SNS COLLEGE OF NURSING

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DEPARTEMENT OF NURSING

COURSE NAME: BSC (NURSING) IIYEAR

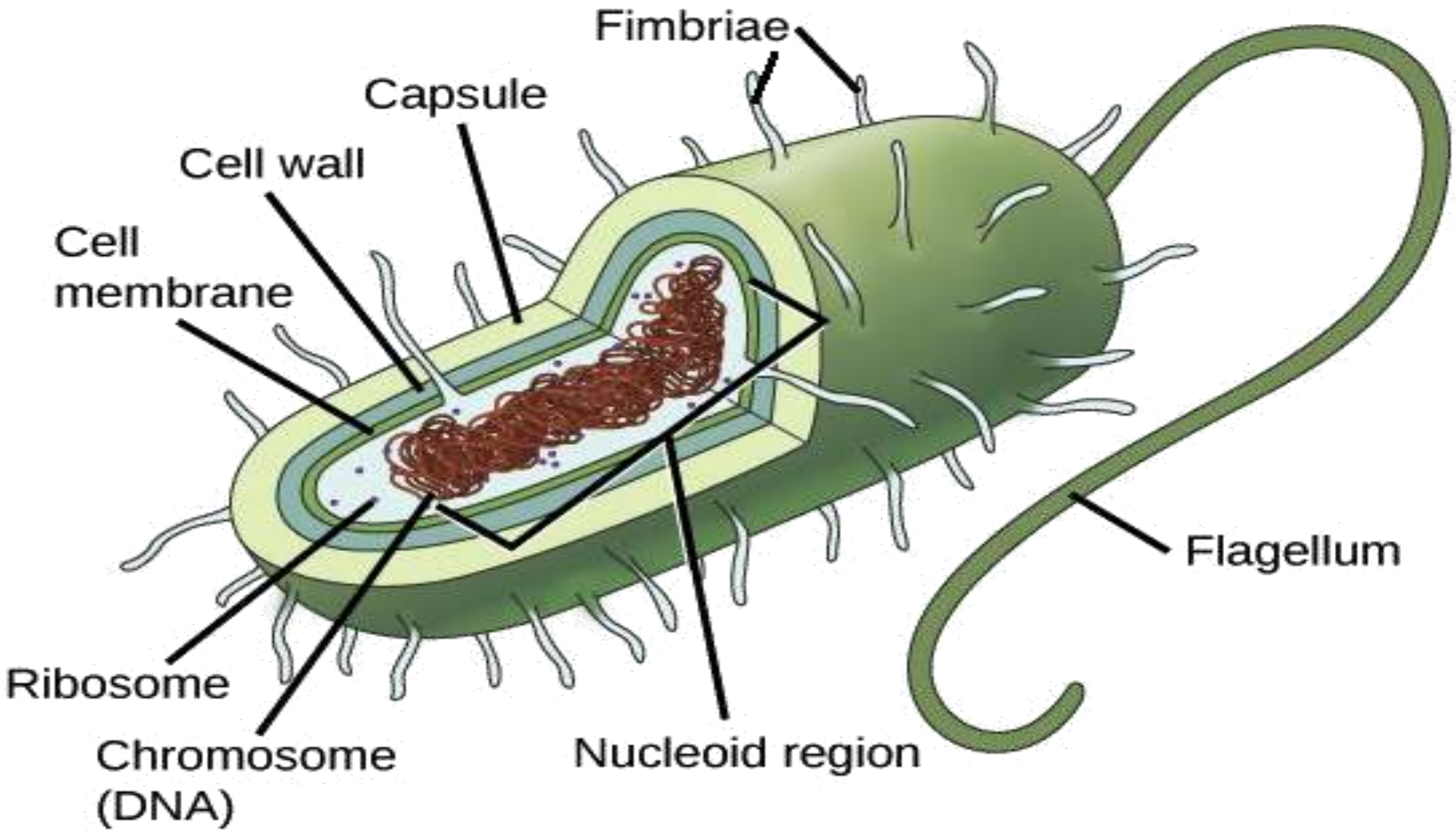
SUBJECT : GENETICS

UNIT I –INTRODUCTION OF GENETICS

TOPIC- CELLULAR DIVISION AND CHARACTERISTICS

INTRODUCTION

- Cell is the single unit of life. In order to propagation of life, cell division becomes necessary.
- Cell division is the process by which the cell divides forming two daughter cells.
- These are essentially two types of cells which form the fulcrum of cell biology:
- Prokaryotic: Simple, non nucleated
- Eukaryotic: Complex, nucleated cells.


