3-D Molecular Designs
...where molecules become real ™

MSOE UNIVERSITY Center for BioMolecular Modeling

# DNA STRUCTURE WEBINAR

**TUESDAY | MARCH 15 6:30 - 8 PM CST**

**PRESENTER:**

## TIM HERMAN, PhD

**MSOE Center for BioMolecular Modeling &**
**3D Molecular Designs**

## Why DNA & RNA?

MODELING MARVELS
2022 EDUCATORS WEBINARS

# Teaching your kids to think…

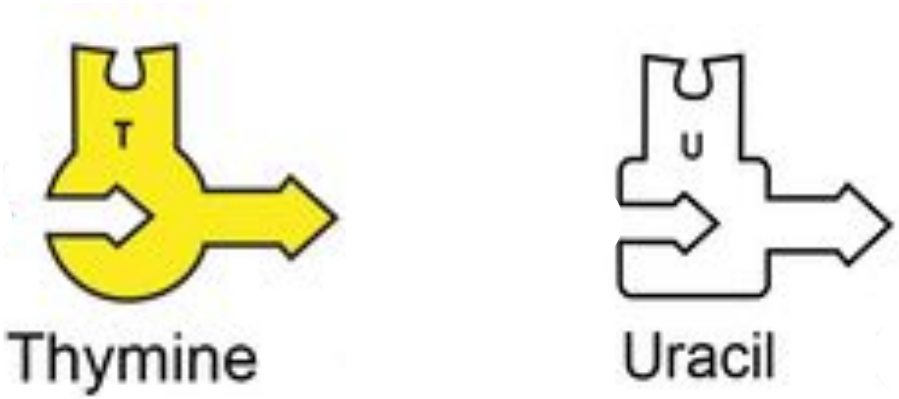
**As you reflect on your teaching, you may notice that you ask your students a lot of "what" questions:**

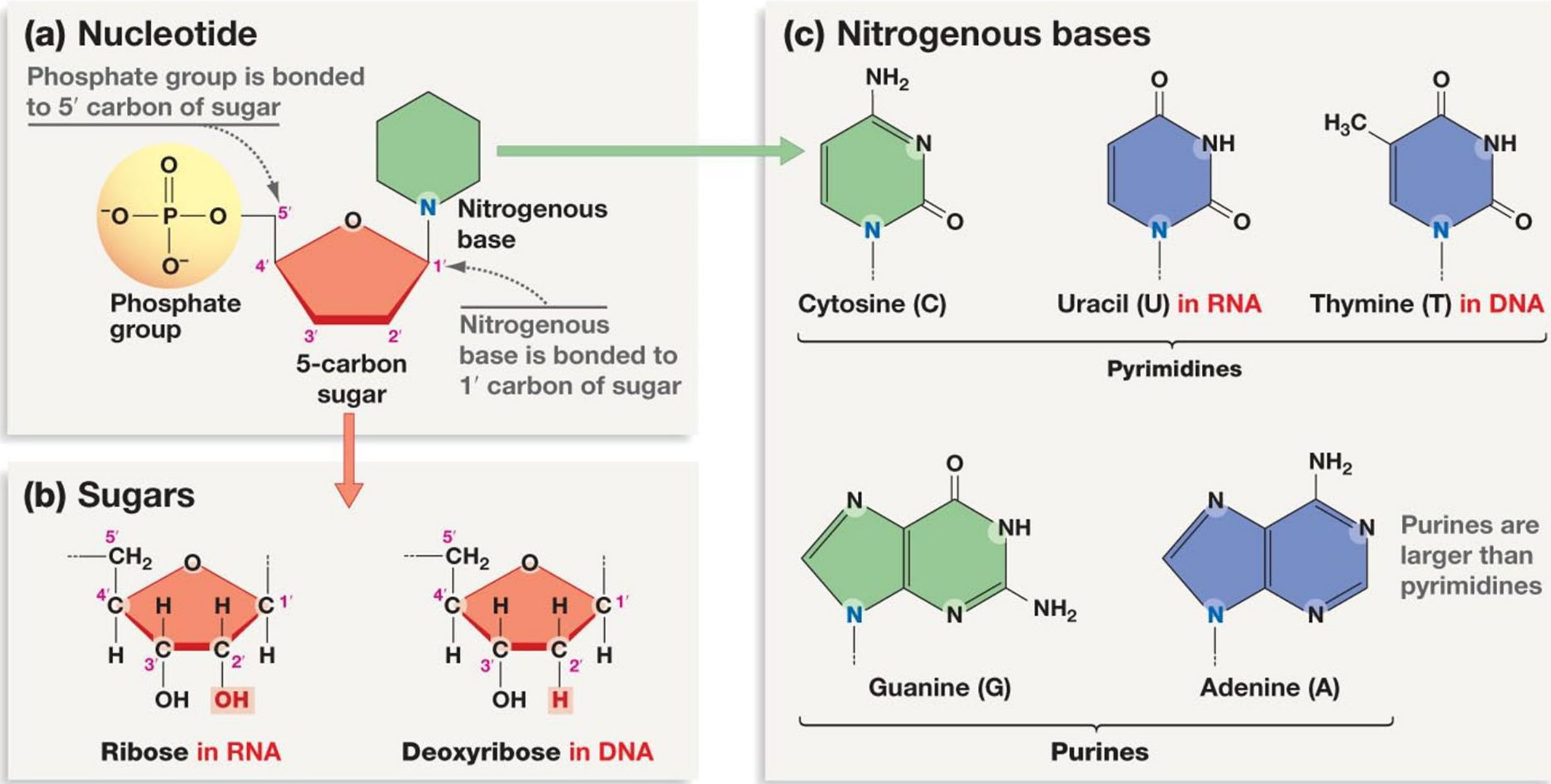
***What is the difference between DNA and RNA?***

