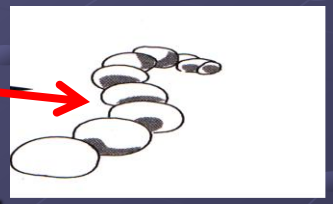
Transcription

and

Translation

But first, a little bit of review…

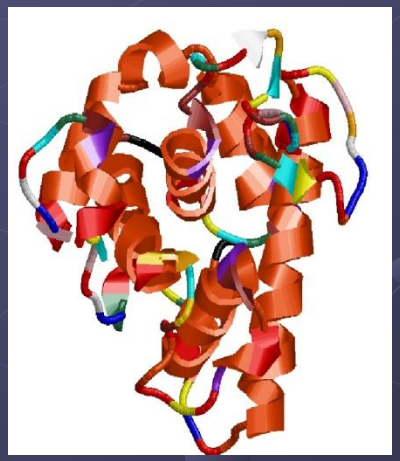
- YOU and your cells are made mostly of PROTEIN
- Proteins are made of amino acid. subunits (20 kinds)
- AA + AA + AA + AA = polypeptide



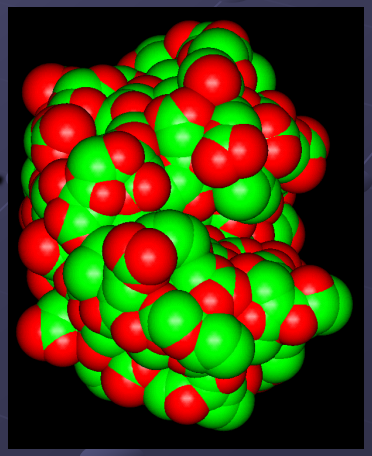
- Polypeptide + Polypeptide = Protein

+

=



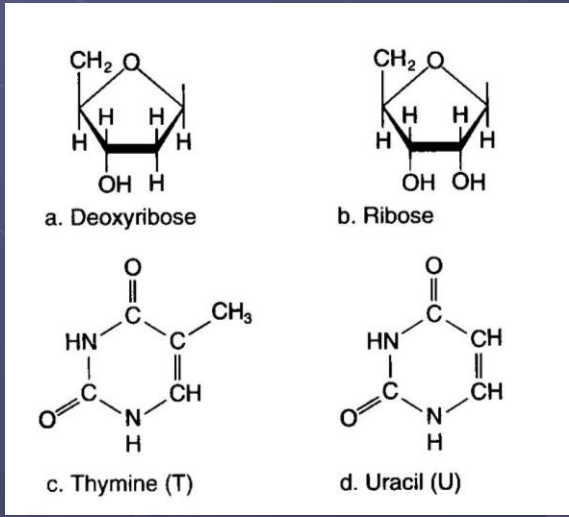
or



- Different Amino Acids = different Protein Shape = different function

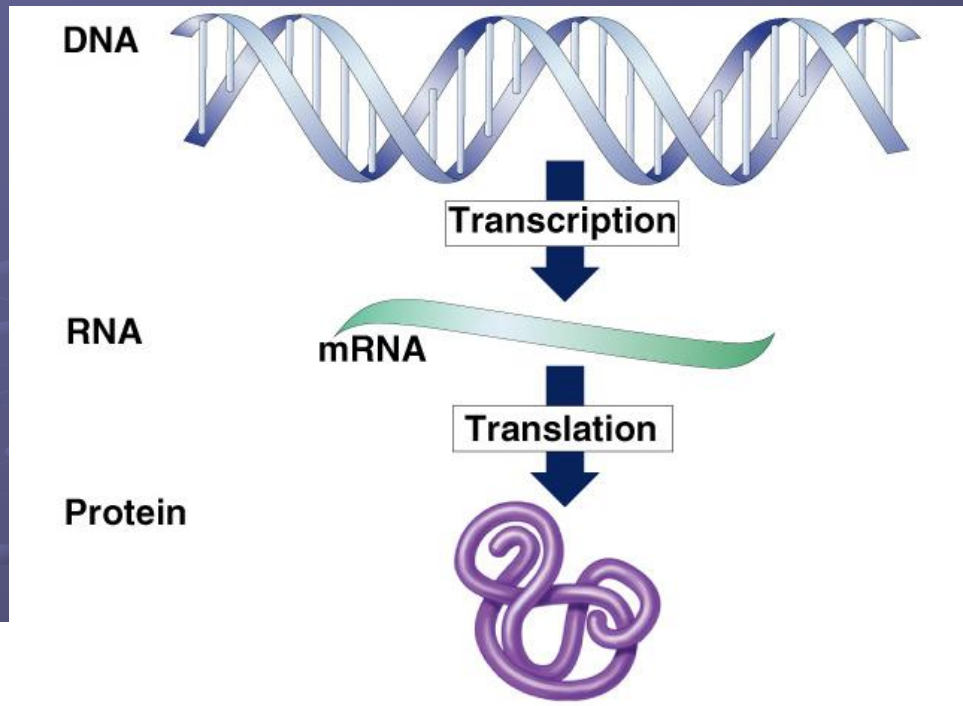
Differences between DNA and RNA

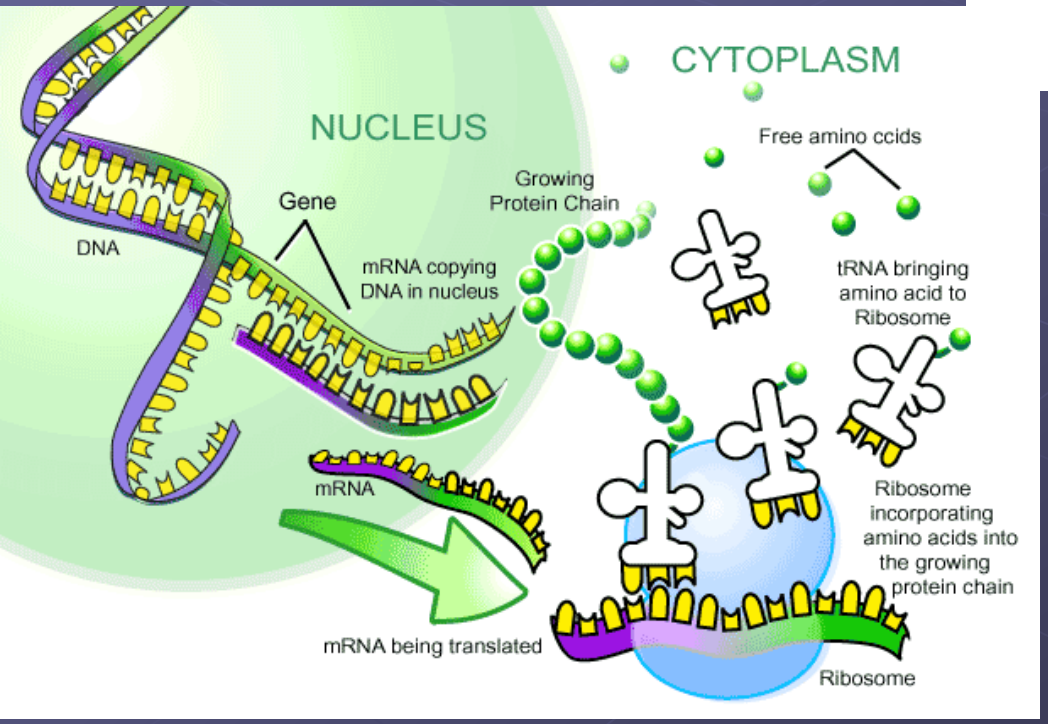
- **D**eoxyribo**N**ucleic **A**cid
- 2 strands
- 5-C sugar is deoxyribose
- Nitrogen bases:
  - Cytosine
  - Guanine
  - Adenine
  - Thymine



- **R**ibo**N**ucleic **A**cid
- 1 strand
- 5-C sugar is ribose
- Nitrogen bases:
  - Cytosine
  - Guanine
  - Adenine
  - Uracil

Chapter 10.

