

MODELING MARVELS

2022 EDUCATORS WEBINARS

- **MARK ARNHOLT**

Discovering DNA: Brief 153-year
history of DNA (in 40 minutes)

- **TIM HERMAN, PhD**

Why DNA & RNA?



DNA STRUCTURE WEBINAR

TUESDAY | MARCH 15 6:30 - 8 PM CST

EDUCATION PRODUCTS

TEACHER RESOURCES

WORKSHOPS & COURSES

CUSTOM MODELS

SHOP

Hands-on, minds-on kits and models

help students understand molecular structures and engage in the compelling world of science. Read more on the importance of using models:

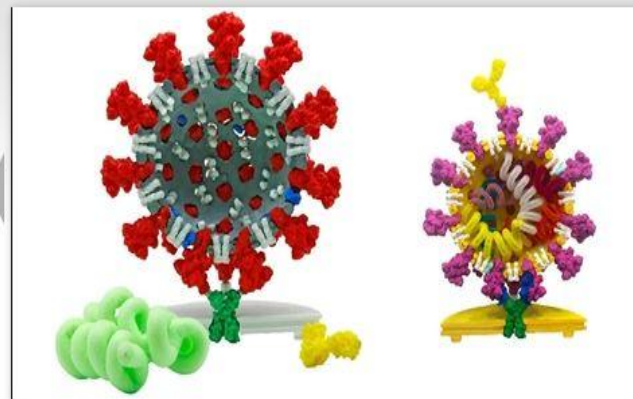
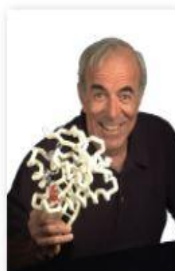
[Next Generation Science Standards – Developing and Using Models](#)

[Vision and Change in Undergraduate Education – Ability to Use Modeling and Simulation](#)

Custom 3D print molecular models for researchers and educators.

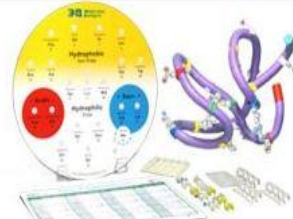
[Read More.](#)

[Request a quote.](#)



FREE Student Series! The Science of Coronaviruses

https://info.3dmoleculardesigns.com/newsletter_sign_up

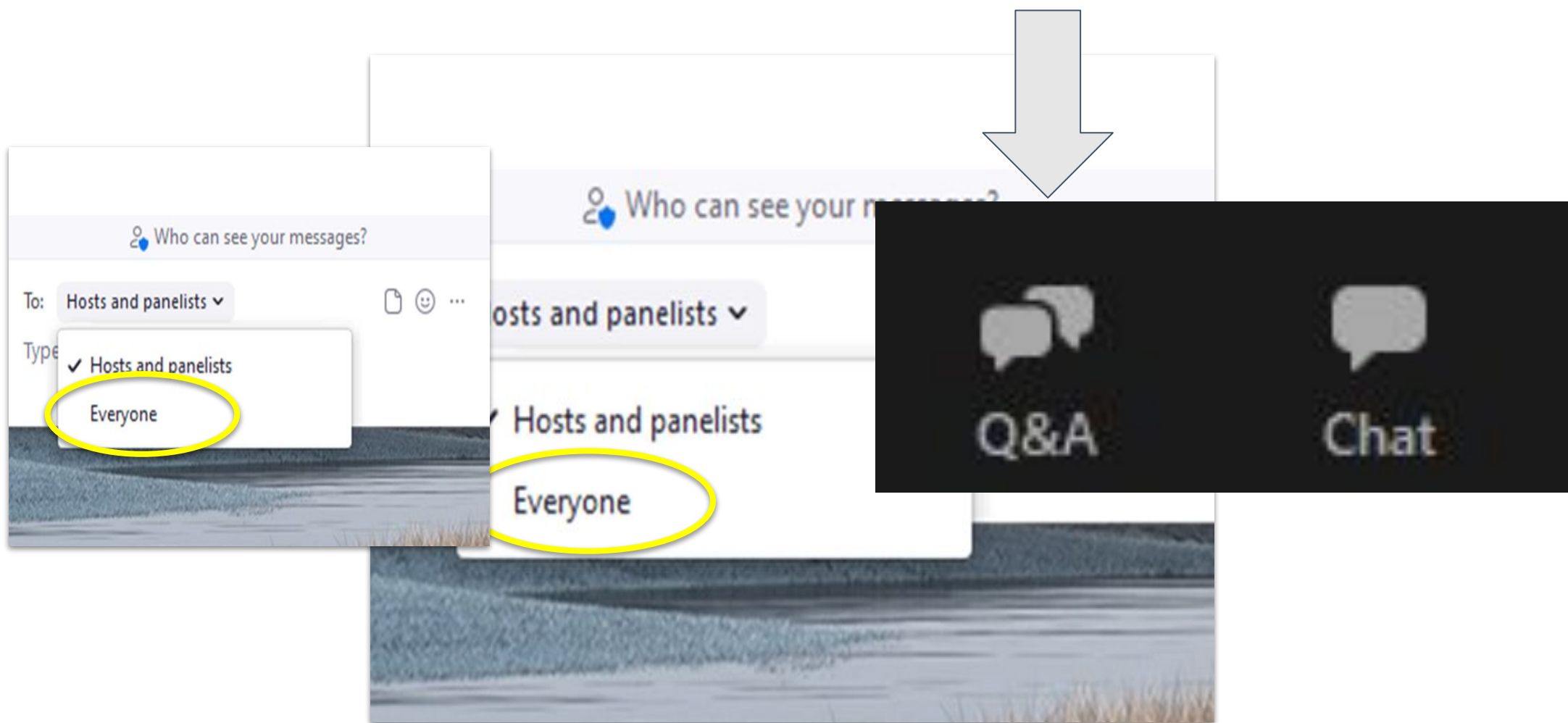


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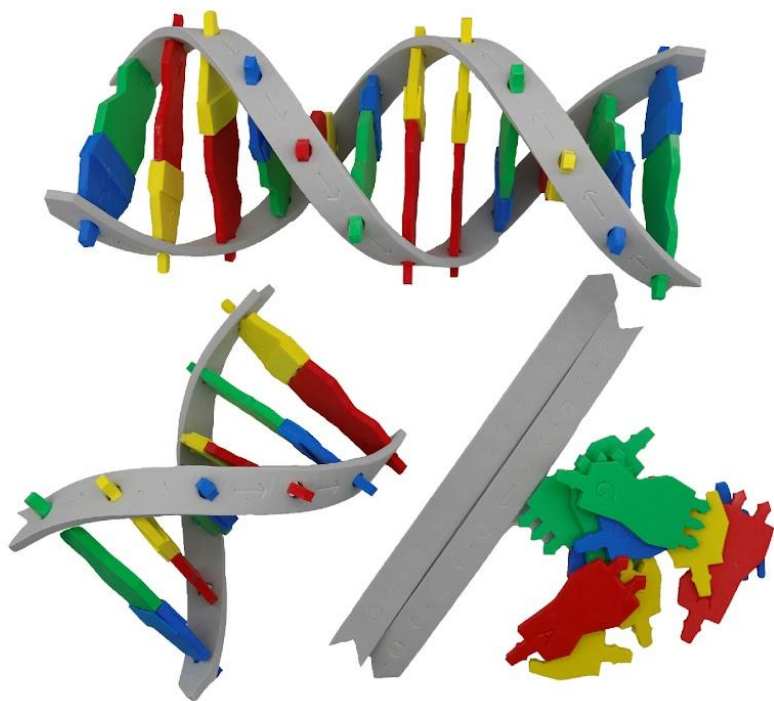
[Videos & Digital Resources](#)