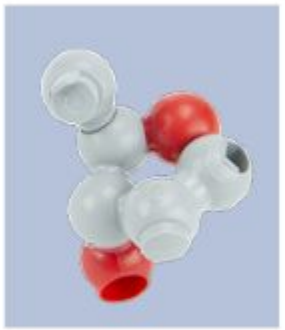
- ***RNA has U's and DNA has T's***
- ***DNA has deoxyribose… RNA has ribose***
- ***RNA is single-stranded… DNA is double-stranded***

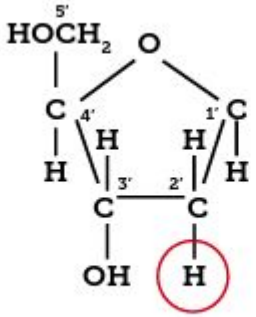
**Let's think about teaching the "*why*" of these subjects, such as:**

***Why does T replace U in DNA?***

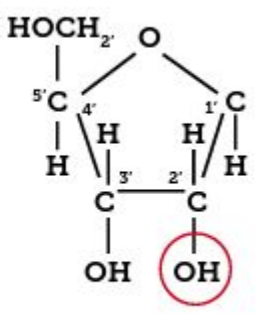




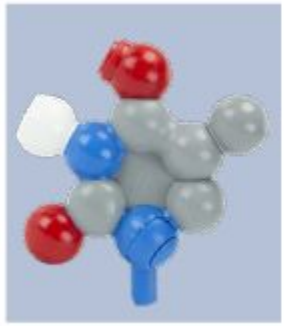


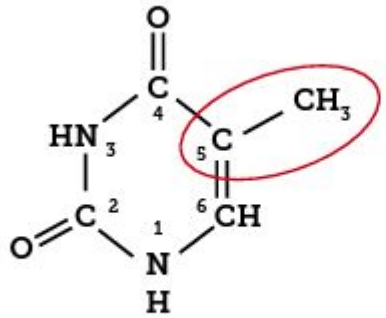



deoxyribose

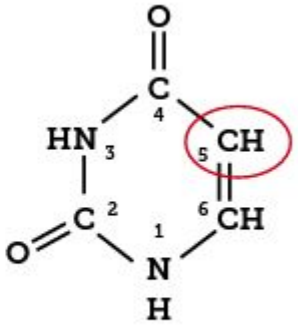



ribose






thymine (T)

