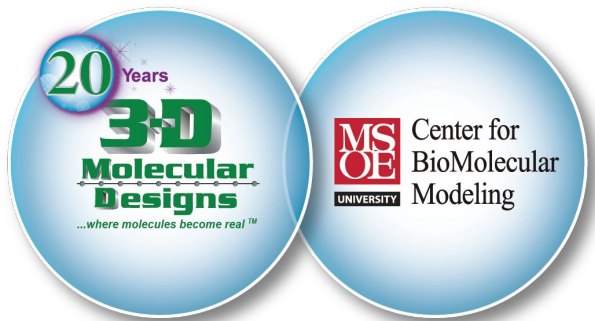
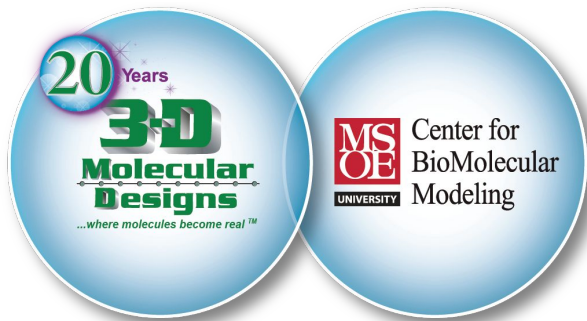




A Tale of Two Sisters:

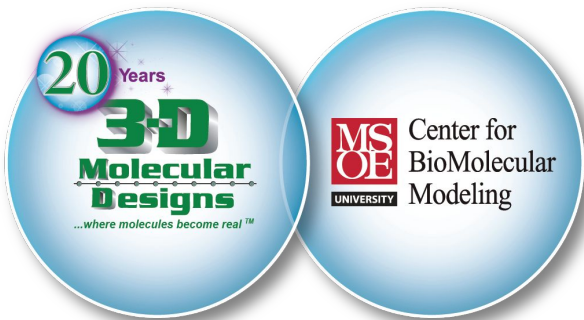
Transcription, Translation, & Sickle Cell Anemia



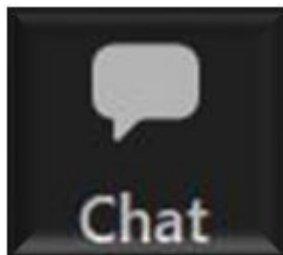


Center for BioMolecular Modeling





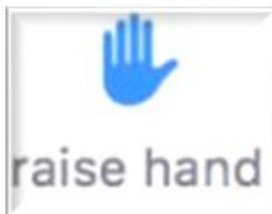
Webinar norms



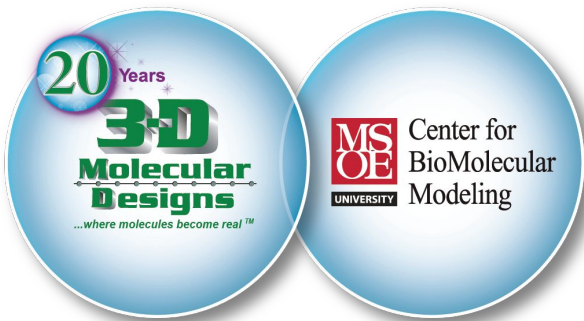
Comments and Questions for 3D Molecular Designs Staff should be entered into the Chat box.



Questions for the Speaker should be entered into the Q&A box.



Use the Raise Hand button to participate in discussion when applicable.



Fran Grant, M.S.

B.S., Biology, Secondary Education

University of WI - Eau Claire

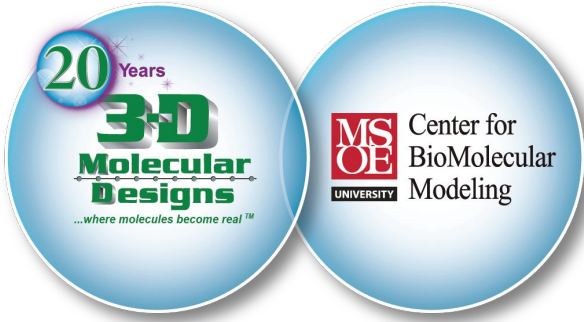
M.S., C and I, Concordia
University

Grafton High School, Grafton, WI

PLTW Biomedical Science Teacher
(PBS, HBS, MI, BI)

Anatomy and Physiology, Biology





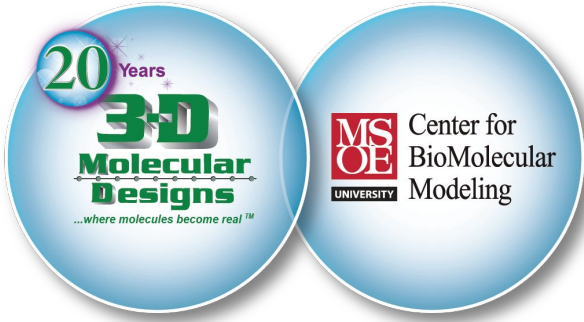
Mark Arnholt

BA Secondary Ed
BS Biology - Concordia
University

20 years at Hartford Union High
School, Wisconsin

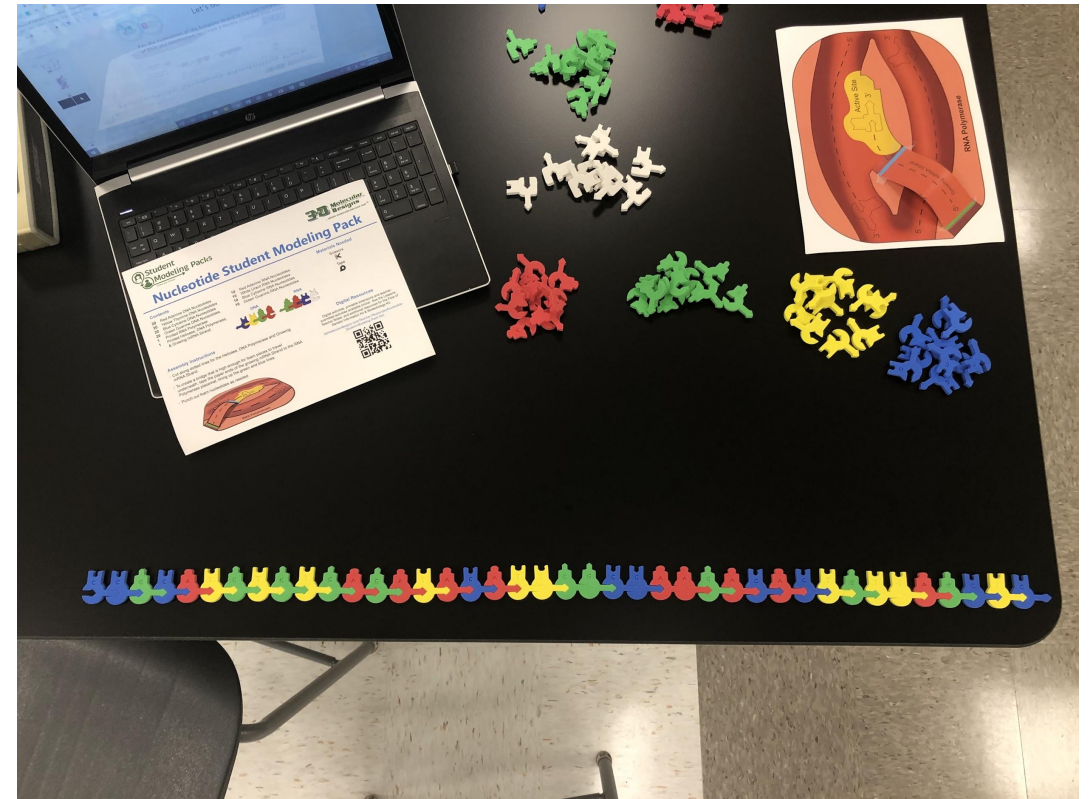
Teaches Fr. Biology, Medical
Interventions, Biomedical
Innovation

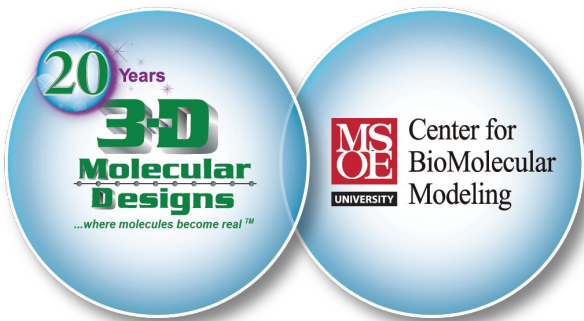




What you'll need for today

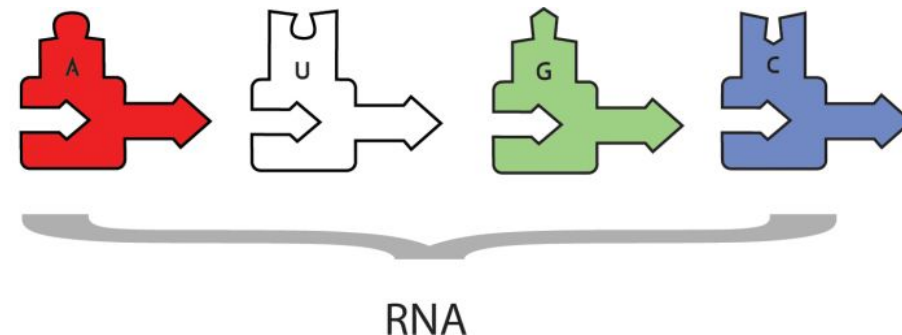
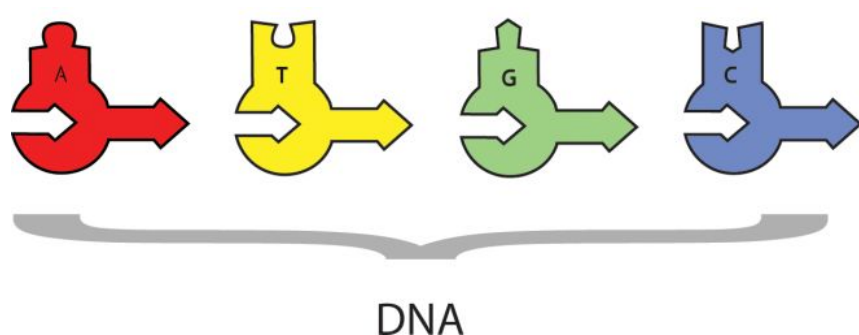
- 1) All of the nucleotides from your student modeling pack
- 2) RNA Polymerase sheet with the bridge taped in place
- 3) SPACE! Make sure you have a room to work in



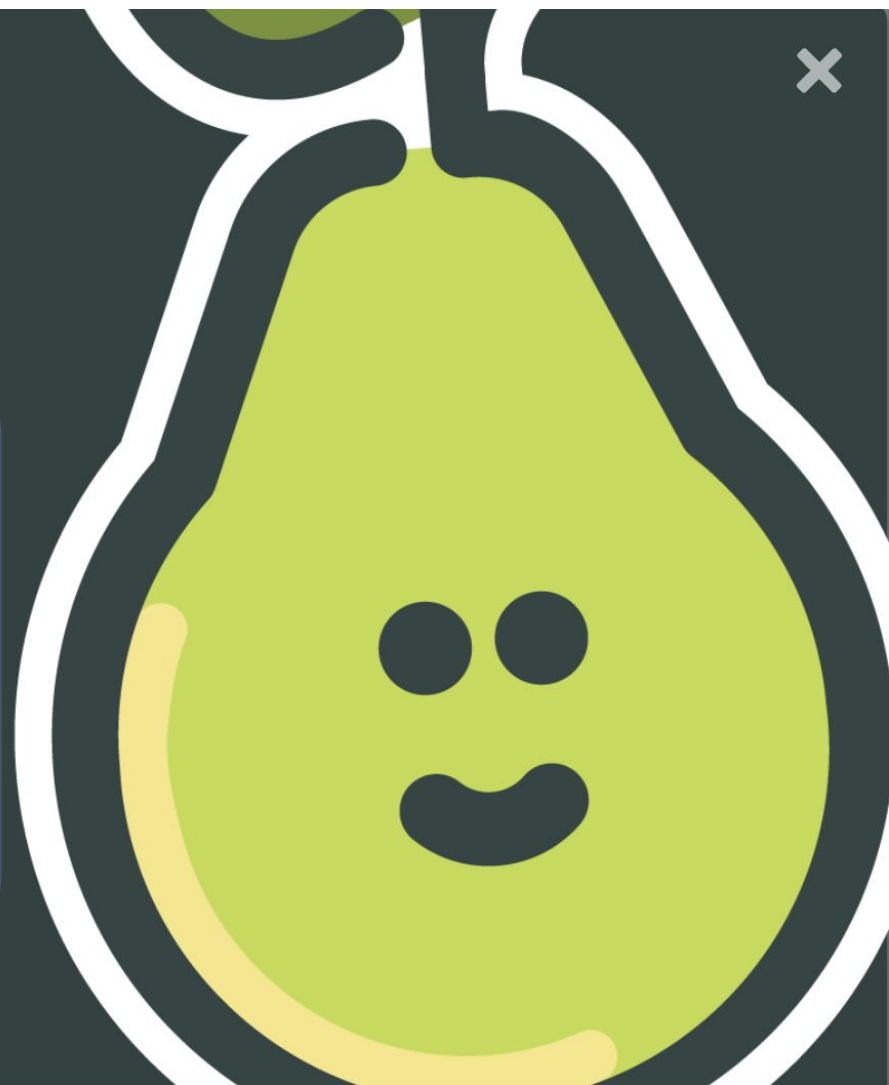


Workshop Norms

- Raise your hand to unmute your microphone.
- Ask questions in the Q&A
- Feel free to use the “chat” option.
- Hopefully you have your DNA set up. If not, no worries.
- Have RNA nucleotides ready.



joinpd.com



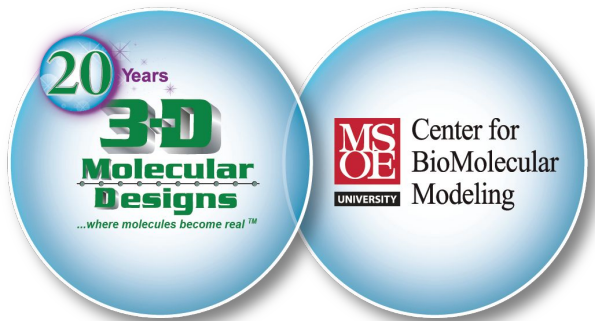
No students connected



Give Students a Link



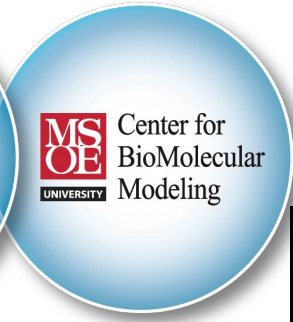
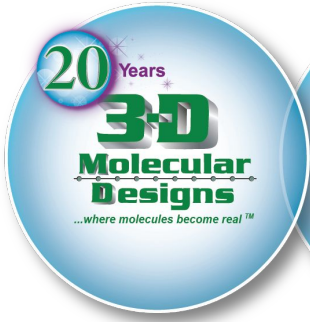
Open Teacher Dashboard



Let's do it!