[What's New](#)

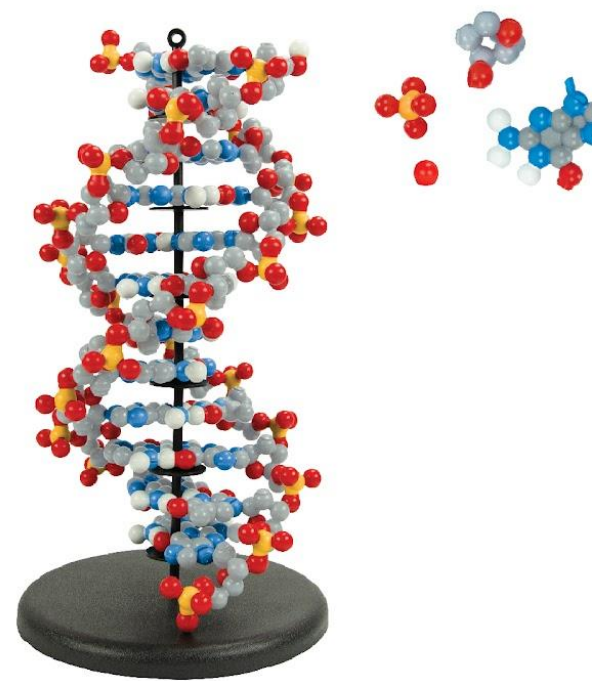
[Buy a Gift Certificate](#)



Double Helix Student Modeling Pack



Dynamic DNA Kit®



DNA STRUCTURE WEBINAR

TUESDAY | MARCH 15 6:30 - 8 PM CST

PRESENTER:

MARK ARNHOLT

Hartford Union High School, Hartford, WI

**Discovering DNA: Brief 153-year
history of DNA (in 40 minutes)**



**MODELING
MARVELS**
2022 EDUCATORS WEBINARS

Workshop Learning Goals

- 1) Investigate the scientific process by looking at the history of DNA
- 2) Scope and sequence of Genetics Unit - General Biology (9-10)
- 3) Use models to gain a deeper understanding of DNA structure
- 4) Have fun!

Gregor Mendel

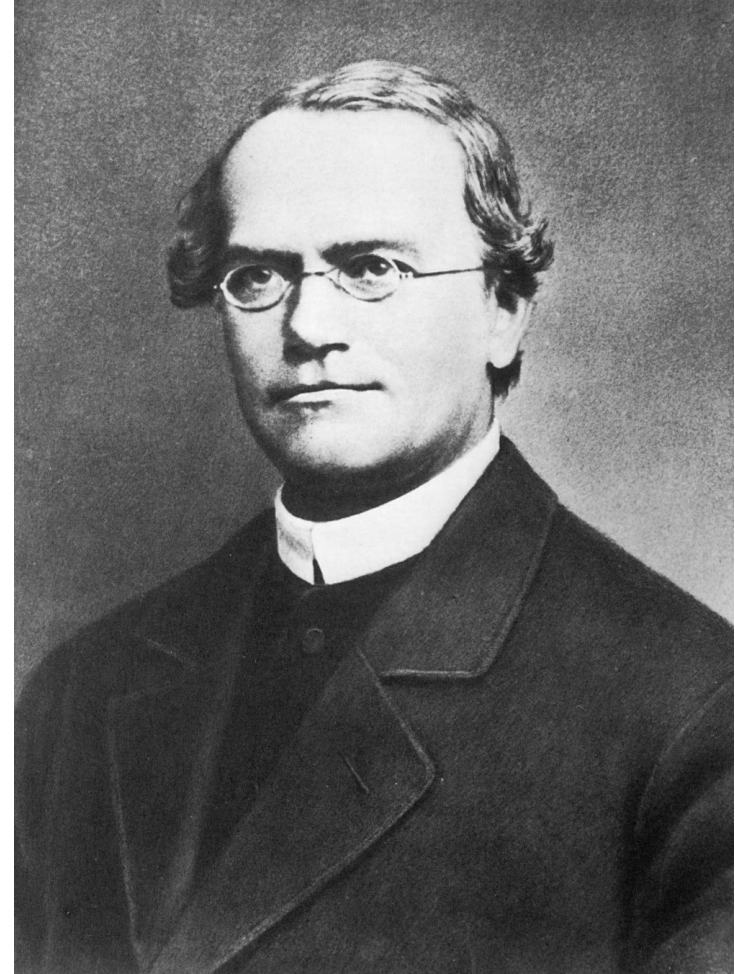
1854-1856 (published 1866)

Suggested a mechanism was in place to pass characteristics from generation to generation

Called them “factors”

Determined dominance / recessive traits

Chat question: What wet or dry labs do you do here?



Friedrich Miescher

1868-1869

Working with Neutrophils

Collected precipitate that did not behave like lipids or proteins

Called it nuclein -

Later determined to be DNA and associated proteins

Things to think about:

Where would you get neutrophils in 1868?

How would you pellet them out?

Chat Question: What lab could you use to mimic his work?



Walther Flemming

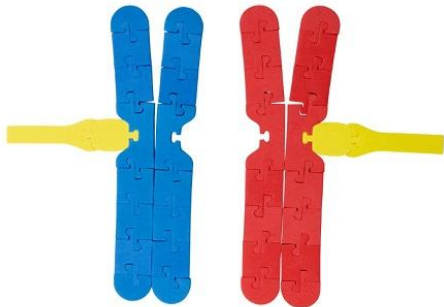
1879

Determined the principles of Mitosis

Used dyes (aniline) on salamander embryos

Thread like structures later called chromosomes

Chromosome Connection Kit



Albrecht Kossel

Nobel Prize Winner 1910

1885 - 1901

Named nuclein Deoxyribonucleic Acid (DNA)