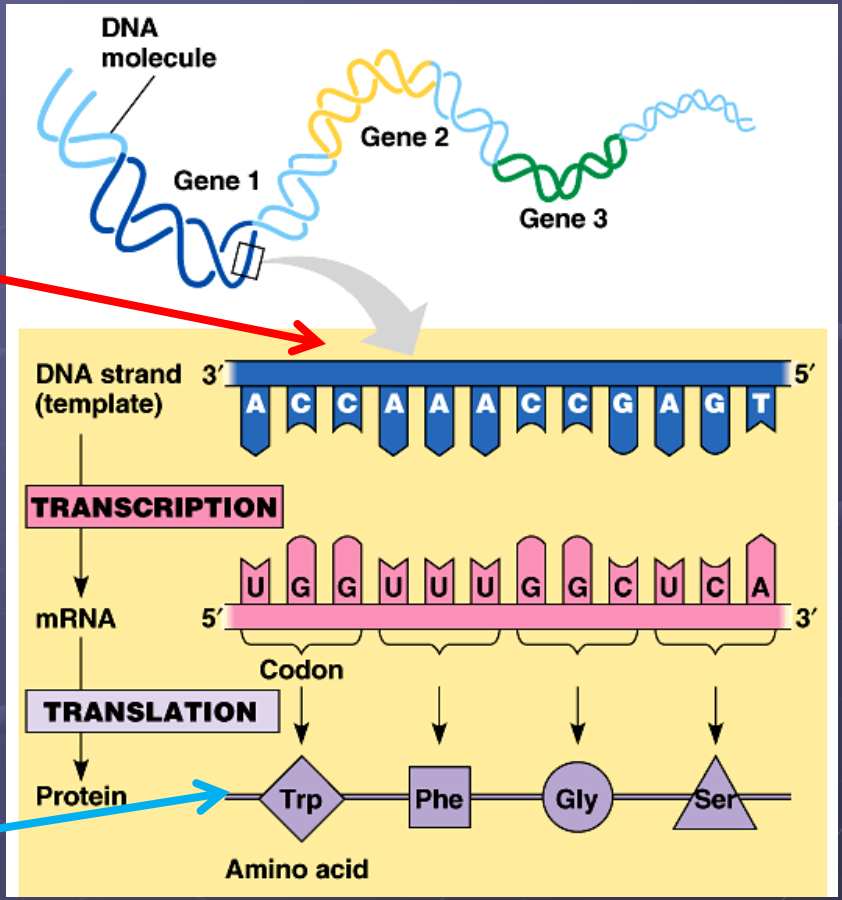


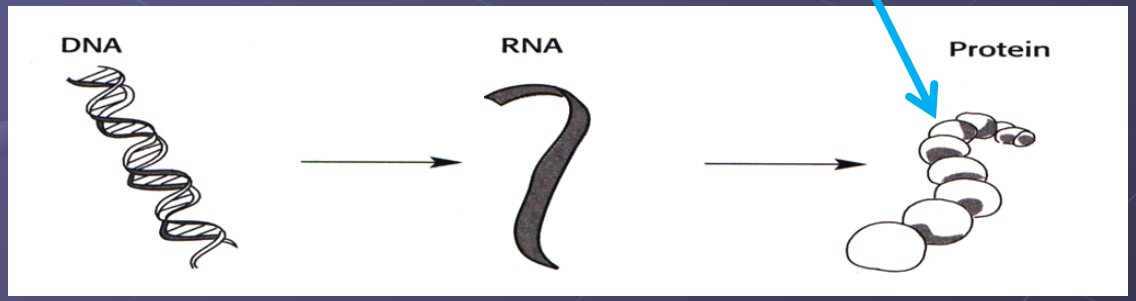


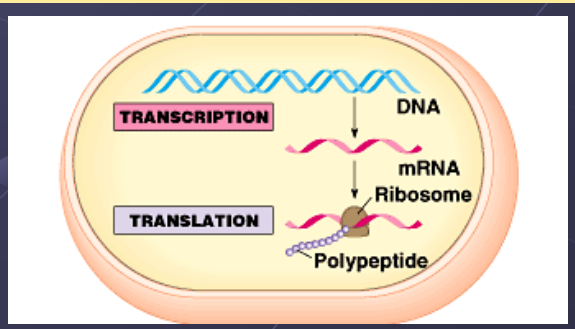
From Gene to Protein

Protein Production: The BIG PICTURE

- **Gene** = _piece_ of DNA code with instructions for making a trait