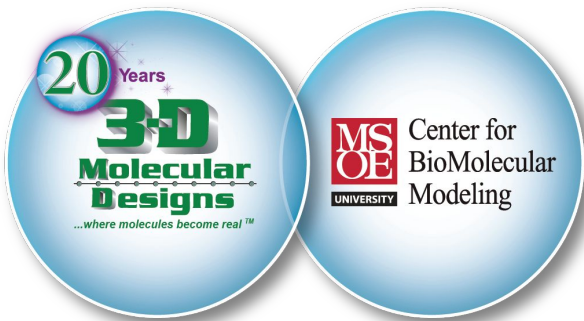
5' CCGCATCTGTGAGATAC 3'



Meet Helen Obando



Kolata, G. (2020, January 10). A Teenager's Breakthrough Gene Therapy for Sickle Cell Disease. Retrieved July 27, 2020, from <https://www.nytimes.com/2020/01/10/the-weekly/sickle-cell-dna-reset.html>



Workshop Learning Goals

Educators attending this workshop will:

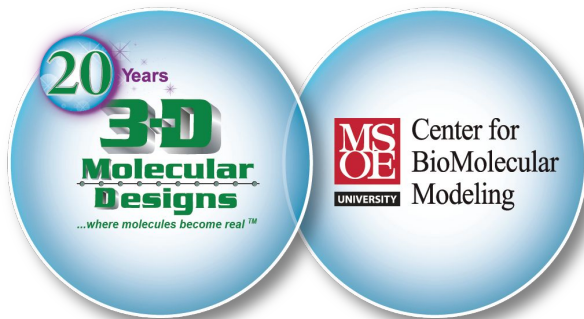
- Utilize a model for the flow of genetic information that supports both the NGSS student learning outcomes of three dimensional lesson.
- Learn how to create hands-on, interactive community virtually to teach biomolecular concepts.
- Learn something new and interesting for your own professional development.



What do you teach?

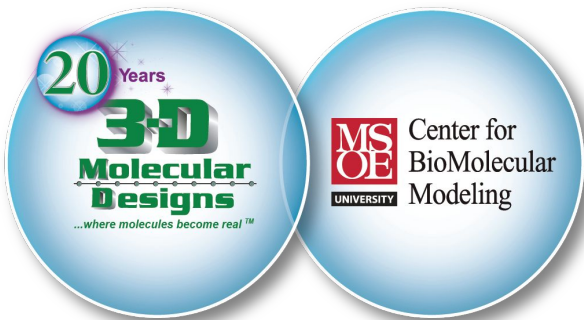


Students choose an option

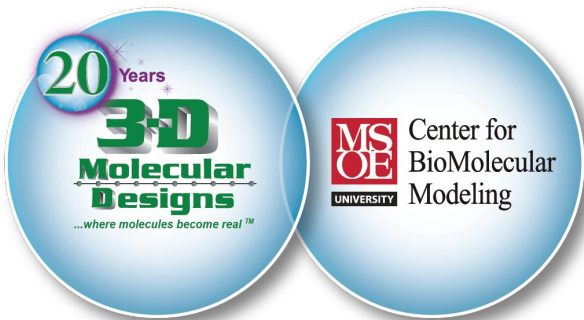


Why Model?



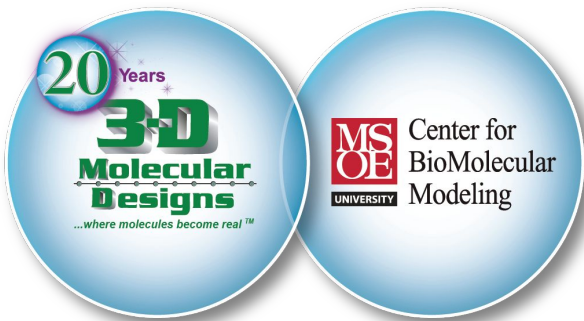


PBS	HBS	MI
KS 9.1.1 Describe the structure and function of nucleic acids and the relationship among genes, alleles, chromosomes, proteins, and traits. Lessons: PBS 1.1, 2.2	KS7.1.1 Explain the structure and function of DNA.	KS9.2.1 Explain how molecular tools, such as ligase and restriction enzymes, are used to cut and paste DNA from different sources.
KS 9.1.2 Explain how the order and chemical properties of amino acids influence a protein's structure and function, PBS 2.2	KS7.1.2 Explain the action and use of restriction enzymes.	KS9.2.2 Identify which restriction enzyme to use for a given situation.
KS 9.1.3 Describe the processes of DNA replication and protein synthesis. PBS 2.2	KS7.1.3 Describe how gel electrophoresis can be used to examine DNA differences between individuals.	KS 9.4.1 Identify single base- pair differences in DNA through laboratory techniques, such as DNA extraction, PCR, and restriction analysis.
KS 9.1.4 Explain how mutations in nucleic acids can lead to diseases or disorders or promote evolutionary change., PBS 2.2	KS7.1.4 Analyze gel electrophoresis data	
KS 9.4.1 Explain and demonstrate techniques in molecular biology (DNA extraction, restriction digestion, gel electrophoresis) and interpret results. PBS 1.1 ,1.2, 1.3, 2.2, 2.3		
KS 12.2.3 Create, describe, and analyze models of biological processes to explain proper and improper functioning.		



TARGETED NGSS DIMENSIONS

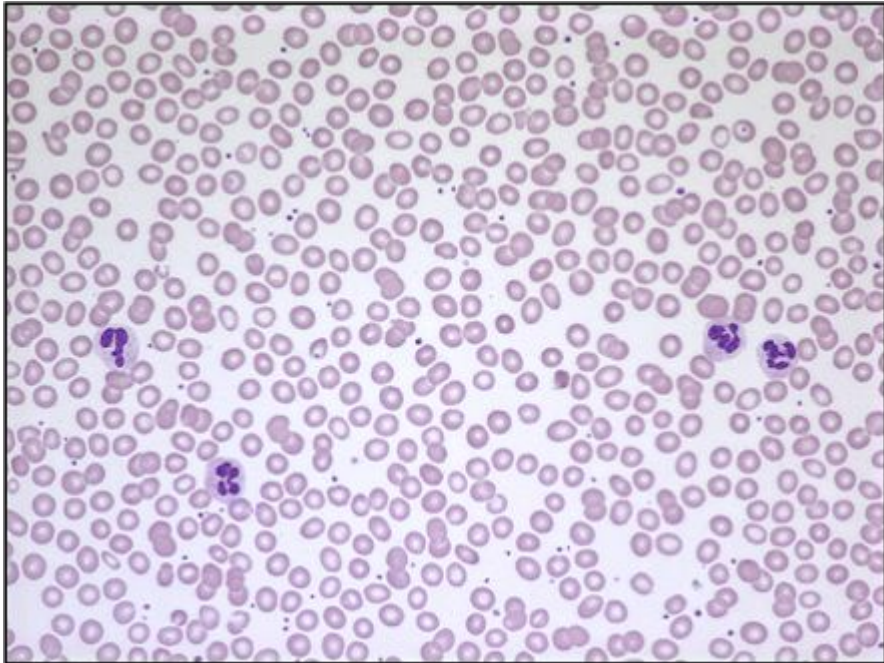
SEPs	CCCs	DCIs
Asking questions	Patterns	LS1.A: Structure and function
Developing and using models	Cause and effect	LS3.A: Inheritance of traits
Constructing explanations	Systems and system models	LS3.B: Variation of traits
Analyzing and interpreting data	Structure and function	



Helen's Medical History

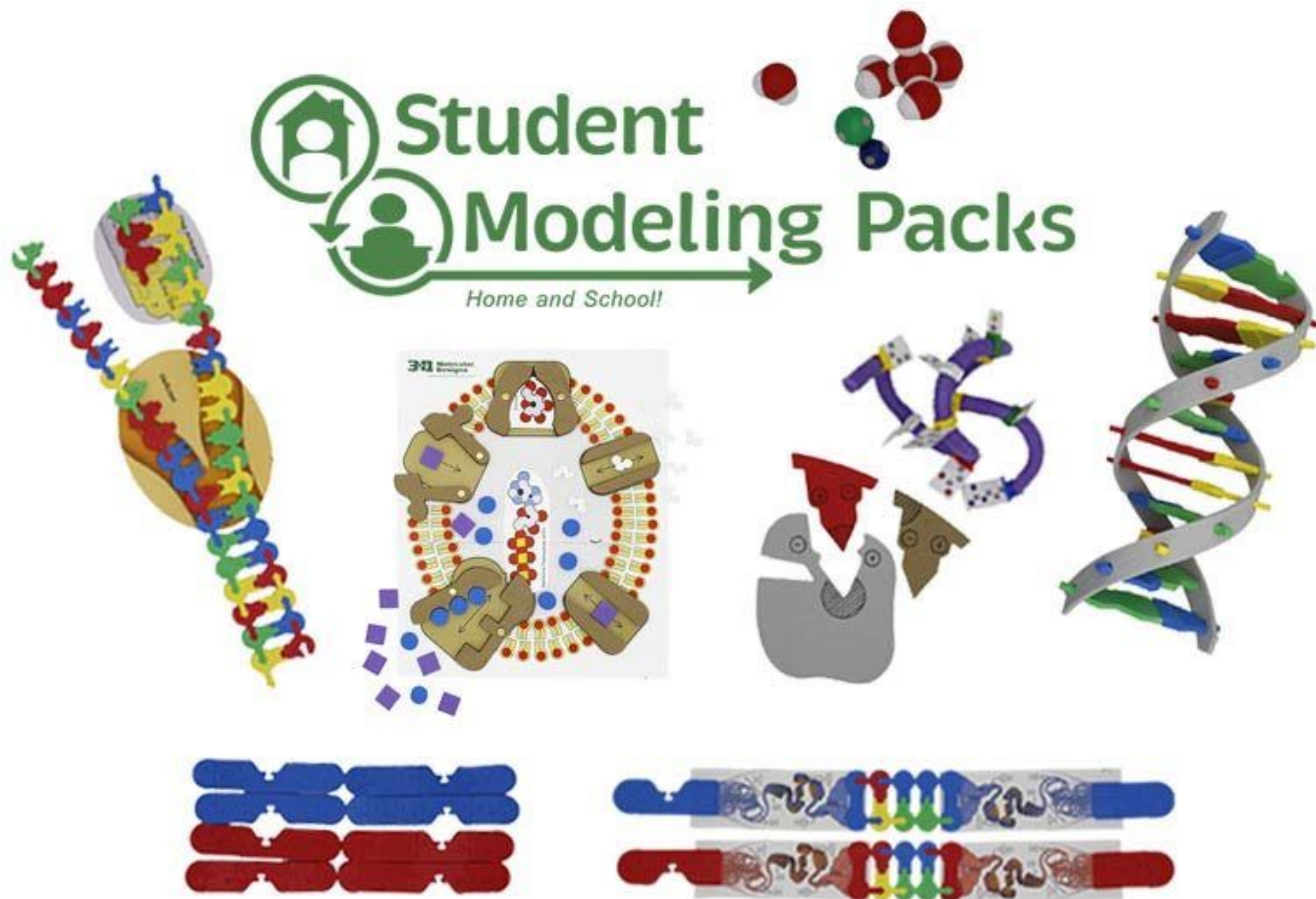
- 9 months - blood clot in pelvis
- 2 yrs. old - spleen removed
- hospitalized 13 times with acute chest syndrome
- bacterial infections in her spine
- experiences episodes of severe pain
- Hispanic