Fimbriae
Capsule
Cell wall
Cell membrane
Ribosome
Chromosome (DNA)
Nucleoid region
Flagellum

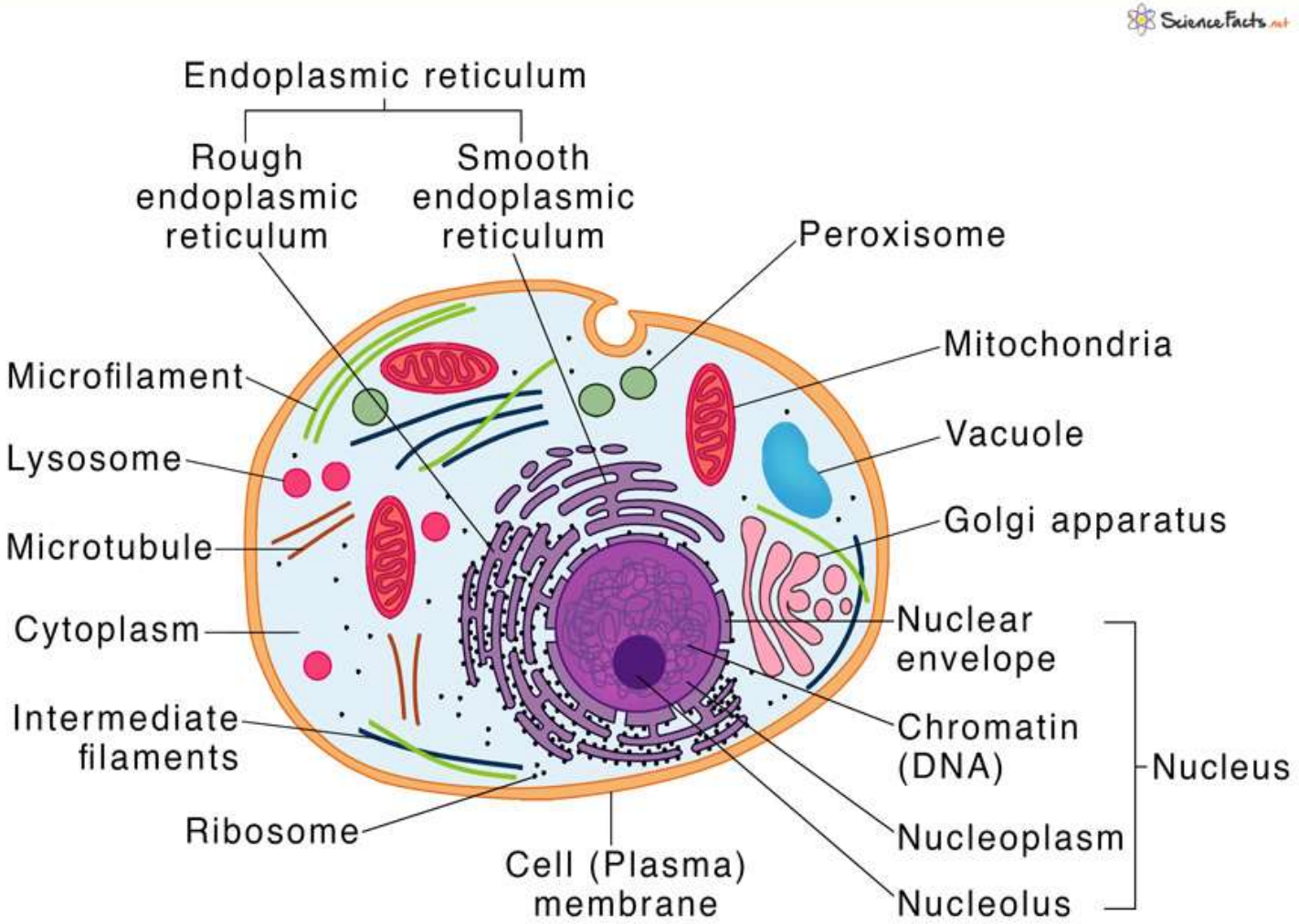
PROKARYOTIC CELL WITH DIFFERENT CELL ORGANELLES

- It is much simpler in cell organization.
- The cell has a larger number of cell organelles but do not possess a well differentiated nucleus.
- The method of replication or reproduction in these cells is much simpler, the single DNA molecule first replicates and attaches to a portion of the cell membrane when the cell divides (cytokinesis) each part gets one of the DNA molecules.
- The process by which prokaryotic cells divide is known as binary fission.
- At the end of binary fission, two cells with identical genetic make up is obtained.

EUKARYOTIC CELLS

- It is more complex in cell organization.
- Although the number of cell organelles in an eukaryotic cell is much lesser as compared to a prokaryotic cell, it possesses a well differentiated nucleus.
- Unlike the prokaryotic cell which has a single DNA molecule, the eukaryotic cell comprises the genome distributed over multiple chromosomes.
- It also have 2 types of cell division along with cytokinesis.