- Each gene has a code for making 1 specific _polypeptide_

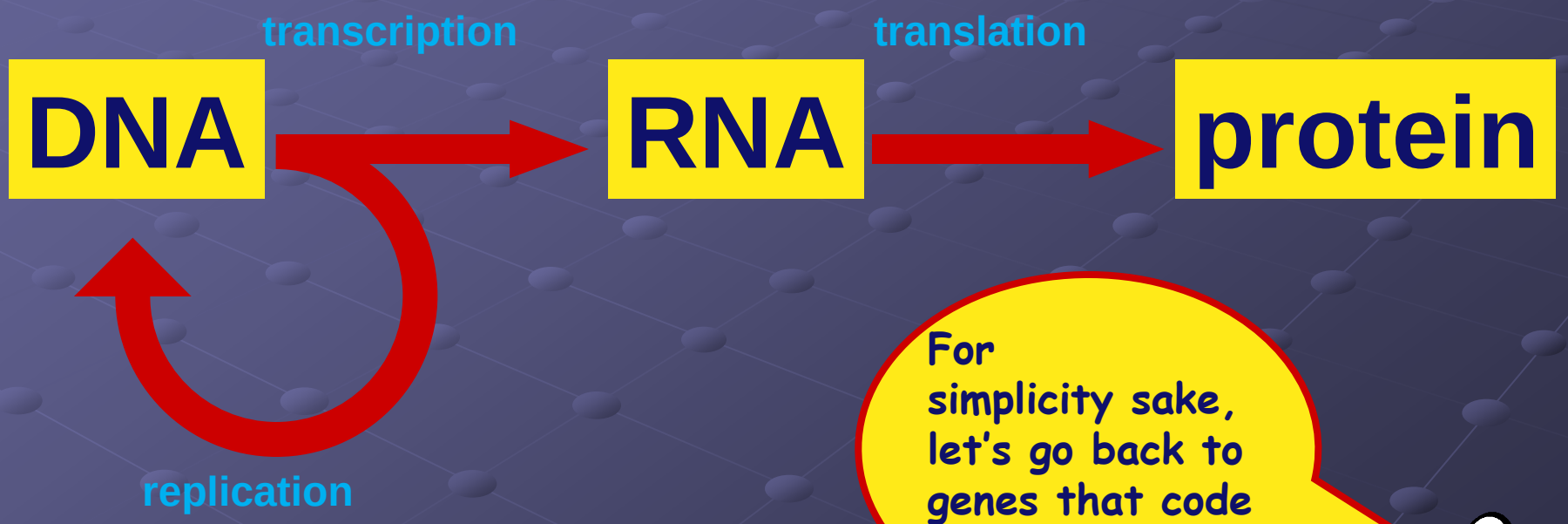






The “Central Dogma”

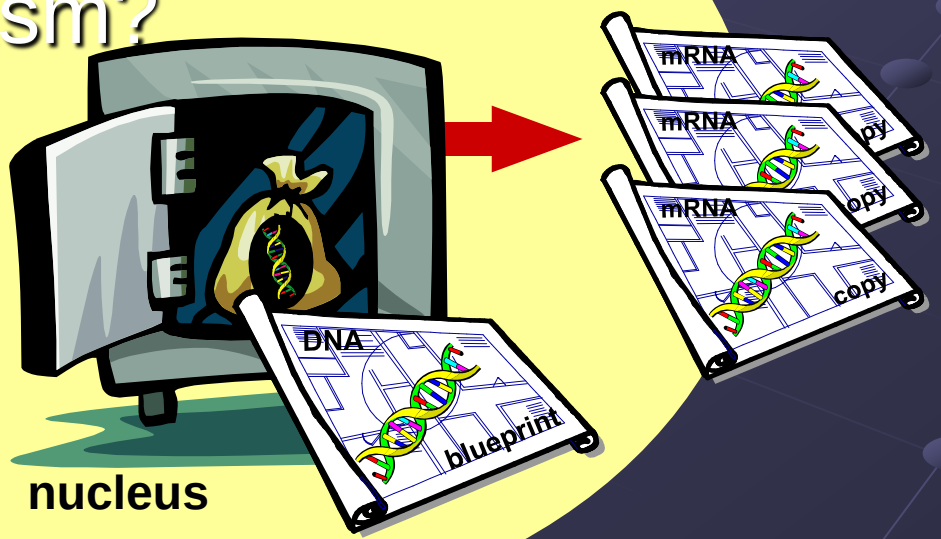
- How do we move information from DNA to proteins?



