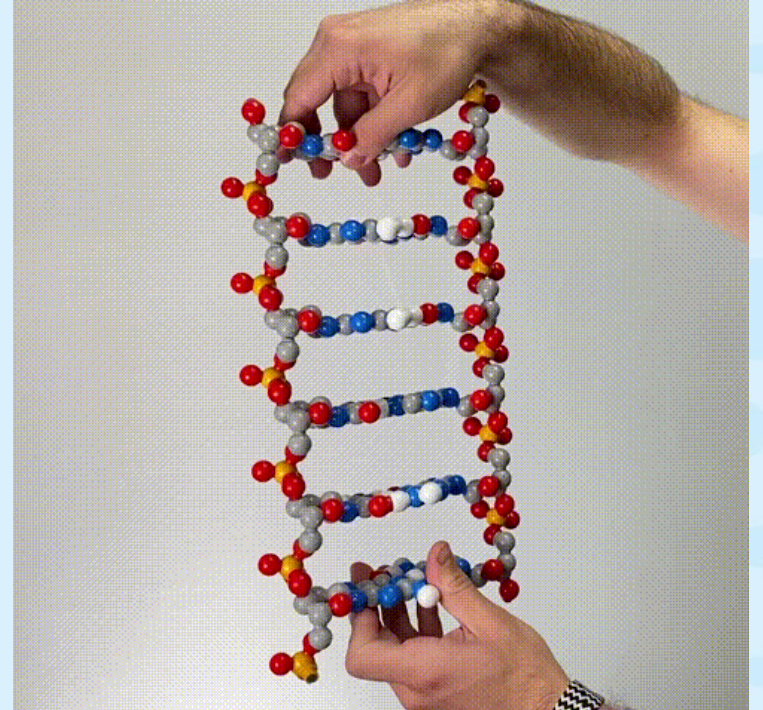


Dynamic DNA

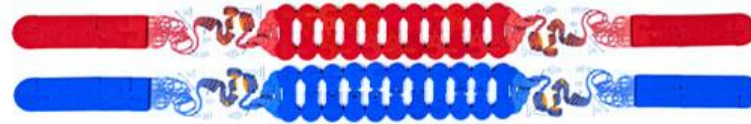
...more than a just a bunch of
A's, T's, G's and C's

Tim Herman



DNA... *what do you teach?*

Genetics

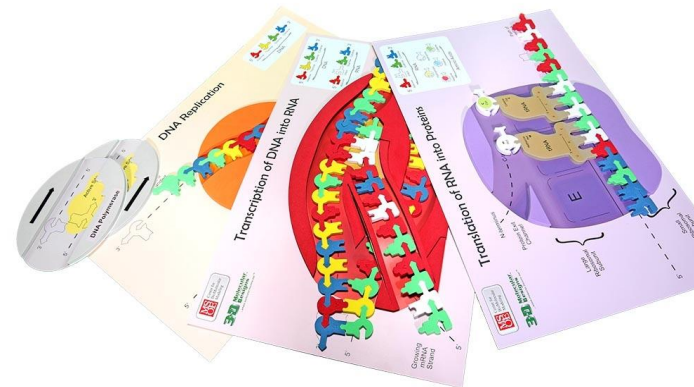


DNA Structure



The Central Dogma

DNA → RNA → Protein



More DNA-related topics you could teach:

Bioinformatics.... *Gene Maps (Paper Bio-informatics),*
Data Science, AI and Alpha-Fold

Biotechnology

Recombinant DNA Technology

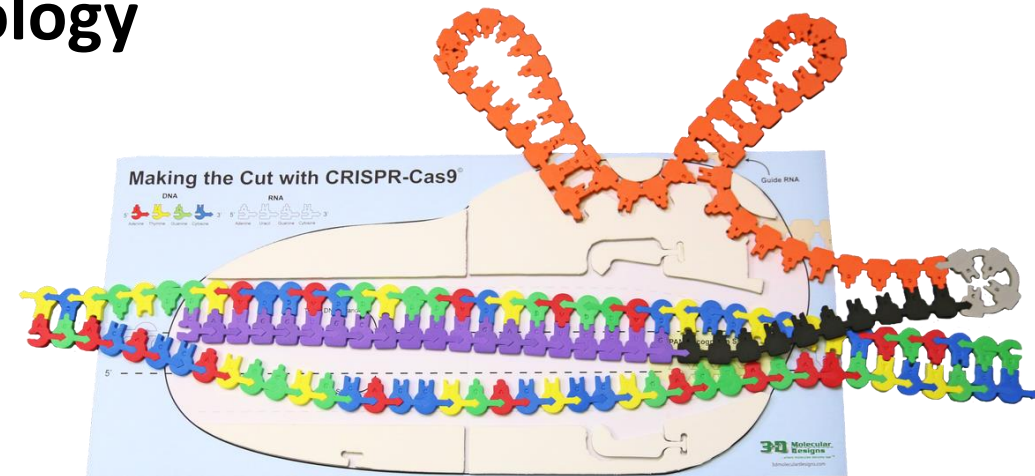
Sanger DNA Sequencing

PCR

CRISPR-based Genome Editing

Epi-genetics... *chemical modifications of both histones and DNA*

mRNA Vaccines and Pseudouridine



Sign-Up for a 3DMD Summer Course

Modeling the Molecular World

Fee-based



Session 1: July 29 – August 2

Session 2: August 5 – August 9

Modeling Infection & Immunity

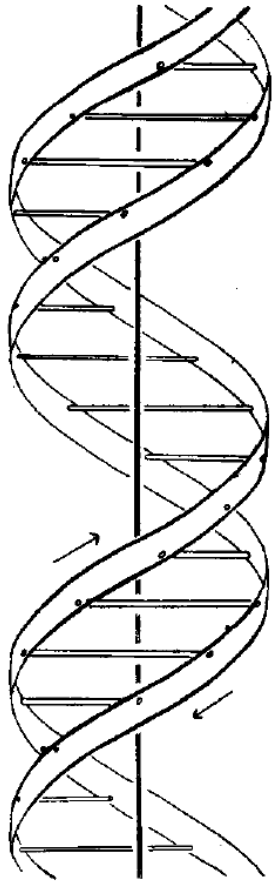
Grant supported



June 24–28, 2024

Watson and Crick,..... in 1953

1



It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material

2

Whether a special enzyme is required to carry out the polymerization, or whether the single helical chain already formed acts effectively as an enzyme, remains to be seen.

*Since the two chains in our model are intertwined, it is essential for them to untwist if they are to separate: As they make one complete turn around each other in 34. Å., there will be about 150 turns per million molecular weight, so that whatever the precise structure of the chromosome a considerable amount of uncoiling would be necessary. **It is well known from microscopic observation that much coiling and uncoiling occurs during mitosis, and though this is on a much larger scale it probably reflects similar processes on a molecular level.***

Although it is difficult at the moment to see how these processes occur without everything getting tangled, we do not feel that this objection will be insuperable.