Eukaryotic Cell

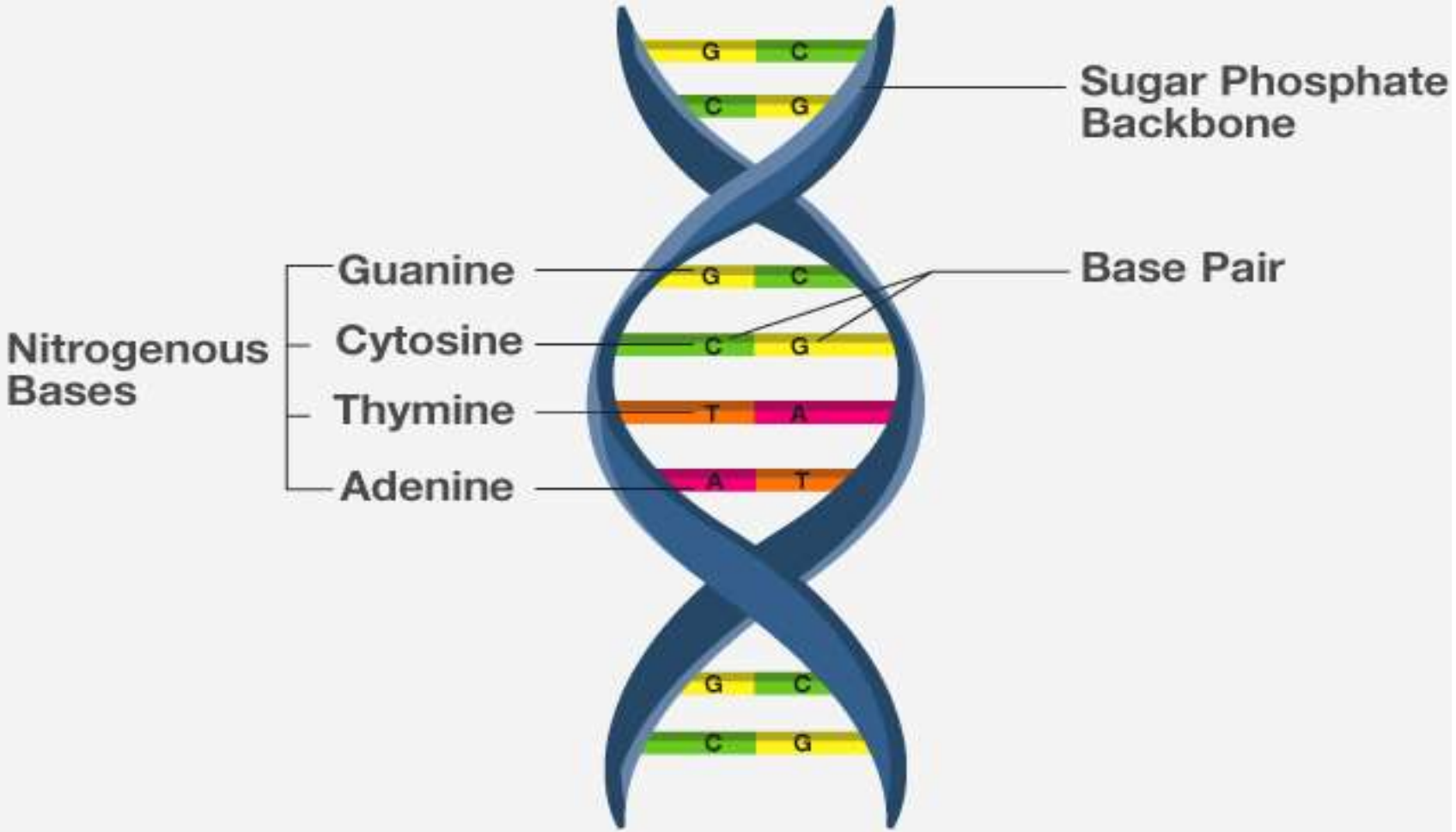


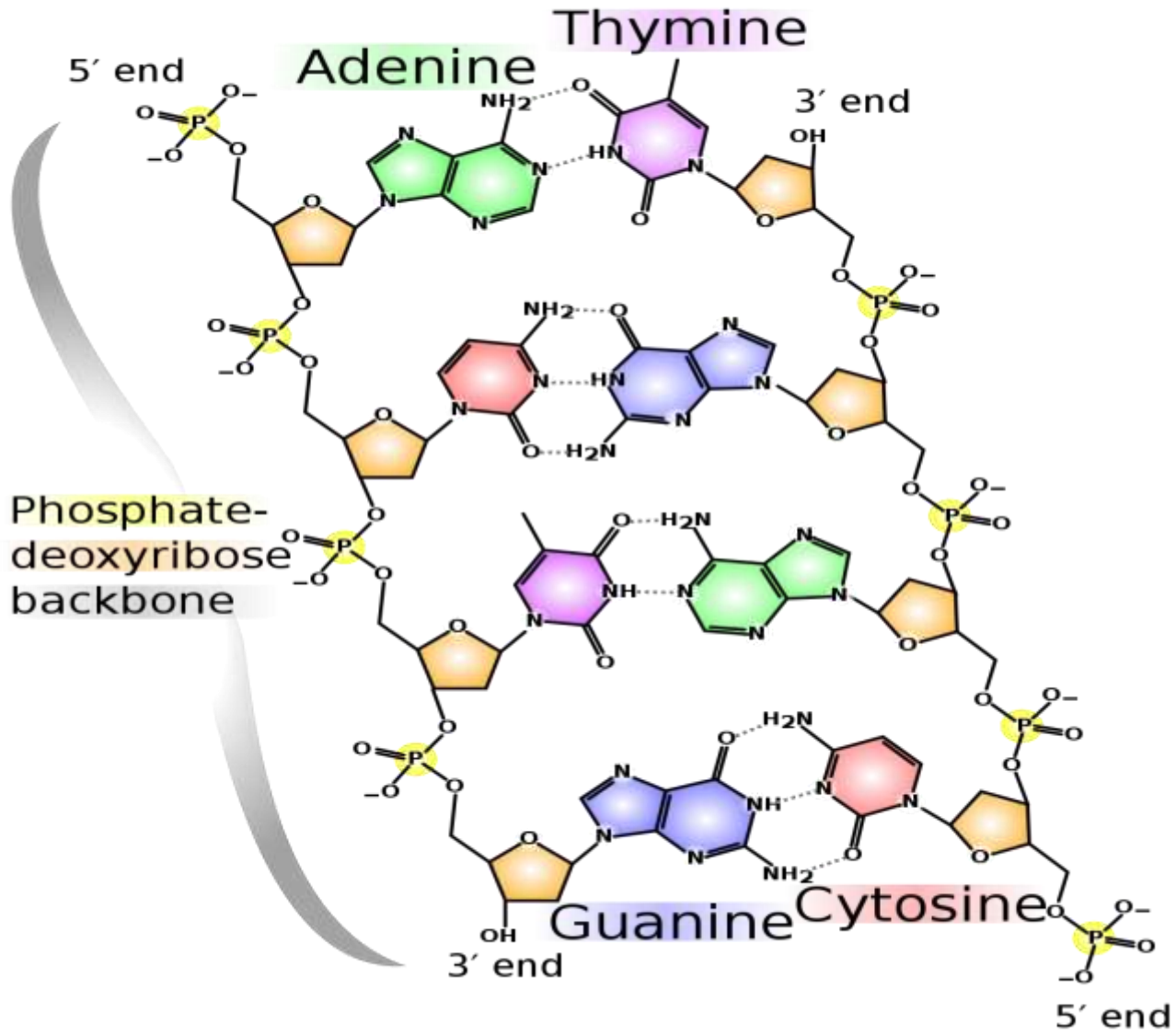
DNA

- The structure of DNA is made of two long polymer chains comprising of a sugar (pentose sugar - deoxyribose) phosphate backbone, a base which is bound to the base on the other DNA strand.
- The two DNA strands are wound together in a double helix.
- The arrangement of the DNA strand is anti-parallel.
- The asymmetric ends are termed the 5’ (prime) and the 3’ (prime) ends.

- The double strand is held together by hydrogen bonds between the bases of each strand.
- The bases present in the DNA belong to two groups purines and pyrimidines.
- Purines are heterocycylic compounds; the two types of purines present are adenine and guanine.
- Pyrimidines on the other hand are ring compounds, namely thymine and cytosine, a fifth pyrimidine seen uniquely in RNA is uracil.
- Adenine binds to thymine with the help of two hydrogen bonds and guanine binds to cytosine (in DNA) or uracil (in RNA) with the help of 3 hydrogen bonds.