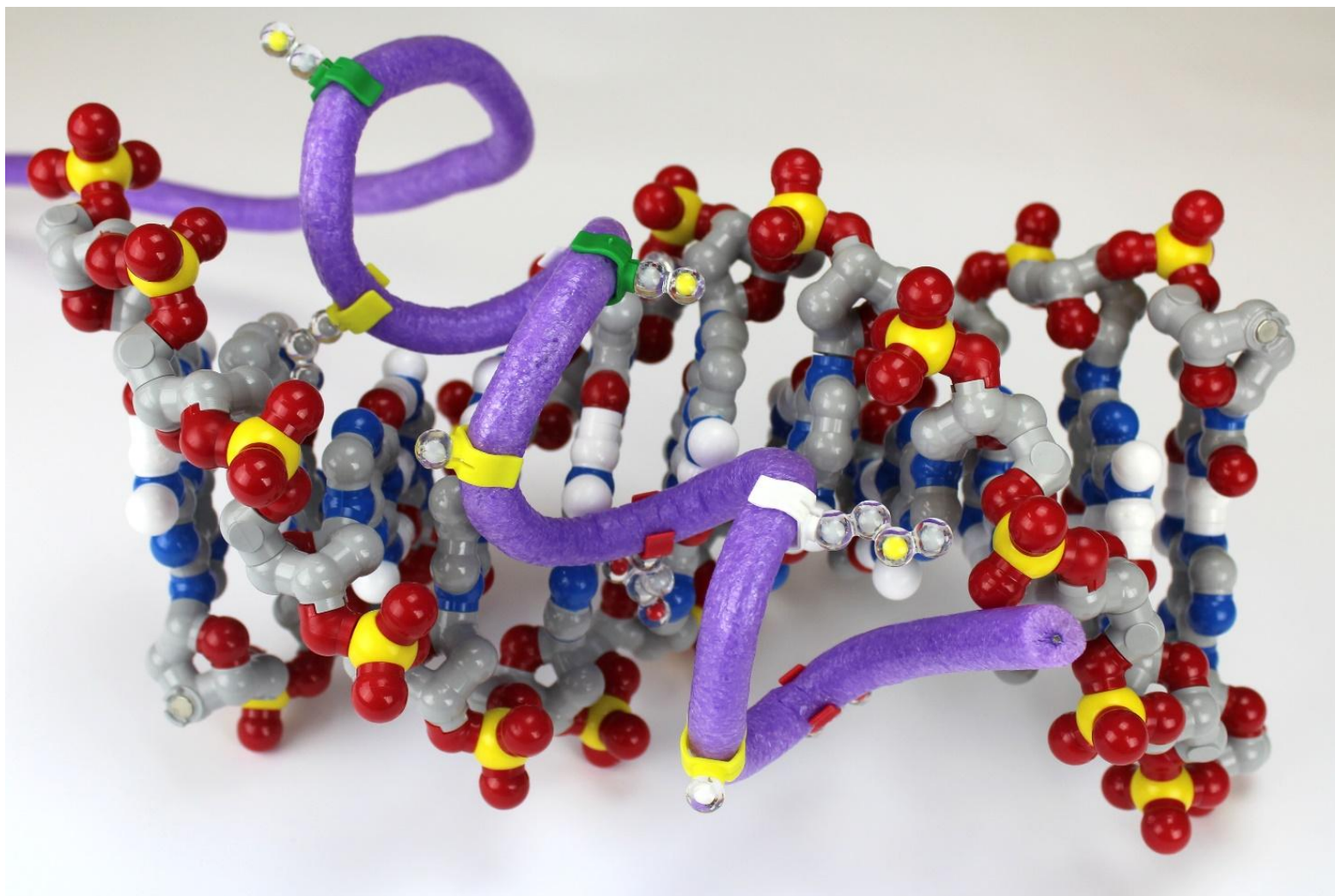
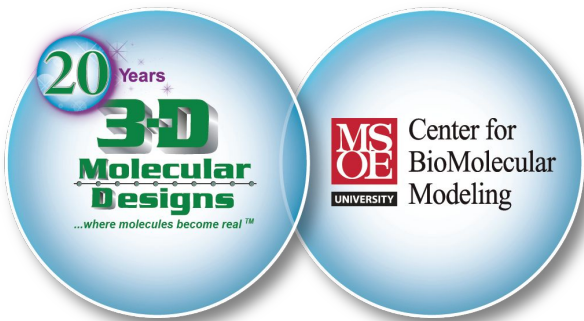


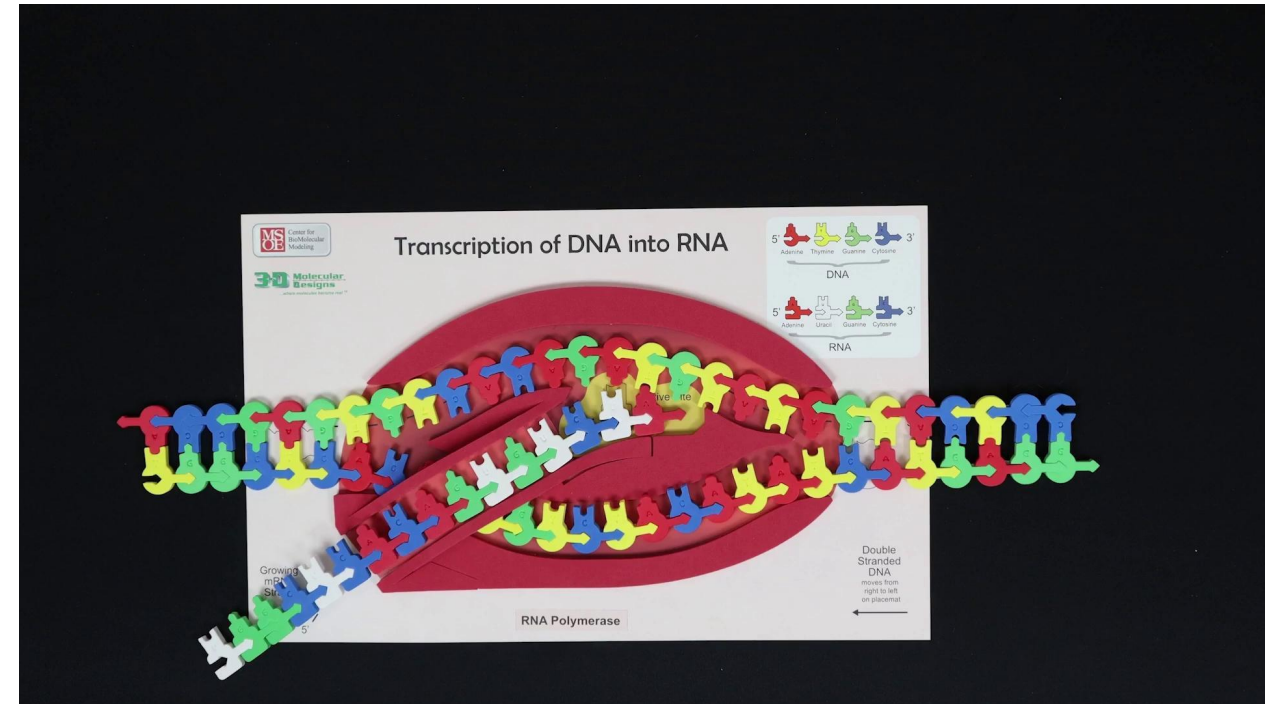
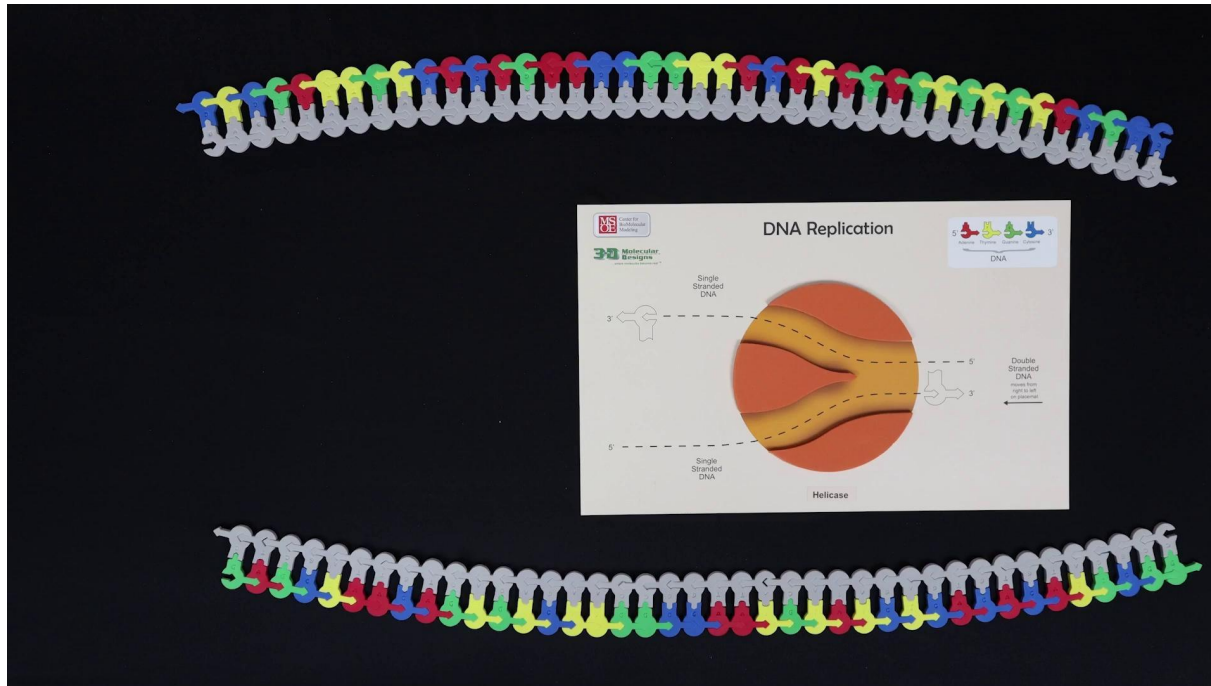
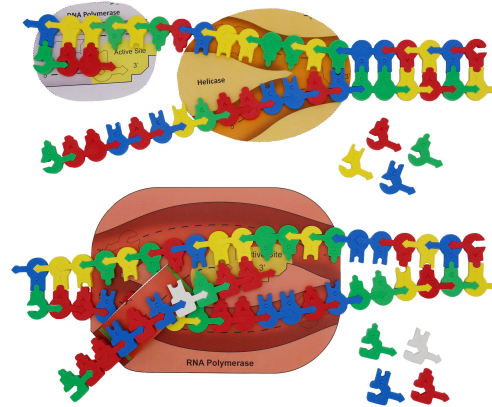
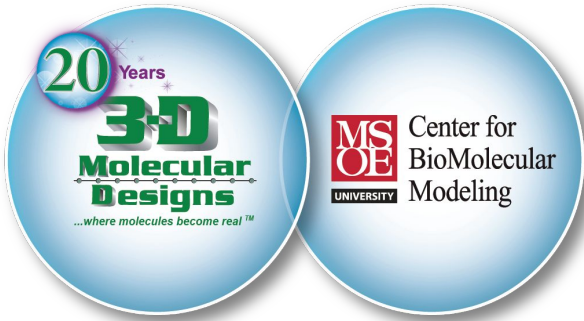
Students, drag the icon!

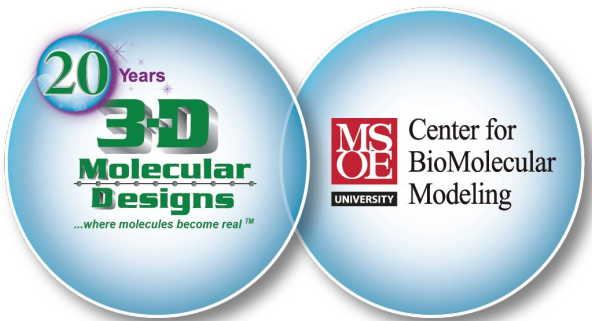




[www.https://www.3dmoleculardesigns.com/Education-Products/Student-Modeling-Packs.htm](https://www.3dmoleculardesigns.com/Education-Products/Student-Modeling-Packs.htm)

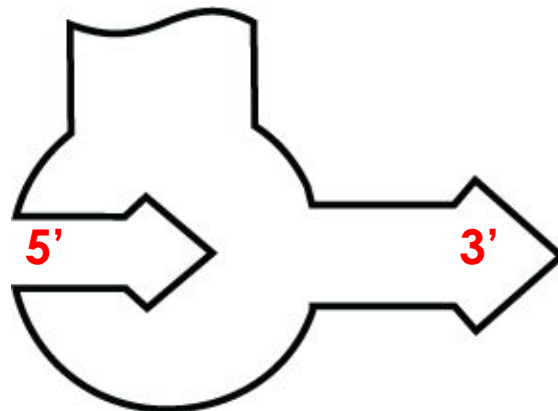
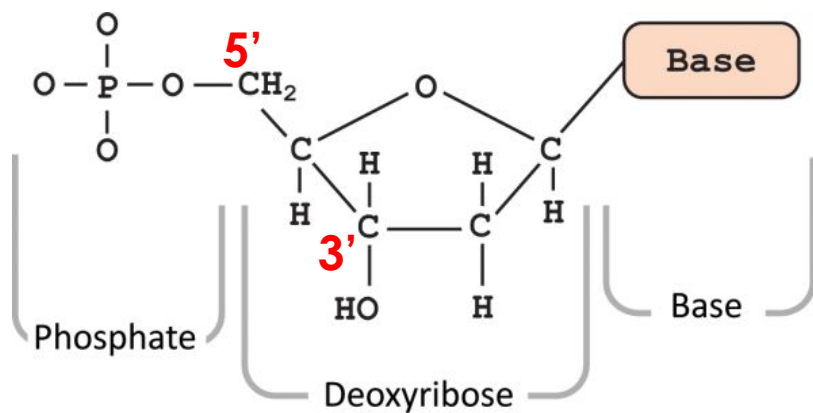


