

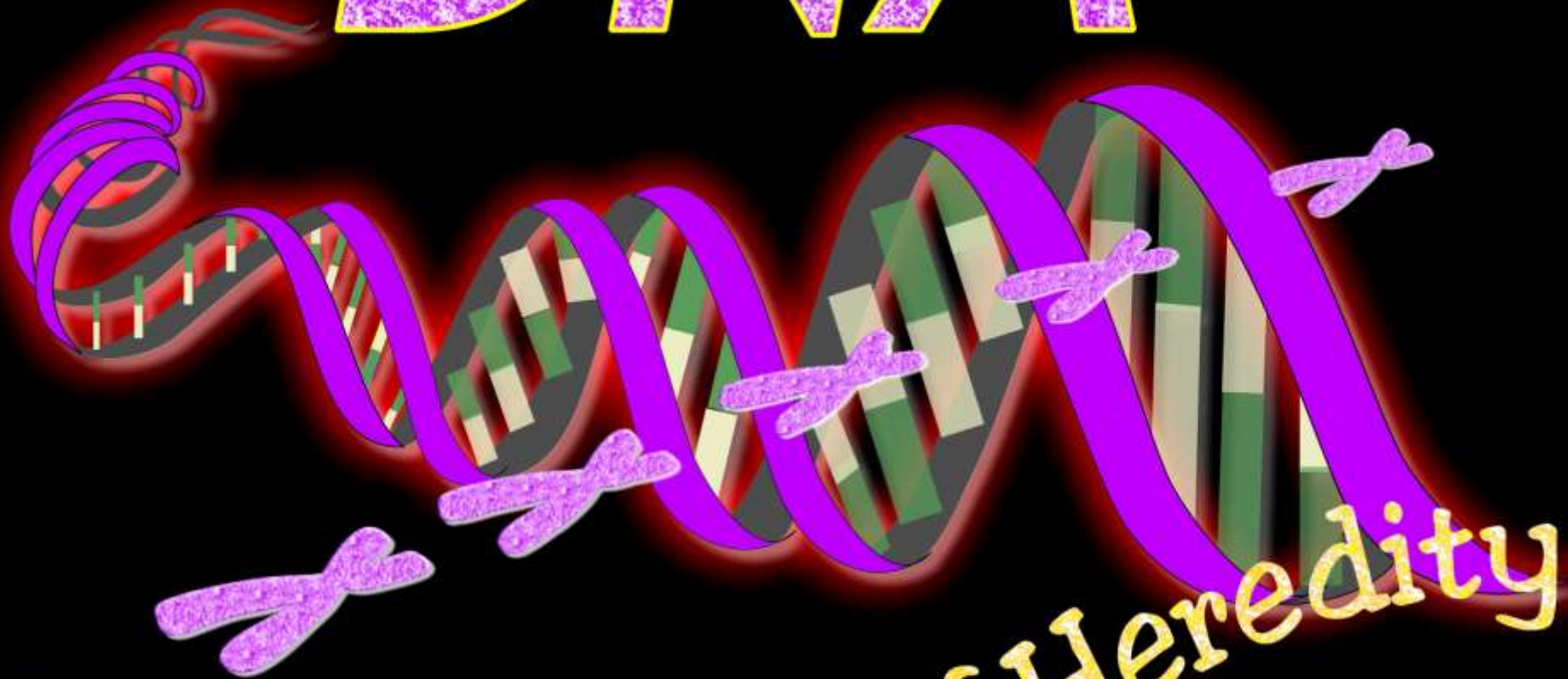
Protein Synthesis

B. Sc III, Sem V, Sec I

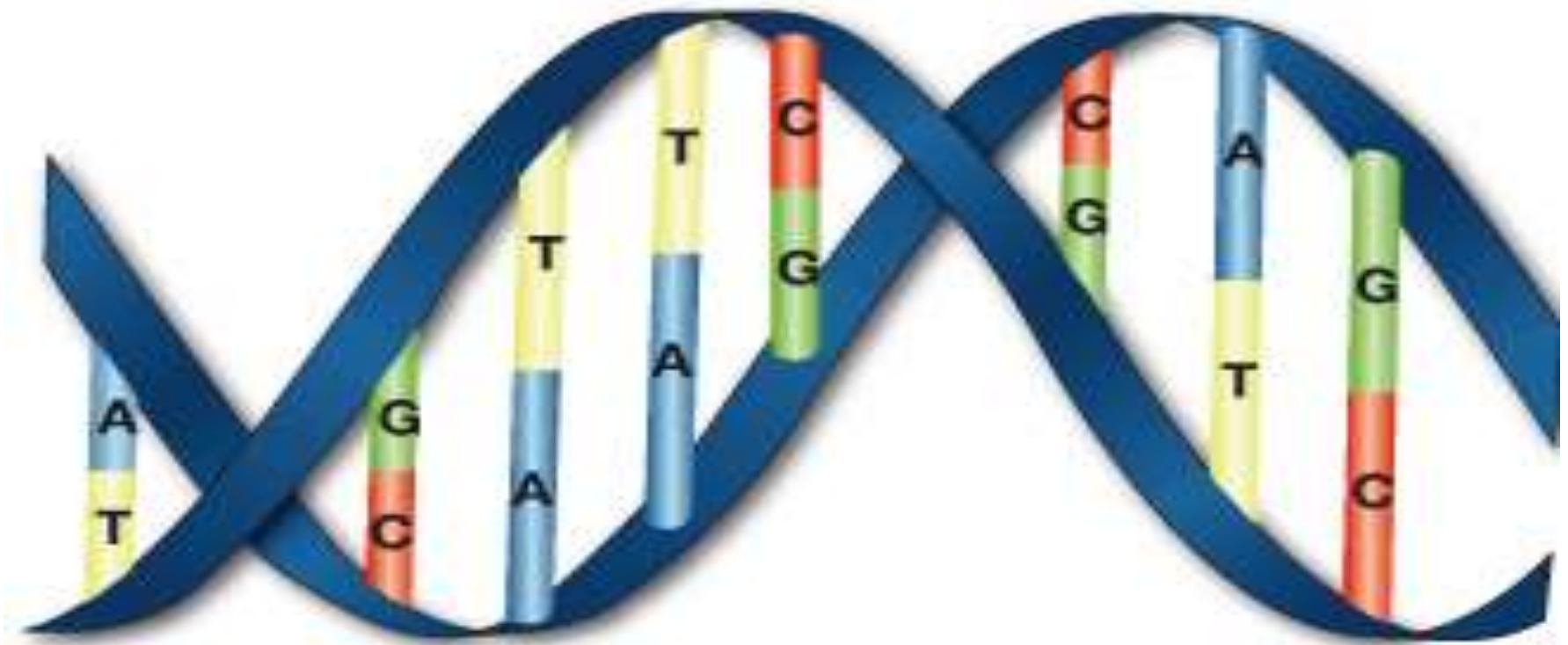
“Plant Biochemistry and Stress Physiology”