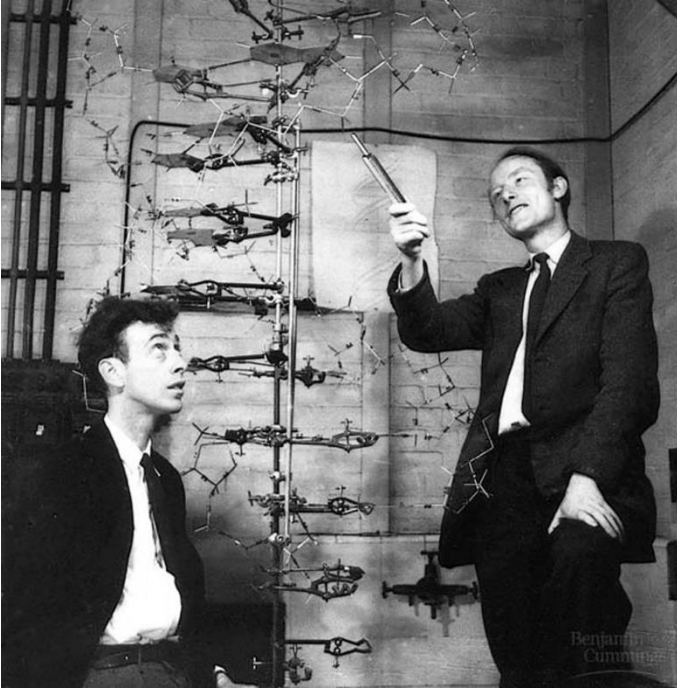
Nature 171, 964-967 1953 (May 30) **Genetical Implications of the Structure of Deoxyribonucleic Acid**



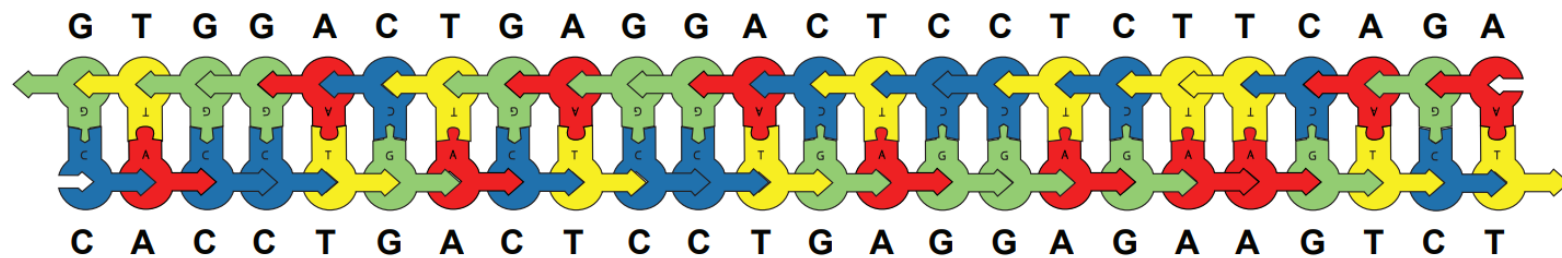
Nature 171, 737-738, 1953 (April 25) **Molecular Structure of Deoxypentose Nucleic Acids**

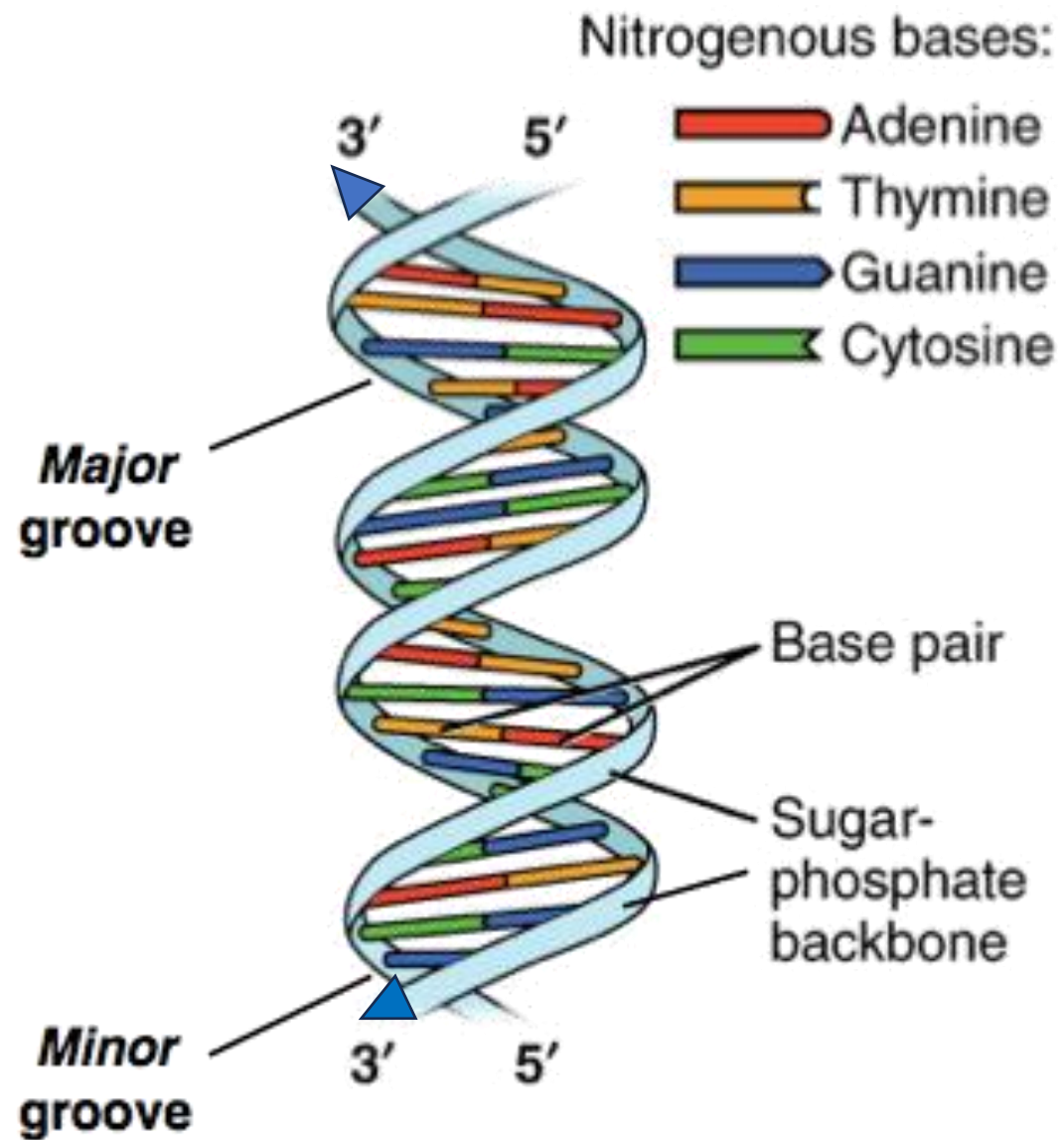
The MRC Laboratory of Molecular Biology

.... a Nobel fellow on every floor....

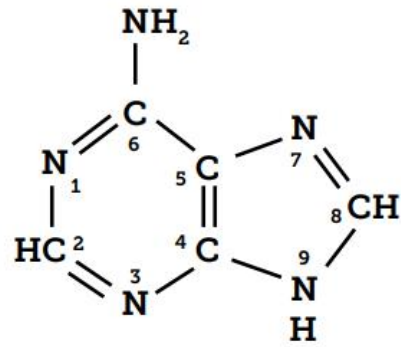


"We have discovered the secret of life."

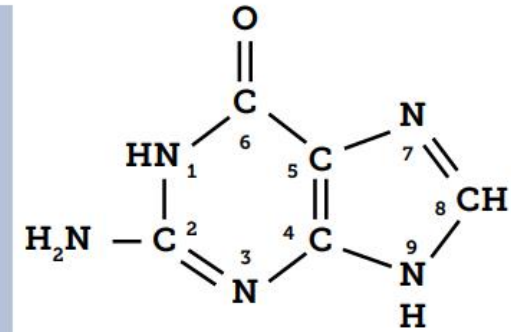




Purines

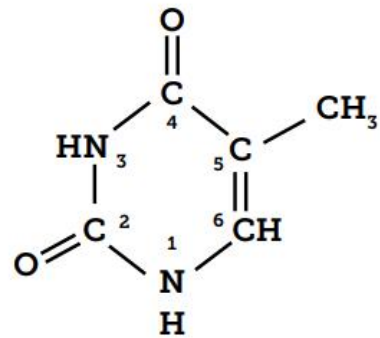
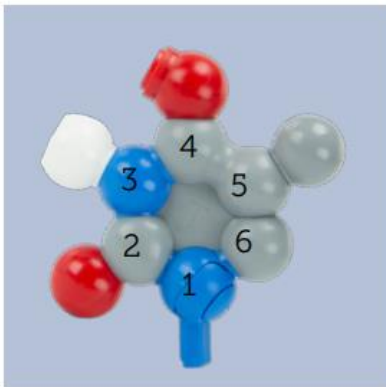


adenine (A)