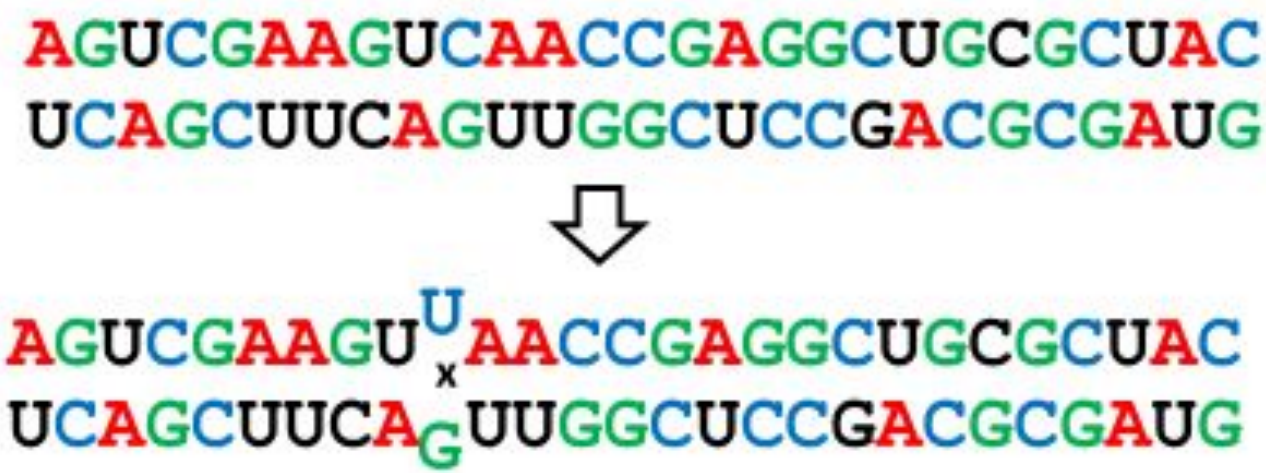



uracil (U)

# WHY…did T replace U in DNA?

…if we had not switched…

spontaneous oxidative deamination of C




A DNA repair system can remove “U” from DNA.
But,…how can we distinguish between a “deaminated C” and a normal U?

ANSWER: We can’t.

# WHY…did T replace U in DNA?

…but after we switched…

spontaneous oxidative deamination of C

AGTCGAAGTCAACCGAGGCTGCGCTAC
TCAGCTTCAGTTGGCTCCGACGCGATG

AGTCGAAGT$^{U}_{x}$AACCGAGGCTGCGCTAC
TCAGCTTCA$_{G}$TTGGCTCCGACGCGATG

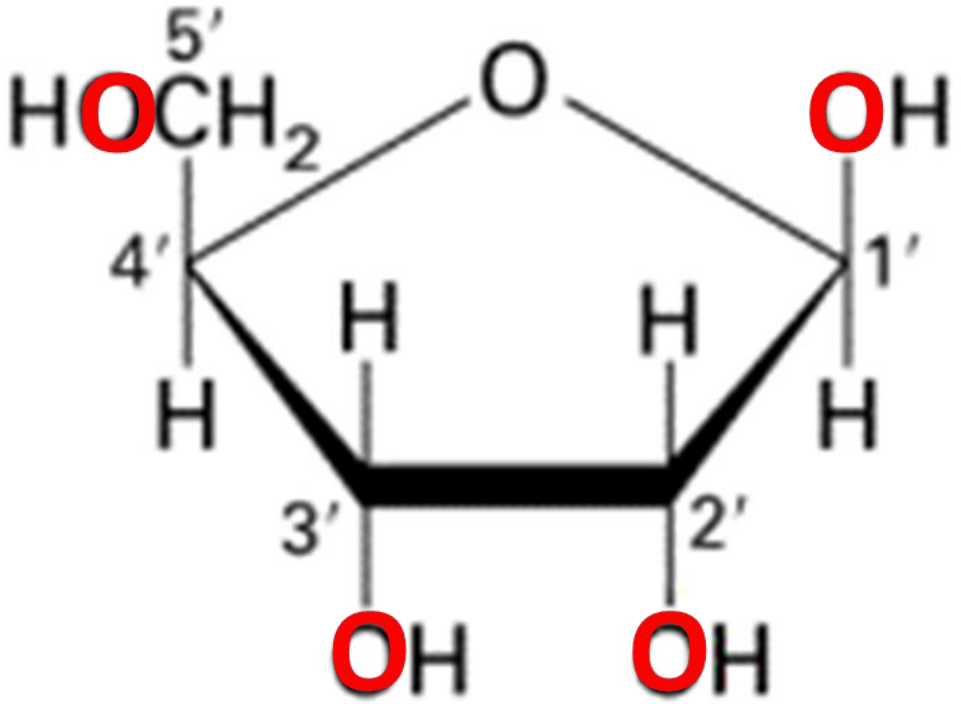
Uracil glycosidase constantly scans the DNA….looking for U's.
Any U … is a bad U…and should be repaired.

