

SEED Academy, Spring 2012
Synthetic Biology

Homework #2
Due Feb. 25, 2012

There are two principal objectives for this homework assignment. The first question will get you to think more deeply about final project ideas. The next questions will ensure you understand the process of *cloning* a piece of DNA and the way we will talk about manipulating DNA in this course. Almost anything that happens in synthetic biology (and, for that matter, most other subfields of biological science or engineering) begins with the process of cloning. This will be your lab work for the semester.

Part 1:

Since we have had a more in-depth discussion about biological engineering and synthetic biology, we want you to return to your initial list of ideas for the system you would like to create. From that list, or using additional ideas that you may have recently thought of, choose 2-3 of your favorites and think about these questions:

What, specifically, does this system do?
What actually has to happen in order for this system to function?

Take the “bacterial balloon” from the comic as an example. Think about a regular rubber balloon and ask yourself, “How does this actually work? Which aspects of its form and function do I care about, and which are irrelevant?”

- a) Why does a balloon float instead of sink?
- b) When can air enter/exit the balloon, and when is it trapped? How do you make the balloon change from one state to another?
- c) What are the sub-parts of a balloon? (If you don't think a balloon has sub-parts, consider a fancier balloon like a weather balloon or hot-air balloon.)
- c) Can any material be used to make a balloon? Are there special properties that a material must have in order to be suitable for making a balloon?
- d) When do people care about the size/shape/color of a balloon, and when do they not care?

You will not commit yourself to a specific project idea until much later in the semester, but you should start thinking about your favorite ideas right now. Write about 3-5 sentences (or more, if you are inspired!) of thoughts, questions, and answers about your 2-3 favorite project ideas. See if you can name some of the devices needed to make your system work. Feel free to discuss your ideas with your friends or the course staff; this assignment is more about getting you thinking than about producing something nicely written to hand in.

Part 2:

Do the Post-Lab worksheet for Week 2.

Read the lab packet for Week 3 and do the Pre-Lab worksheet. All answers to the questions can be found in the reading, but think back to lecture as well.

Part 3:

The Registry of Standard Biological Parts is a collection of genetic parts that can be mixed and matched to build synthetic biology devices and systems. This will be one of your most important resources for the rest of the semester. The goal of this problem is to introduce you to the registry and also give you a better idea of how synthetic biology works.

Go to the registry (http://partsregistry.org/Main_Page) to answer the following questions. You may also find the Help page useful (<http://partsregistry.org/wiki/index.php/Help:Contents>). Note that this question has two parts (a and b).

a) Define the following terms:

BioBrick

Composable (composability)

Abstraction (Abstraction Hierarchy)

Restriction Enzyme

Plasmid

b) Name 2 different types of parts and 2 different types of devices. Draw the symbol for the part/device (e.g. arrow, rectangle, stop sign, etc.). Write a few words about how the part/device works.