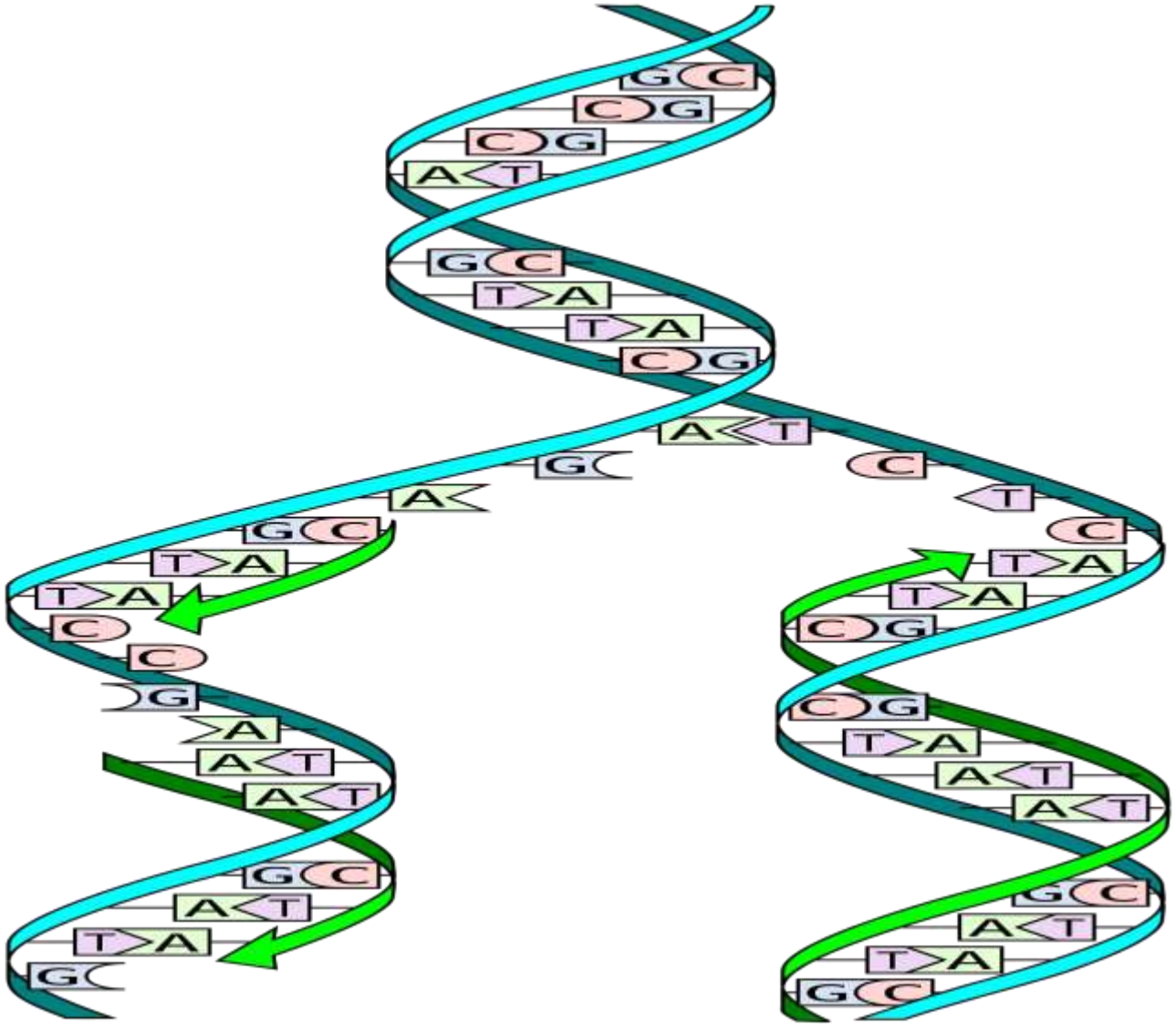
DNA STRUCTURE




Thymine
5′ end
Adenine
3′ end
Phosphate-
deoxyribose
backbone
Guanine
Cytosine
3′ end
5′ end

DNA REPLICATION

- Prior to cell division, it first becomes important for the DNA to replicate.
- DNA replication is achieved by the following steps:
- Unwinding or uncoiling of the double helix.
- The enzyme DNA polymerase uses each of the uncoiled strands as a reference strand and finds the complementary base.
- Thus, at the end of DNA replication, a new set of DNA is obtained which is identical of the parent strand.