**Let's think about teaching the "*why*" of these subjects, such as:**

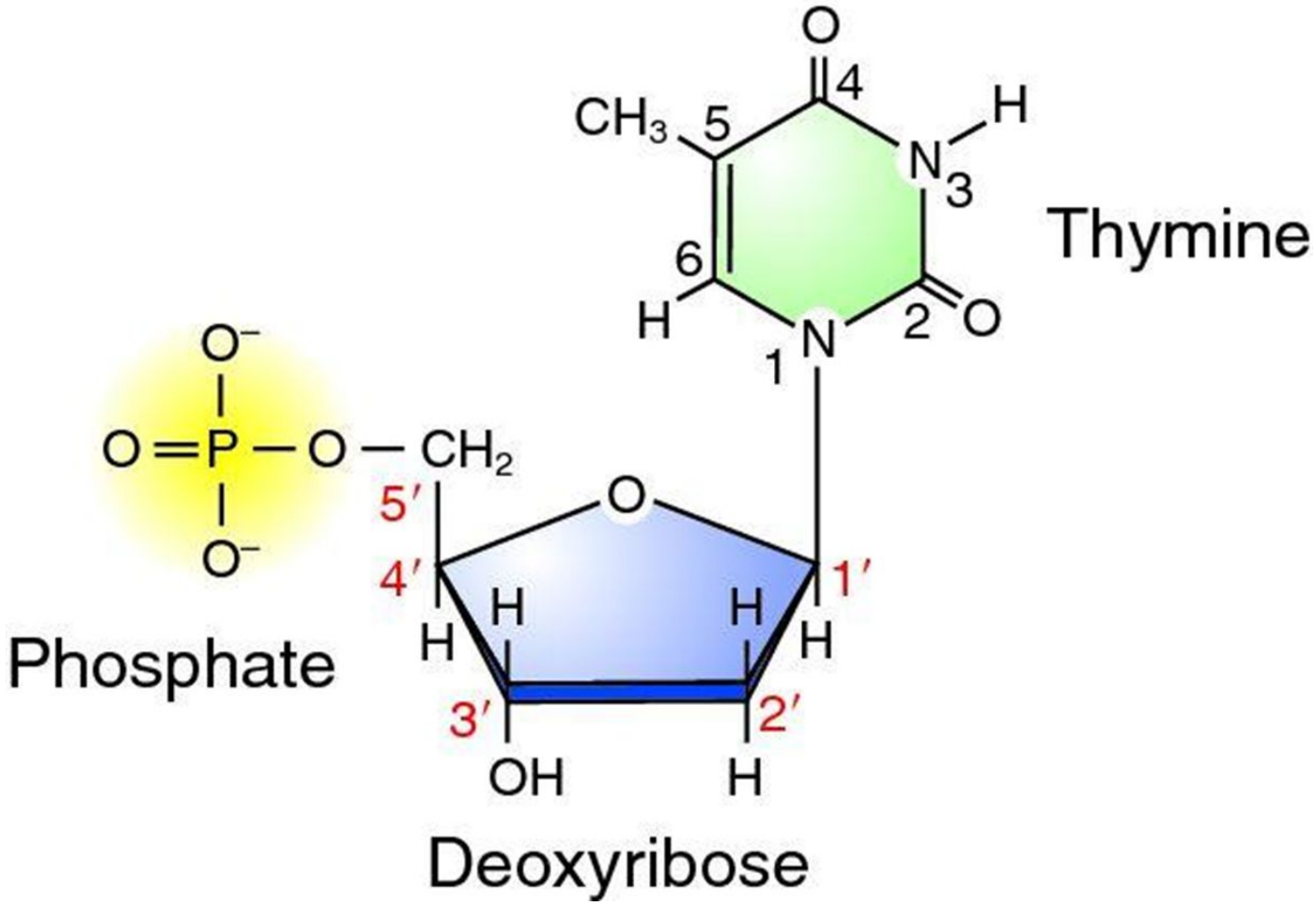
***Why does T replace U in DNA?