Isolated and determined the 5 nitrogenous bases of nucleic acids

Adenine

Cytosine

Guanine

Thymine

Uracil



Chromosome Theory

Independently worked on different organisms and developed the idea

Grasshoppers for Sutton

Sea Urchins for Boveri

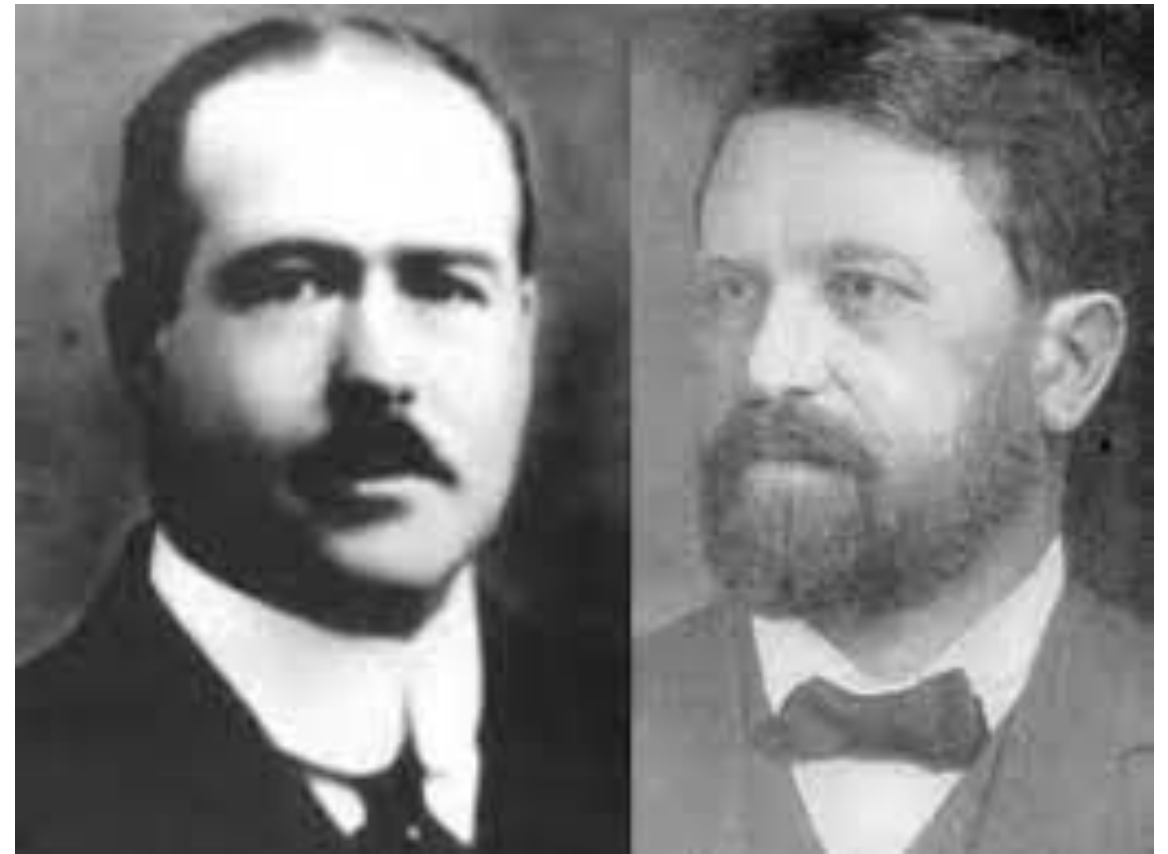
- Chromosomes were the carrier of genetic material
- Linear structure
- Genes located at specific loci

Connected Mendel and Flemming

Chromosome crossover frequencies and mapping

Walter Sutton and Theodor Boveri

1902-1903



Erwin Chargaff

1950

Paper Chromatography and UV
Photospectrophotometer

Tetranucleotide model is incorrect

Human DNA

A =30.9%

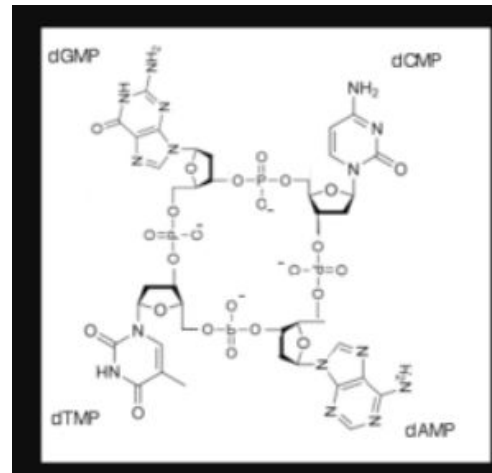
T =29.4%

G=19.9%

C=19.8%

Varies from Species to Species
DNA Comparison

P. Levene 1935

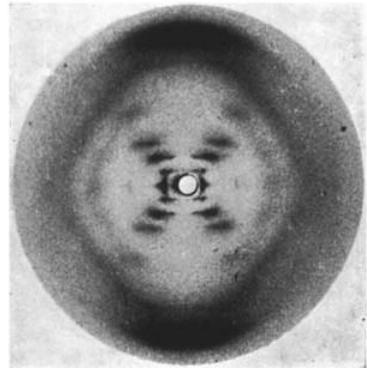


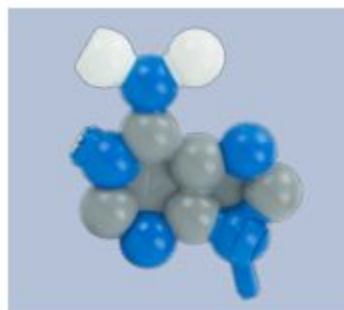
Rosalind Franklin, Watson & Crick

1953

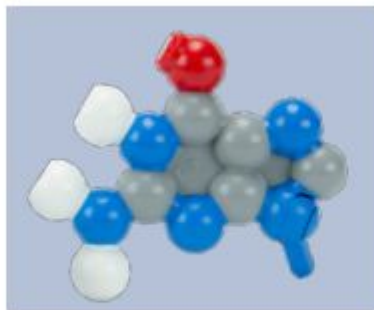
Crystallography and X-ray Diffraction

Double helix and antiparallel structure
of DNA

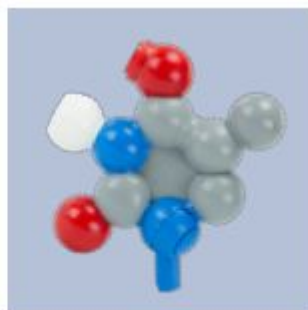




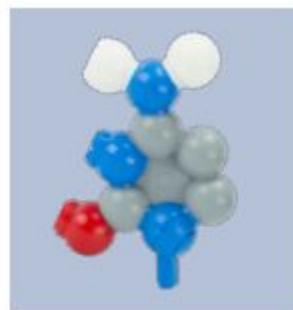
adenine (A)



guanine (G)

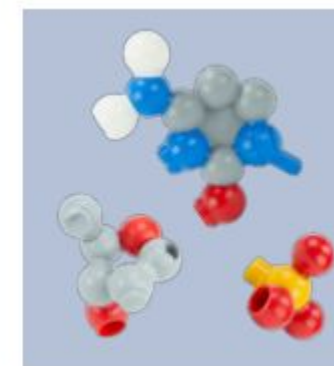
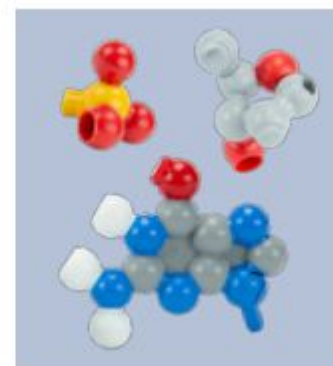


thymine (T)