by Dr. A. R. Alvikar

DNA



The Molecule of Heredity



Thymine (Yellow) = T Guanine (Green) = G
Adenine (Blue) = A Cytosine (Red) = C

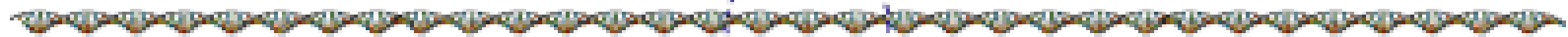
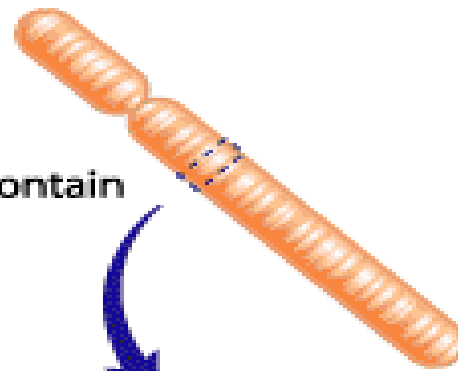
DNA is a very long molecule that looks like a twisted ladder.

It is made up of 4 different subunits called **nucleotides which can be arranged in any order**

The bases are complementary

- DNA has two strands.
- The strands are stuck together by the complementary bases.
- Adenine to Thymine **A-T**
- Cytosine to Guanine **C-G**

This small section may contain many genes.



A gene is a section of DNA that has hundreds or thousands of base pairs



Sections within a gene



Controls such things as when and where the gene is turned on or off and the amount of product formed.

Start code for transcription to form protein TAC.

Codes for protein consists of triplets (codons) of bases.

Stop code for transcription to form protein ATT ATC or ACT

Controls such things as the off/on and rate of protein synthesis.

It is the **Sequence** of bases that act like a code

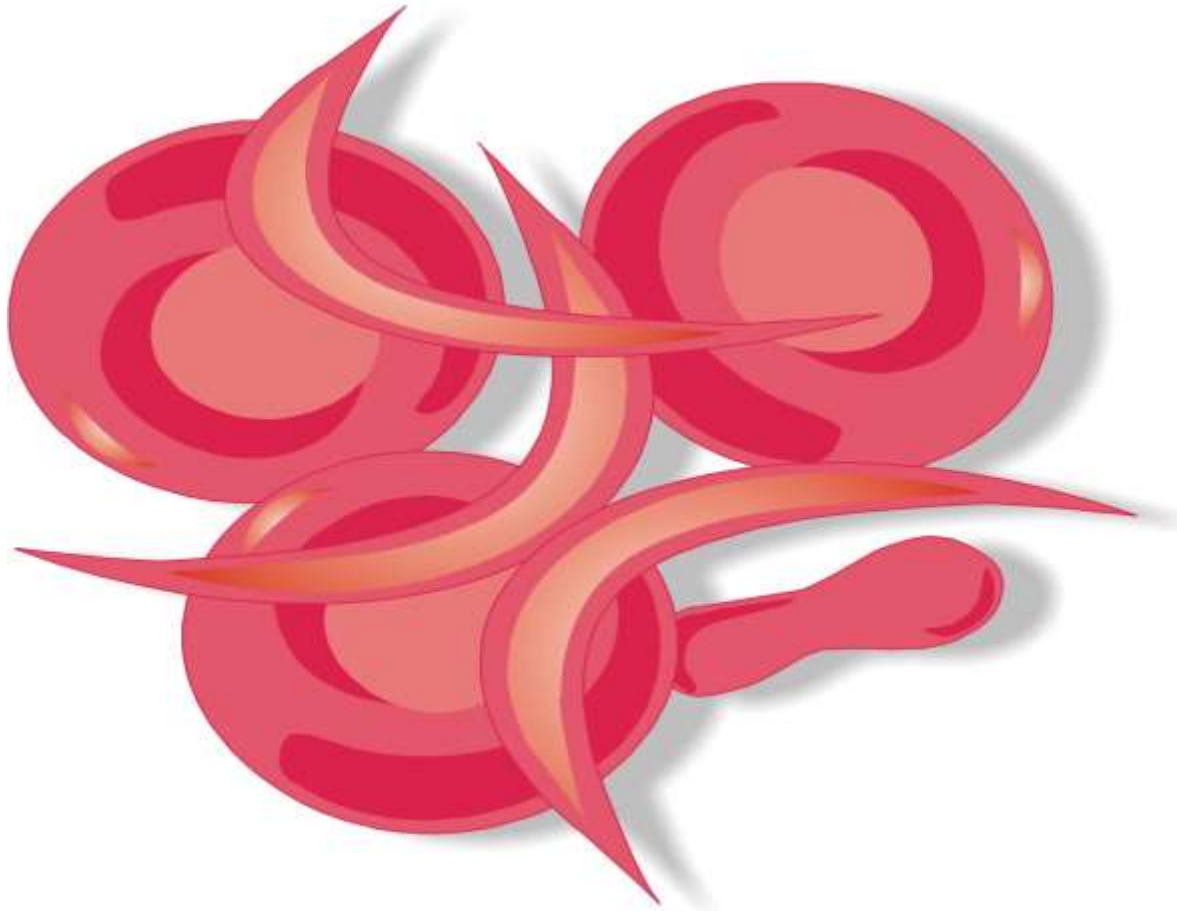
The **sequence** (order) of bases tells the cell what proteins to make.

