years to combat the loss of bees with little success. Modification with CRISPR may give the bees a way to survive.

Cons
- Early stages/may be complicated: No hygiene-associated genes have been definitively identified, and the combination of genes driving the behavior may turn out to be complex. It is not clear whether changing the hygienic genes might cause other behavior changes in the bees.
- Reason not to do genetic modification: If hygiene-associated genes are identified, conventional breeding may be enough to spread resistance to new populations, potentially making CRISPR unnecessary.
Discussion

STEP 4: DISCUSS AND MAKE A RECOMMENDATION
30 minutes
Flip to the other side of this paper to write your recommendation as a group. City council is specifically interested in the answers to the following questions:

1. **Would you like this technology to be used? If so, how? If not, why not?**
   - Restricted to research use? Commercialized? Used in clinical applications, if applicable?
   - What benefits do you hope will result from the use of this technology?
   - What concerns do you have about its use?

2. **Should the university bring this technology to market/the world? If so, how?**
   *Generally, filing a patent is the first step whether an inventor wants to charge for the use of their discovery or allow people to use it freely.*
   - Charge people who want to use it? If so, should the price be low or high?
   - Or allow people to use it freely? If so, should they insist on some restrictions on profits for companies who make products that use it?

3. **What restrictions, if any, would you like to see implemented to maximize the benefits and safety of editing this genome?** Who should regulate/oversee the use of this technology?
   - The scientists themselves? The city council? The state government?
   - The federal government or a federal agency (e.g. FDA)?
Poll #2
New Opportunity

Building with Biology Forum Stipend

Stipend discussion –

• Stipend overview
• Budget and expenses
• Application and selection process
• Timeline
Forum Stipends
Application deadline: May 31st

One-time stipends in the amount of $1,200 are intended to:

• help support the planning and implementation of a Building with Biology forum, in connection with your planned Building with Biology event
• to engage public audiences and create conversations among publics and scientists about synthetic biology and its societal implications
Stipend Overview

Building with Biology Forum Stipend Overview – provides details on stipend criteria and eligibility, the evaluation and reporting requirements, allowable expenses, and application and selection process.

Eligibility

- Only recipients of Building with Biology physical kit can apply for a forum stipend.

- The forum stipend is designed for institutions (e.g., museums, universities, and industry and professional organizations) within the United States.
## Stipend Budget and Expenses

<table>
<thead>
<tr>
<th>Eligible expenses</th>
<th>Ineligible expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff time – planning meetings, recruiting forum participants</td>
<td>Cannot be used to pay for indirect costs (overhead)</td>
</tr>
<tr>
<td>Audio/Visual, space rental</td>
<td>Cannot be used for alcohol</td>
</tr>
<tr>
<td>Subsistence (participant food only)</td>
<td>Cannot be used to pay participants to attend the forum</td>
</tr>
<tr>
<td>Honorarium for outside presenters</td>
<td>Cannot be used for any prizes or entertainment costs</td>
</tr>
<tr>
<td>Other – parking and incidental expenses for guest presenters</td>
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Application & Selection Process

Application deadline is Tuesday, May 31st


• Applications will undergo review process by Building with Biology project team

• Applicants will be informed of their award status in early June 2016; stipends issued in June
Stipend Timeline

May 31st: Deadline to apply for forum stipend

June 2016: Applicants informed of award status in early June; stipend received in late June/early July

June 23rd: Evaluating Building with Biology Forums (required for those awarded stipend) webinar; 2:00 – 3:00 PM EST

June 24th – September 30th: Host a Building with Biology forum
Poll #3
Activities and Conversations about Synthetic Biology

Forum Stipend

Evaluation Requirements
Forum Evaluation Questions

• What do scientists and publics learn from the forum and from each other?

• Does participation increase publics’ and scientists’ interests in PES or synthetic biology? If so, how?

• What do scientists and publics value about their participation in the forum?

• What follow-up behaviors does participation prompt in scientists and publics?

• What are scientists’ and publics’ viewpoints about synthetic biology?
Data Collector Requirements

• Provide documentation of human subjects training completion

• Attend a 1-hour webinar: “Evaluating Building with Biology Forums”

• Collect surveys and discussion materials on the day of the forum

• Mail the surveys and discussion materials back to the Museum of Science
Pilot Events – Summer 2015
Data Collected from Forum Participants

Document contents
Introduction ........................................................................................................... 2
Data collection .................................................................................................... 2
Data analysis ....................................................................................................... 3
Themes within the data ....................................................................................... 3
Questions to consider ......................................................................................... 4
Authorship .......................................................................................................... 4
Presentation of data ............................................................................................. 5
Forum participants represented various backgrounds, ages, genders, and group types. ......................................................... 5
In some cases, volunteers and visitors experienced the forums differently. .............................................................................. 6
Forums increased participant—especially visitor—interest in future synthetic biology activities. ............................................. 7
Participants learned from interacting with one another and from the forum experience overall. ............................................. 7
Participants valued a number of things about their experience, especially aspects of the discussion. .................................... 10
Participants offered some suggestions for improving the forums. .......................................................... 11
Questions?

http://www.buildingwithbiology.org/project-evaluation

Contact: Elizabeth Kollmann (ekollmann@mos.org)
Resources

• Guides
  – Mosquito guide available now
  – Editing the Genome guide coming soon!
• Training video coming soon!
• Forums manual available now
• BWB website: http://buildingwithbiology.org/forums
• Introduction to Synthetic Biology and Society video available now
• Me!
What to think about now

• The parts of your forum that need the longest lead time are:
  – Choose a date, and find and reserve a location
  – Decide which forum you want to host
  – Find and confirm a speaker, if you want to have one
  – Publicize the forum
    • Create a registration list for participants to sign up

• This will also take a while and needs to be done in advance:
  – Find synthetic biologists and other scientists to attend as participants
  – You may also want to run a practice forum with volunteers or staff to familiarize yourself with the process and content
Q&A

To get in touch with questions, email clowenthal@mos.org
Upcoming Webinars

Host site staff
We have a number of webinars and project orientations designed to help prepare host site staff for hosting their Summer 2016 Building with Biology events and forums.

• 5/16: Host Site Overview: Communicating Synthetic Biology (12PM EDT)
• 6/14: Evaluating the Public’s Experience at Building with Biology Events (1PM EDT)
• 6/21: What’s in Your Building with Biology Kit (2PM EDT)
• 6/23: Evaluating Building with Biology Forums (2PM EDT)

Scientist Volunteers
Online project orientations led by our project partner, AAAS, target your scientist volunteers. These three webinars will take place throughout the month of May.