3D Printed Models for Science Education

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BROWARD COLLEGE

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Summary

3D models will be printed and used to help students understand biological systems. Use of models can increase the understanding of chemical representations (Wu et. al, 2001). Working in groups, students will manipulate the moving pieces of microscopic processes making the learning experience more impactful (Blatchford et. al, 2003). Through hands on learning students will achieve a profound level of understanding.

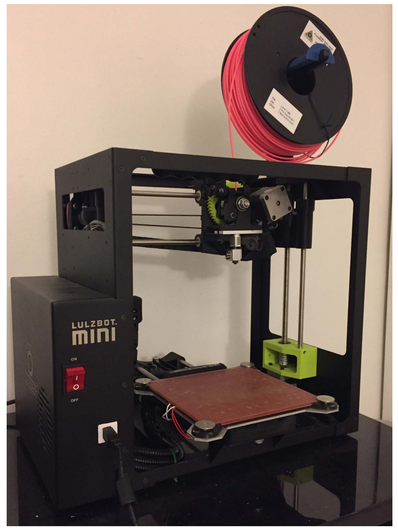
Goals

The short-term goal of this project is to increase student understanding and comprehension of protein synthesis in which DNA is used to make RNA and proteins. The long-term goal is to use the 3D printer to make lesson plans and model sets for various complicated structures and pathways in biology and other sciences.

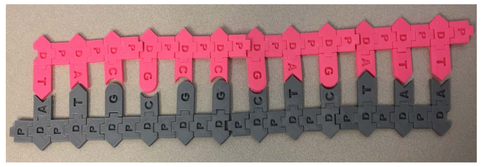
Learning Objectives

1. Compare the molecules involved and organize and explain the sequence of events of protein synthesis.
2. Explain the roles different parts of ribosome structure play in protein synthesis.
3. Describe the post-transcriptional modifications that occur with eukaryotic RNA and relate their role in protein synthesis.
4. Demonstrate understanding of protein synthesis by building an example protein given a specific set of DNA as a code for that protein

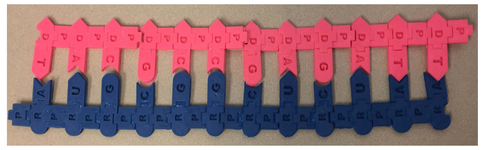
LULZBOT



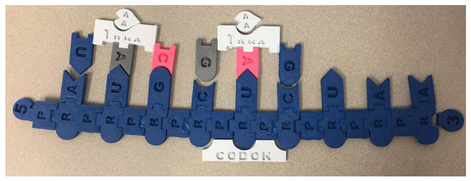
Lulzbot mini 3D printer



3D printed model representing double stranded DNA



3D printed model representing transcription of messenger RNA



3D printed model representing translation of proteins

Timeline

November 2017	Received grant, place order for printer
January 2018	Develop lesson plans and choose 3D models
February 2018	Set up 3D printer and begin printing models
March 2018	Perform 3D model activity in class
April – August 2018	Develop 3D printing workshop
August 2018 - May 2019	Run workshops for North Science faculty to use 3D printer

Outcomes

Products of this project include the classroom set of 3D models of DNA, RNA and proteins that and the accompanying lesson plan. 3D printing in biology and anatomy can be expanded to many other microscopic structures and dynamic processes. 3D printed models and the 3D printing technology will be available to other science faculty for use.

Evaluation

The project will be assessed by the grades earned by the student assignments and exams. Each question on the assignment and exam will be aligned with one or more of the learning objectives. Student surveys can be used evaluate the effectiveness of using the 3D printed model sets.

References

Hsin-Kai Wu, Jos Hsin-Kai Wu, Joseph S. Krajcik, Elliot Soloway. Promoting understanding of chemical representations:Students' use of a visualization tool in the classroom *Journal of research in Science Teaching*, 38:7 (2001) 821-842.

Peter Blatchford, Peter Kutnick, Ed Baines, Maurice Galton. Toward a social pedagogy of classroom group work. *International Journal of Educational Research* 39 (2003) 153–172.

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