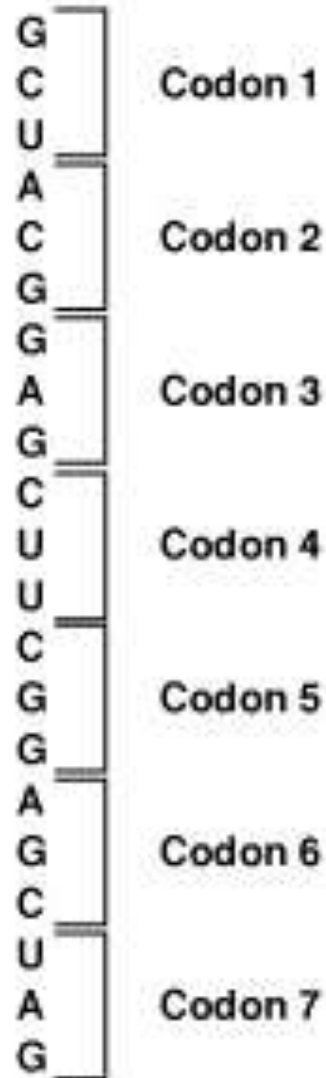
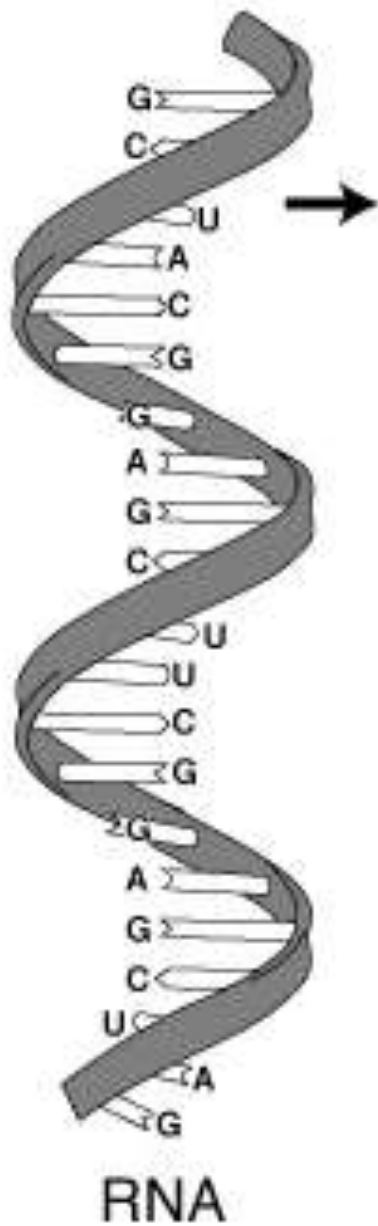
The **sequence** of bases dictates the **sequence** of amino acids, which determines the shape of a protein.

If the protein is the wrong shape it will not work properly (it may work differently)

So if the **sequence** in the DNA is wrong it may result in a genetic disease

Sickle cell anaemia is caused by *one* change in the DNA base code





It is a triplet code.