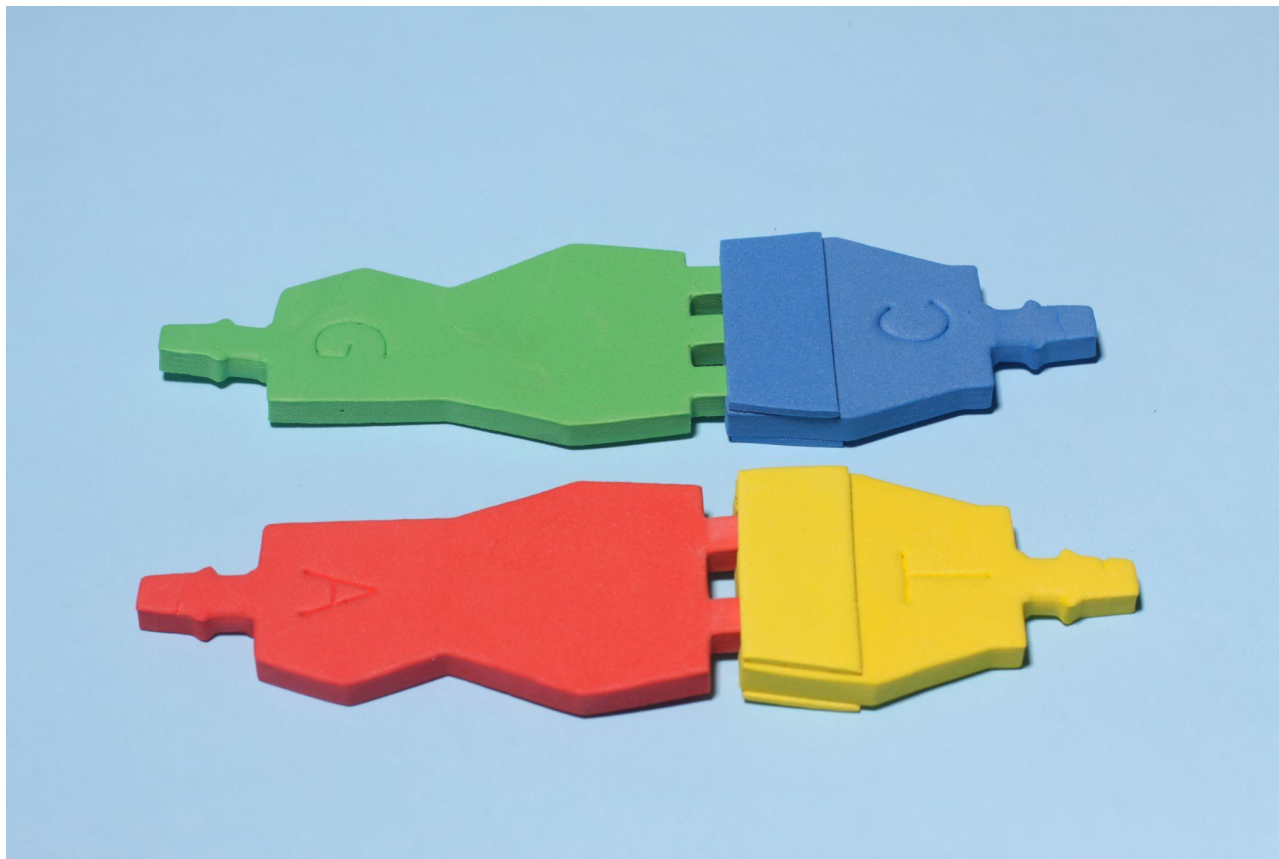


cytosine (C)

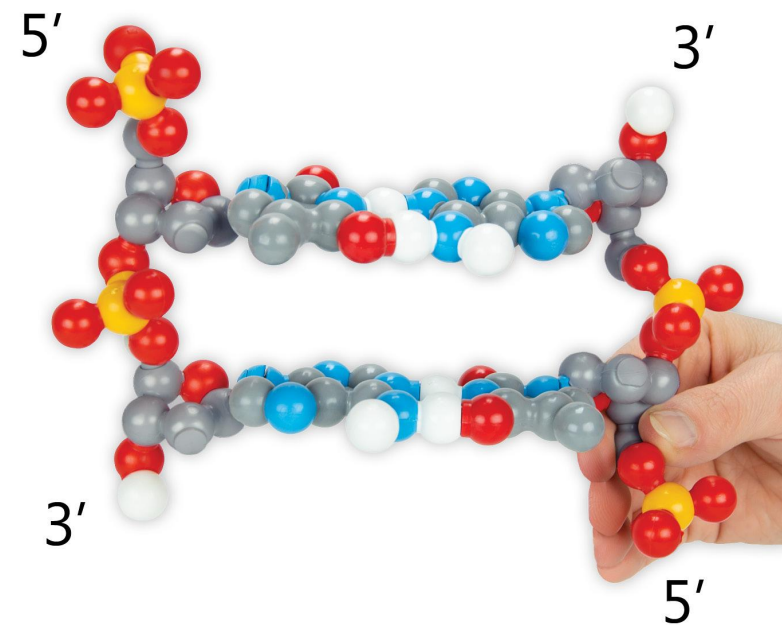
Dynamic DNA Kit



DNA Starter Kit



Dynamic DNA Kit



Take a look at your models of A and G.

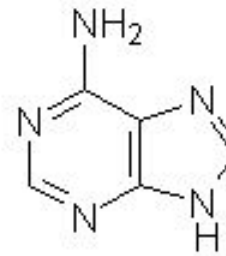
Chat questions:

What do they have in common?

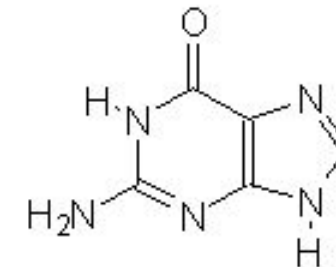
What makes them different?

The Purines

Adenine

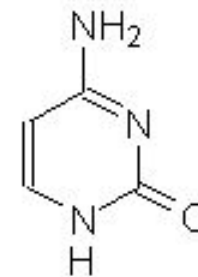


Guanine

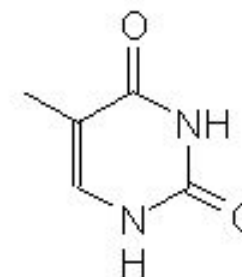


The Pyrimidines

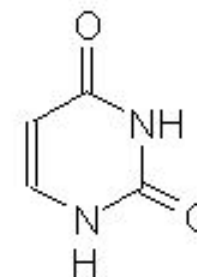
Cytosine



Thymine



Uracil



Take a look at your models of T and C.

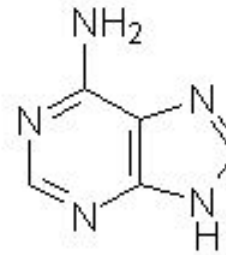
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What do they have in common?

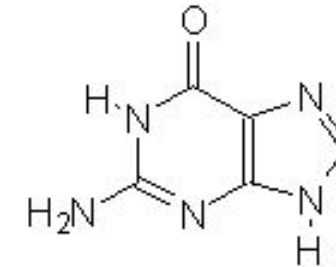
What makes them different?

