

Biology 12 - The Molecular Basis of Inheritance

1. Define the following terms, **IN YOUR OWN WORDS, IN AS FEW WORDS AS CLARITY ALLOWS.** (4)

i. complementary base pairing	nucleotide bases fit together (H-bond) in a precise way: A-T, C-G, A-U
ii. purines	Nitrogenous base in DNA/RNA having two rings
iii. pyrimidines	Nitrogenous base in DNA/RNA having one ring
iv. replication	process by which DNA unwinds and makes exact copies of itself
v. mRNA	messenger RNA, carries complementary code from DNA to specify amino acids.
vi. transcription	process by which complementary mRNA is produced off of one side of a DNA molecule
vii. codon	3 bases on mRNA. Each 3 bases code for one a.a.
viii. rRNA	ribosomal RNA. Structural part of ribosomes (along with proteins). Non-coding.
ix. tRNA	transfer RNA. Carries a.a.'s to mRNA in translation. About 20 different ones
x. anticodon	complementary 3 base sequence on tRNA that binds to codon of mRNA during translation.
xi. polysome	many ribosomes together translating the same mRNA molecule.
xii. recombinant DNA	inserting DNA of another species (e.g. humans) into DNA of another species (e.g. bacteria)
xiii. mutagens	anything that causes changes in DNA e.g. pesticides, X-RAYS
xiv. translation	process of assembling proteins according to mRNA instructions. Occurs along surface of ribosomes
xv. ribosome	organelle made of protein and RNA. Serves as site of protein synthesis.
xvi. Genetic Code	triplet code. 3 mRNA nucleotides code for one (and one only!) a.a.

2. All nucleotides are made of the following three parts:

phosphate group	sugar	base
-----------------	-------	------

3. In RNA, the base **THYMINE** is replaced with the base **URACIL**.

4. Mix and match the following bases with their correct partner for base pairings: (2)

G	1.	purine	A	adenine
D	2.	pyrimidine	B	cytosine
E,F	3.	adenine	C	guanine
B	4.	guanine	D	purine
C	5.	cytosine	E	uracil
A	6.	thymine	F	thymine
A	7.	uracil	G	pyrimidine

- DNA replication is called **SEMI-CONSERVATIVE** because each new double helix is made of an old strand and a new strand.
- A mutation is a change in the sequence of **NUCLEOTIDES** within a DNA molecule.
- During transcription, DNA serves as a **TEMPLATE** for mRNA formation.
- DNA carries a **TRIPLET CODE**; every three bases stand for one amino acid.
- Each tRNA has an **ANTICODON** at one end and a specific **AMINO ACID** at the other.

10. A person with PKU has a defective **ENZYME** so that phenylalanine cannot be converted to tyrosine.
11. The nucleolus is a concentration of a nucleic acid called **RNA**.
12. The "backbone" of a strand of DNA (i.e. the poles of the DNA "ladder") is composed of **sugars** and **phosphates** held together with **covalent bonds**.
13. The "rungs" of the DNA ladder are composed of **bases** held together with **hydrogen bonds**.
14. List 3 differences in structure in RNA, compared to the structure of DNA.

1.	substituted ribose for deoxyribose
2.	single stranded
3.	substitute uracil for thymine

15. Fill in the following table: (3)

DNA	C	C	A	C	A	T	T	A	A
mRNA	G	G	U	G	U	A	A	U	U
anticodon	C	C	A	C	A	U	U	A	A
amino acid	GLYCINE			VALINE			ISOLEUCINE		

16. Ribosomes are the site of **protein synthesis**. Ribosomes are composed of **two** subunits. Ribosomes are made up of **protein** and **RNA**.
17. Protein is produced during the process called **translation**. This process has three main parts:

initiation	elongation	termination
------------	------------	-------------
18. **messenger** RNA is produced having bases that are **complementary** to the bases in DNA. Thus, it is said that DNA serves as a **template** for mRNA production. Three bases on a length of mRNA are called a **codon**, and code for one **amino acid**. (2)
19. **transfer** RNA molecules bring **amino acids** to the ribosome during translation. The **anticodon** of the tRNA is complementary to the codon of the mRNA.
20. Environmental factors that cause mutations are called **mutagens**. Mutations might also cause **genetic diseases** in offspring if the **sex** cells of the parents are affected, or might cause **cancer** in the individual if the **somatic** cells are affected. (2)