It takes 3 bases to code for one amino acid

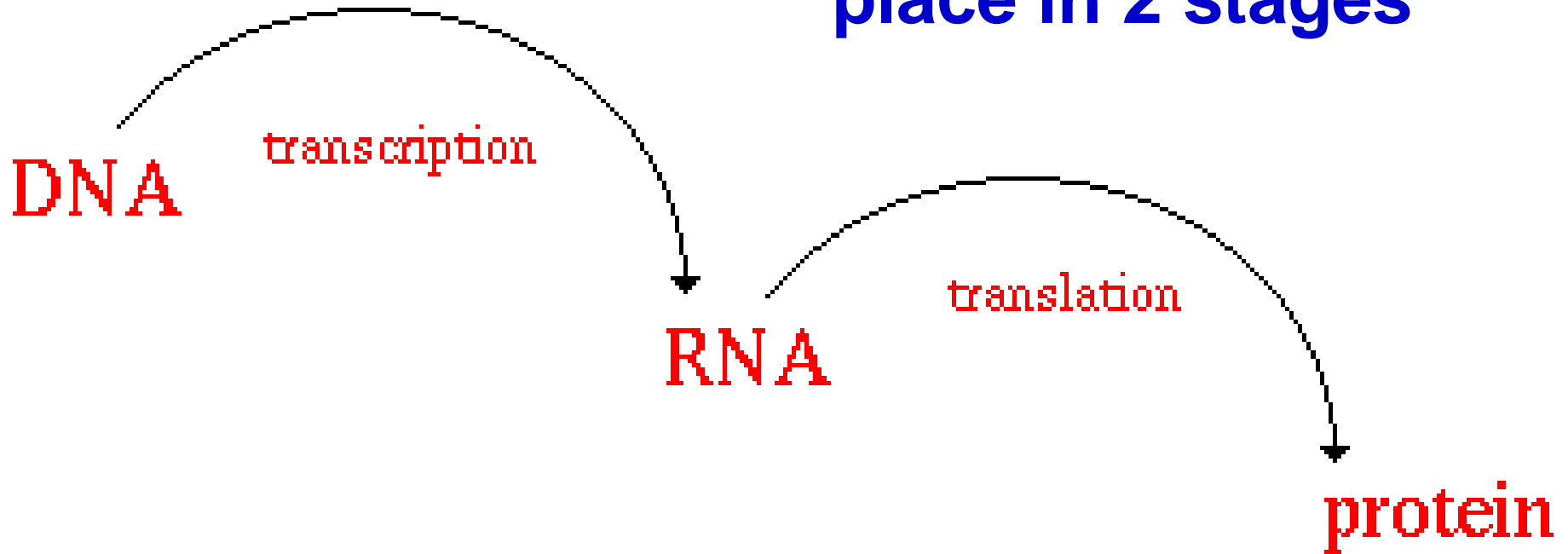
Ribonucleic acid

Second base

| | | Second base | | | | | |
|------------|---|--|---|--|---|---|---|
| | | U | C | A | G | | |
| First base | U | UUU } Phenylalanine F UUC } UUA } Leucine L UUG } | UCU } Serine S UCC } UCA } UCG } | UAU } Tyrosine Y UAC } UAA } Stop codon UAG } Stop codon | UGU } Cysteine C UGC } UGA } Stop codon UGG } Tryptophan W | U | C |
| | C | CUU } Leucine L CUC } CUA } CUG } | CCU } Proline P CCC } CCA } CCG } | CAU } Histidine H CAC } CAA } Glutamine Q CAG } | CGU } Arginine R CGC } CGA } CGG } | C | A |
| | A | AUU } Isoleucine I AUC } AUA } AUG } Methionine start codon M | ACU } Threonine T ACC } ACA } ACG } | AAU } Asparagine N AAC } AAA } Lysine K AAG } | AGU } Serine S AGC } AGA } Arginine R AGG } | A | G |
| | G | GUU } Valine V GUC } GUA } GUG } | GCU } Alanine A GCC } GCA } GCG } | GAU } Aspartic acid D GAC } GAA } Glutamic acid E GAG } | GGU } Glycine G GGC } GGA } GGG } | G | A |
| | | | | | | U | C |
| | | | | | | A | G |
| | | | | | | G | C |
| | | | | | | U | C |
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| | | | | | | A | G |
| | | | | | | G | C |
| | | | | | | U | C |
| | | | | | | A | G |
| | | | | | | G | C |

Each triplet codes for a different amino acid.