For simplicity sake, let’s go back to genes that code for proteins…

From nucleus to cytoplasm…

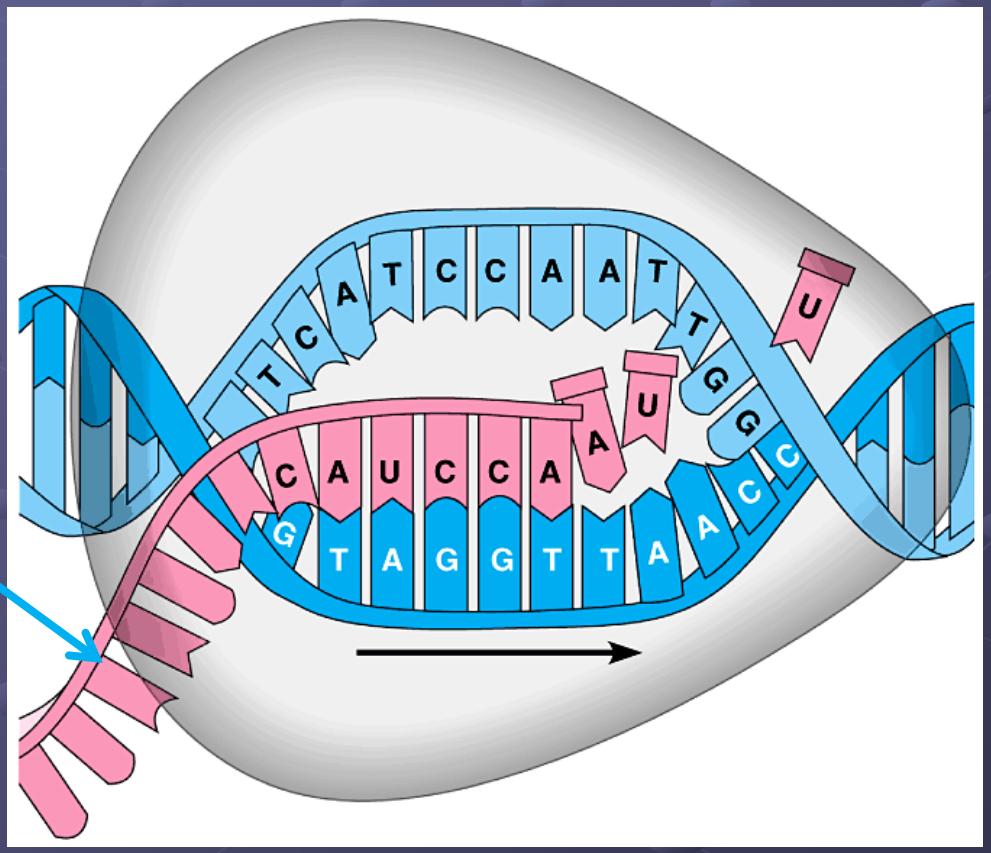
- Where are the genes?
  - genes are on chromosomes in nucleus
- Where are proteins synthesized?
  - proteins made in cytoplasm by ribosomes
- How does the information get from nucleus to cytoplasm?
  - messenger RNA



Protein Production

Part I: Transcription

1) The DNA gene code is copied into messenger RNA (from here forth known as mRNA)