- The double helix unwinds and each strand acts as a template for the replication process.


G C
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T A
G C

RNA (RIBONUCLEIC ACID)

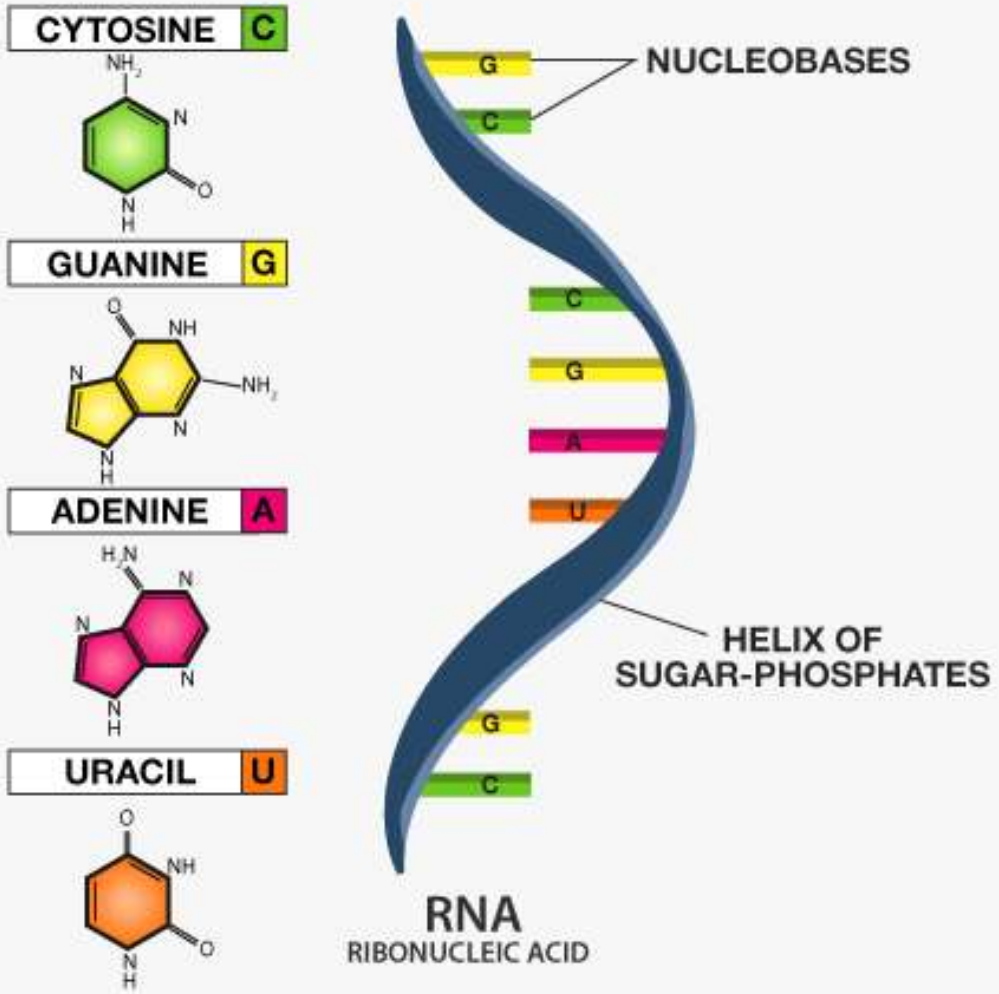
- It is a singe stranded polymer.
- Unlike the sugar in the DNA, the sugar in RNA is ribose.
- The bases present in RNA is the same as those present in DNA, namely adenine, cytosine, guanine and uracil (instead of thymine)
- The base is usually bound to the 1’ carbon position.