Protein Synthesis takes place in 2 stages

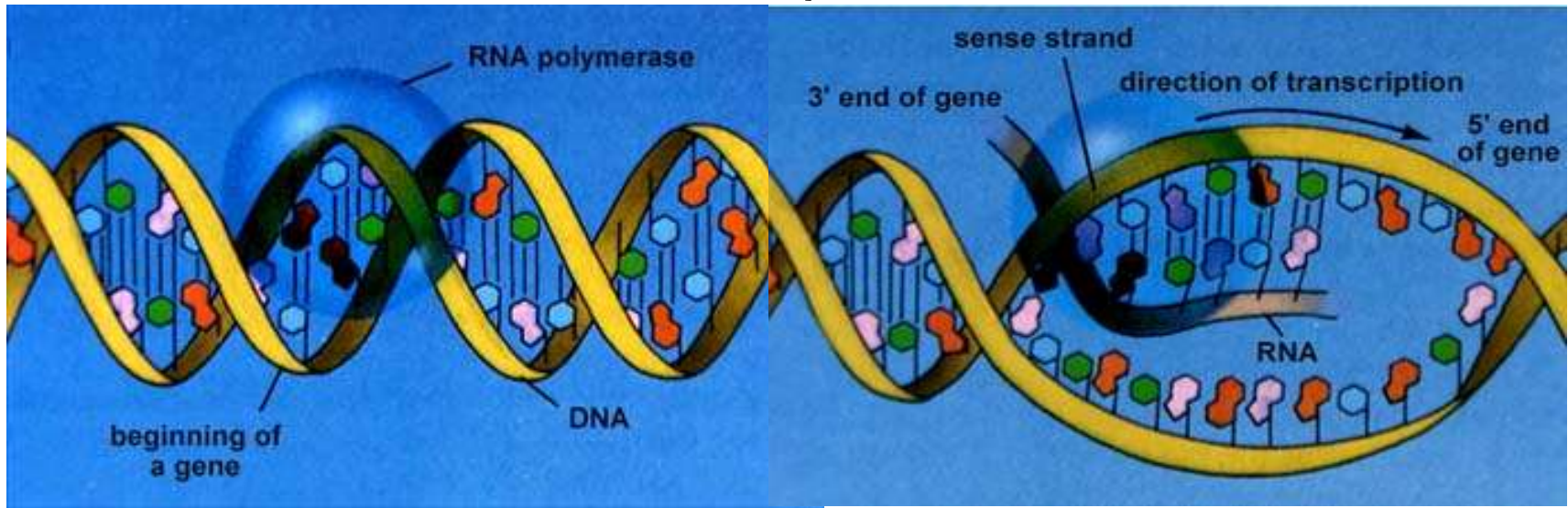


DNA carries the code for every protein that can be made by a cell.

A gene is a length of DNA which codes for a particular protein

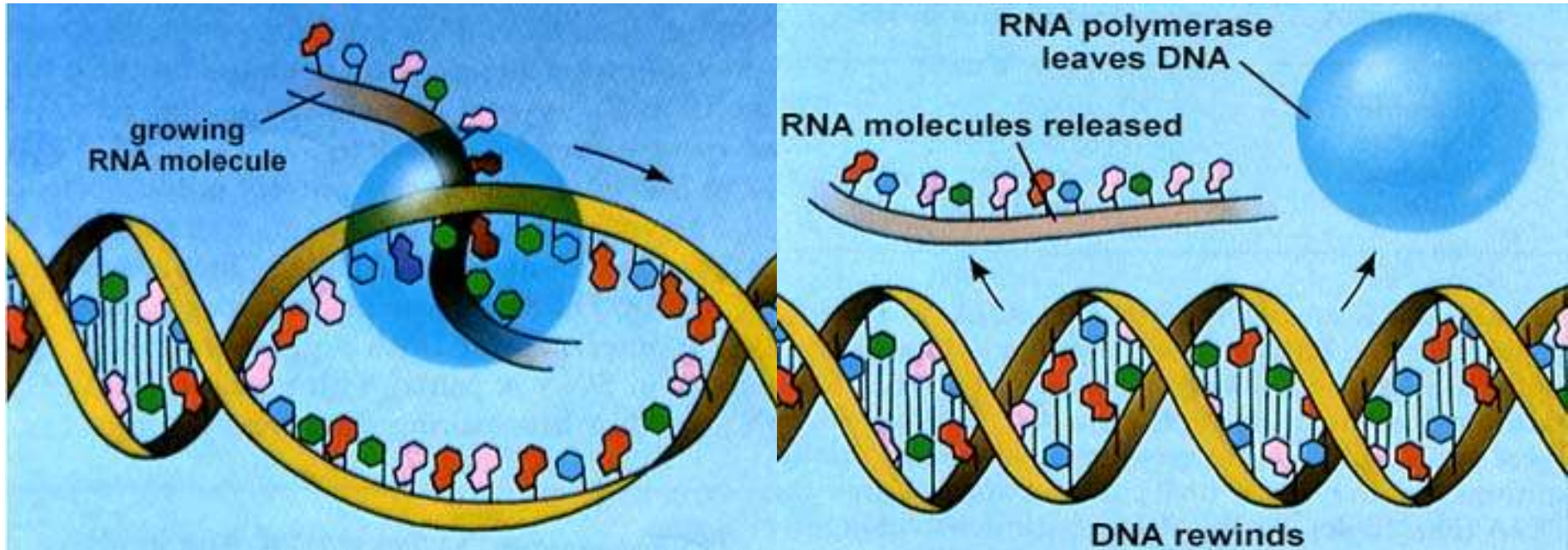
Transcription 1

(making a messenger RNA copy of DNA)



- Part of the DNA molecule (the gene) unzips
- An RNA copy is produced, by matching complementary bases