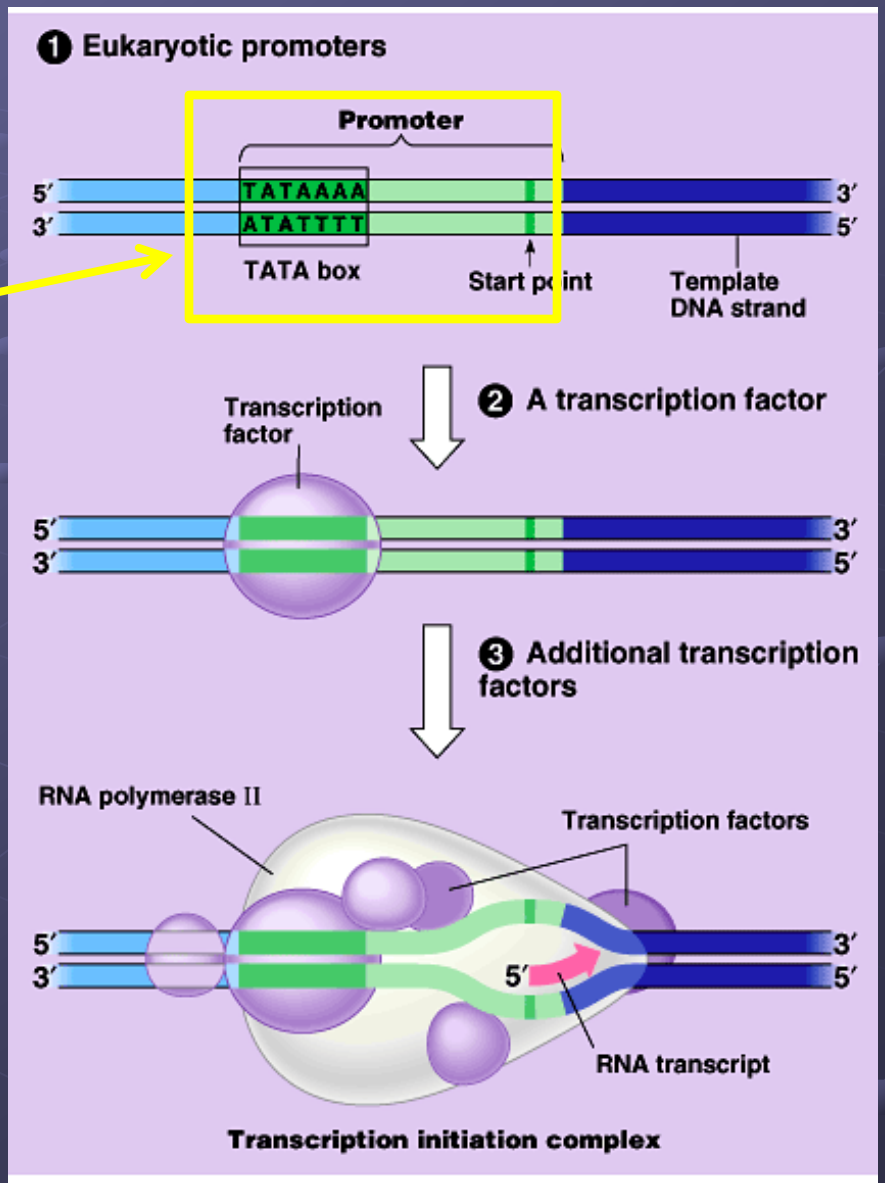
Transcription … HOW?

A) DNA Helicase enzymes open the DNA exposing the coding and **noncoding** strands

B) RNA Polymerase binds to the coding DNA at the **promoter** site upstream from the gene code

C) Many **transcription factors** bind to the promoter causing Polymerase to play "Red-light, Green-light"

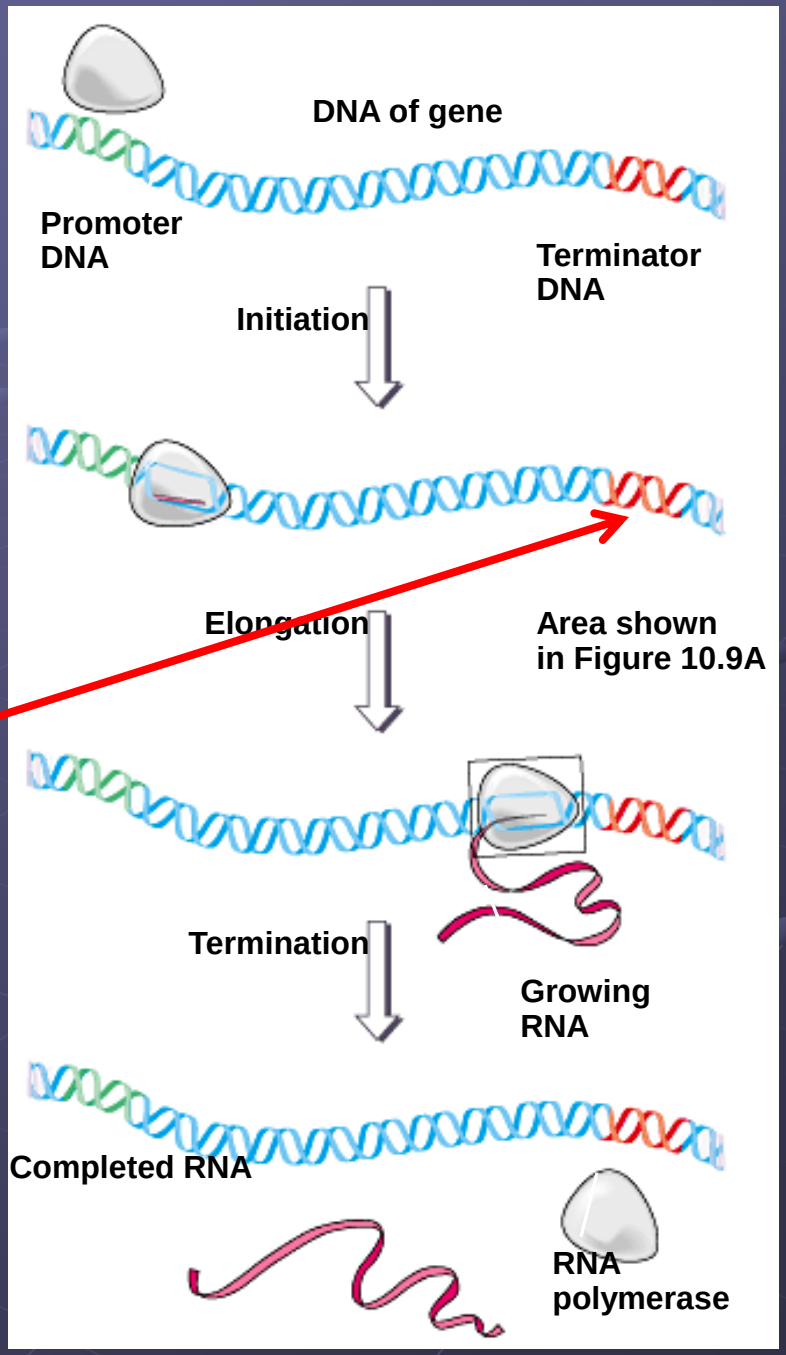
- Activators = GO
- Repressors = STOP



D) Once activated, Polymerase reads the coding strand and builds a complementary mRNA strand by following the **base-pairing** rules