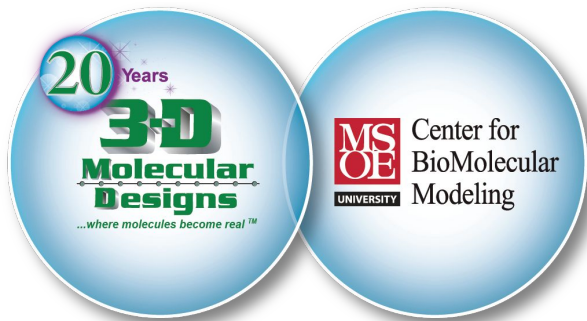




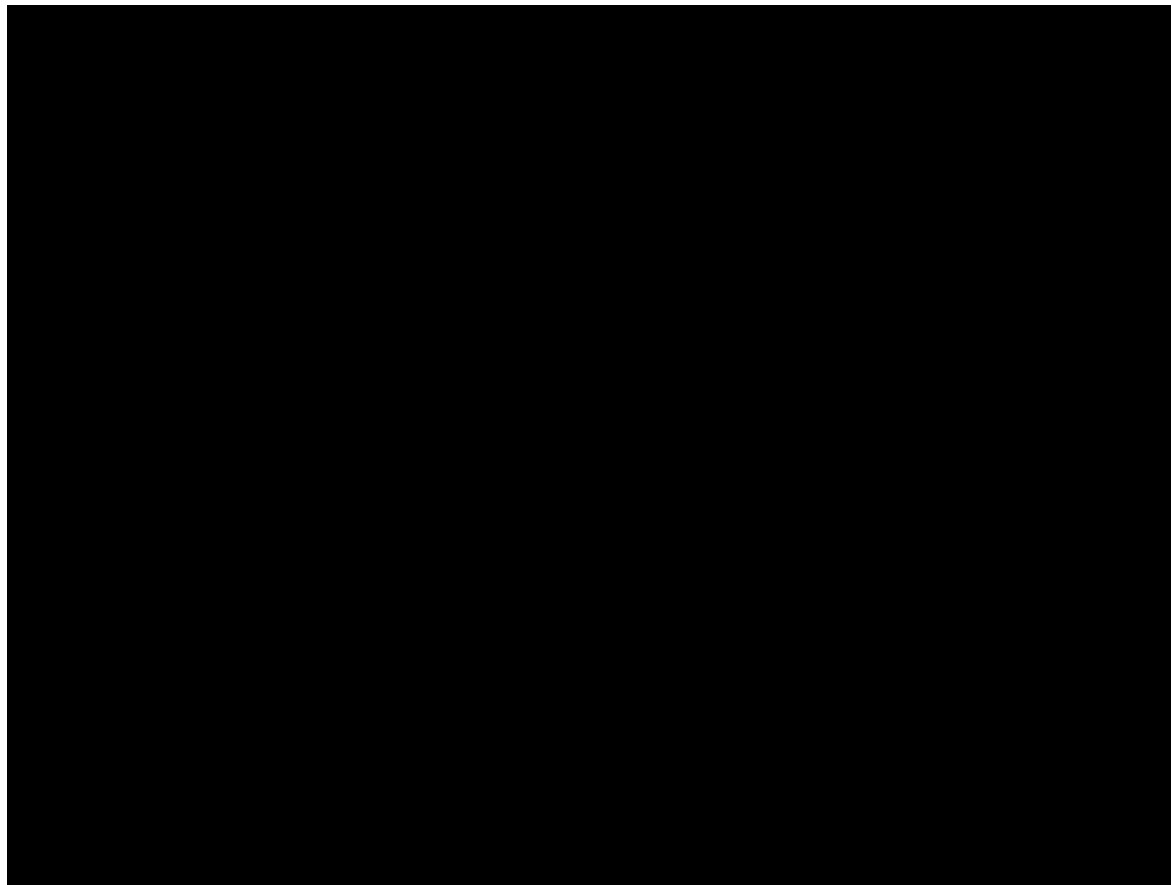
TRANSCRIPTION

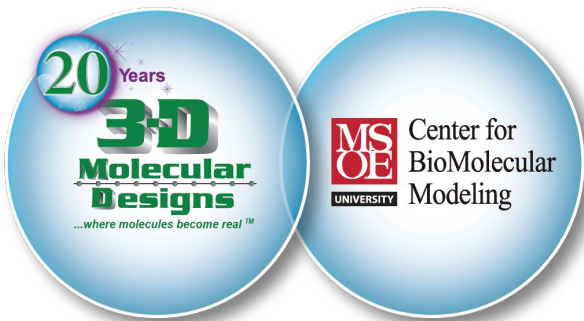
THE DEVIL IS IN THE
DETAILS!





A little bit of direction





Transcription

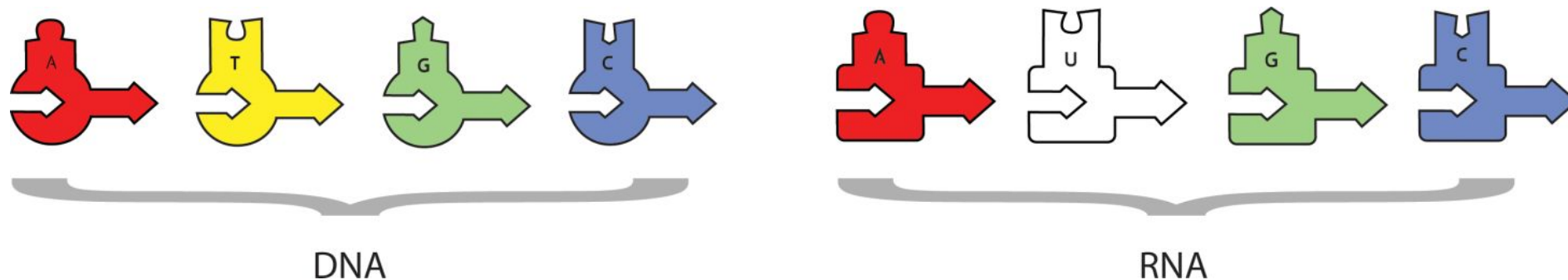
DNA: Place red dot on the template strand



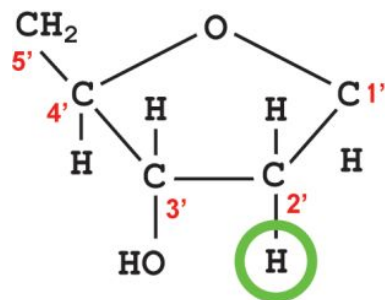
Students, drag the icon!



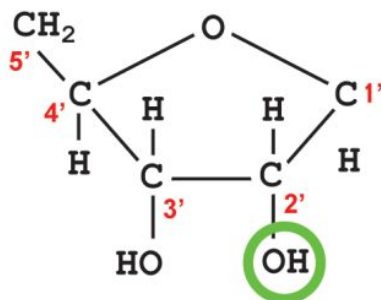
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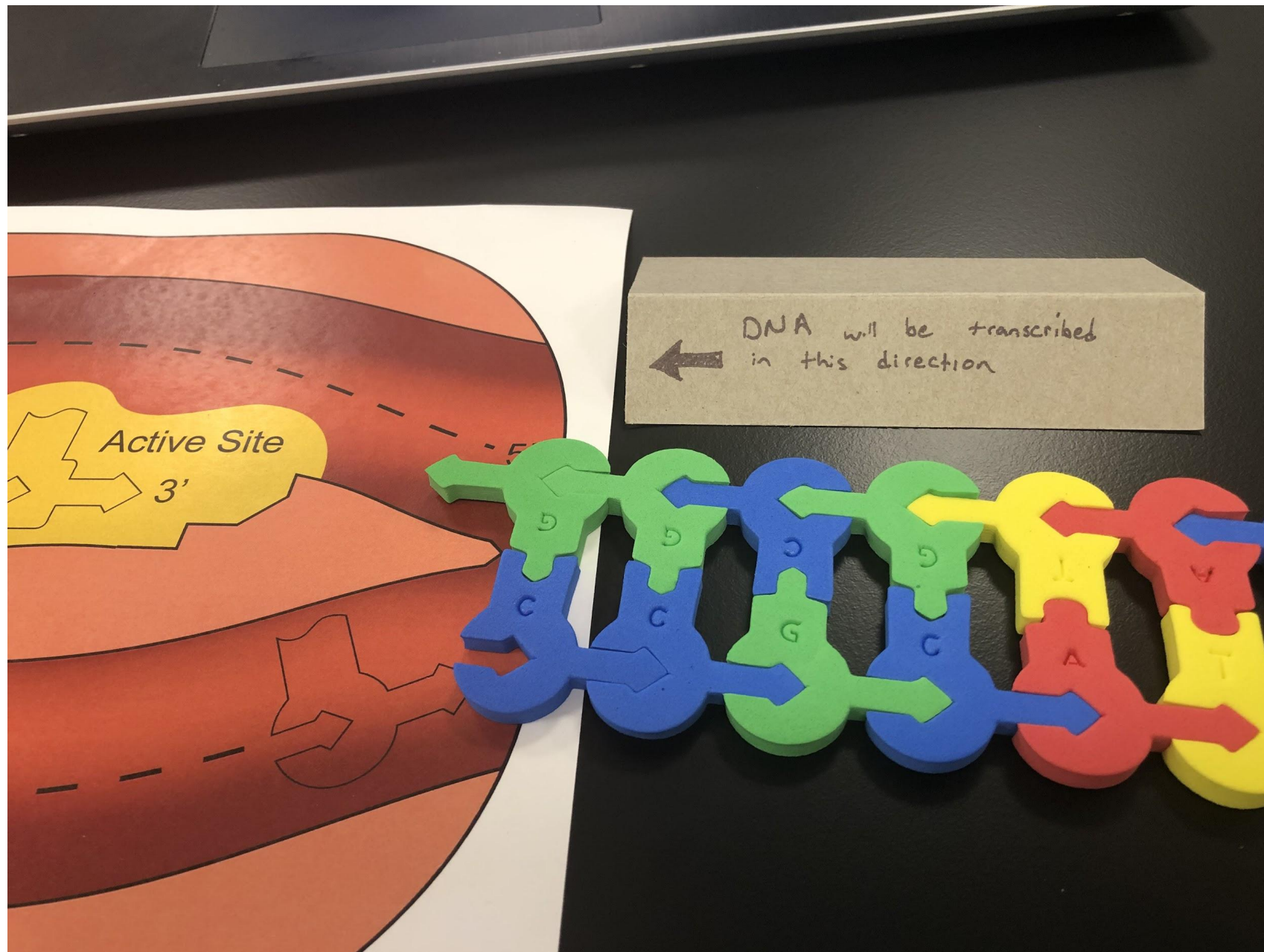
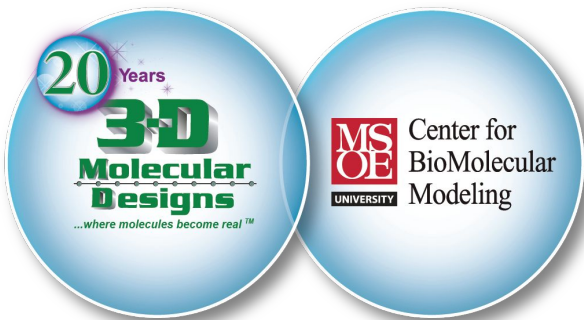
Deoxyribose
found in DNA