Transcription 2

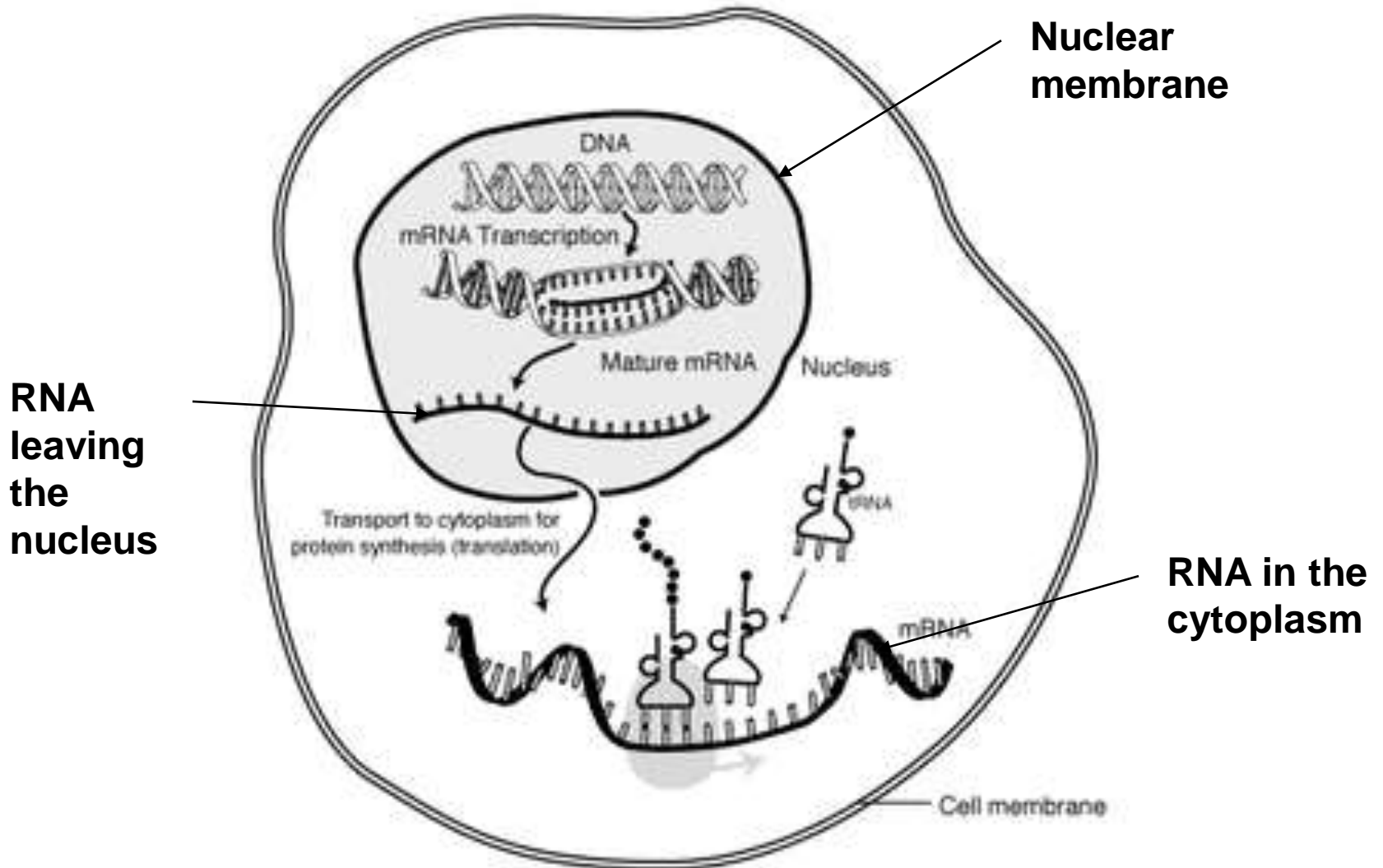


- The mRNA copy is made with the help of **RNA polymerase**.

Complementary base pairing

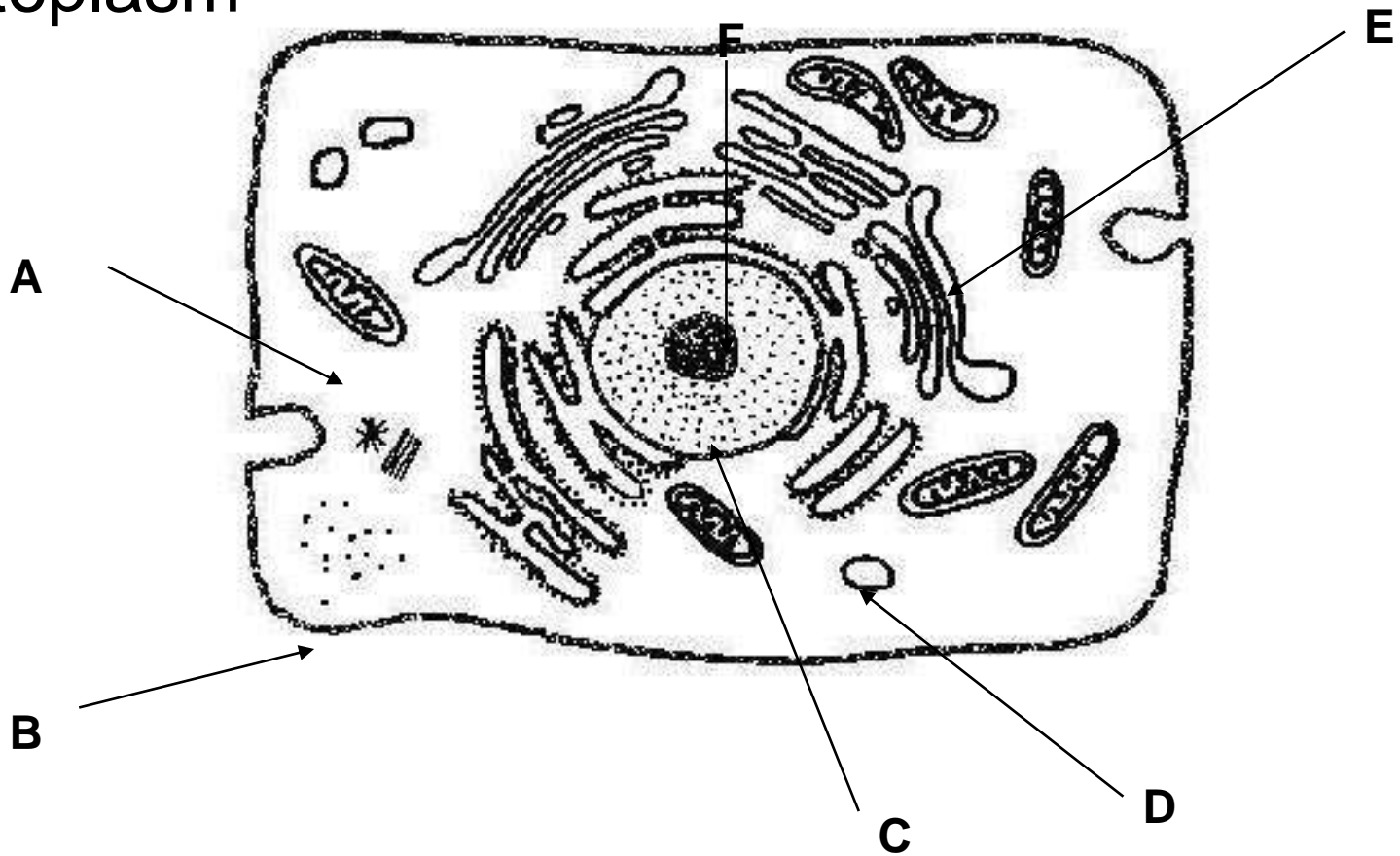
| DNA Base | Complementary RNA Base |
|----------|------------------------|
| G | C |
| C | G |
| A | U |
| T | A |