The Purines

Adenine

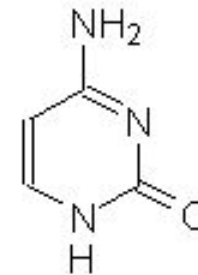


Guanine

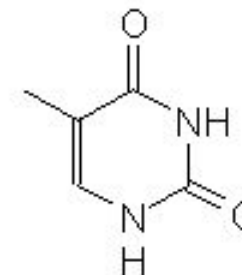


The Pyrimidines

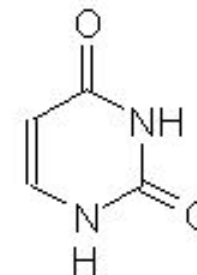
Cytosine



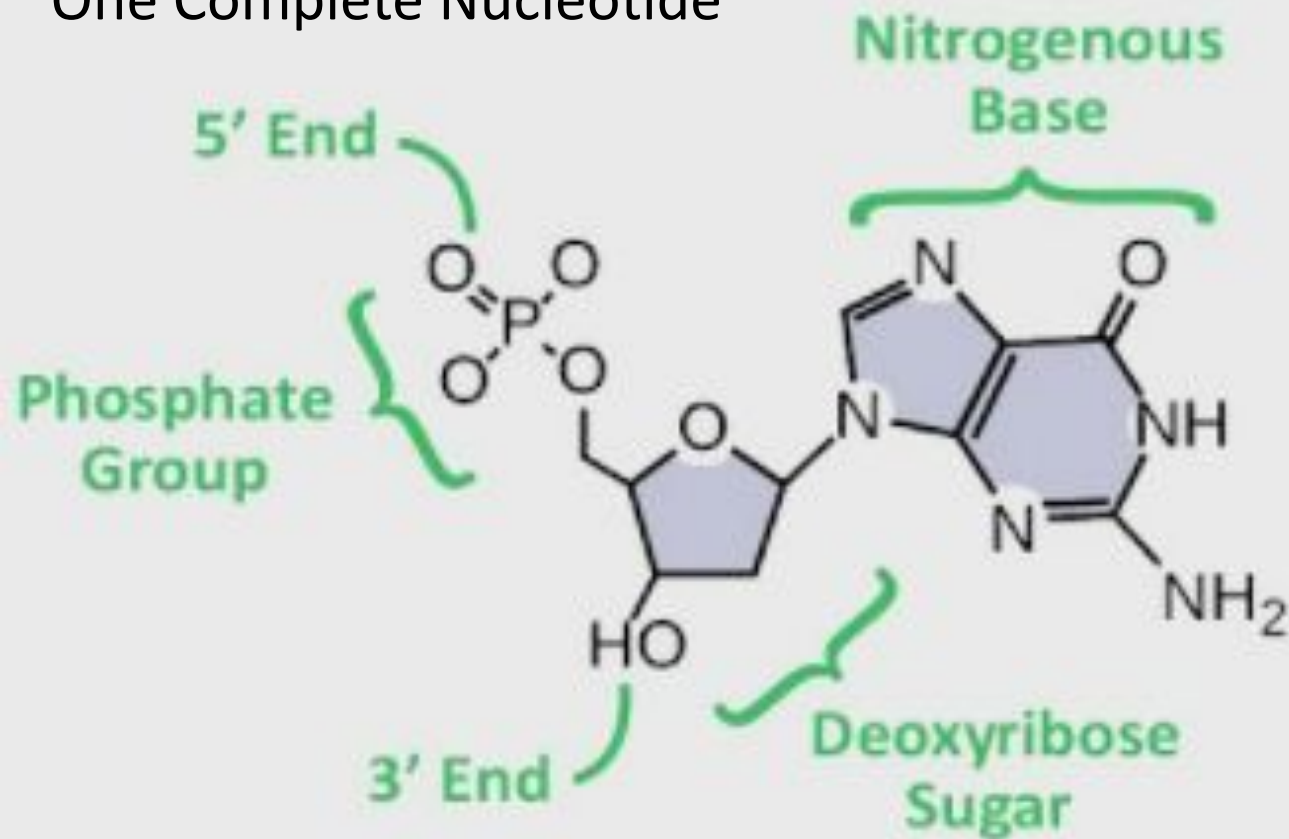
Thymine



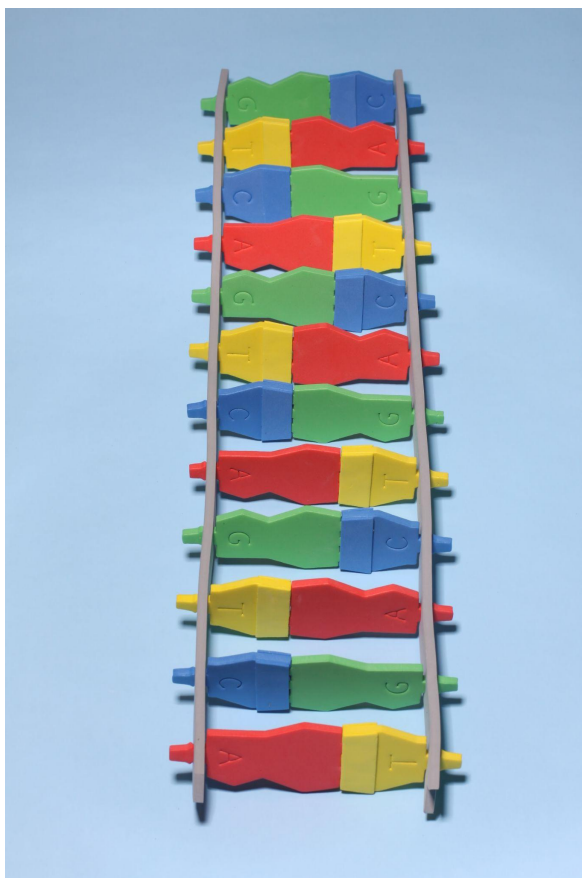
Uracil



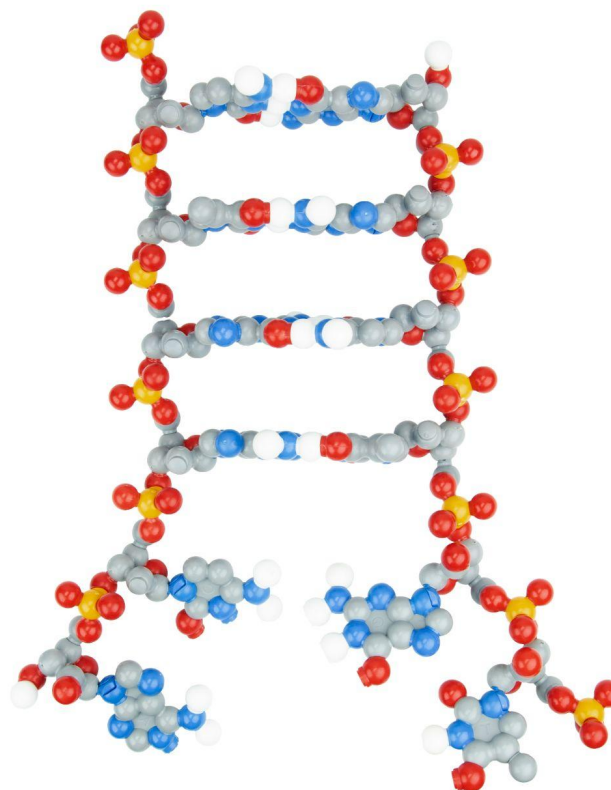
One Complete Nucleotide

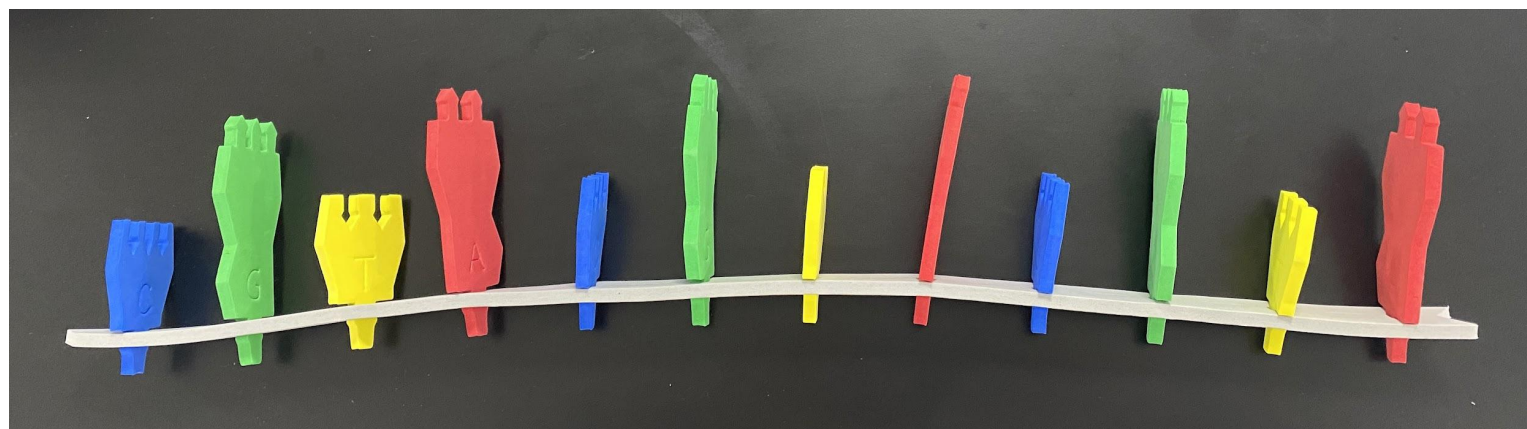
