Benchling Plasmids On Paper (Summer Pathways)

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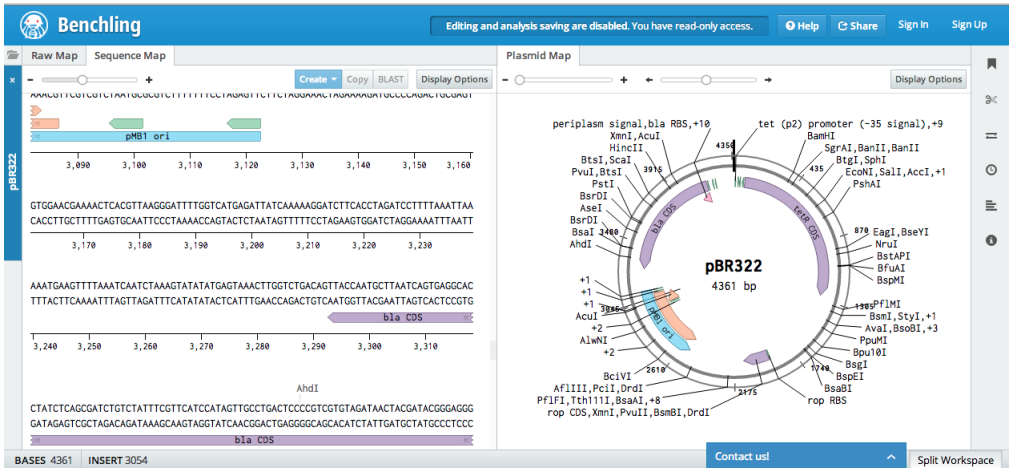
July 12th 2017

1 Introduction



About me:

I am a computer science major at Boston University, but I am working with CIDAR to learn more about how to apply computer science to synthetic biology research. Right now, my role in the CIDAR lab is bio-informatics, which is a field that combines both computer science and life sciences together. It is my pleasure to introduce to you today one of the main computing tools that the BU CIDAR lab uses to build replicas of life-science models: Benchling.

Question 1: Why Use Benchling?

Benchling is a tool that the BU CIDAR lab uses to model life science research, using computing technology to automate the labs. In addition, Benchling supports an electronic lab notebook, which contains tutorials and procedures on building Gibson Assemblies, oligos, enzyme procedures, and many other applications to synthetic biology.

However, the focus of today's activity will be the building of plasmids, especially using a model that will describe the thought process / design that goes into building the plasmids.

Question 2: How Will Use Benchling For This Activity?

Website that demonstrates the the plasmid built for today's activity:

https://benchling.com/jasonlu2017/f/I0oHeimf-benchling-primer/etr-dr7NkWSC-guide-for-moclo-computing-with-cidar-lab/edit

2 Primer / Guiding Questions:

1) In your own words, describe what a plasmid is.

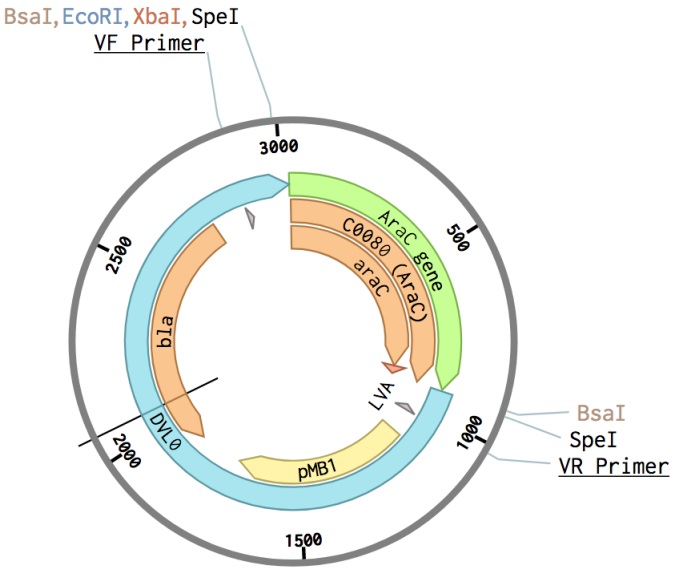
2) Discuss the pros and cons of trying to do laboratory experiments without the help of computers / software like Benchling.

3) Why do we need a technology like Benchling to help us make the laboratory experiments easier to conduct?

4) Explain (in your own words), what is the purpose of the forward (FWD) and reverse (REV) strands of the plasmids.

3 The Activity: Plasmid Puzzle

In your designated groups, take a careful look at the following C0080_CD plasmid (built by a member of the BU CIDAR group):



You have in front of you the following pieces of the plasmid:

For context, the "length" referred is the measurement of the plasmid part in DNA base-pairs (bp).

INVENTORY:

3 AraC Genes, of different lengths (length of about 600, 700, 900), orange color

1 long DVL0 annotation (about length of 2100), blue color

2 bla strands (one forward and one reverse (length of about 860)), also orange color

2 AraC Gene annotations [note for the future researchers], about length of 900, green color

2 very small LVA enzymes, each about length 40 (triangular grey shapes)

2 pMB1 forward strands, about length of 600, yellow color

2 C0080 AraC strands, about same length as the green annotation

You have a total length of 3020 for the C0080_CD plasmid.

You also have 14 total parts. The plasmid requires 8.

In the group, come up with a solution that best replicates the primer shown in page 3 of this handout.

Hints:

Think about how the pieces connect together (example: the plasmid is in a shape of a circle, and that the AraC gene and the DVL0 annotation connect in the circle)

There are more pieces available than you need. Think about what pieces are needed.

Since Benchling plasmids are circular, and that they can be rotated in the center, the foam model can also be rotated as well with a pivot in the center. So, the placement of the shapes in the correct final design will not matter.

4 Post-Activity Q+A

Here are some questions, post-activity, that you can answer before heading to your next activity in Summer Pathways:

1) What was easy about the activity, what was difficult?

2) Why do you think design is important when using technology to do synthetic biology? What can go wrong?

Did you have fun with this activity? How did this "puzzle" help you figure out the key pieces to building a plasmid?

4) How can you apply this activity to team-building exercise and problem-solving in the real world? For everybody in STEM-Pathways teamwork, collaboration, and mentorship is key to getting quality research done well and on time.

Thank you for participating, and enjoy your next activity! Welcome to STEM Pathways :-)