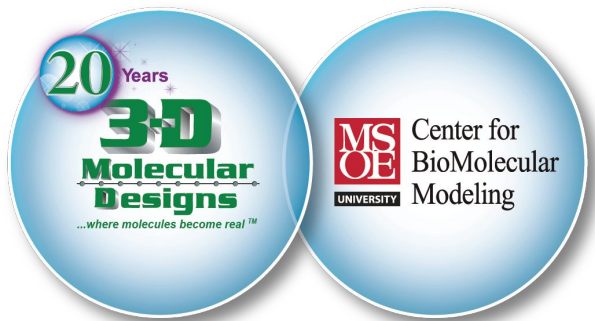


Ribose
found in RNA

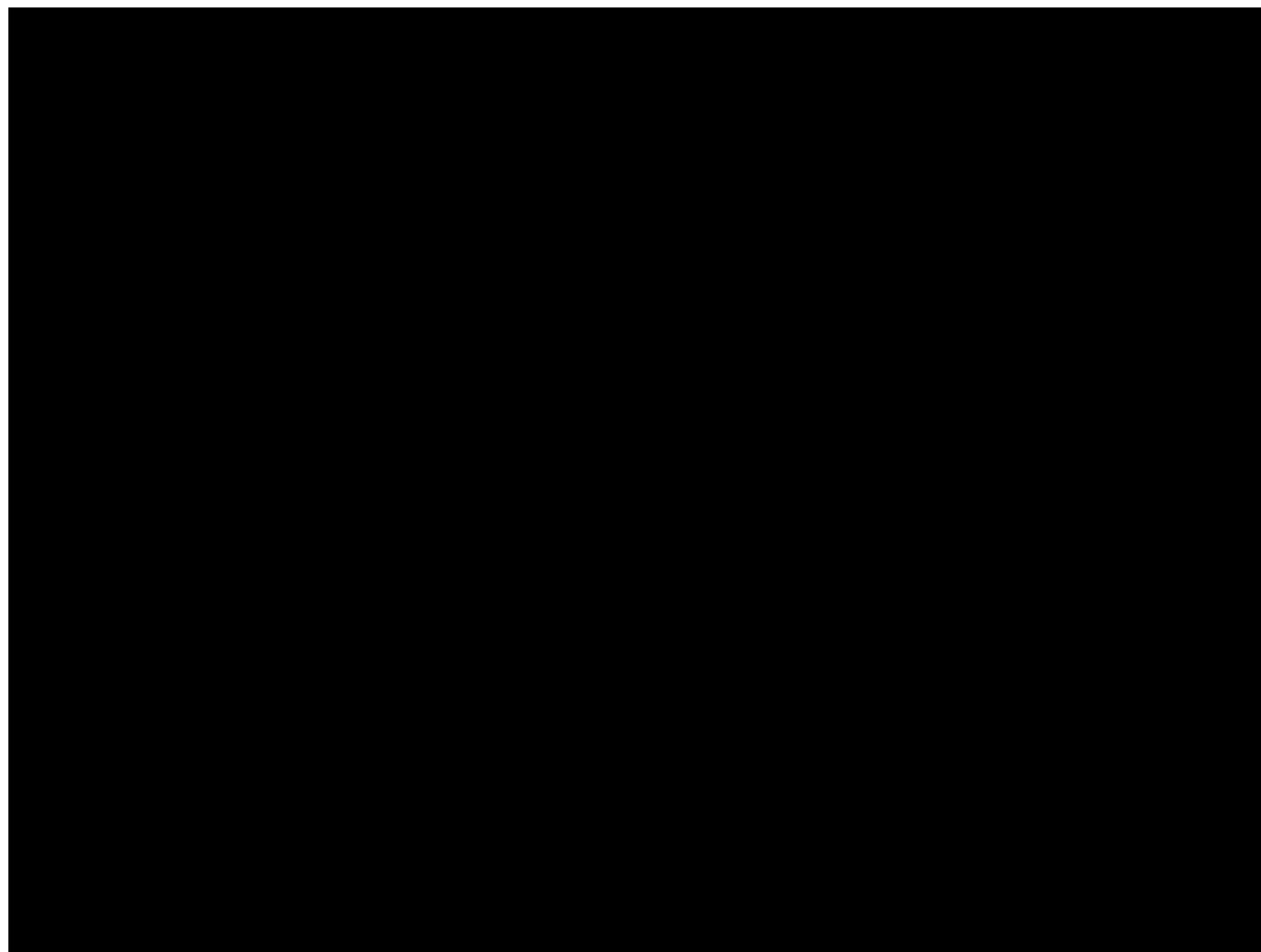


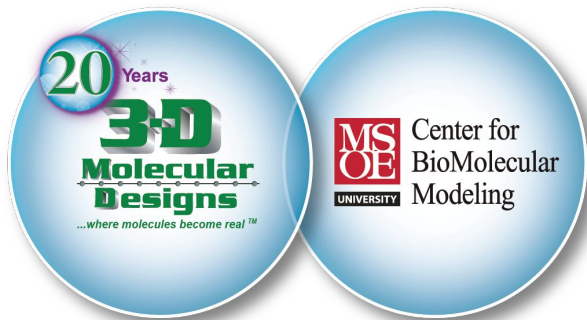
TAKE NOTE!



