

Warm-Up 10/28

- What are some major differences between DNA and RNA?

8.4 Transcription



Central Dogma of Molecular Biology

- Information flows in one direction
 - DNA → RNA → protein
- Replication copies DNA
- Transcription converts DNA to RNA
- Translation interprets RNA into a string of amino acids (protein)

Where does transcription occur?

- Prokaryotes
 - Replication, transcription and translation all occur in the cytoplasm
- Eukaryotes
 - Replication and transcription happen in the **nucleus** which stores the DNA
 - Translation happens in the cytoplasm

*we will focus on Eukaryotes from here on

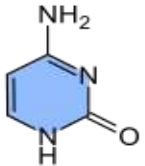
RNA

- Ribonucleic acid
- Still made of sugar (ribose), phosphate group and nitrogenous base
- Consider it to be temporary copy of DNA that is used and destroyed

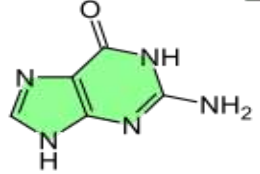
RNA differs from DNA in 3 ways

1. The sugar has an extra oxygen- ribose instead of deoxyribose
2. A nitrogenous base called Uracil (U) replaces Thymine and pairs with Adenine
 - So in RNA we've got G-C and A-U
3. RNA is single-stranded, not a double helix

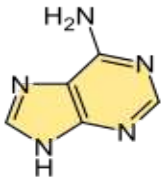
Cytosine **C**



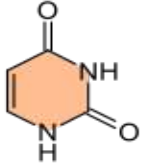
Guanine **G**



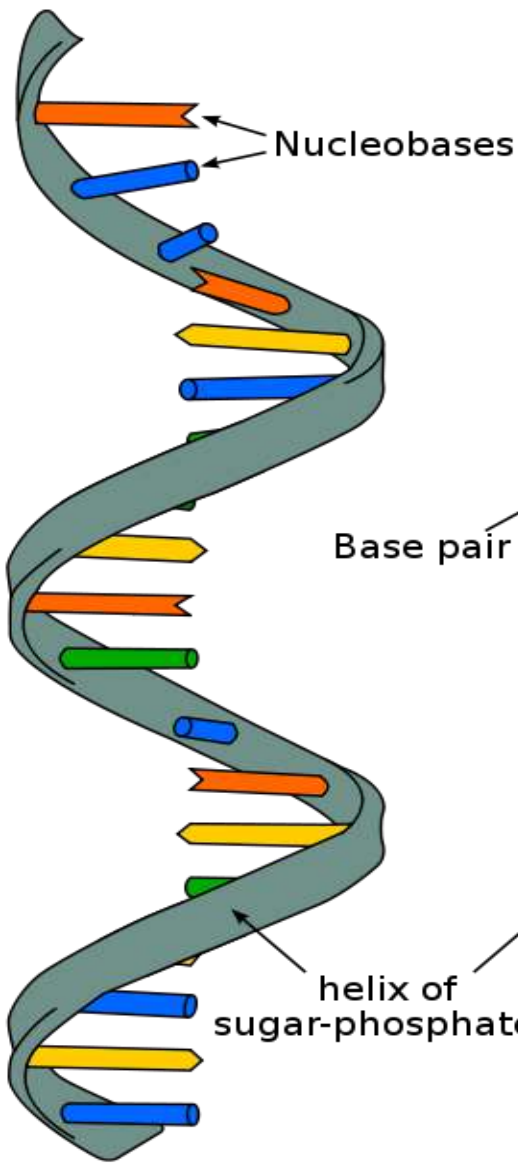
Adenine **A**



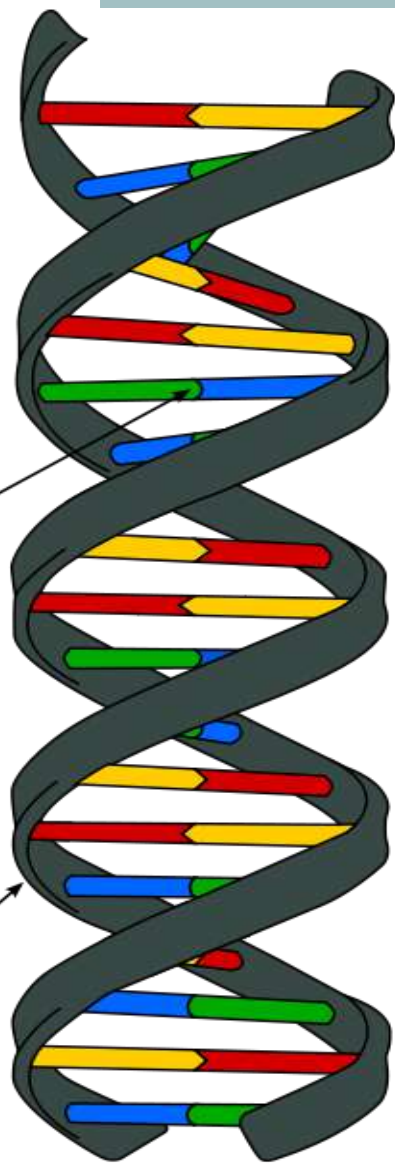
Uracil **U**



Nucleobases of RNA

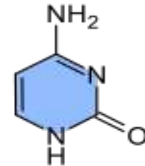


RNA
Ribonucleic acid

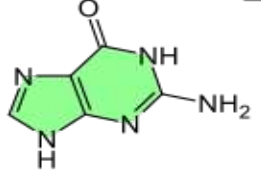


DNA
Deoxyribonucleic acid

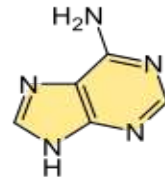
Cytosine **C**



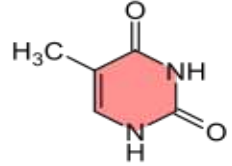
Guanine **G**



Adenine **A**



Thymine **T**



Nucleobases of DNA

Transcription

- process of copying DNA to make a complementary strand of RNA
- Just as DNA is catalyzed by DNA polymerase, transcription is catalyzed by RNA polymerase

3 Steps of Transcription

1. RNA polymerase and other enzymes and proteins assemble at the transcription start site on a segment of DNA (gene) then the strands of the double helix are unwound

3 Steps of Transcription

2. RNA polymerase, using only ONE strand of DNA as a template, creates the complementary RNA strand which will hang freely as the DNA “zips back up”

What is the complementary RNA Strand to this DNA segment?

AATCGAATTTAGCCGGGATTGCA

3 Steps of Transcription

3. Once the gene has been transcribed it detaches itself from the DNA

Transcription Produces 3 types of RNA

- **Messenger RNA (mRNA)**
 - Intermediate message that is translated by a ribosome to make a protein
- **Ribosomal RNA (rRNA)**
 - Forms a part of ribosomes
- **Transfer RNA (tRNA)**
 - Brings amino acids from the cytoplasm to a ribosome to help make the growing protein

Questions

- How do DNA and RNA differ?
- Explain why transcription occurs in the nucleus of eukaryotes.
- Why must the DNA strands unwind and separate before transcription can take place?
- What happens to the RNA transcript after it separates from the DNA in step 3?