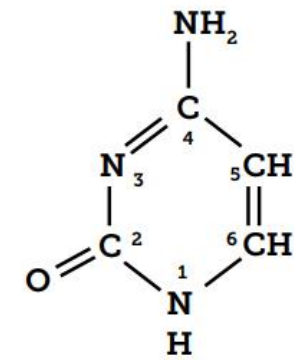
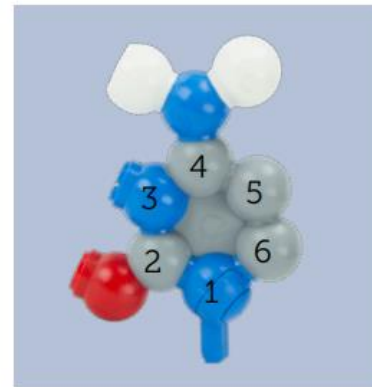


guanine (G)

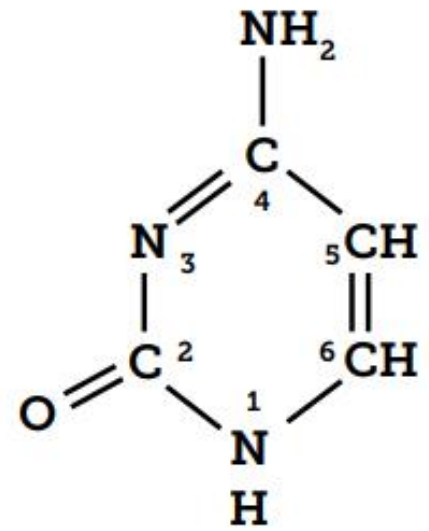
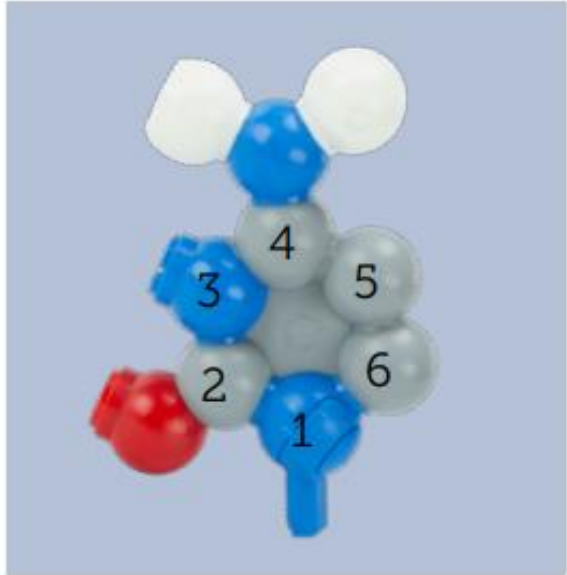
Pyrimidines



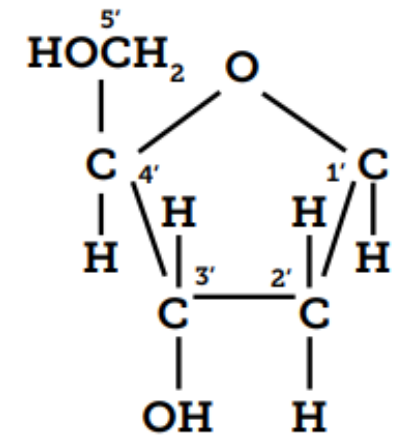
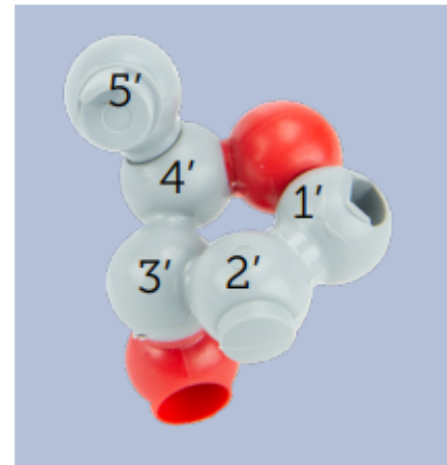
thymine (T)



cytosine (C)

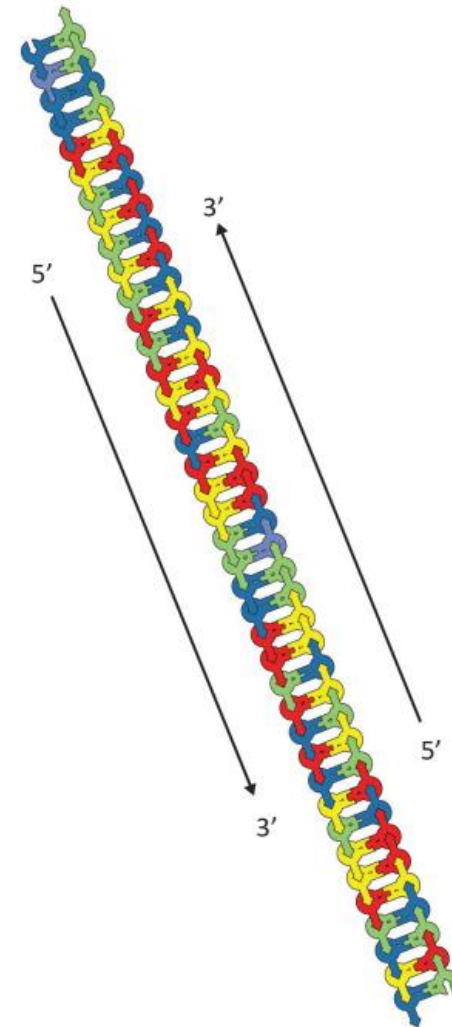
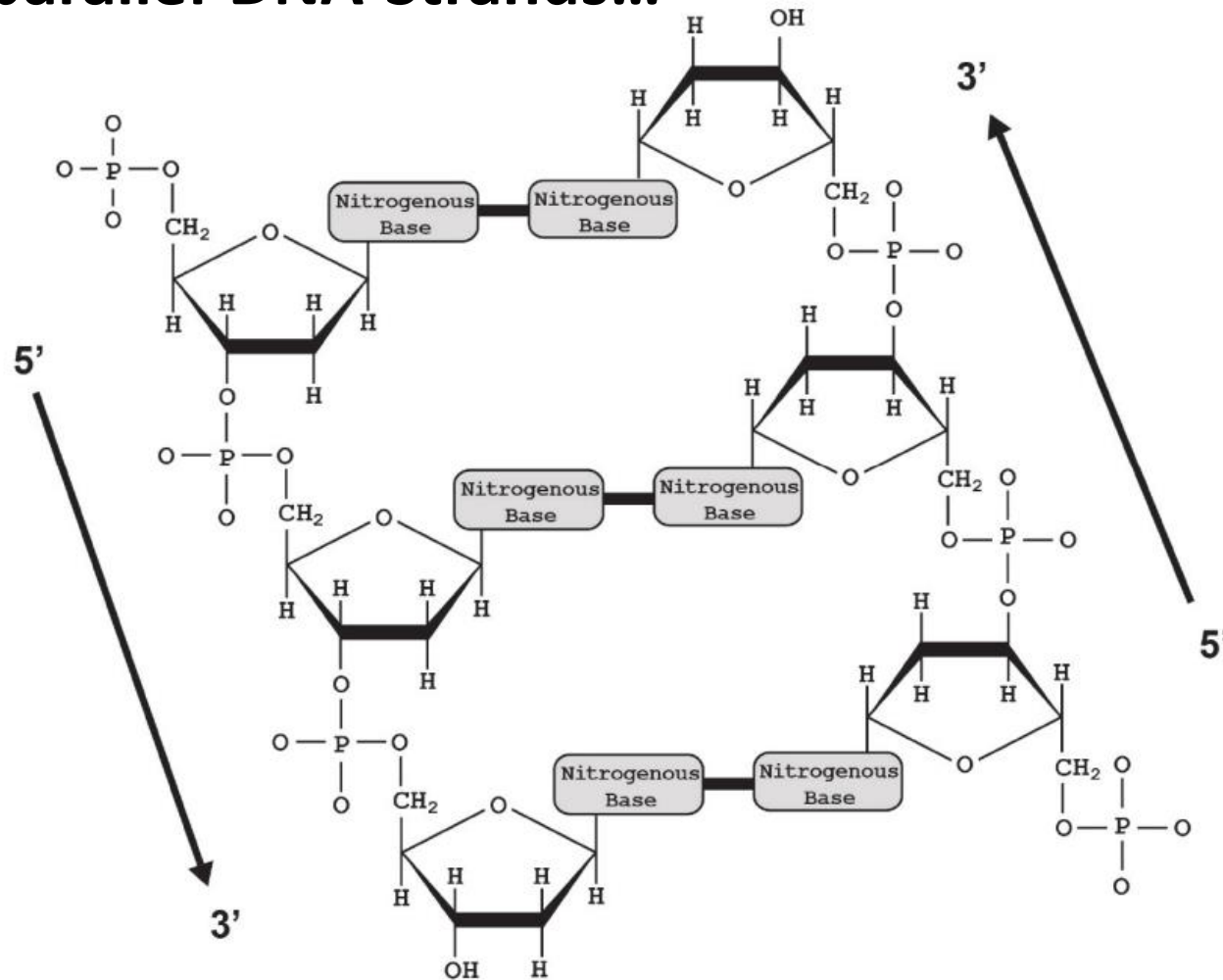