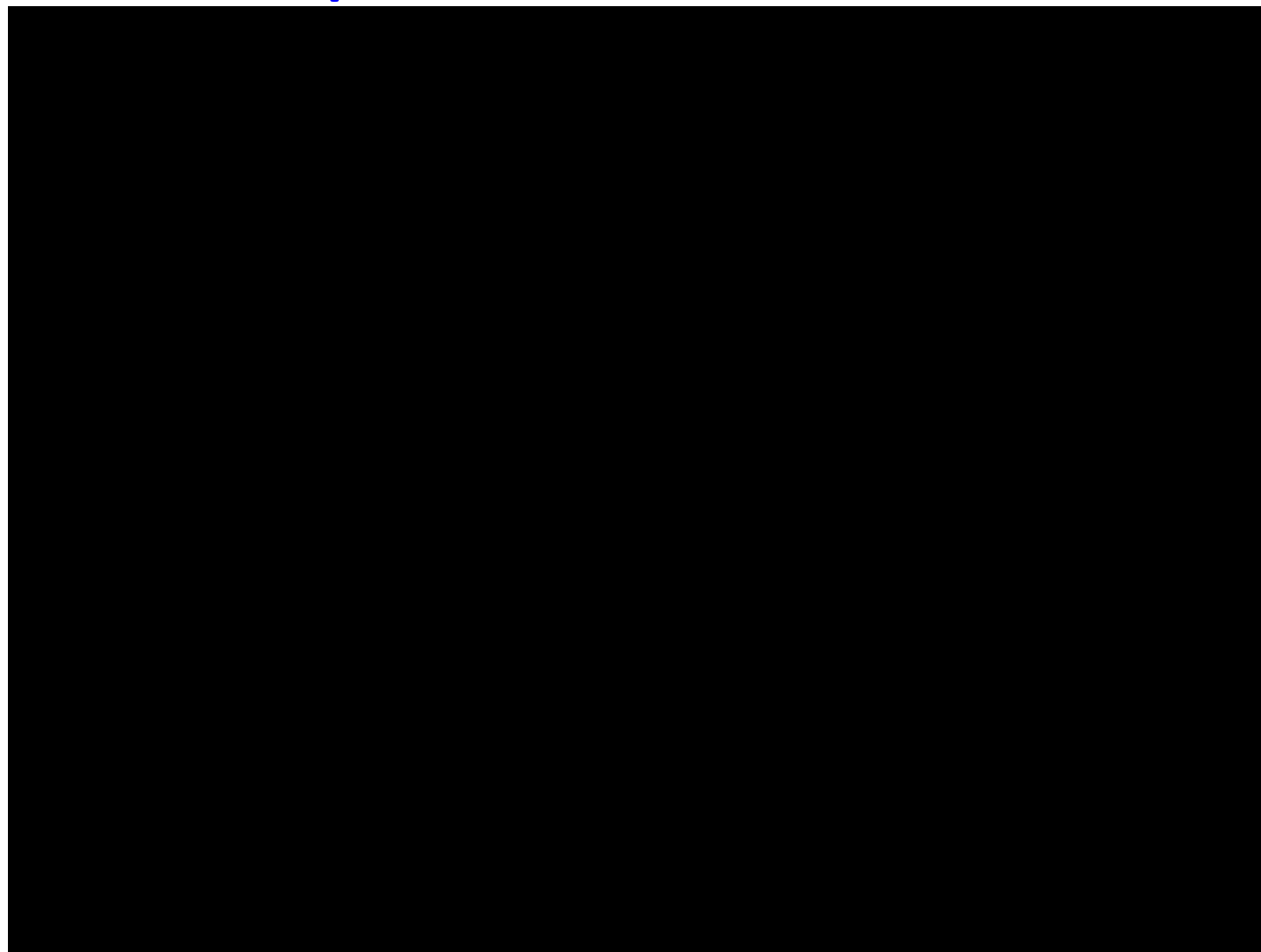


Nucleotide Student Modeling Pack: Transcription

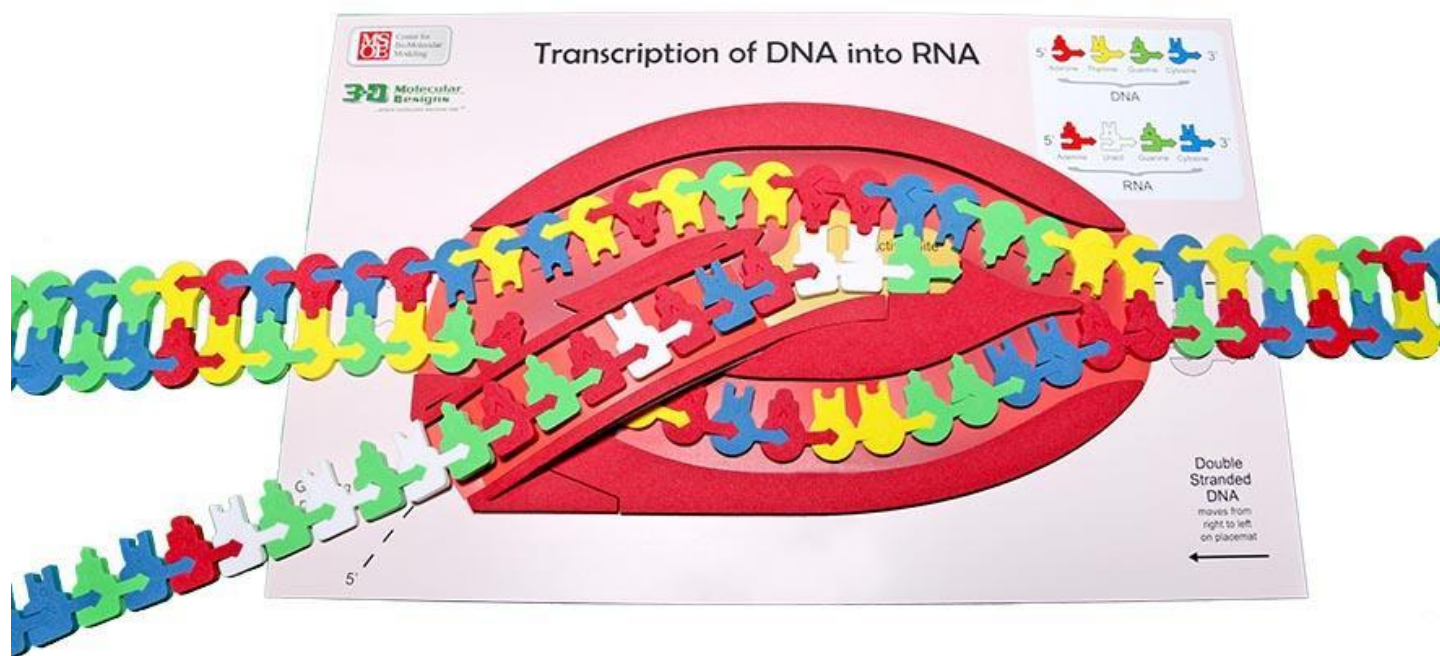




Flow of Genetic Information Kit: Transcription

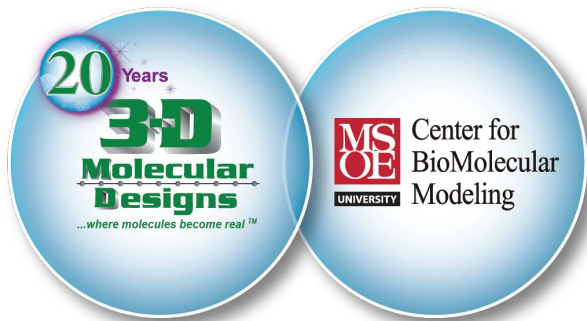


Modeling Transcription

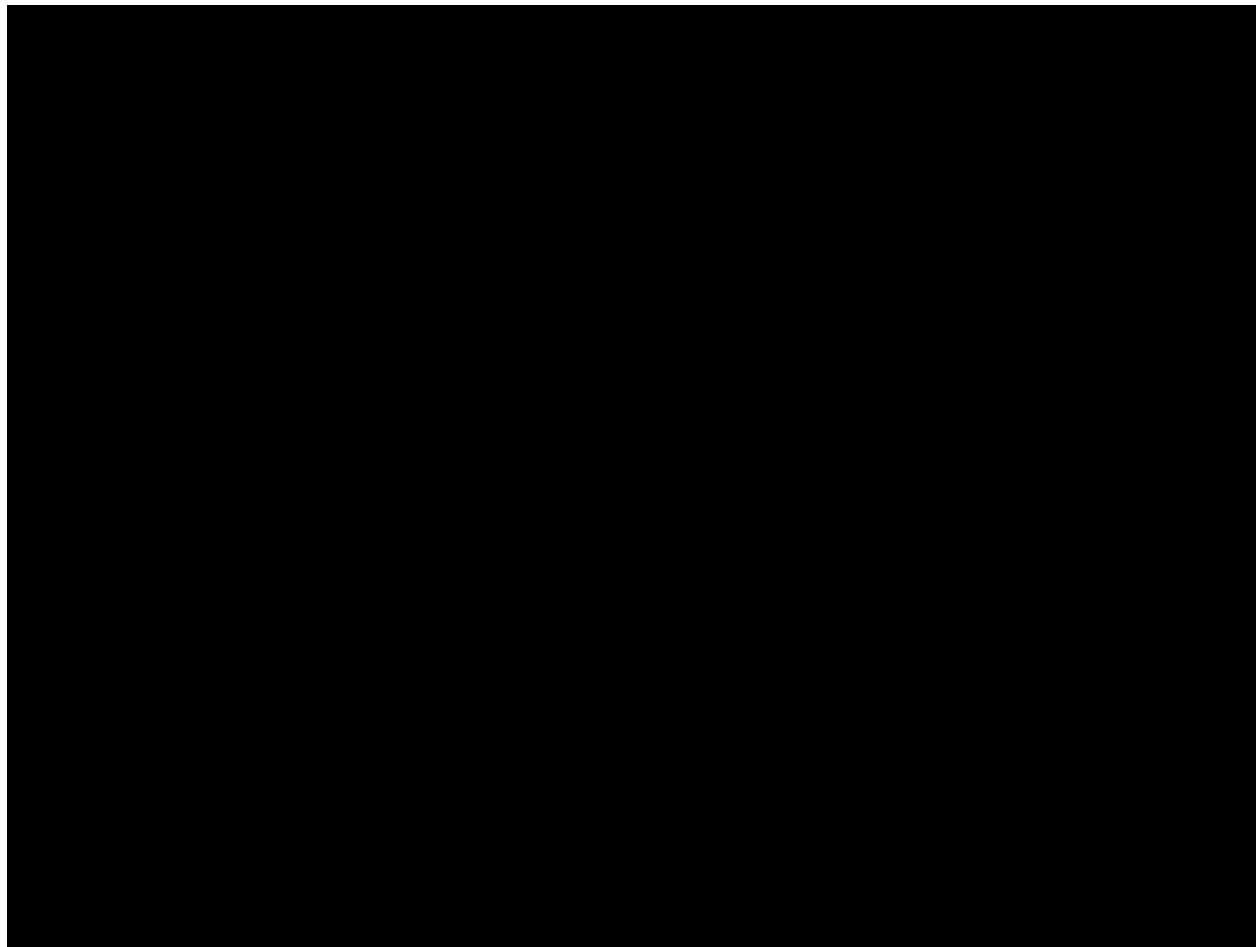


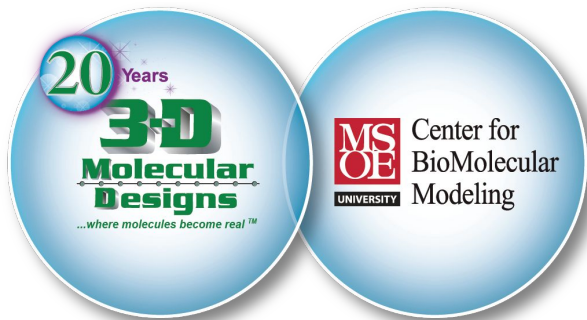
Elongation: Student kit



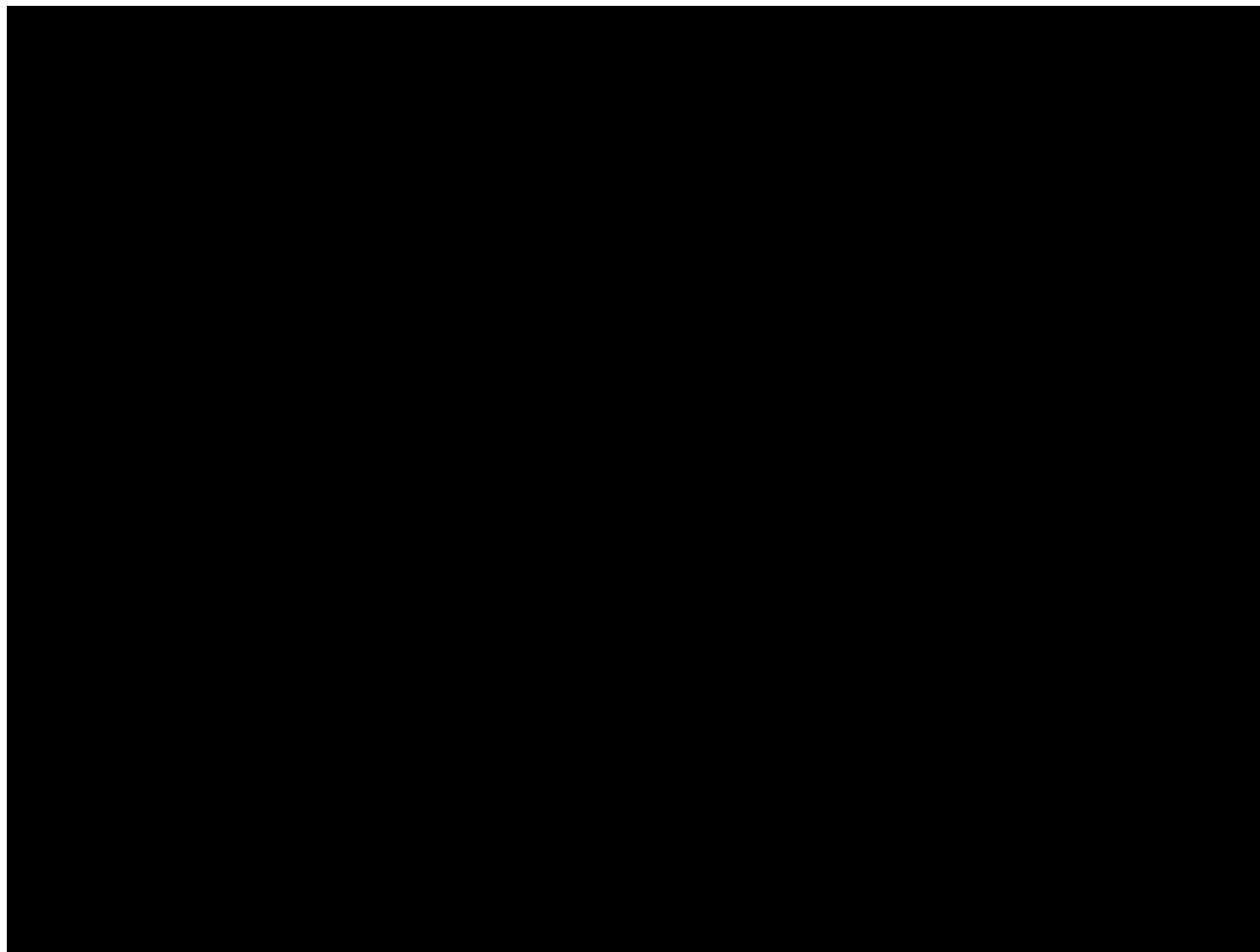


Student question # 1

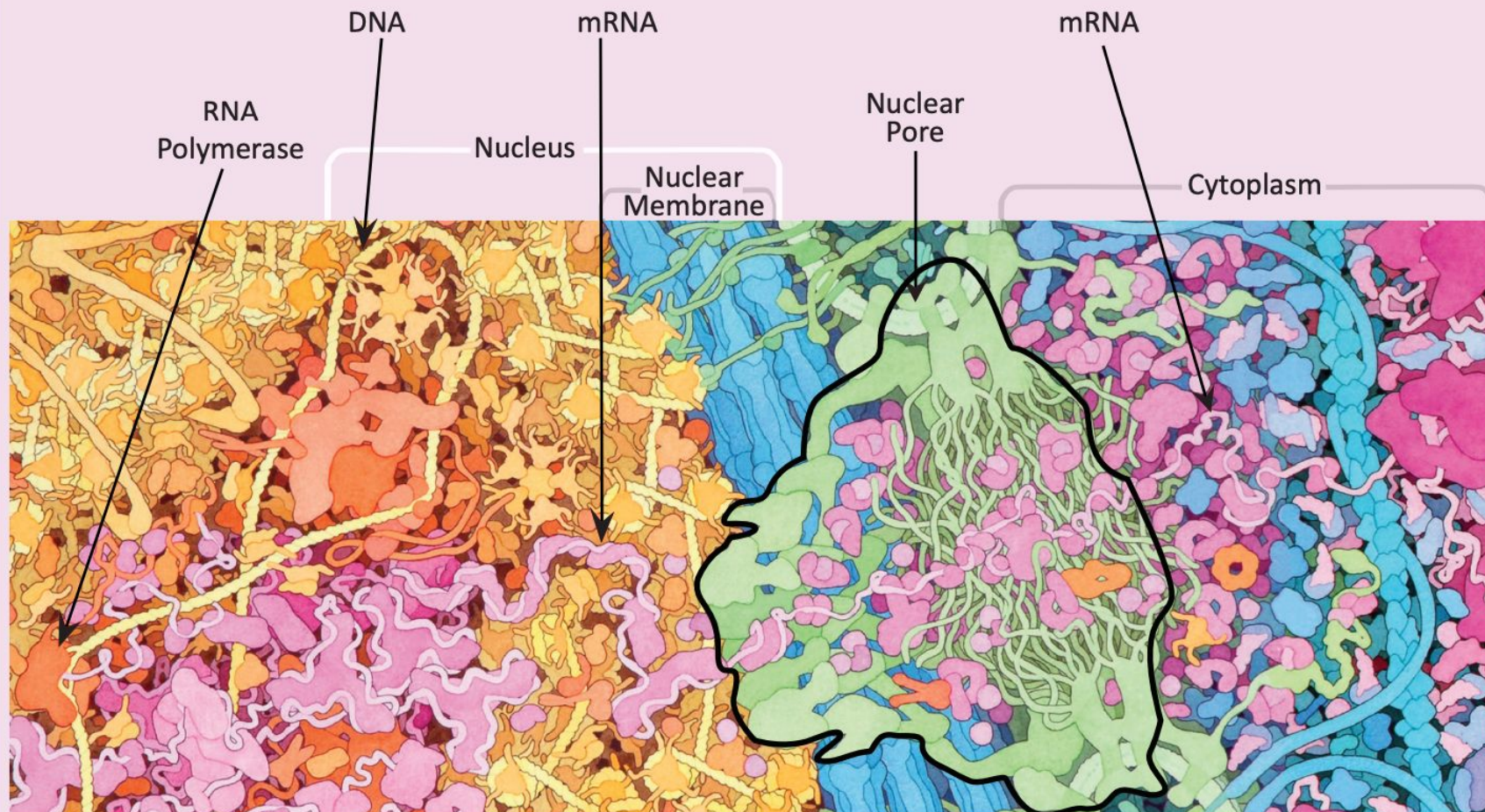




Student question #2

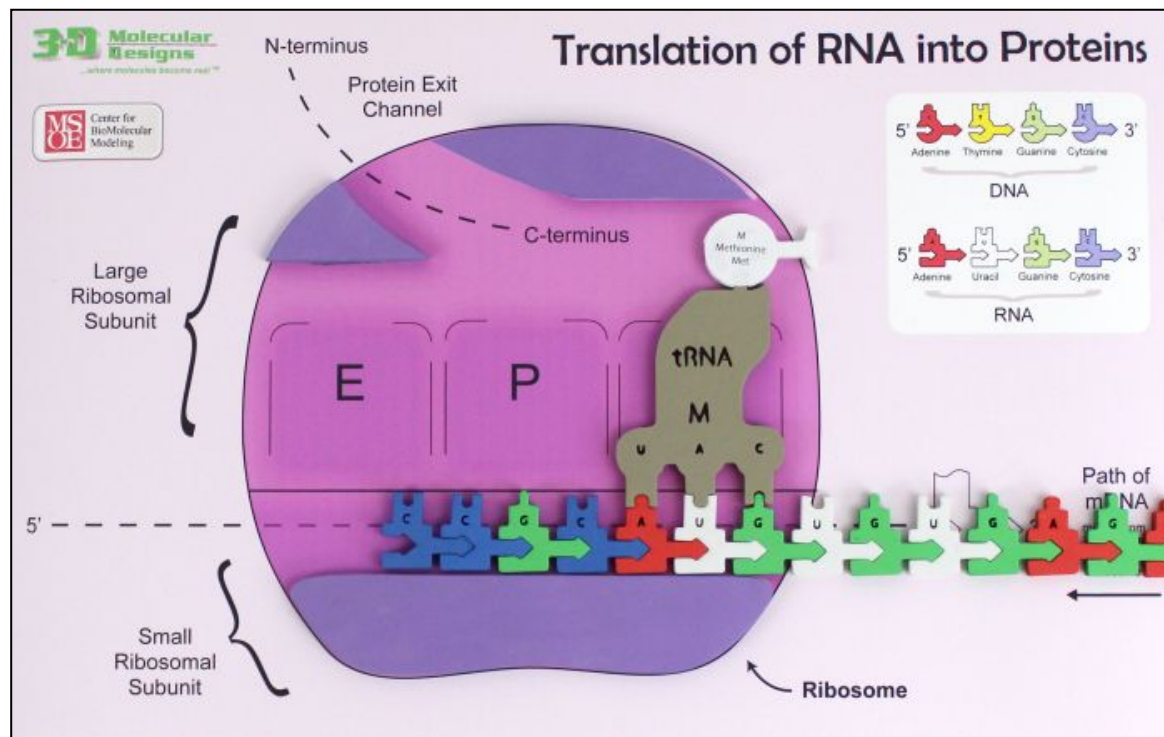


16. Trace the mRNA from the arrow point in the nucleus, through the nuclear pore and to the arrow point in the cytoplasm.

