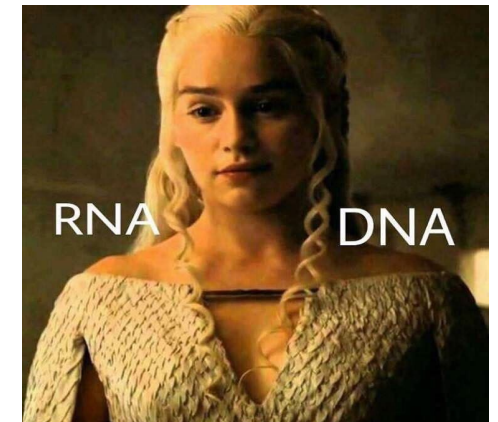


Teaching our kids to think

As we reflect on our teaching, you may notice that we ask our students a lot of “**what**” questions

What is the difference between DNA and RNA?

- *RNA has U's and DNA has T's* — Yes, but Why?
- *DNA has deoxyribose; RNA has ribose* — Yes, but so What?
- *RNA is single-stranded; DNA is double-stranded* — Not really....

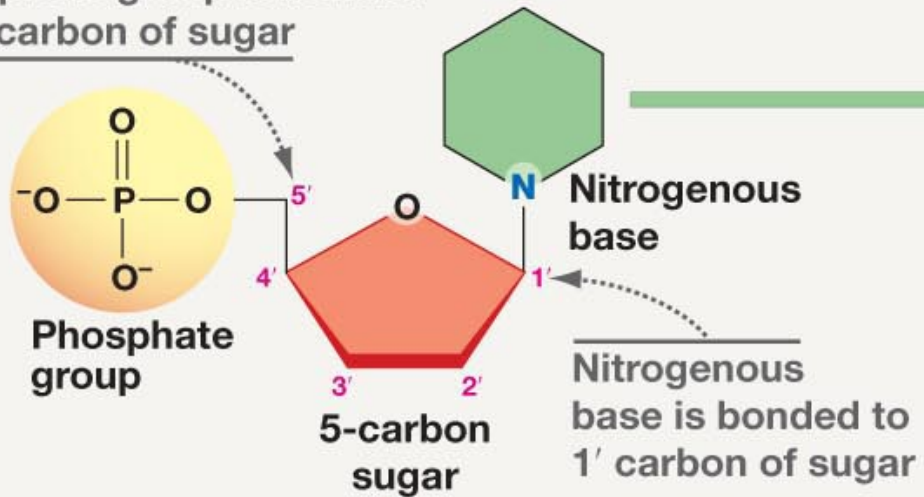


STOP Teaching... the **What**

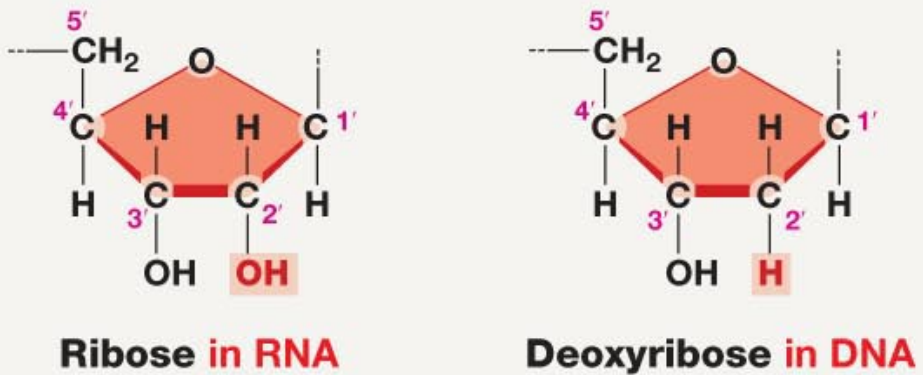
START Teaching... the **Why**