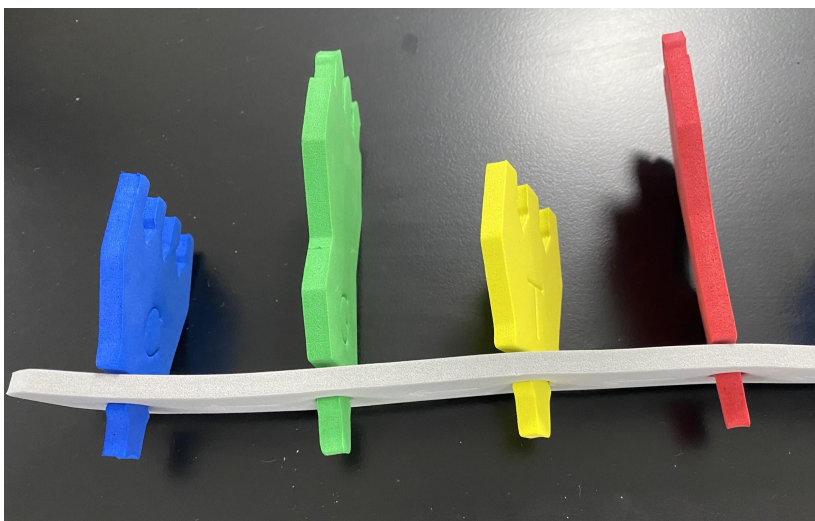


DNA Starter Kit



Dynamic DNA Kit





Let's build one side with a repeating sequence CGTA

Let's build the complementary strand using Chargaff's Rule

A-T

C-G

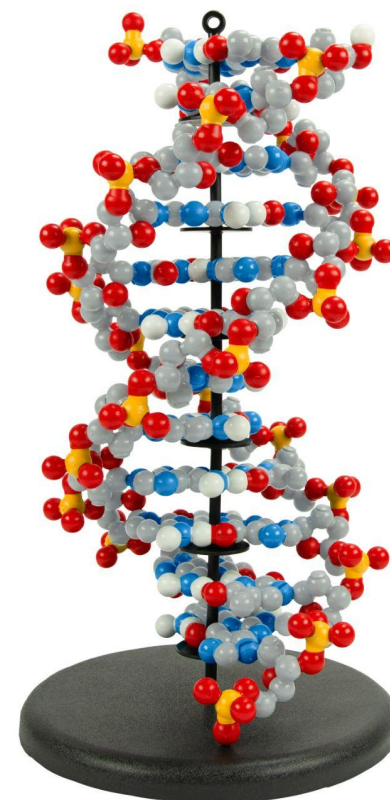
[Link](#) to Student Activity - Technology Standards

Chat Question: Which end should we start on to build in the 5' ->3' direction? Why?