E) The mRNA continues to grow until Polymerase finds a terminate sequence on the coding strand

F) The completed primary mRNA is released from the DNA for processing



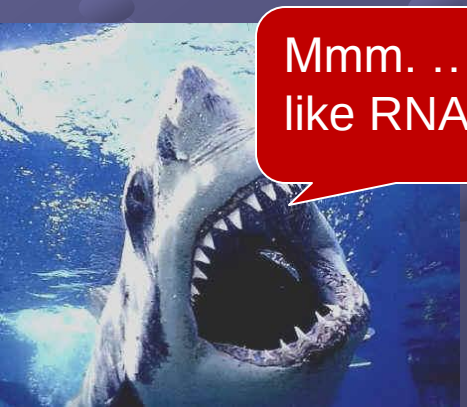
2) The primary mRNA code is processed into mature mRNA before leaving the nucleus

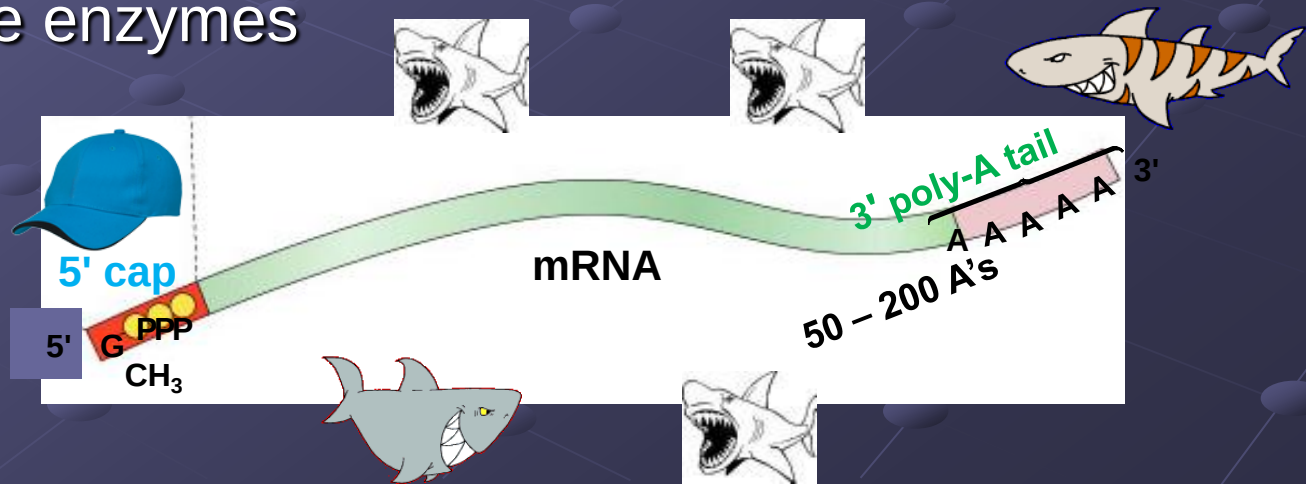
A) 5’ end has a methyl-guanine (mG) **cap** added

- Helps the mRNA bind to a ribosome with its RRS (ribosome recognition sequence)
- Helps protect the mRNA from “hungry” RNA eating ribonuclease enzymes