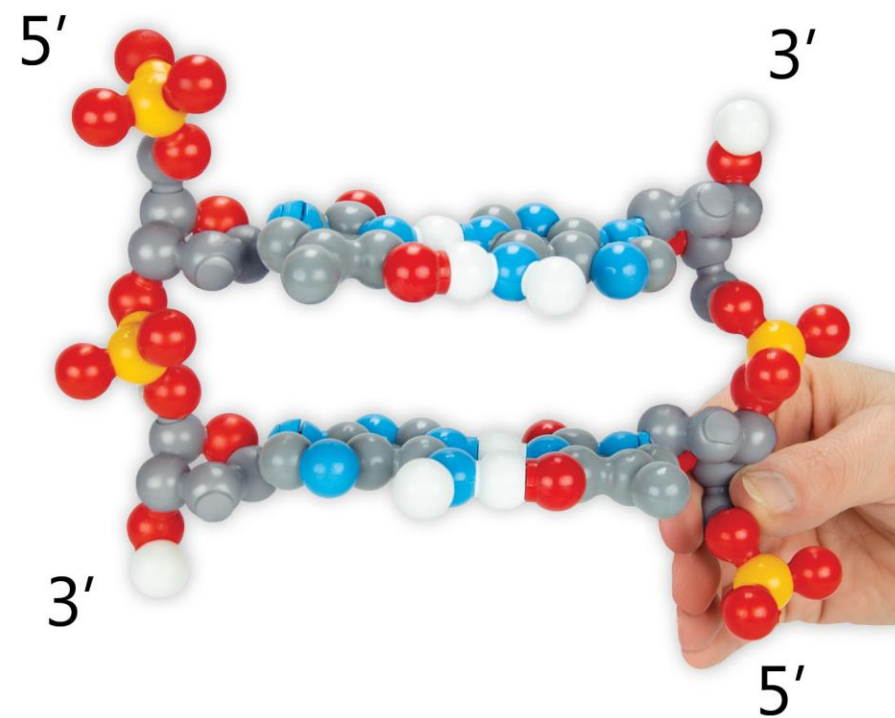
cytosine (C)

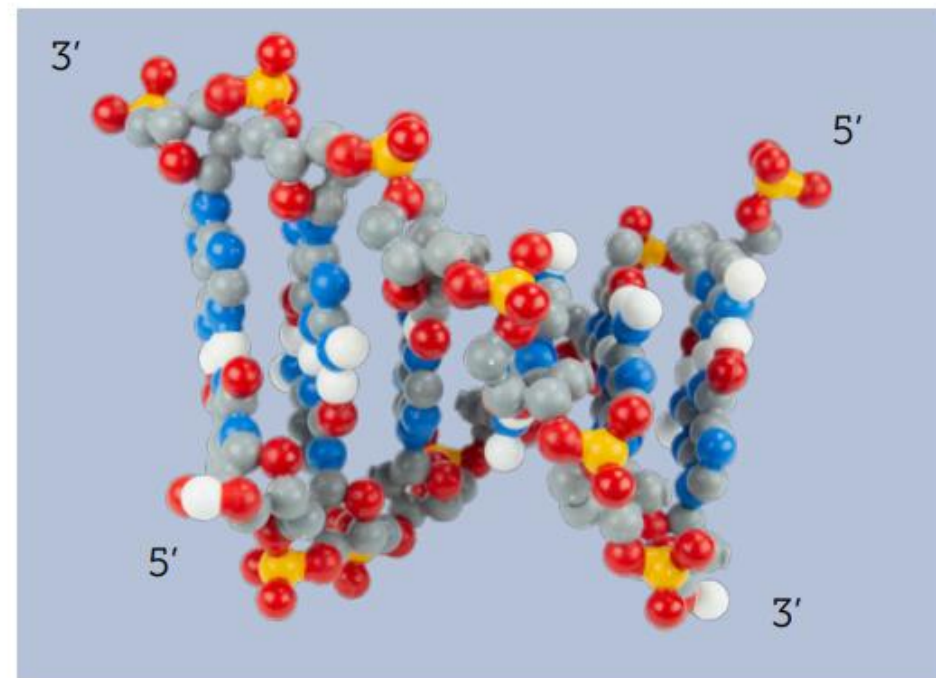
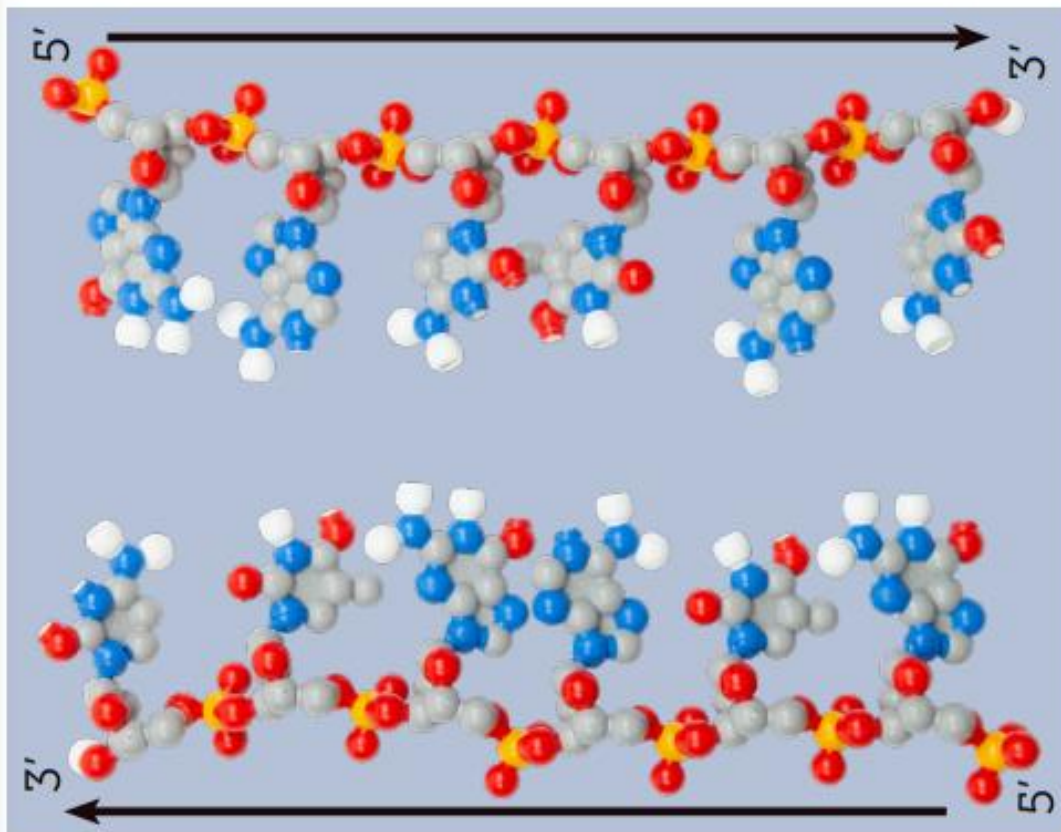


deoxyribose

Anti-parallel DNA Strands...