DNA Starter Kit



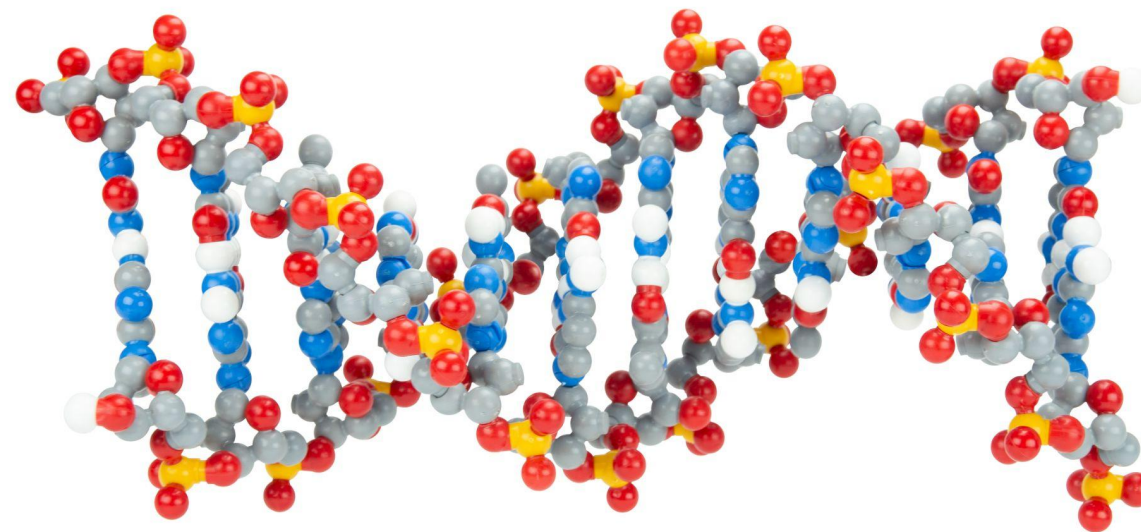
Dynamic DNA Kit



DNA Starter Kit



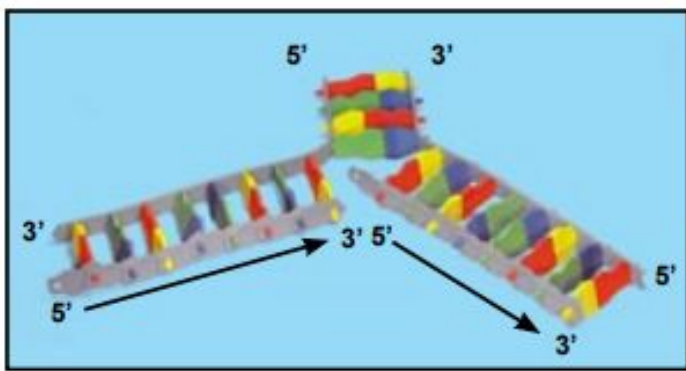
Dynamic DNA Kit



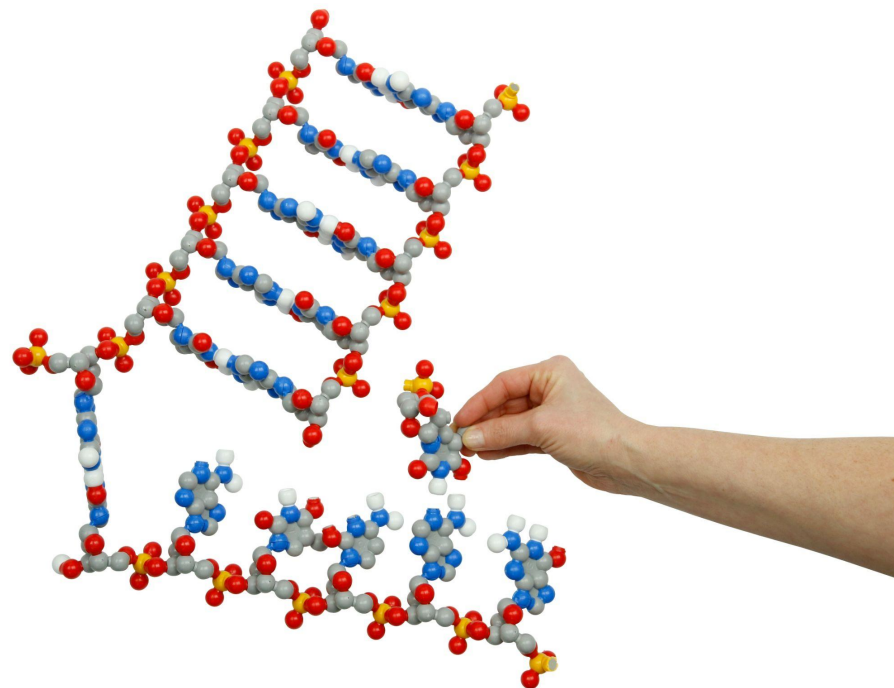
Dynamic DNA kit vs DNA Starter Kit

Dynamic DNA	Concept	DNA Starter Kit
X	DNA Structure	X
X	Molecular visualization	
X	Major vs Minor Groove	
X	DNA Synthesis	X
X	Epigenetics	X
X	Replication and Transcription	X

DNA Starter Kit



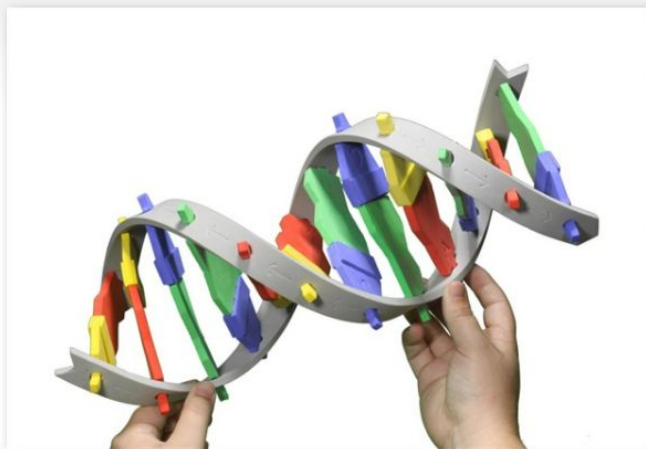
Dynamic DNA Kit



Links to 3D-Molecular Design Resources

DNA Starter Kit

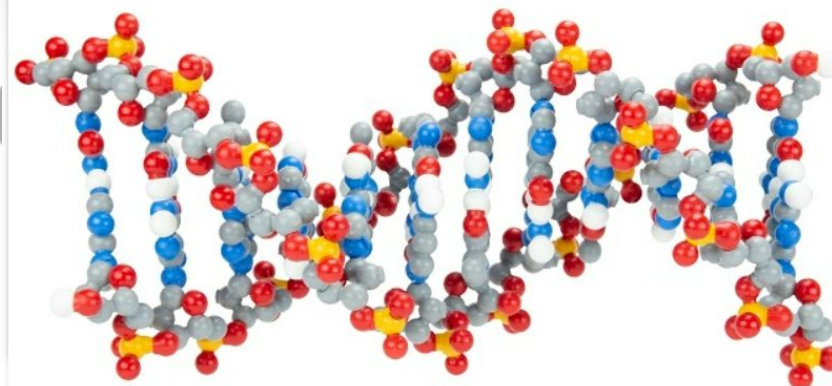
DNA Starter Kit©



3D Molecular Designs' friendly, interactive foam DNA model makes double-stranded DNA and single-stranded RNA. It will quickly capture your students' attention as you introduce the basics of DNA structure then move into replication and transcription.

Dynamic DNA Kit

Dynamic DNA Kit© Teacher Resources

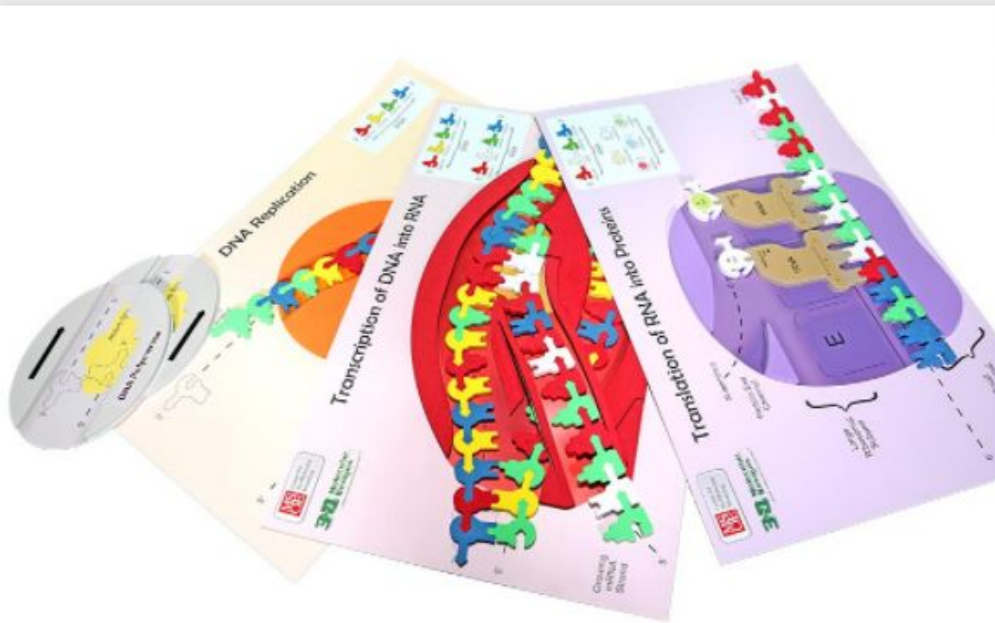


Twist - untwist - replicate - transcribe. Using the *Dynamic DNA Kit*© students will assemble the nucleotides, feel the hydrogen bonding of the A-T and G-C base pairs and discover the double helical structure of DNA just as James Watson and Francis Crick did in 1953. PLUS, they will twist and unwind the double helix to model DNA replication and RNA transcription.

What's next?