B) 3’ end has addition of 50 – 200 adenines = **Poly-A-Tail**

- Helps **protect** the mRNA from “hungry” RNA eating ribonuclease enzymes

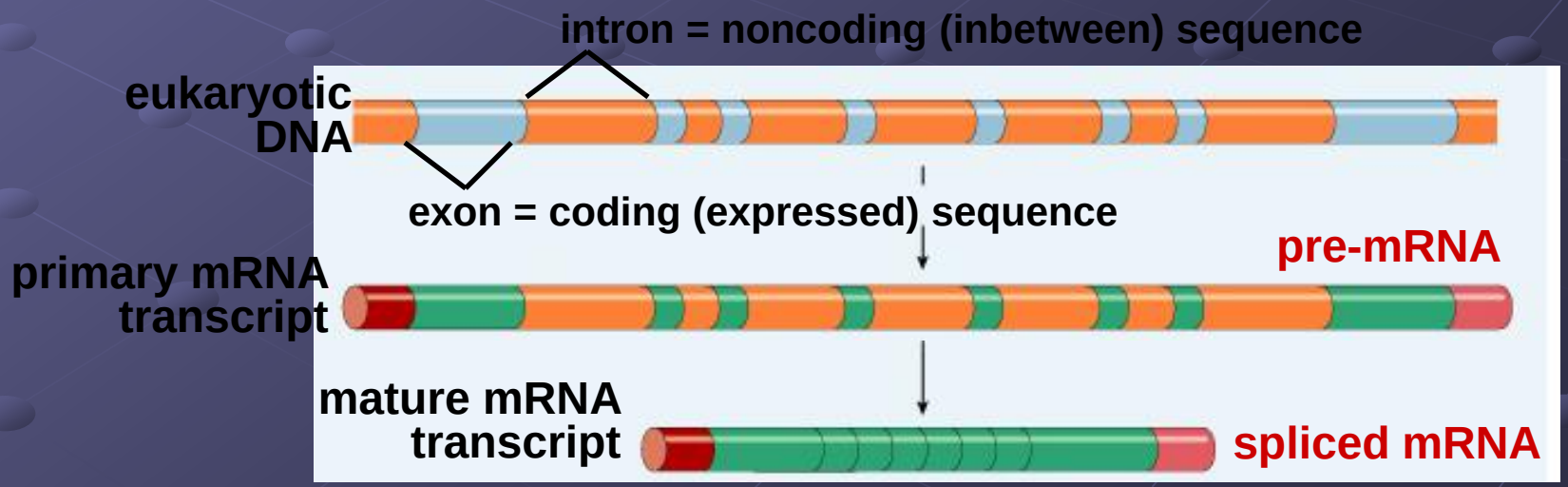


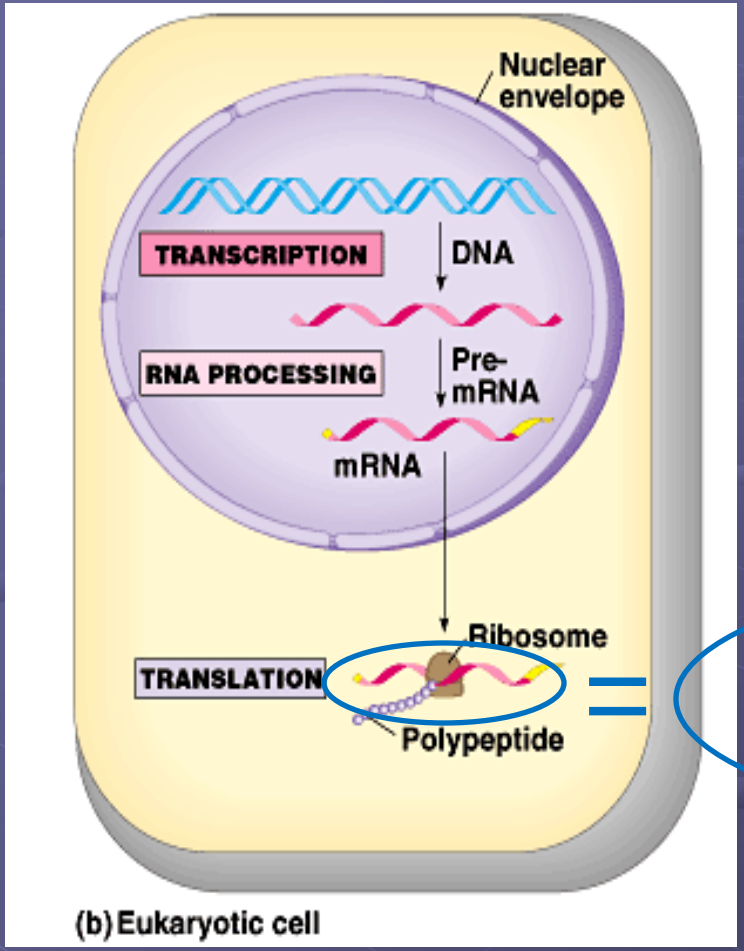


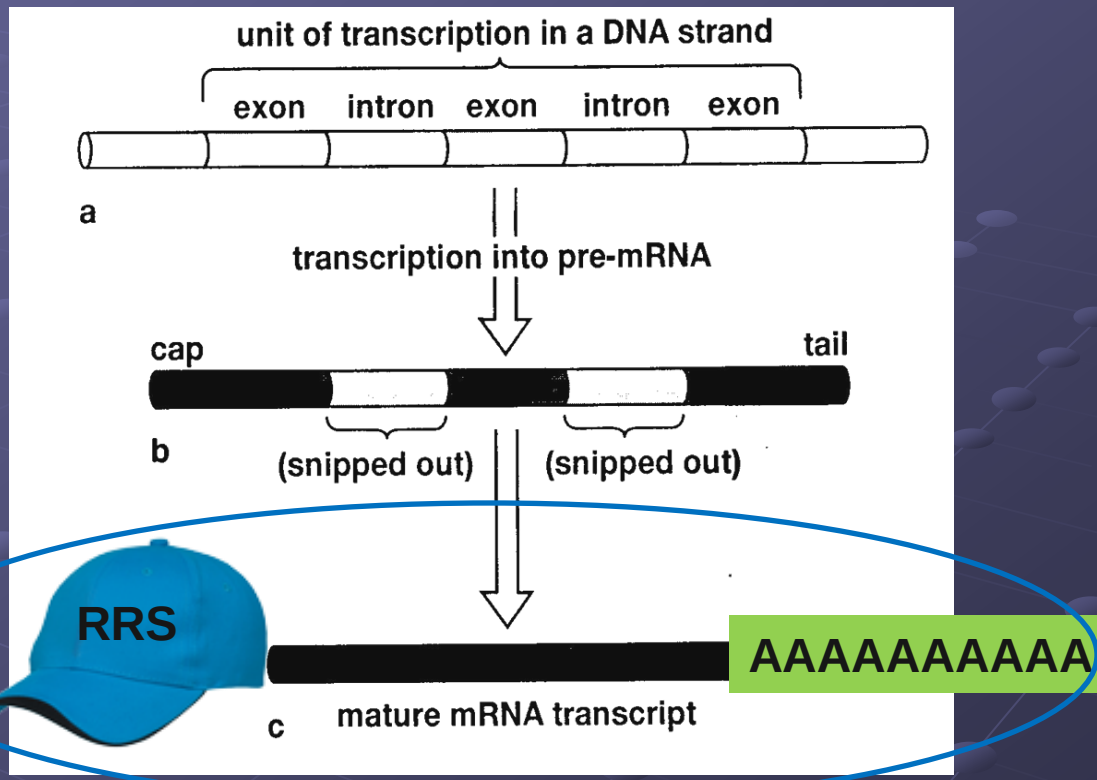
C) Splice out and remove any "junk" RNA letters that do not code for a **protein**