And now,... **EPIGENETICS**

In epigenetics, both ~~histones~~ and DNA
are chemically modified...
...to regulate gene expression.

Cytosine (**C**) is methylated...
only if it is followed by Guanosine

5'**C**pG.....3'

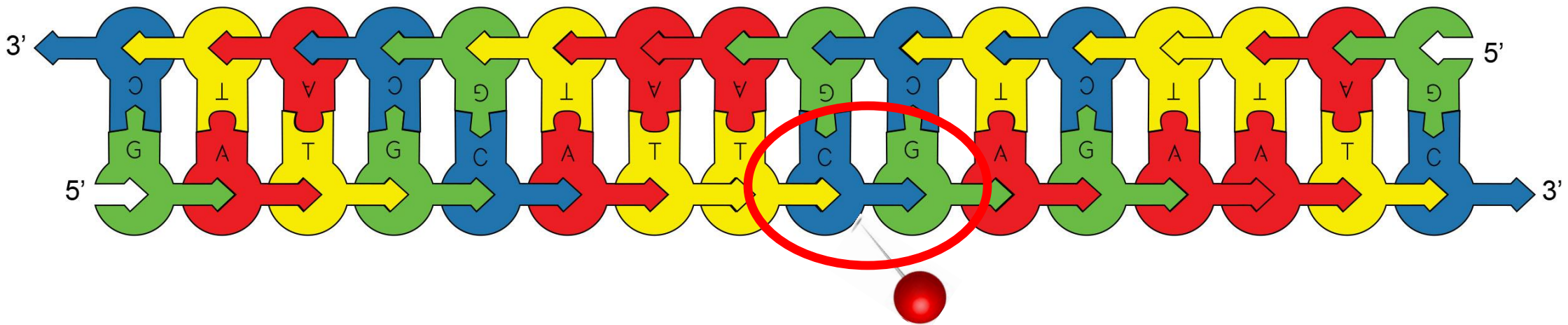
Let's go beyond teaching the **WHAT**....
... and start and start teaching the...

HOW? *There are enzymes called methylases*

WHEN? *Sometimes,.... Life is complicated*

WHY? *To impact the binding of transcription factors and to regulate gene expression*

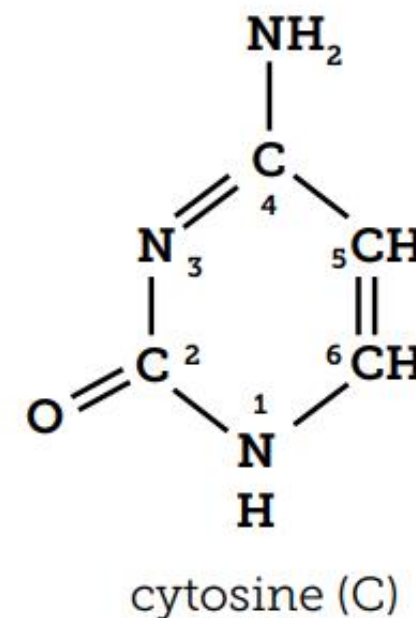
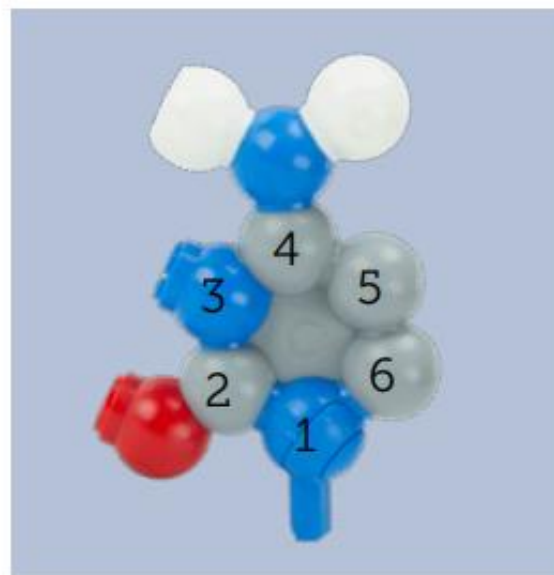
Find a 5'...CpG...3' -- and stick a pin in the C

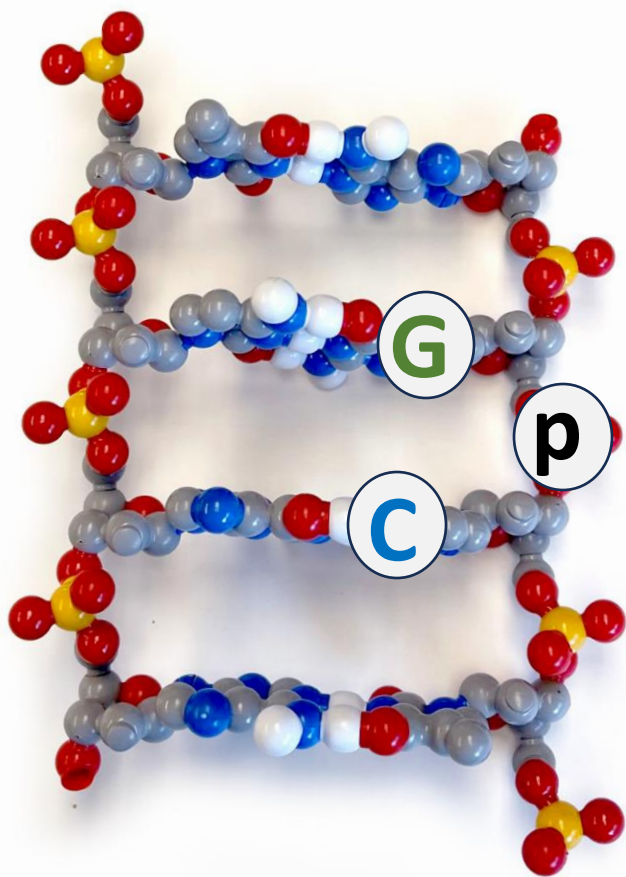


Then find a 5'...CpG...3' in your Dynamic DNA model

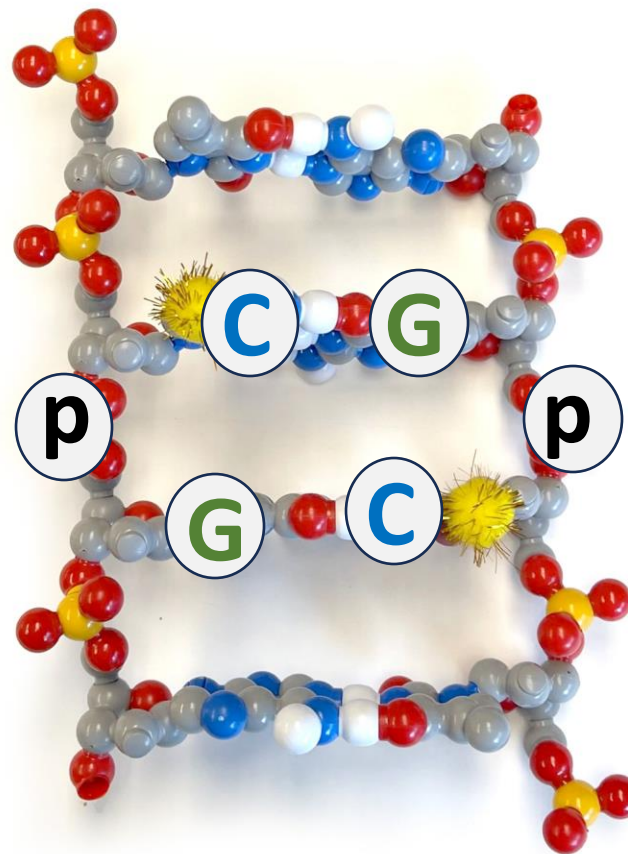
In epigenetics, the **#5 carbon** is methylated.

Find a CpG in your
Dynamic DNA ... and
put a methyl group
(sparkly hat) on the
#5 carbon.