21. Three chemical mutagens are:

pesticides	PCB's	certain pollutants/ red food colouring
------------	-------	--

22. Three radiation mutagens are:

X-rays, cosmic rays	UV rays	nuclear reactors
---------------------	---------	------------------

23. Put phrases 1 - 6 in the correct order to describe protein synthesis: (1)

1. mRNA is produced in the nucleus
2. ribosomes move along mRNA
3. DNA has a code
4. polypeptide results
5. tRNA brings amino acids to ribosomes
6. mRNA moves to ribosomes

ANSWER: 3 1 6 2 5 4

FUN with-DNA! - Fill in the Blanks, Using Your Knowledge of Translation and the Genetic Code

1. DNA 5' mRNA a.a.

T	A	C	T	C	A	A	A	C	C	G	C	G	T	A	A	C	T	G	G	T	G	T	A	T	G	A	T	T	
A	U	G	A	A	G	U	U	G	G	C	C	G	C	A	U	U	G	A	C	C	A	C	A	U	A	C	U	A	A
*Met	Lys	Phe	Gly	Ala	Leu	Thr	Thr	Leu	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	Thr	STOP	

2. *Met = Start/Met DNA 5' mRNA a.a.

T	A	C	G	T	A	G	T	C	T	T	A	T	T	C	T	A	C	T	T	G	C	C	T	C	A	A	T	C	
A	U	G	C	A	U	C	A	G	A	A	U	A	A	A	G	A	U	G	A	A	C	G	G	A	C	U	U	A	G
*Met	His	Gln	Asp	Lys	Asp	Gln	Asp	Lys	Asp	Gln	Asp	Gln	Asp	Gln	Asp	Gln	Asp	Gln	Asp	Gln	Asp	Gln	Asp	Ser	Ser	Ser	Ser	STOP	

3. DNA 5' mRNA a.a.

T	T	A	T	A	C	A	A	A	G	A	C	A	A	C	T	A	A	C	A	T	A	C	T	T	A	C	T	A	T	G	C	
A	A	U	A	U	G	U	U	U	C	U	G	U	U	G	A	U	U	G	A	U	A	U	G	A	A	U	A	A	U	A	C	G
		*Met	Phe	Leu	Leu	Leu	Leu	Ile	Val	STOP																						

4. DNA 5' mRNA a.a.

T	A	C	C	A	G	C	G	A	C	T	A	C	T	T	C	C	G	T	C	T	T	T	A	C	C	A	T	T		
A	U	G	G	U	C	G	C	U	G	A	U	G	A	A	G	G	C	A	G	A	A	A	A	U	G	G	U	A	A	
*Met	Val	Ala	Asp	Gln	Gly	Arg	Lys	Trp	STOP																					

5. DNA 5' mRNA a.a.

T	A	C	G	G	T	T	C	A	T	C	C	A	T	T	G	G	T	A	A	A	T	A	C	C	A	G	A	C	T	
A	U	G	C	C	A	A	G	U	A	G	G	U	A	A	C	C	A	U	U	A	U	A	U	G	G	U	C	U	G	A
STAR	PRO	SER	ARG	STOP																										
T																														

6. tRNA 5' mRNA a.a.

U	A	C	A	C	A	G	U	A	U	G	U	C	A	A	A	A	G	G	G	A	U	U	C	C	C	C	C	C			
A	U	G	U	G	U	C	A	U	A	C	A	G	U	U	U	U	C	C	U	A	A	G	G	G	G	G	G	G	U	G	A
*Met	Cys	His	Thr	Val	Phe	Pro	Lys	Gly	STOP																						