***

***Why is RNA single-stranded?***

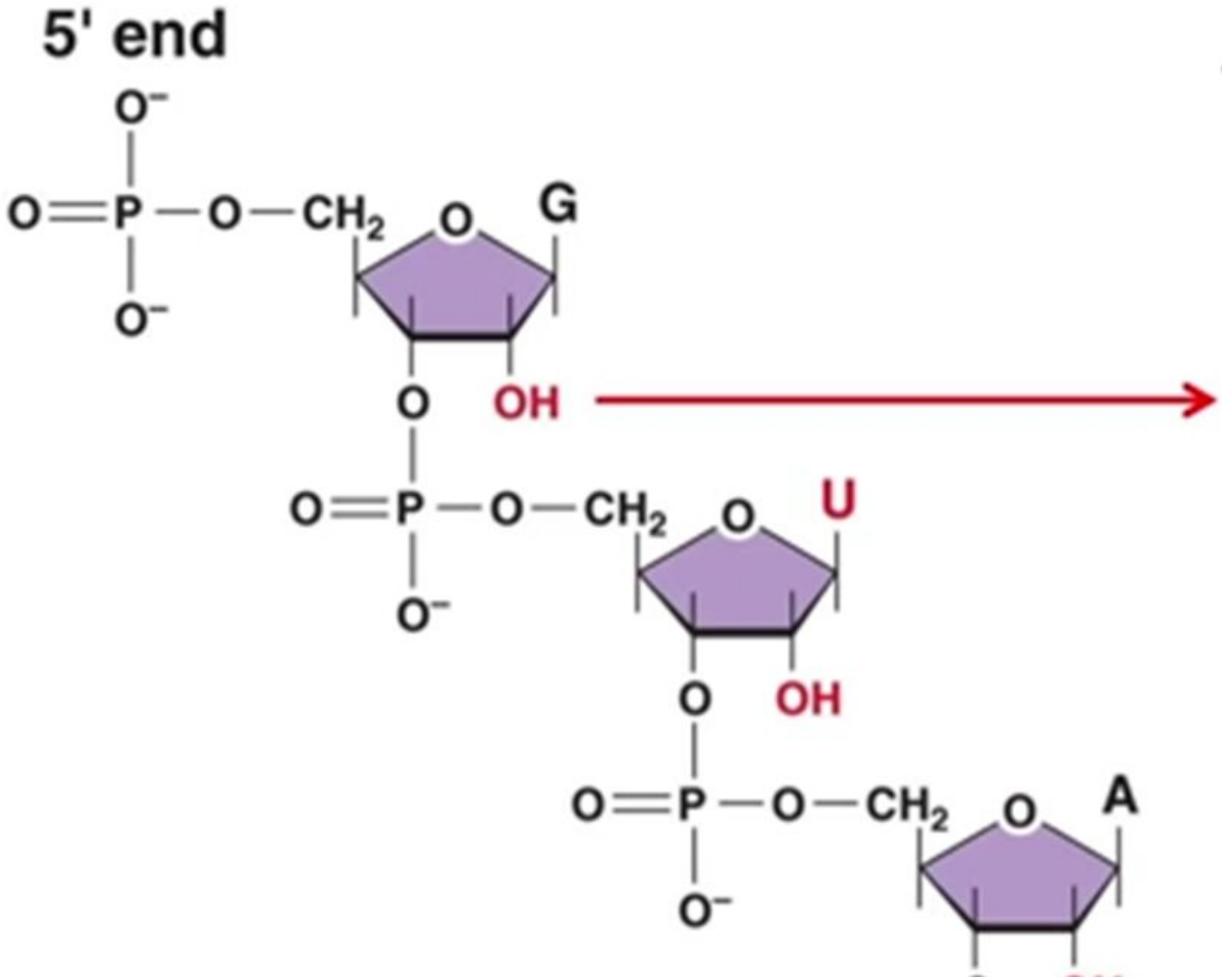
***…but wait, RNA is not single-stranded…***