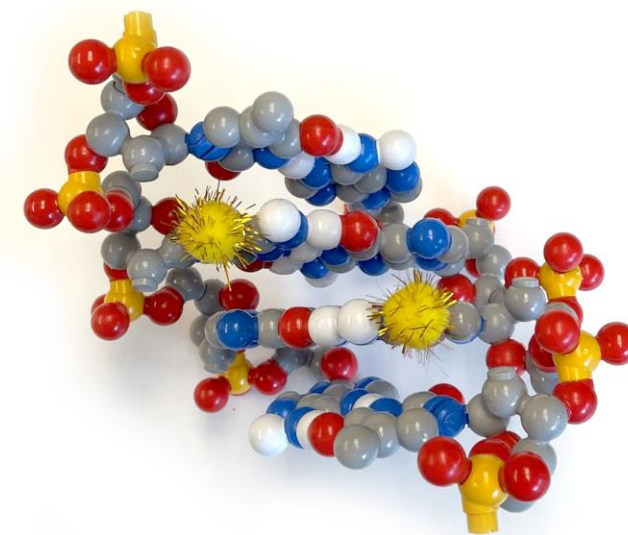




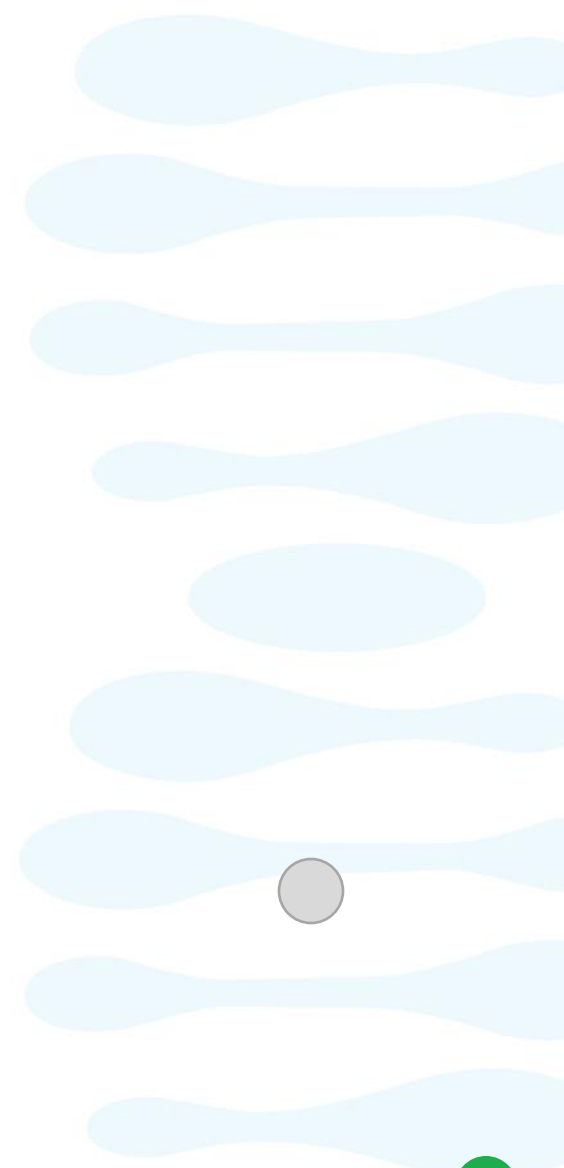
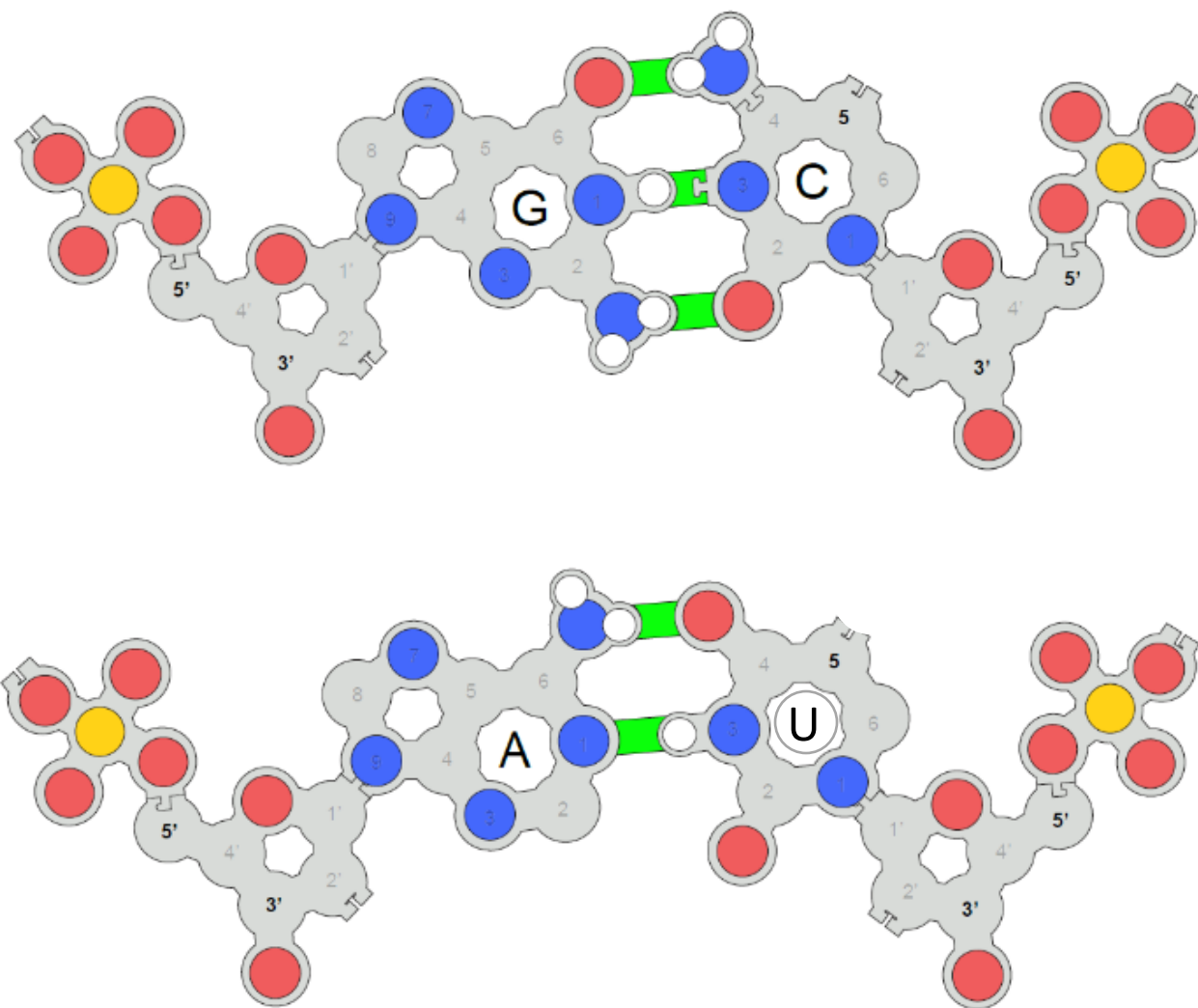
Whenever you find 1 CpG...