The m-RNA leaves the nucleus through a nuclear pore

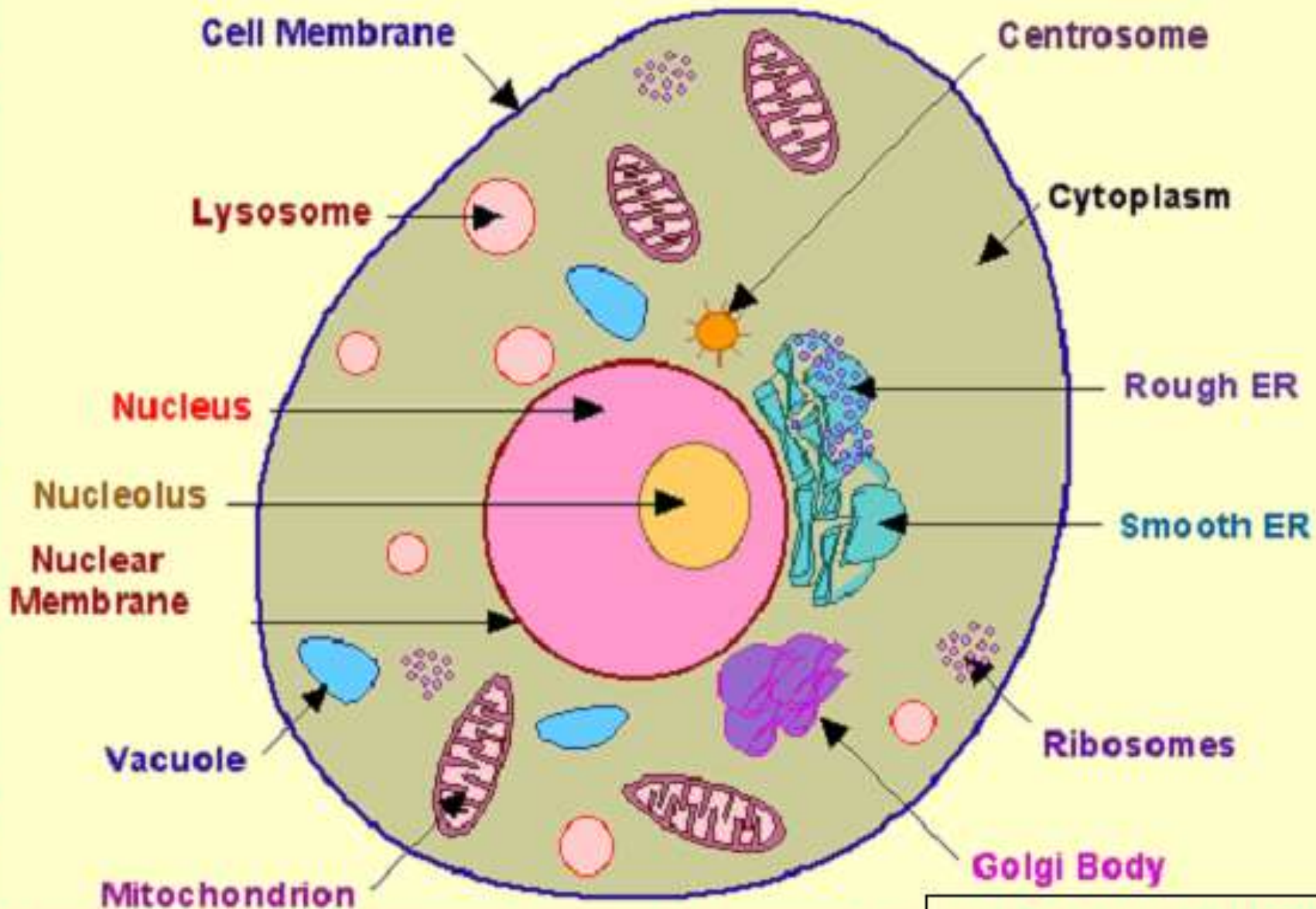


Translation

- The m-RNA goes to the Ribosomes in the cytoplasm

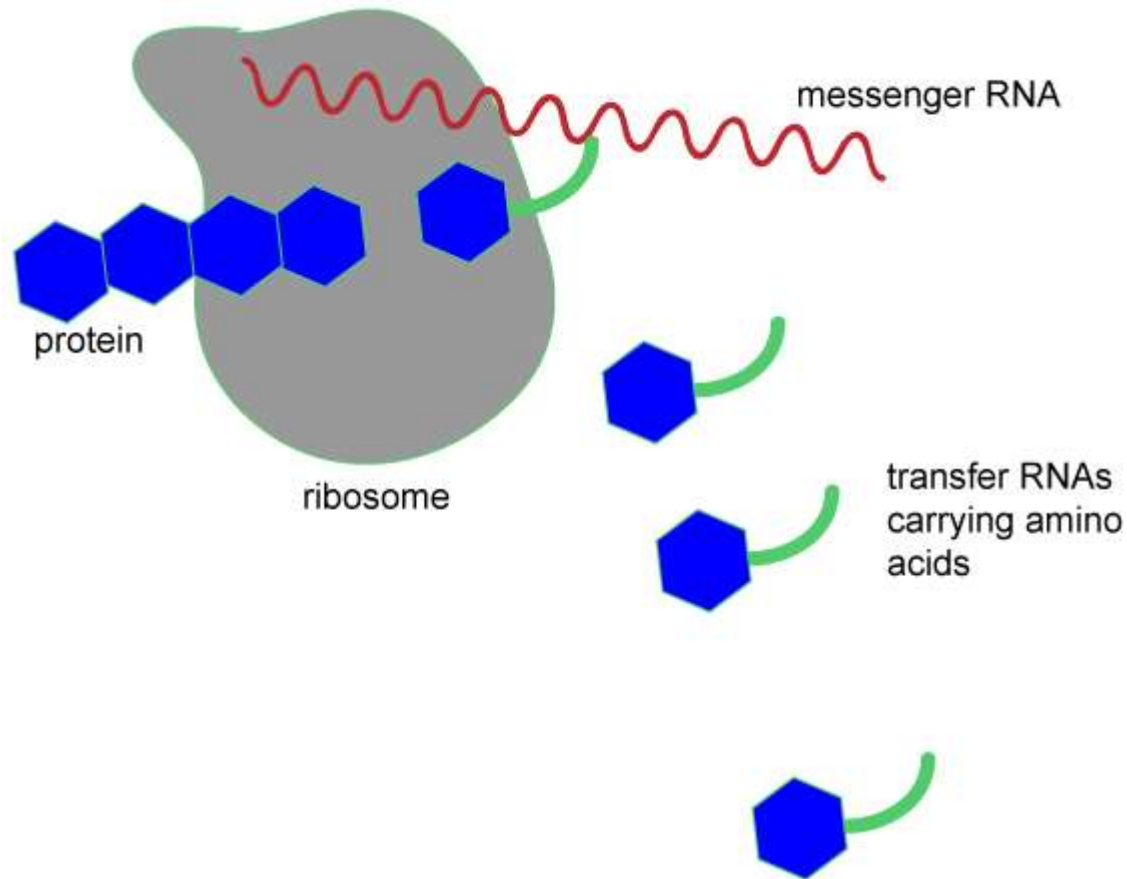


Cross-Section of an Animal Cell



ER=ENDOPLASMIC RETICULUM

The ribosomes read the code and join the amino acids together

