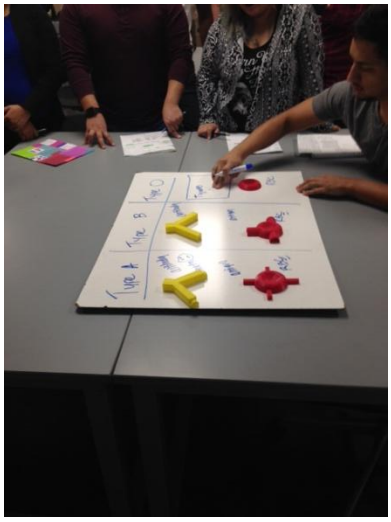
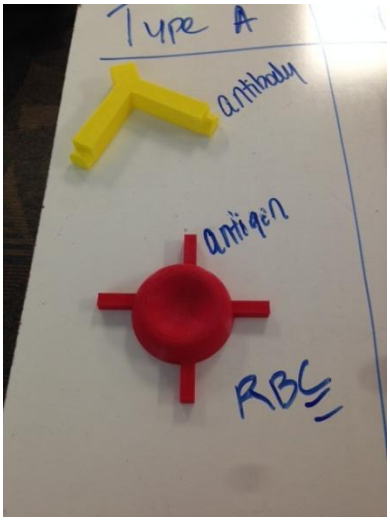
CATS Use of 3-D models in class

Trying to visualize molecular processes for students can be very challenging. Neil Raymond and I decided to try 3-D printed objects to use in the classroom to teach these concepts in Biology. I used the database thingiverse to search for models, and Neil designed and printed his own working sarcomere through tinkercad. After using the models in class, I discovered that they can be powerful tools to aid in conceptualizing and visualizing processes, especially at the molecular level. The 3-D printing is a compliment to STEM curriculum and promotes problem solving skills. I used 3-D printed models of red blood cells containing antigens and antibodies in BIO160. Next week I will be using a 3-D model of DNA, mRNA, and tRNA to teach the structures of each molecule, in addition to the process involved in protein synthesis. Students traditionally struggle with this molecular process. I will use data from the test they just took to compare the class that used the models to the class that did not. This worked out based on when the models were finished and available.

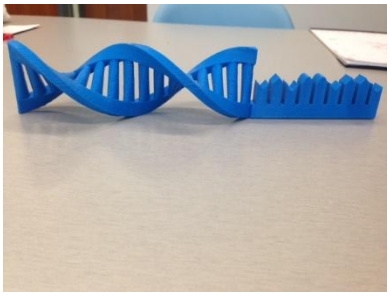
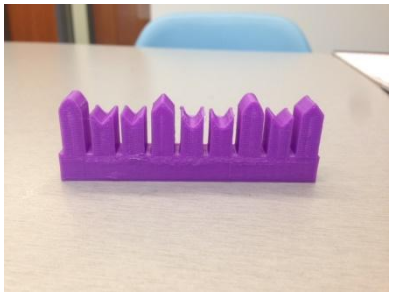
Red blood cell models: During class, I had the students label the models on the white board. They identified the blood type, antigen and antibody present. Then they had to model what would happen during a blood transfusion of the wrong blood type. I also had the students identify which blood type was missing and how that blood type would look as a model. Next semester I will put together a more inquiry-based guided activity when I have a class set for each table to use.





DNA transcription/translation set:

The 3 pieces:


1. Arrange students in 6 groups, B1, B2, P1, P2, Y1, Y2

   B1 and B2 groups will receive a DNA molecule

   P1 and P2 groups will receive a mRNA molecule

   Y1 and Y2 will receive a tRNA molecule

2. Have students label and identify the following parts of the molecule:
   a. DNA: sugar-phosphate backbone, nitrogen bases, hydrogen bonding, covalent bonding; identify how DNA structure differs from the RNA structure
   b. mRNA: sugar-phosphate backbone, nitrogen bases, covalent bonding; identify how the RNA structure differs from the DNA structure
   c. tRNA: what is a tRNA made of? Identify the anti-codon
3. Have students identify HOW their "part" of the molecule works in protein synthesis.
4. Put the "1s" and "2s" together and have them first teach each other the parts of the molecule. Then, explain how their part fits into the steps of protein synthesis
5. As with all models, there are some limitations. In groups, discuss limitations of these models.

As time permits, within the 1s and 2s, have them exchange models and start over!

Data collection: This is the first semester I have taught BIO181 at Estrella. I do not have data to use from previous semesters. I will take pre-test data and post-test data as a basis of comparison.