- **Introns** ("junk" letters **IN** the way of the code) are spliced out
  - ➢Alternative intron splicing may create a **variety of different proteins**
  - ➢Others speculate that introns act as **transcription factors** that turn ON / OFF other genes

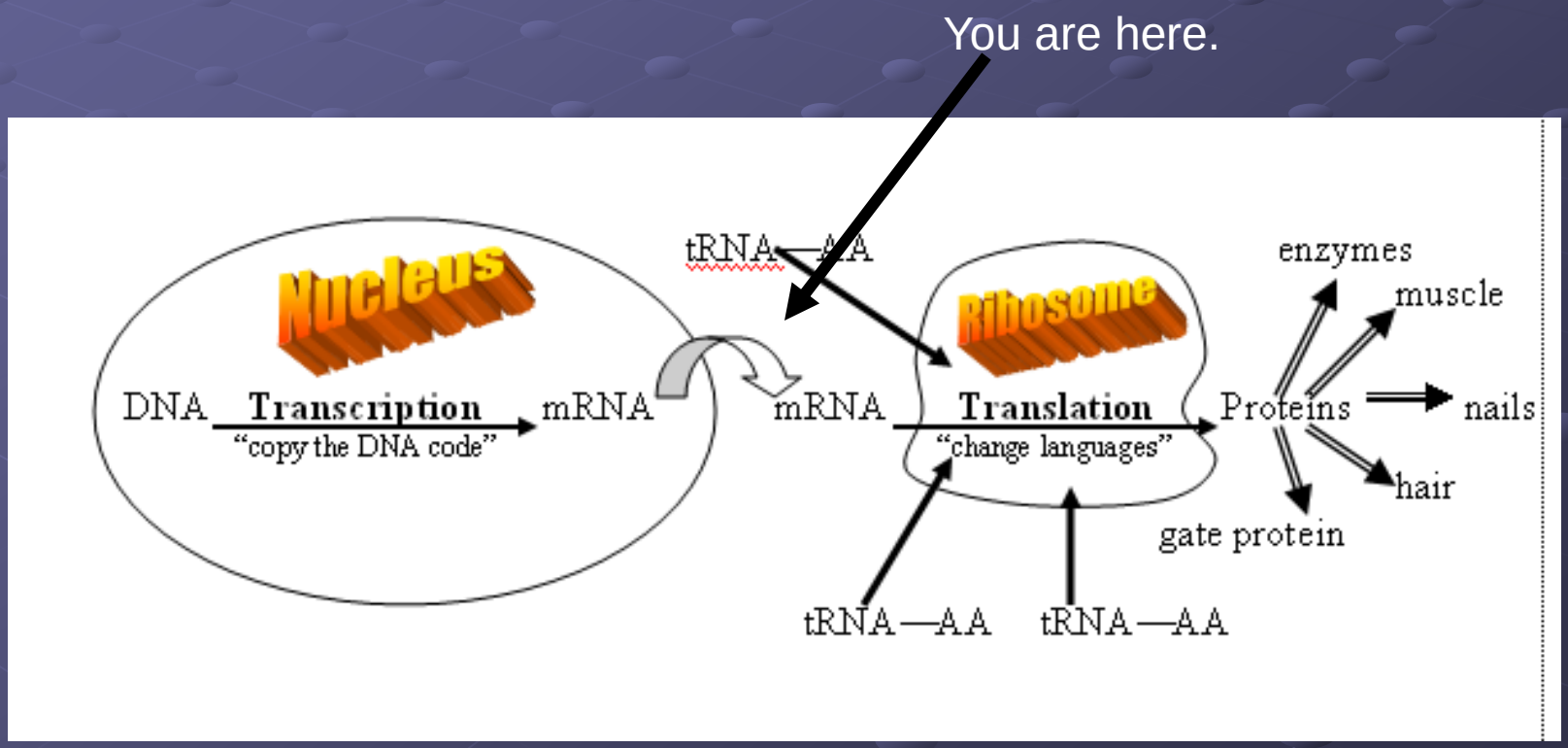
- **Exons** ("good" code letters **EX**pressed as a protein) are linked to make a mature mRNA




Nuclear envelope
TRANSCRIPTION
DNA
RNA PROCESSING
Pre-mRNA
mRNA
Ribosome
TRANSLATION
Polypeptide
(b) Eukaryotic cell


unit of transcription in a DNA strand
exon
intron
exon
intron
exon
a
transcription into pre-mRNA
cap
tail
b
(snipped out)
(snipped out)
RRS
AAAAAAAAAA
c
mature mRNA transcript

3) Finally, the mature mRNA carries the gene code from the nucleus through a **nuclear pore** to a ribosome in the cytoplasm … or on the RER.



From gene to protein