(a) Nucleotide

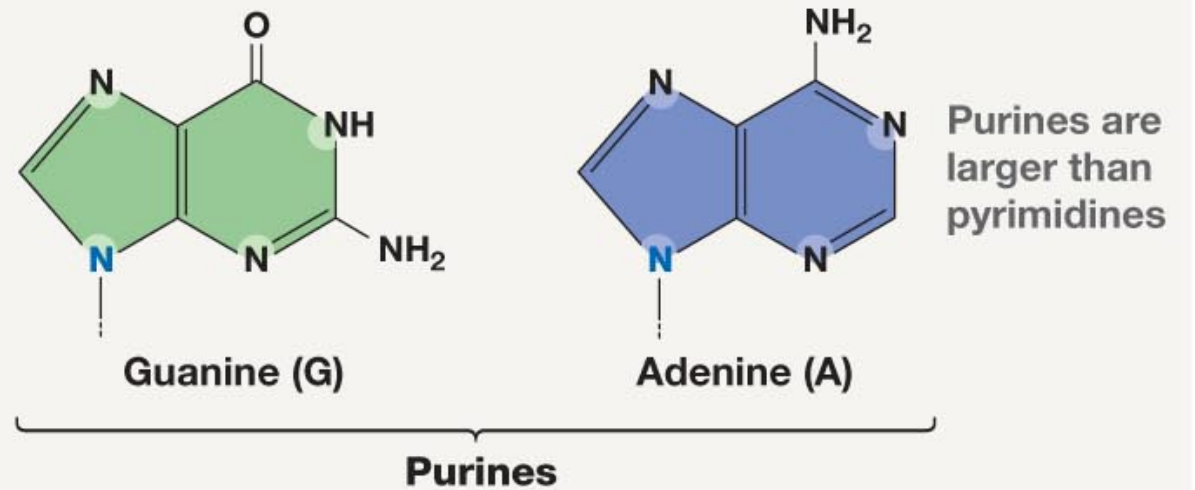
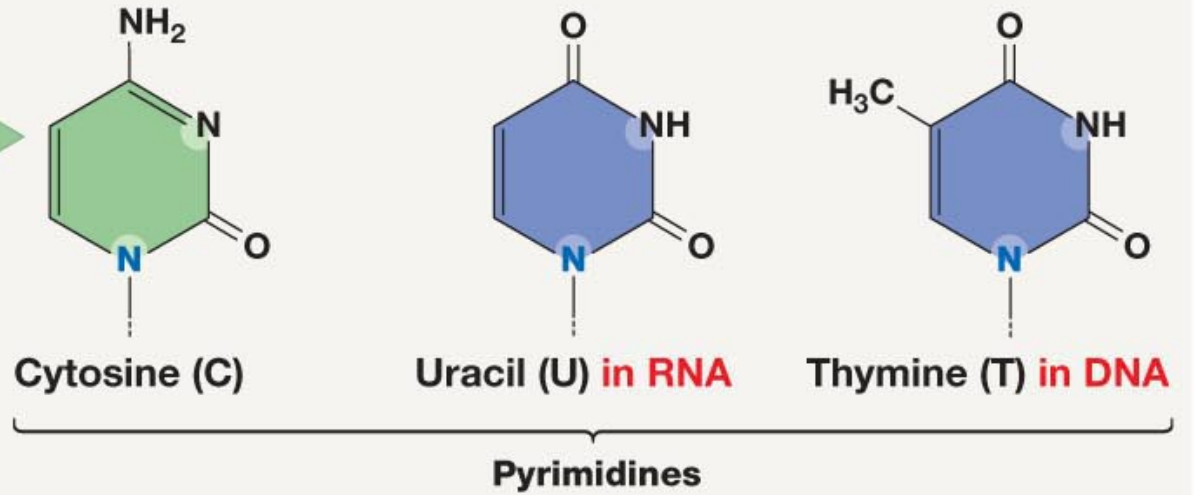
Phosphate group is bonded to 5' carbon of sugar



(b) Sugars



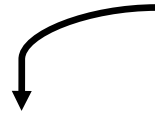
(c) Nitrogenous bases



WHY did T replace U in DNA?

...if we had not switched...

spontaneous oxidative
deamination of C



AGUCGAAGUCAACCGAGGCUGCGCUAC
UCAGCUUCAGUUGGCUCCGACGCGAUG



AGUCGAAGU^U_xAACCGAGGCUGCGCUAC
UCAGCUUCA_GUUGGCUCGACGCGAUG

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
TCAGCTTCA GTTGGCTCCGACGCGATG