Ribose

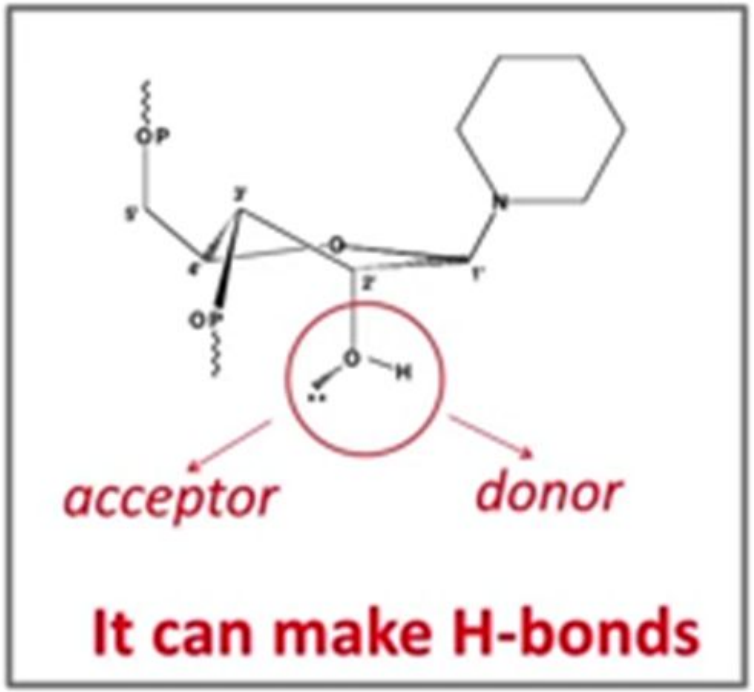

O
4
CH3
5
H
N
3
Thymine
6
H
2
O
N
1
O⁻
O=P—O—CH2
O⁻
5′
O
4′
1′
H
H
H
H
Phosphate
3′
2′
OH
H
Deoxyribose