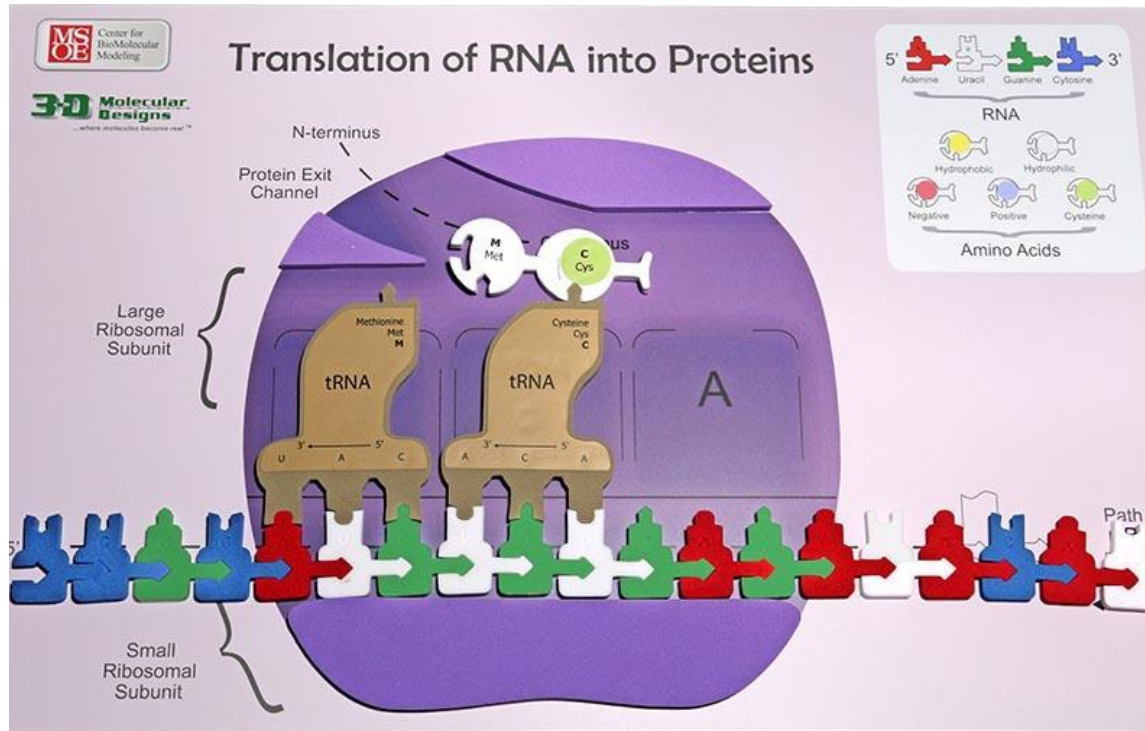
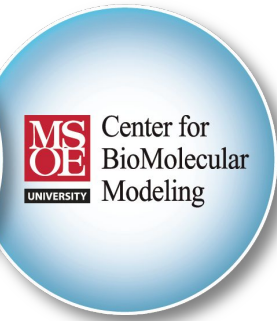
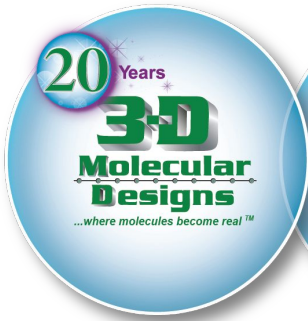


This image is an excerpt from Tour of a Human Cell by David Goodsell, as shown in 3D Molecular Designs' Tour of a Human Cell® poster and David Goodsell's book, *The Machinery of Life*.

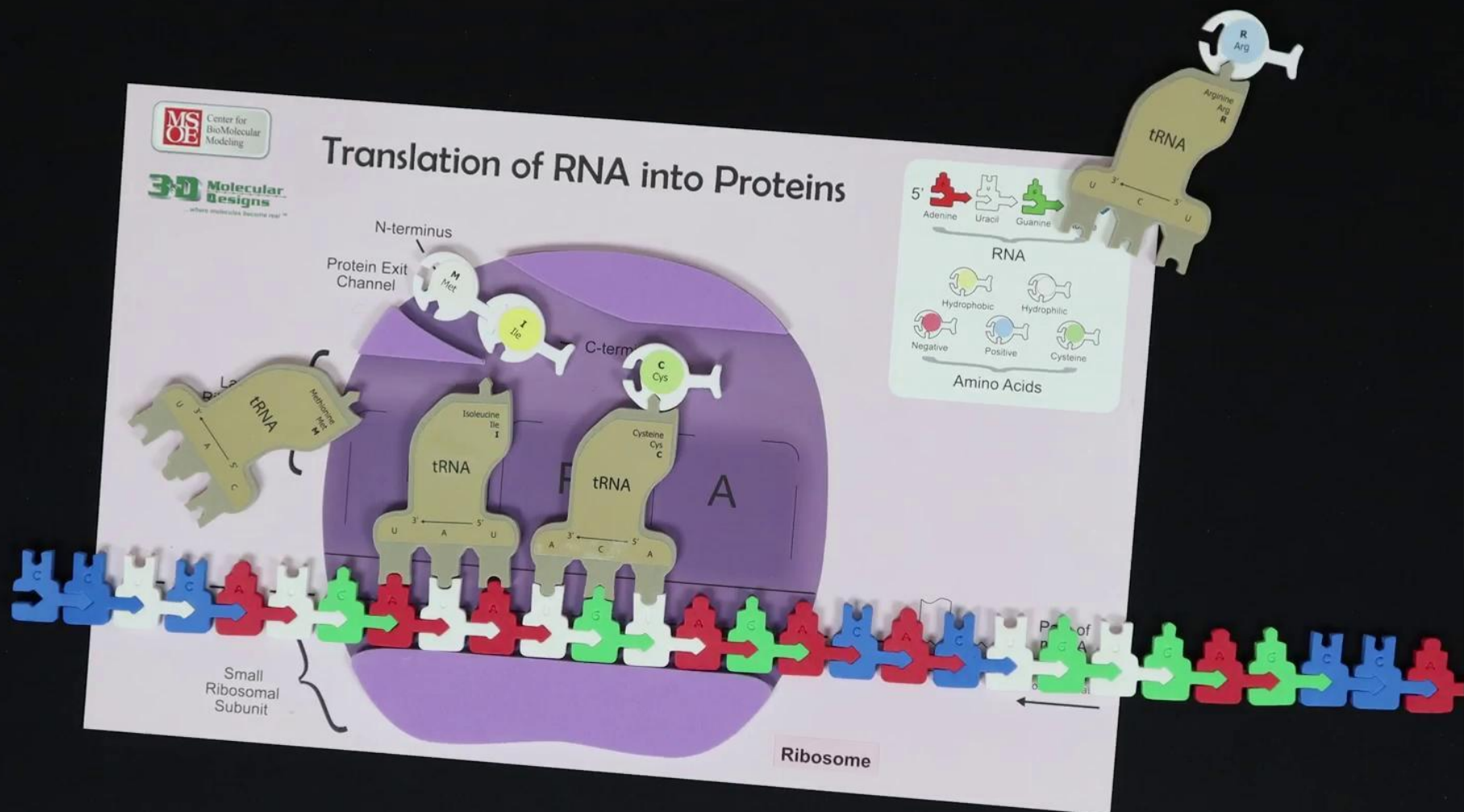
TRANSLATION

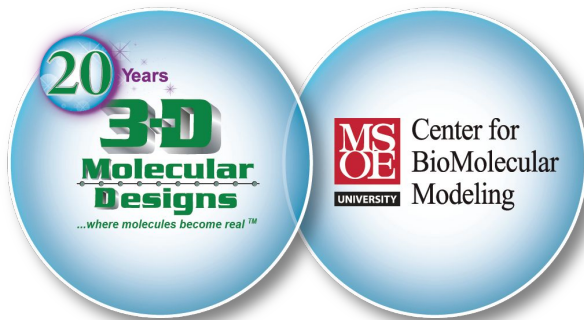


Initiation:



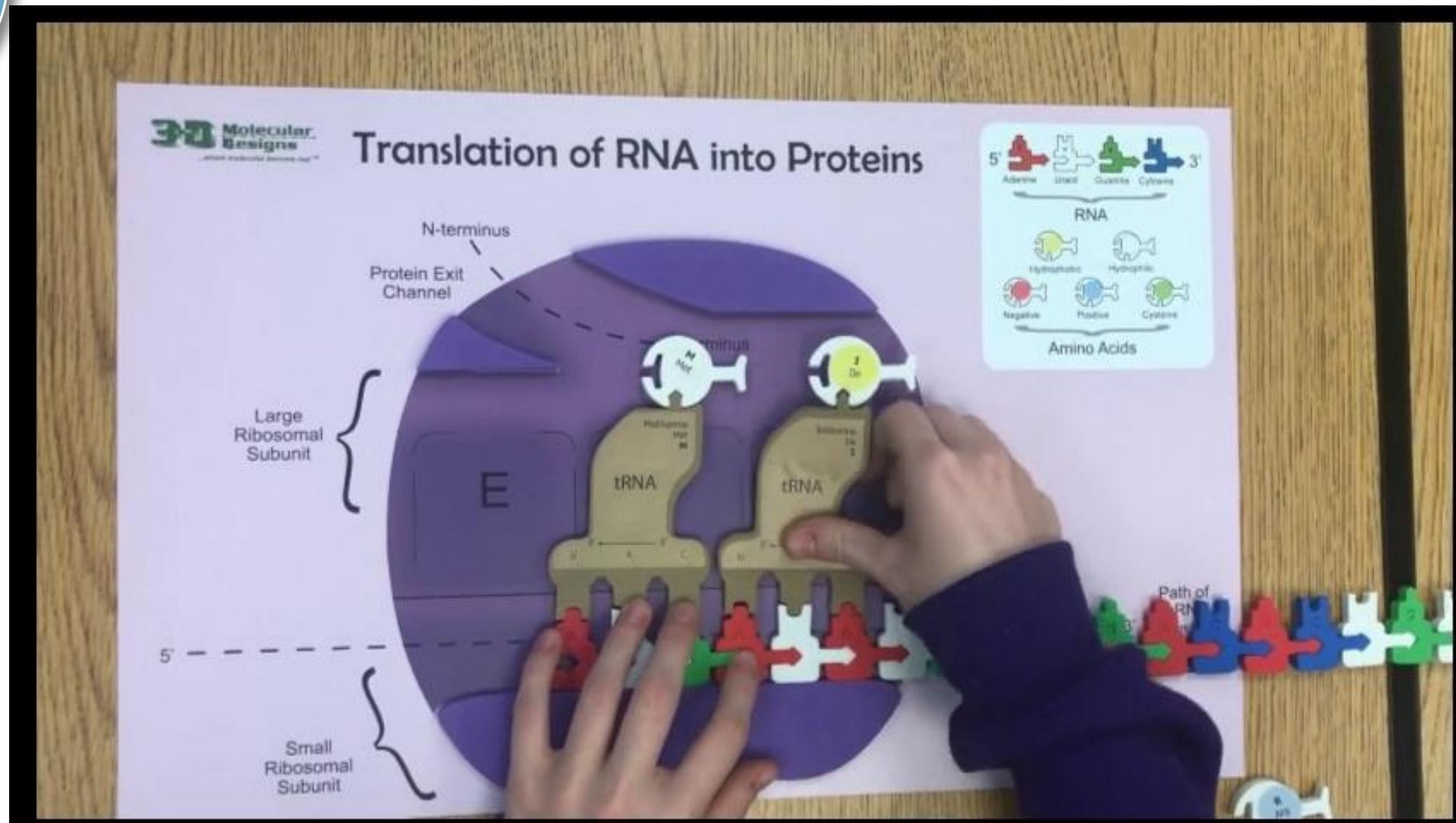
Elongation:





Sample of a student
assessment 2019 -

*Used with permission



SICKLE CELL ANEMIA CAUSED BY A POINT MUTATION

- Sickle Cell Anemia – caused by a point mutation in the beta globin gene changing the amino acid from glutamic acid to valine.
- A is replaced with T

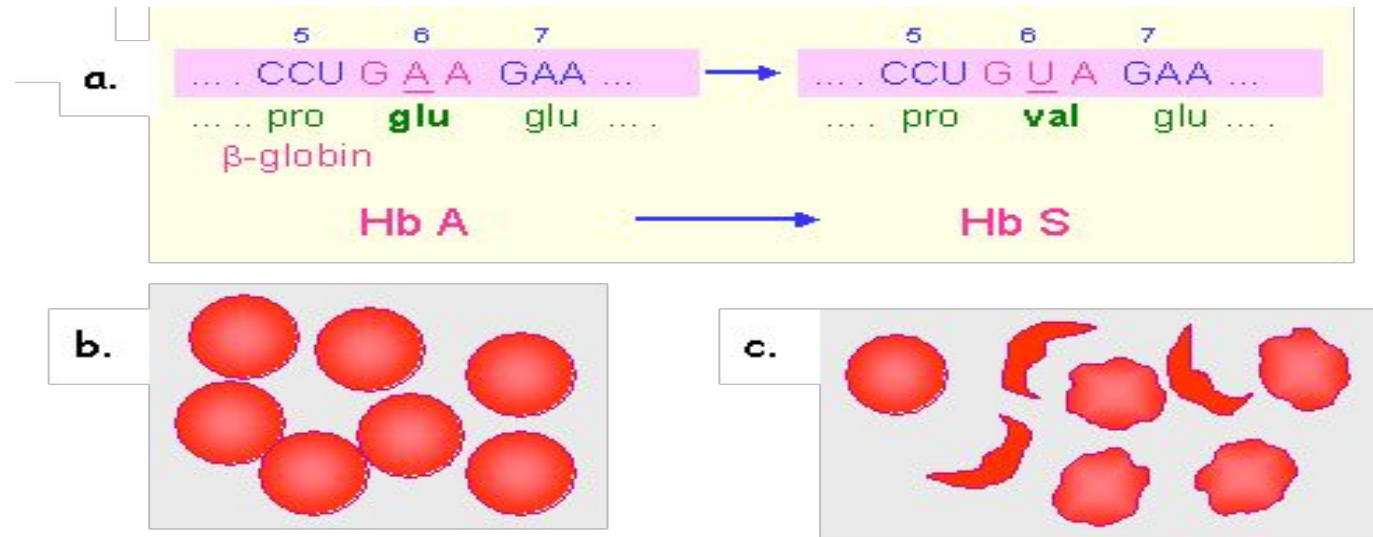


Fig. 5.1 (a) Point mutation in codon number six of the beta β -globin gene results in the substitution of the amino acid number glutamine with valine and the formation of haemoglobin S (HbS); (b) Red blood cells in a smear of normal blood containing HbA; (c) crenated and sickle-shaped red blood cells in sickle cell anaemia.