The structural differences between DNA and RNA have that structure of DNA is much more stable than that of RNA.
Ex: Retroviruses (Use RNA as genetic code).

TRANSCRIPTION

It is the synthesis of RNA from DNA. However since RNA is a singe stranded module only one of the strands is transcribed (template strand), the other strand is usually called the coding strand as the RNA strand which is transcribed is identical to this strand except that thymine is substituted by uracil.

RIBONUCLEIC ACID (RNA)



1.Explain about DNA?

Ans …….

2. Enumerate the steps of DNA replication?

Ans……..

3. Explain about RNA?

Ans ……..

PRE-INITIATION

It does not require a primer to start the RNA polymerase binds to the unwound DNA.The RNA polymerase has been noted to bind to a specific region of the DNA having the sequence TATA known as the promoter or the Pribnow box.

INITIATION:

It begins with the binding of the RNA polymerase to the DNA promoter.

The RNA polymerase is a core enzyme comprising of 5 subunits.

In Eukaryotes, transcription factors aid the binding of the RNA polymerase to the DNA promoter.

The RNA polymerase moves along the template strand using it as a reference and building the complementary strand which has a ribose phosphate backbone and bases corresponding to the template strand of DNA.

TERMINATION

It takes place by two ways:

RHO DEPENDENT TERMINATION: A protein called RHO factor binds to the newly transcribed RNA strand or weakly to the DNA acting as an ATPase.

This results in the release of the RNA and the RNA polymerase from the DNA.

RHO INDEPENDENT TERMINATION

Palindromes (sequences that read the same forward and backward) result in the formation of the hairpin loops in the newly transcribed RNA strand.

POST TRANSCRIPTIONAL MODIFICAITON

The RNAs produced undergo some modifications before they become completely functional.

These modifications include terminal base modification, splicing and terminal base additions.

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TYPES OF RNA

MESSENGER RNA (mRNA): Carry genetic information from the DNA out of the nucleus into the cytoplasm for protein synthesis.
TRANSFER RNA (tRNA): It carries the amino acid to the growing polypeptide chain. Each tRNA has an anticodon which recognizes the codon for protein synthesis.
RIBOSOMAL RNA (rRNA): It is the site at which the protein synthesis takes place.

CATALYTIC RNA (cRNA): It helps to catalyze reactions in the cytoplasm of the cell.
SMALL NUCLEAR RNA (snRNA): Plays important role in processing other classes of RNA.
SMALL NUCLEOLAR RNA (snoRNA): It is primarily found in the nucleolus where it is involved in functions like ribosome production.

1. Explain about RHO independent termination ?

Ans …….

2. Enlist the types of RNA?

Ans…… …….

REFERENCE

- Text book of Genetics for Nursing ,2nd Edition by Dr.S.N.Chug and Dr.Kiran chug,Arya publications

- Genetics for nurses,1st edition by Sara Sheba Ingersoll Jaya Kuruvilla, CBS publishers

THANK YOU