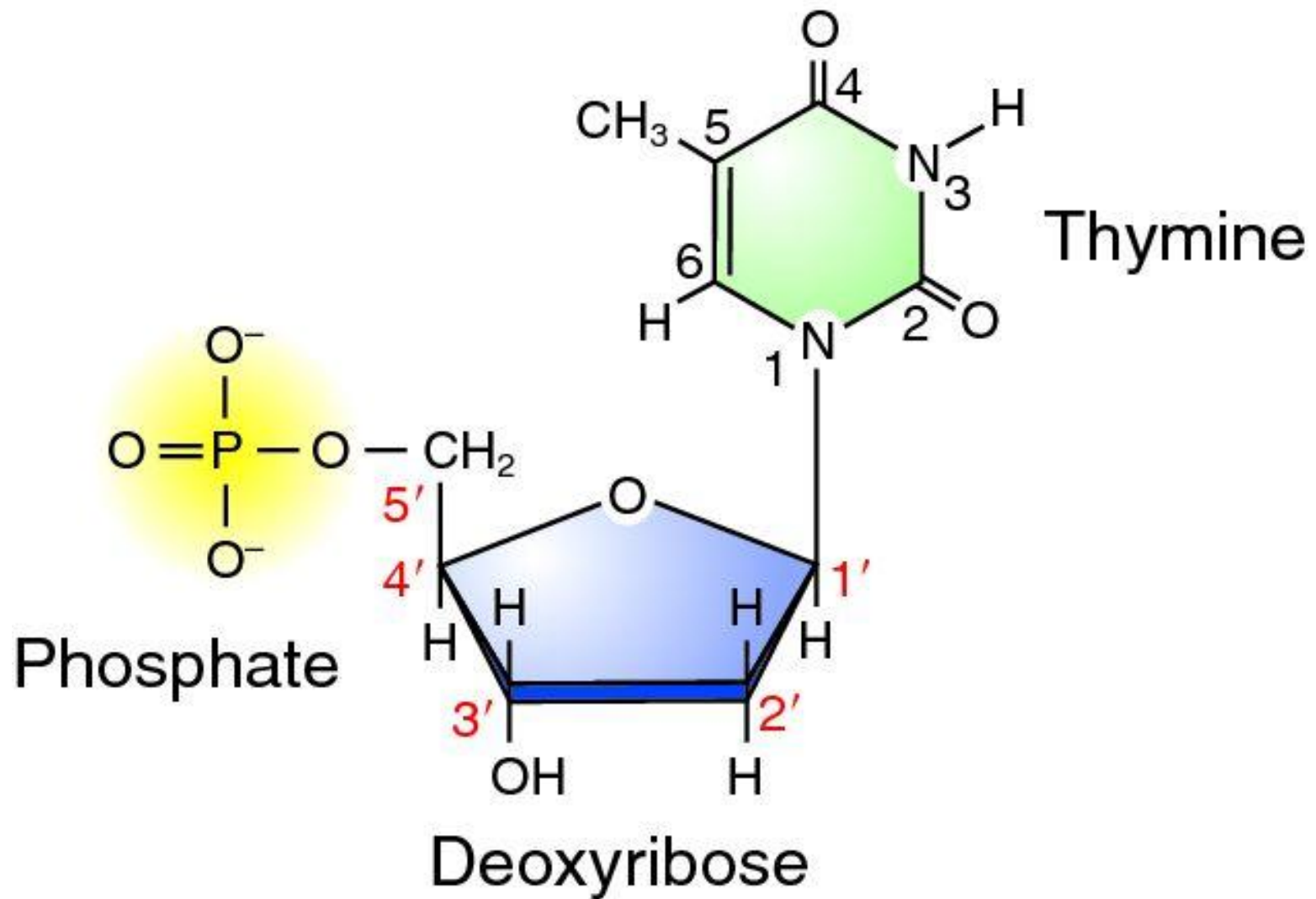


AGTCGAAGT^U_xAACCGAGGCTGCGCTAC
TCAGCTTCA_GTTGGCTCCGACGCGATG

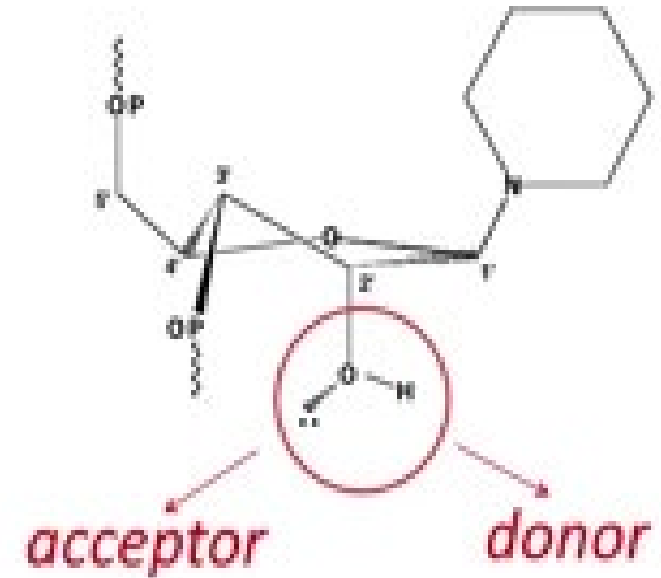
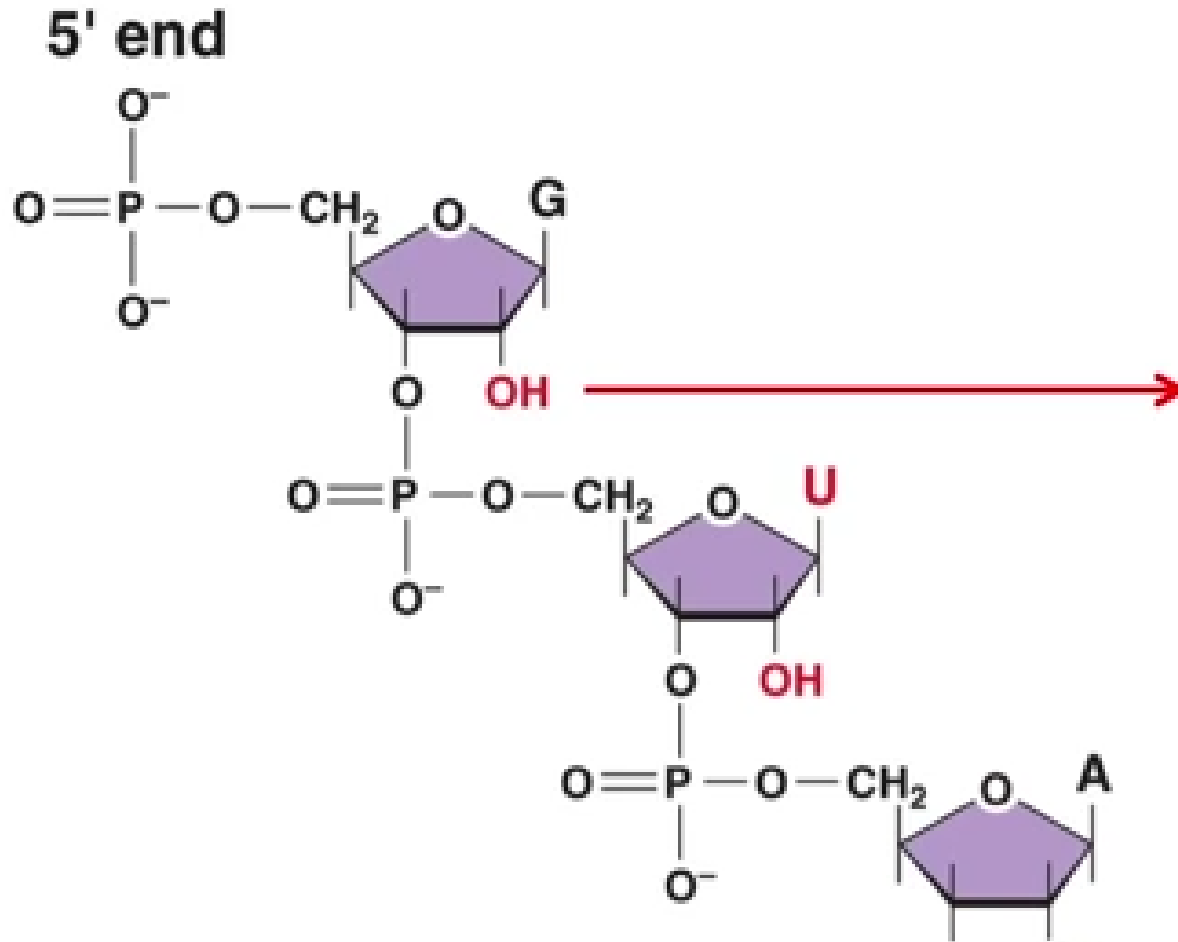
Uracil glycosidase constantly scans our DNA... looking for U's.
Any U is a bad U and should be repaired.

Why is RNA single-stranded?

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



The 2' OH group gives RNA *special powers....*



... it can form **hydrogen bonds**,
and fold into complex 3D
shapes