# RNA has special powers….

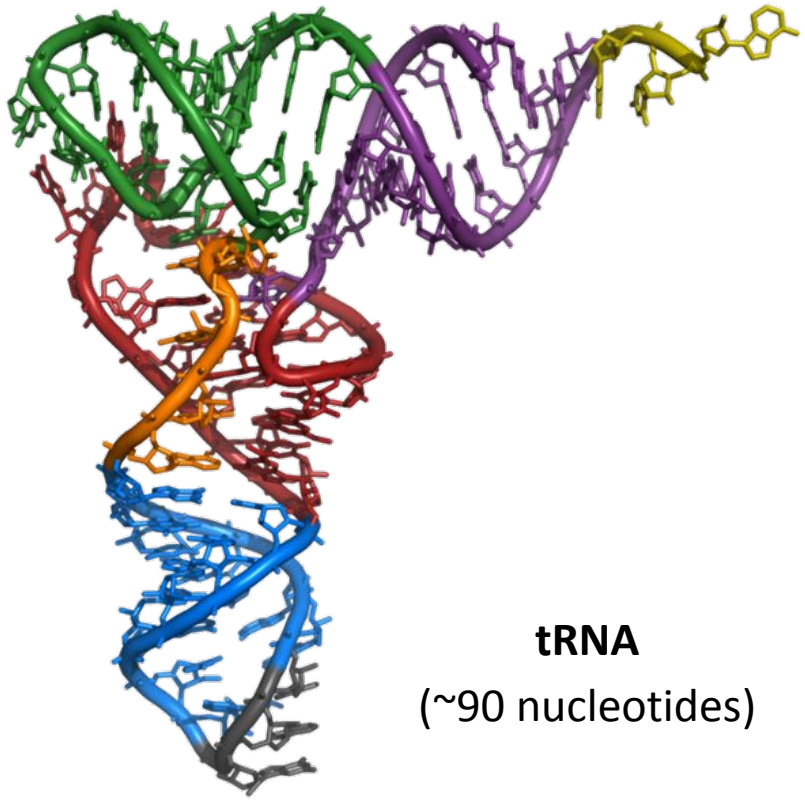



The 2'-OH group gives RNA

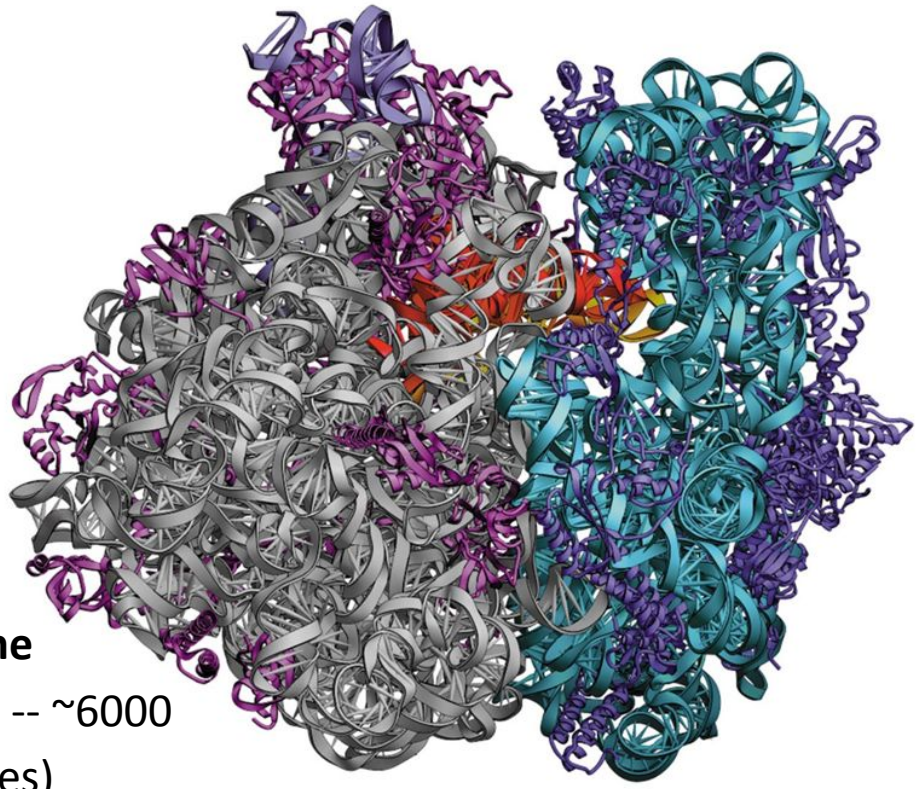
**Special Powers**



RNA folds up into a compact 3D shape,… following the same principles of chemistry that drive protein folding.



**tRNA**
(~90 nucleotides)



**Ribosome**
(ribosomal RNA -- ~6000 nucleotides)

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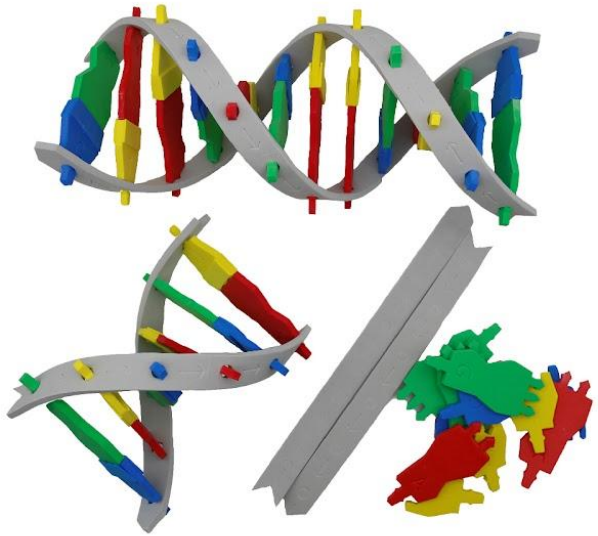
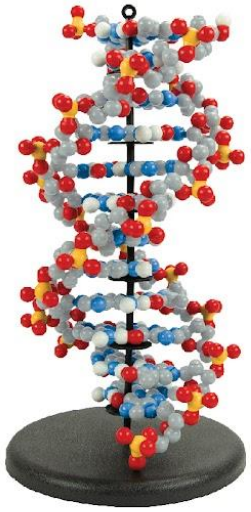
# THANK YOU FOR ATTENDING!

## Kits and models used in this session:





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