...you will find a second CpG in the opposite strand



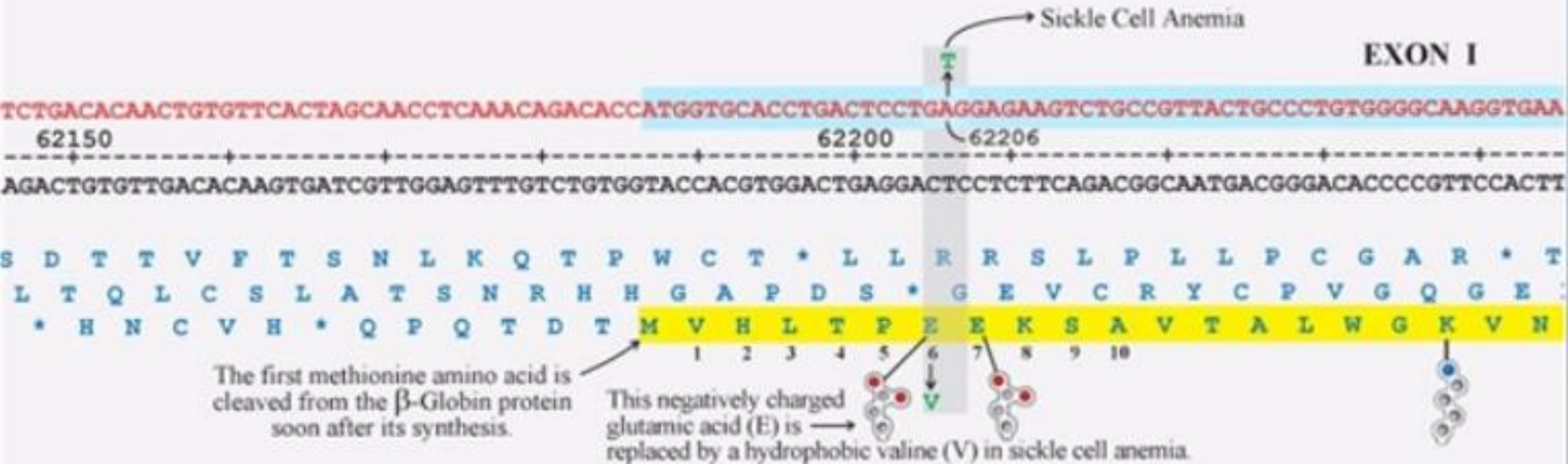
...and both methyl groups will end up in the major groove

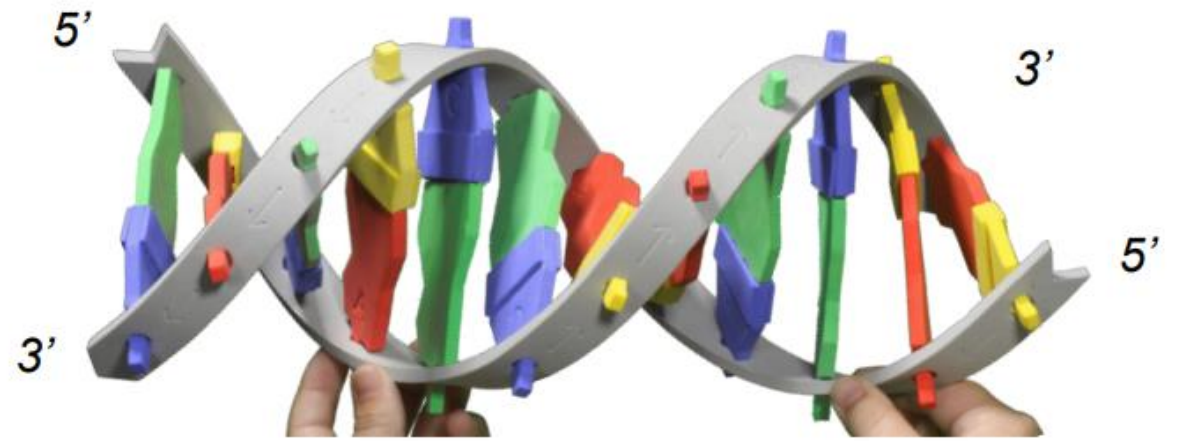
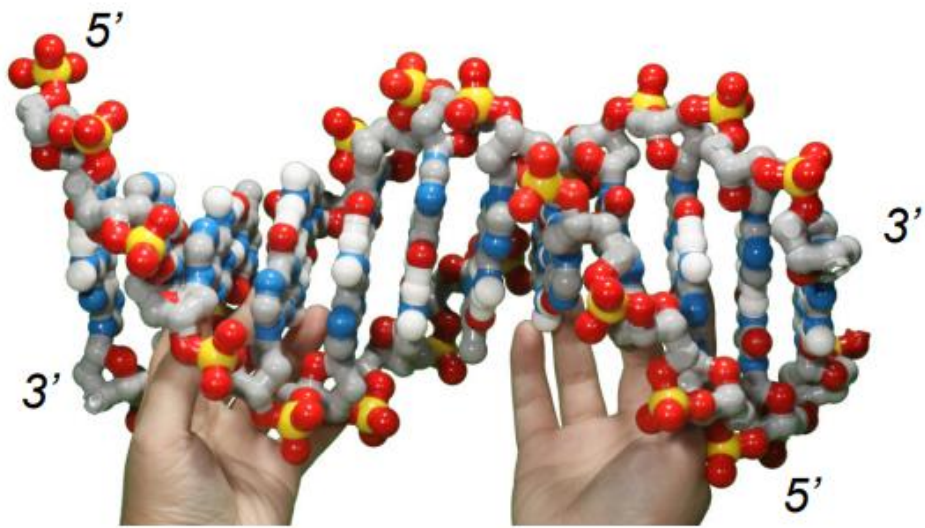


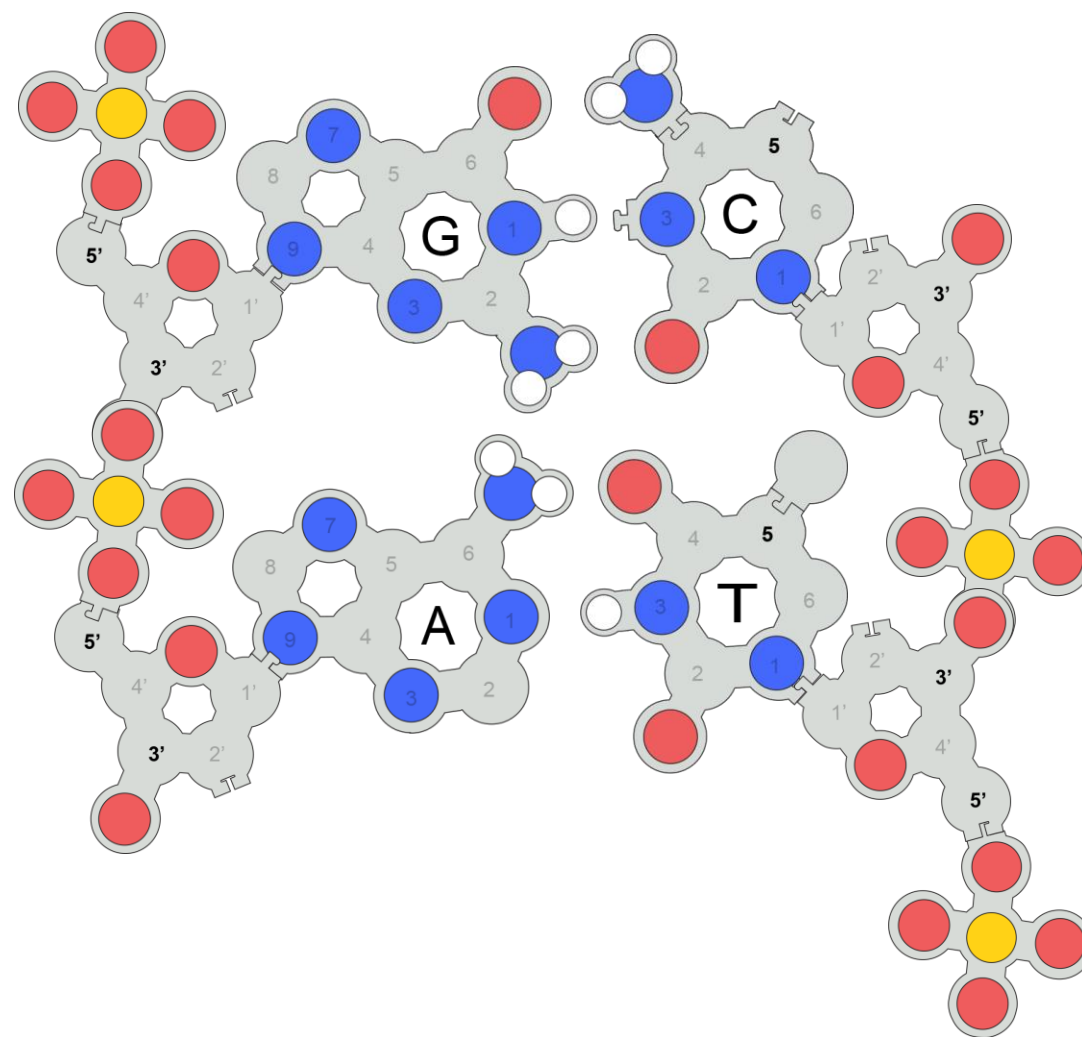
Where have all the CpG's gone? ... *long time passing.*