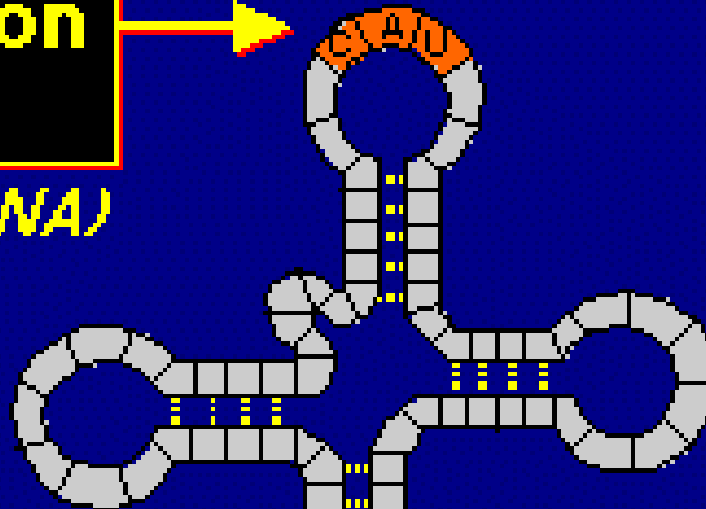


Transfer RNA brings the correct amino acid

Transfer RNA (tRNA)

Anticodon Loop

(binds mRNA)



Amino Acid Attachment Site

Glu

Translation - animation



5' cap AUGAGAUACCAAGAACCUACCAAGGUAGAGCUUUAGCCCG AAAAAAAAAAAAAAAAAA 3'