

## Introduction

1. What are some potential applications of Synthetic Biology?
2. How does a knowledge of genetics help us as Synthetic Biologists?
3. How does a knowledge of molecular biology help us as Synthetic Biologists?
4. What are some ways that BioPhysics can be applied to Synthetic Biology?
5. Mathematical models play a huge role in SynBio systems. Can you think of any cases where a model would be useful to predict the system's behavior?
6. How could synthetic biologists use computer science or Big Data approaches in their work?
7. 'Engineering and Design Principles' definitely seems like the odd man out, but it serves as the foundation of Synthetic Biology. Can you think of some ways that design principles could be used in synthetic biology?

## Central Dogma

1. Why do we have a library of protein coding sequences instead of simply having a repository of proteins?
2. What is an application where we could develop a meaningful change by instructing cells to express different proteins?
3. The Central Dogma can be regulated at various steps: DNA can be blocked by a protein which prevents transcription from starting, the process of transcription can be impeded, RNA transcripts can be marked for destruction, the process of translation can be impaired, and proteins themselves can face many different forms of post-translational regulation (these can either serve to activate or deactivate the proteins). Would regulating the expression of a gene at the transcriptional level have a different effect than regulating at the translational or post-translational level? Make some predictions. (You may find it helpful to sketch out the central dogma and think gene expression like an assembly line).

## Standard Biological Parts

1. How would having a stronger promoter region affect the amount of protein produced from the gene?
2. Do you think changing the strength of the promoter region for a certain gene has any effect on the expression of other genes in the system? In what situations could this happen?
3. What function does the RBS have at the DNA level? (Think of the central dogma)
4. Think of the following: We change the promoter region to one which is twice as effective at recruiting RNAP as the old promoter region, but also change the RBS to one which only binds the ribosome at half the affinity of the old RBS. Do you think the amount of protein produced from this gene would be different than if we didn't make any changes at all?

## Cloning Overview

1. Suppose you started a 25 cycle PCR reaction on a sample that you had 100 template strands of. How many DNA strands would you have at the end of the reaction (including the original template strands).
  
2. What is the use in assembling pieces of DNA? Why go to all the trouble of performing a Gibson assembly instead of just putting individual plasmids into cells without assembling them?
  
3. Why do we need to have an antibiotic resistance marker on the plasmid backbone?
  - a. What would happen if we didn't have the antibiotic resistance marker but still used a plate with antibiotic media?
  
  - b. What would happen if we didn't have the antibiotic resistance marker but didn't use a plate with antibiotic media?