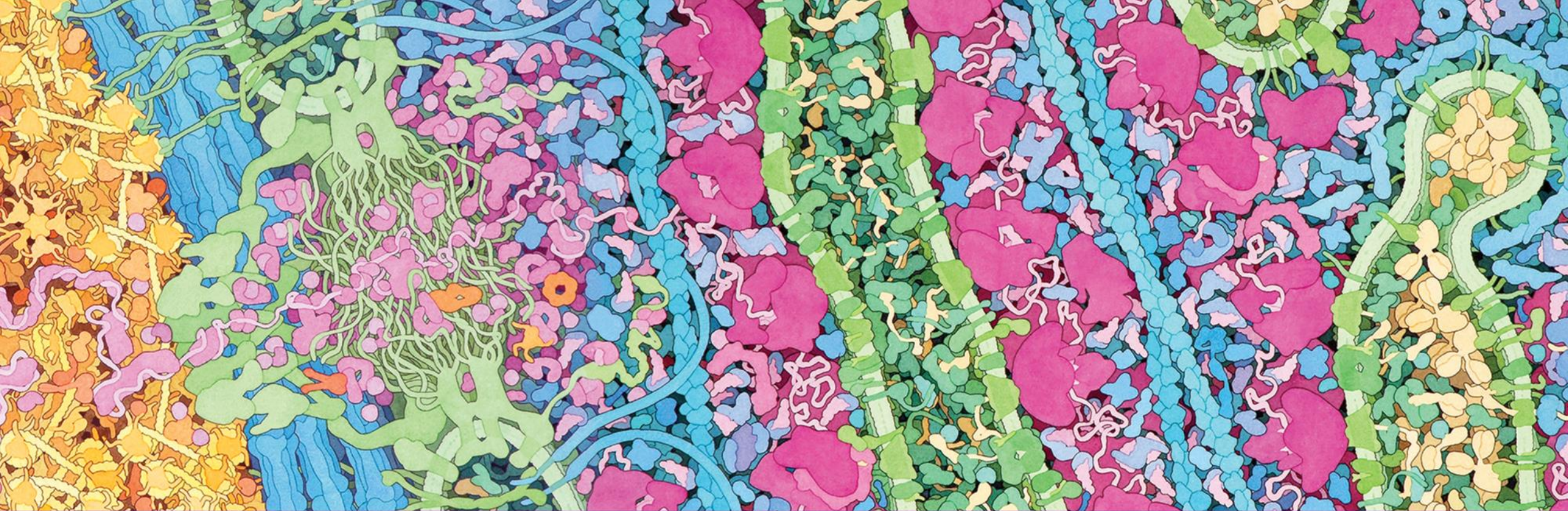
You would expect to find a CpG dinucleotide every 16 basepairs of random sequence

You actually find only 1 CpG dinucleotide every 100 base pairs in the human genome.









3d molecular
designs

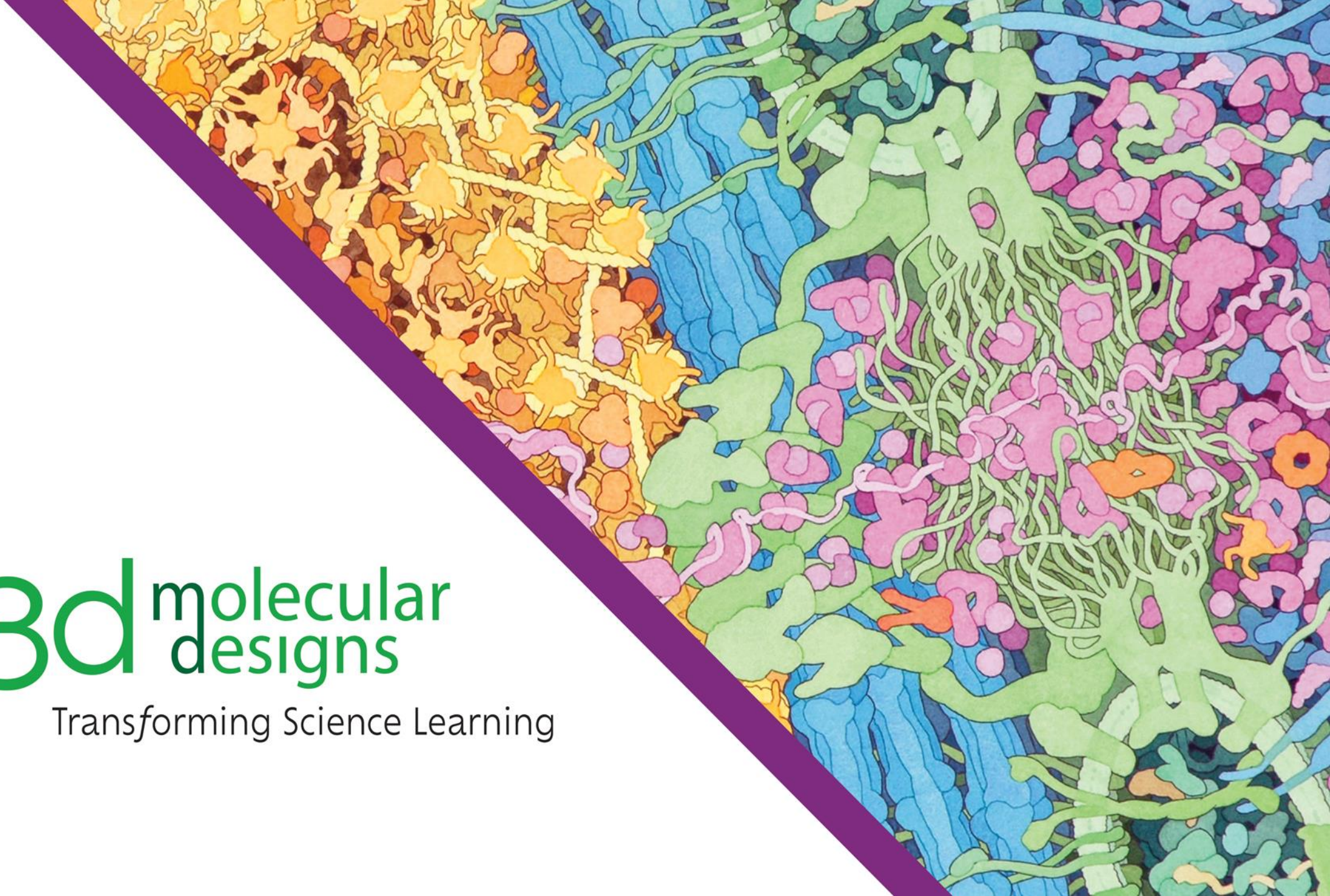
Transforming Science Learning

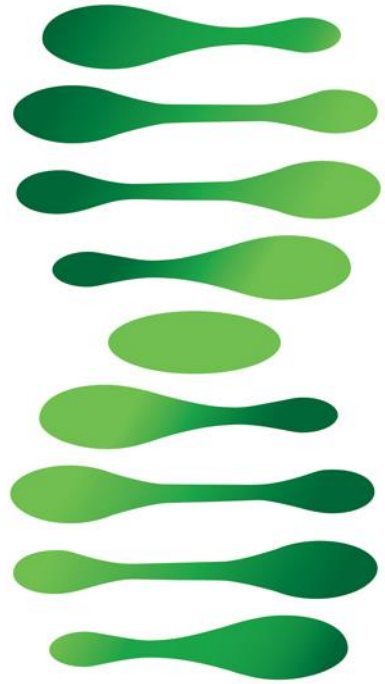




3d molecular
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Transforming Science Learning





Transforming Science Learning