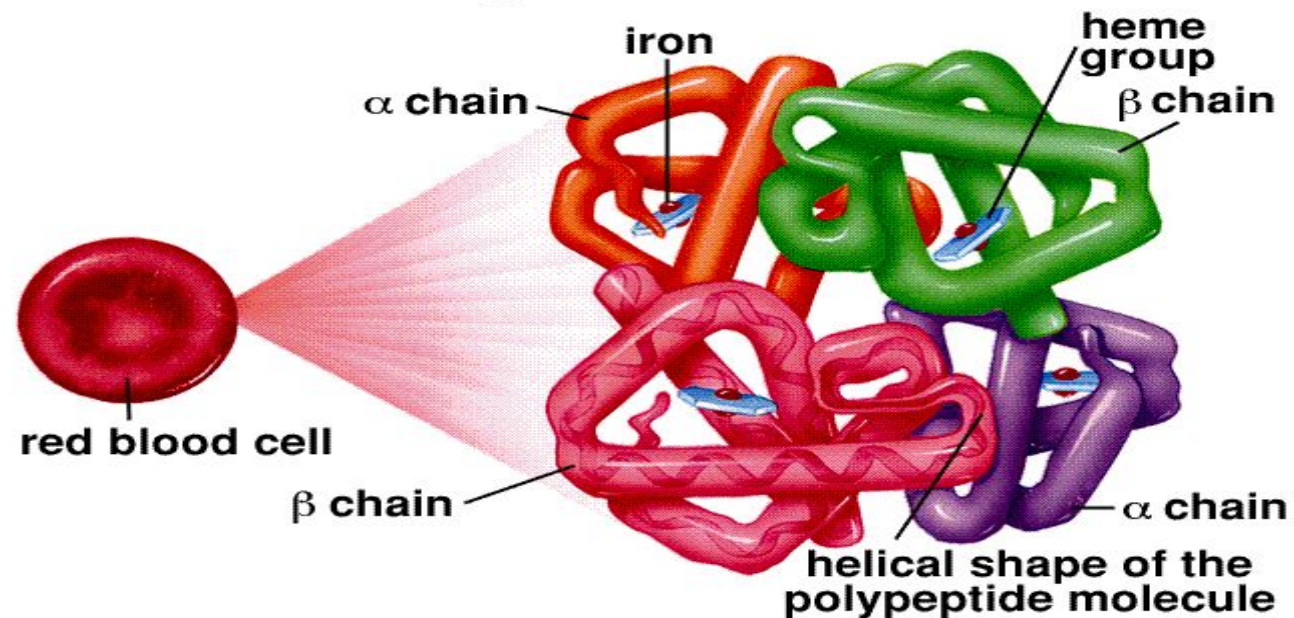
HEMOGLOBIN STRUCTURE

- **Has 4 subunits:**
 - 2 α -globin proteins
 - 2 β -globin proteins

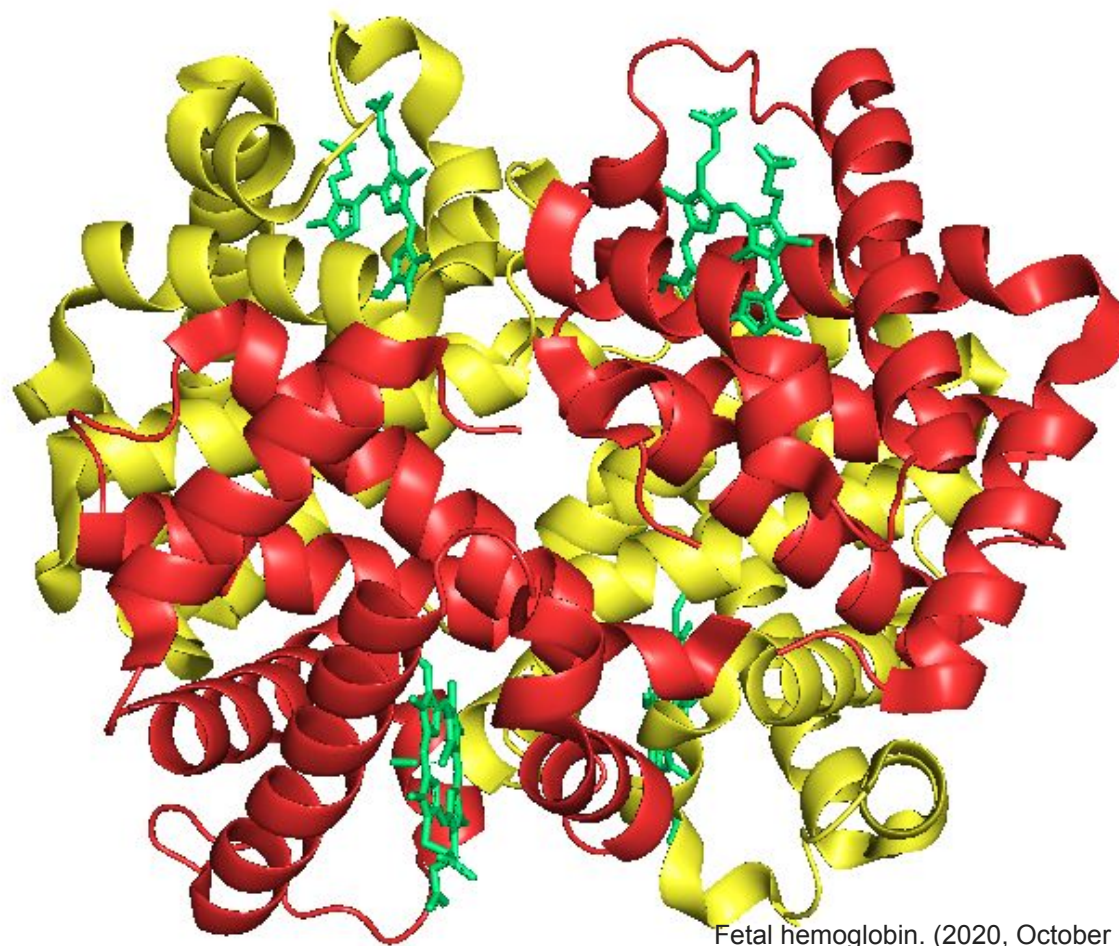


Sylvia S. Mader, Inquiry into Life, 8th edition. Copyright © 1997 The McGraw-Hill Companies, Inc. All rights reserved.

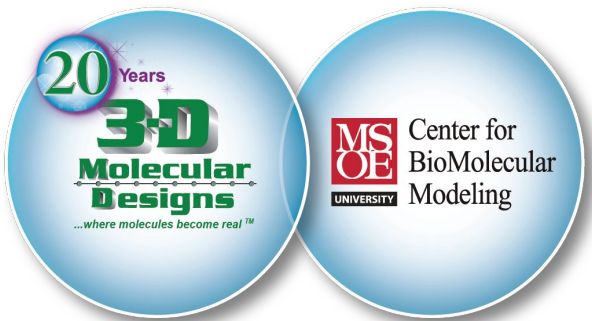
Hemoglobin Molecule



Fetal Hemoglobin

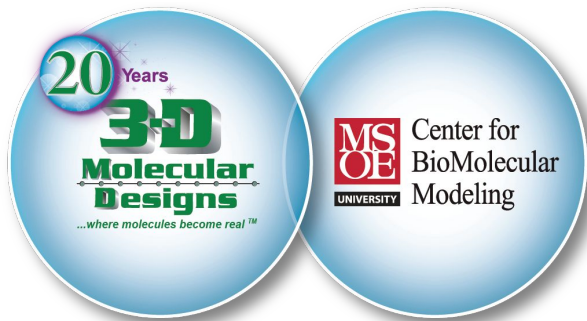


Fetal hemoglobin. (2020, October 19). Retrieved from
https://en.wikipedia.org/wiki/Fetal_hemoglobin



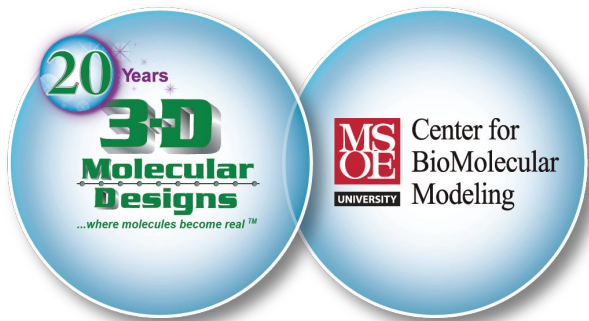
Extension: B-Globin Folding Kit and/or Amino Acid Starter Kit

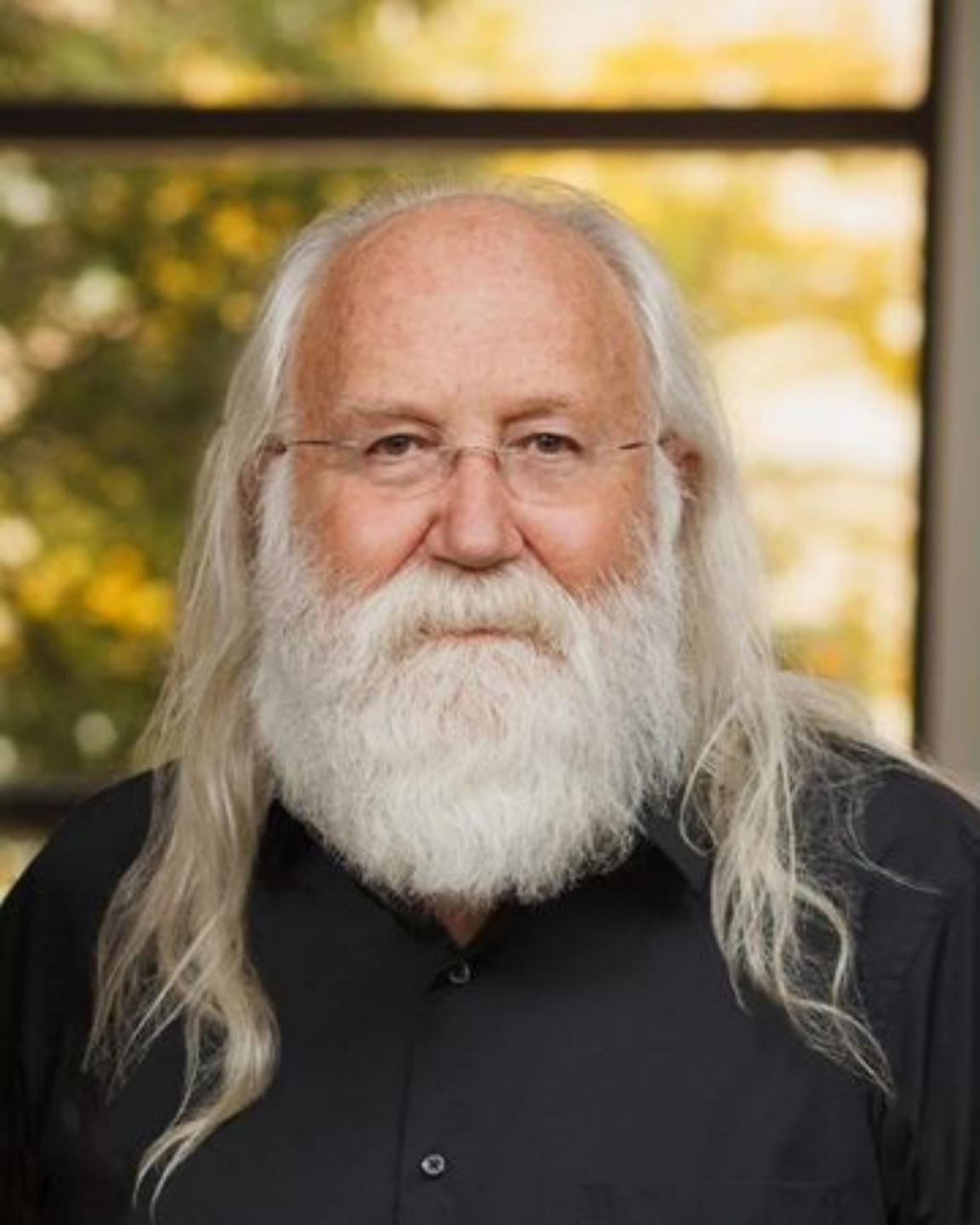




Update: March 2020







Timothy Herman, PhD

- Director of the Center for BioMolecular Modeling at MSOE
- Founding Partner of 3D Molecular Designs
- B.S. in Chemistry from the University of Nebraska
- Ph.D. in Biochemistry from Oregon State University.
- Post-doctoral studies in Molecular Biology at Harvard Medical School.