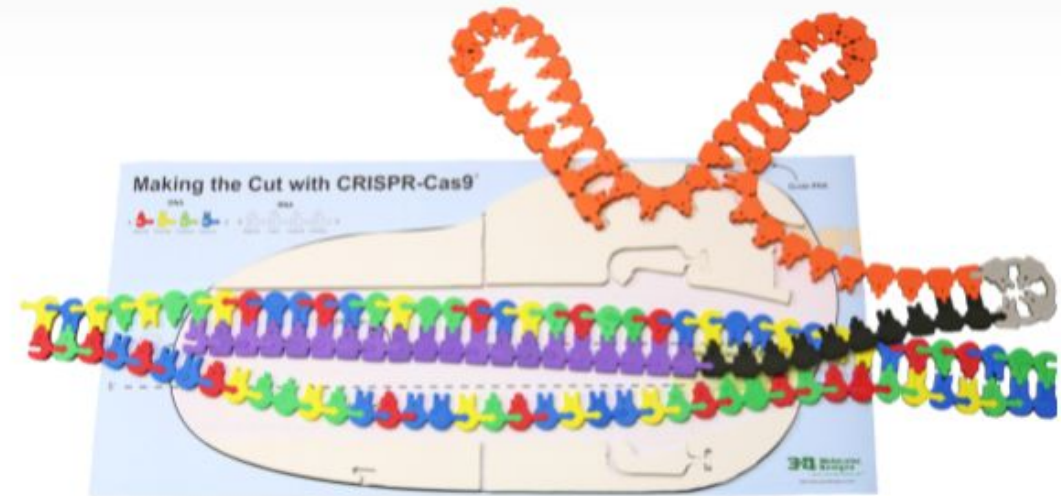
FGIK

Flow of Genetic Information Kit©



CRISPR Cas9

NEW Making the Cut with CRISPR-Cas9©



Lending Library

The Model Lending Library

At the MSOE Schroeder Library

A collaborative project of the MSOE Center for BioMolecular Modeling (CBM), the MSOE Walter Schroeder Library and 3D Molecular Designs (3DMD) that makes many of the physical models produced by the CBM and 3DMD freely available for short-term loan.



**Browse Available
Models**



**Contact the
Lending Library**



**Loan Parameters
and Policies**

Workshop NGSS Connections

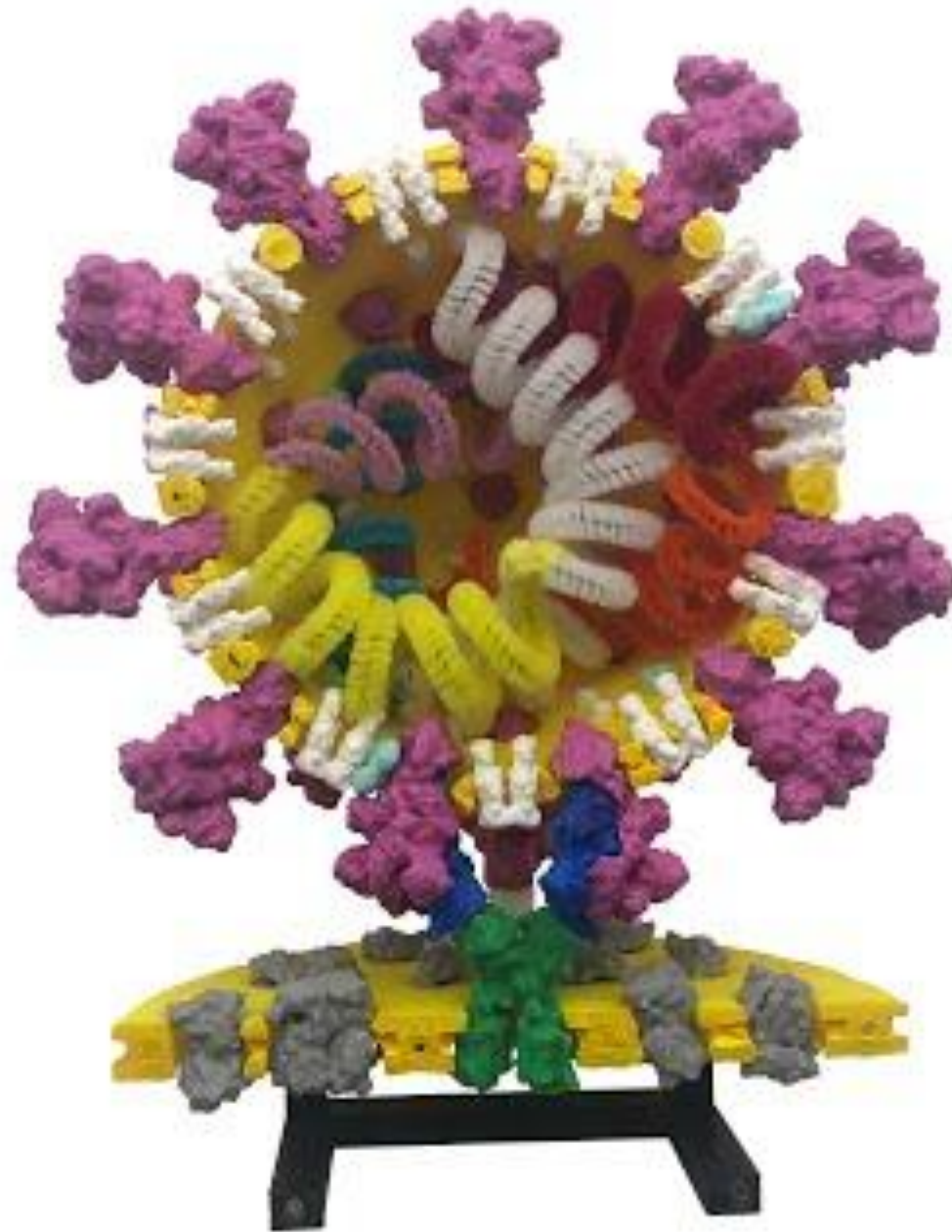
SEPs	CCCs	DCIs
Developing and using models	Scale, Proportion, and Quantity	LS1.1 : Structure and Function
Constructing Explanations and Designing Solutions	Systems and Models	LS3: Heredity: Inheritance and variation of traits
	Structure and Function	LS4: Biological Evolution: Unity and Diversity
	Cause and effect	
	Stability and change	

The Science of Coronavirus Series

<https://www.3dmolecular designs.com/The-Science-of-Coronaviruses.htm>

This four-part series includes:

- hands-on modeling activities
- computer visualization tutorials
- rich videos like the following...



03:00

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PRESENTER:

TIM HERMAN, PhD

MSOE Center for BioMolecular Modeling &
3D Molecular Designs

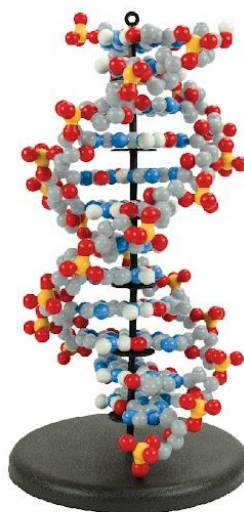
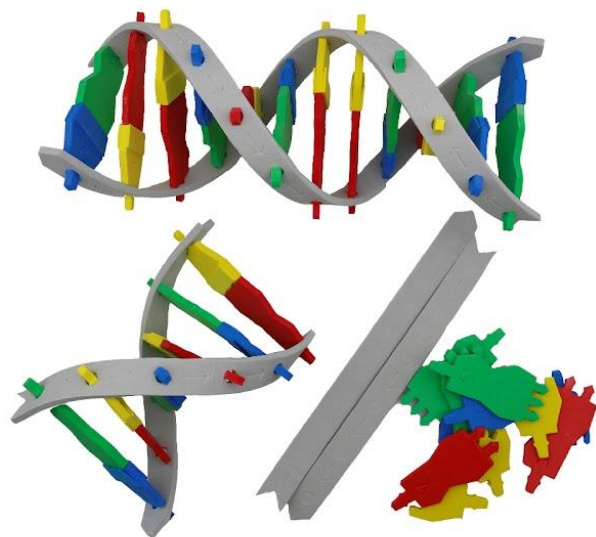
Why DNA & RNA?



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MARVELS**
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THANK YOU FOR ATTENDING!

Kits and models used in this session:



Purchase kits at www.3dmolecular designs.com

Use discount code **WEBINAR20** to receive 20% off most items in our catalog.

Student Modeling Packs are not eligible for discount.