

Exam on molecular biology:

I - Tests

40 CS tests

60 CM tests

II – Practical part

1. Definitions
2. Molecular organization
3. Principles / Steps
4. Gene expression
5. Biological role
6. Legend
7. Practical importance
8. Exercise / genetic code
9. Exercise / restriction fragments / electrophoresis
10. Classification / comparative analysis (several criteria)

The final mark:

50% - average of concluding tests

20% - mark on test

30% - mark on practical part

Repeat all studied topics (reading material, presentations, exercise book);

+ Guides for concluding tests I, II;

+ Questions for final examination from Exercise book

1. Macromolecules:

DNA	}	Structure
RNA		Properties
Proteins		Types
		Functions
		Location
		No in human cells

2. Make a comparative analysis of dynamics of chromosomes in different steps of mitosis and meiosis

		Nr of chromosomes	Nr of DNA molecules	Nr of chromatids	Chromosomal formula
Cell cycle	G1				
	S				
	G2				
	Prophase				
	Metaphase				
	Anaphase				
	Telophase				
meiosis	Prophase I				
	Metaphase I				
	Anaphase I				
	Telophase I				
	Prophase II				
	Metaphase II				
	Anaphase II				
	Telophase II				

3. Make a comparative analysis of main events during mitosis and meiosis:

		Characteristic genetic processes	Cell and molecular events	Biologic role
Cell cycle	G1			
	S			
	G2			
	Prophase			
	Metaphase			
	Anaphase			
	Telophase			
Meiosis	Prophase I			
	Metaphase I			
	Anaphase I			
	Telophase I			
	Prophase II			
	Metaphase II			
	Anaphase II			
	Telophase II			

4. Characterize molecular components of main cellular structures; mention arguments of their presence:

	Molecular organization (arguments)	Biological role, functions
Plasma membrane		
sER		
rER		
GA		
Mitochondria		
Lysosome		
Peroxisome		
Centriole		
Ribosome		
Chromosome		
Chromatin (eu- and hetero-)		
Replisome		
Mitotic spindle		
Structural gene		
Bivalent		

5. Make a characteristic of main genetic events:

Replication

DNA repair

Transcription

Translation

Splicing

Intra-chromosomal recombination

Inter-chromosomal recombination

Apoptosis



Definition

Principles

Steps

Apparatus

Biological importance

6. Name and characterize the following processes:

Steps of phagocytosis

Steps of ribosome's biogenesis

Steps of peroxisome's biogenesis

Steps of lysosome's biogenesis

Steps of gene expression (I, II and III class)

Short characterization of each process

7. Make a short characteristic and show applications for following methods:

	Short characteristic	Applications
PCR		
<i>in vivo</i> cloning		
Electrophoreses		
Restriction of DNA		
RFLPs		
Isolation of genomic DNA		
Synthesis of cDNA		
Isolation of mRNA		

!!! Algorithm of answer:

a) definition and aim of method

b) target of method

c) applications

8. Fill in the table; use additional examples:

Gene	Class	Steps of expression	At		
			Molecular level	Cellular level	Organism level
rRNA 28S					
Tubulin					
Histone 2A					
Ser-tRNA					
Helicase					
Lysosomal nuclease					
rRNA 5S					
Catalase					
TFIID					
Actin					
DNA polymerase					
RNA-polymerase I					
Spectrine					
Cl ⁻ -ATPase					
Met-ARNt					
TFIID					
Ciclin A					
Acid lipase					
Histone 3					

9. Examples of exercises:

- A fragment of coding strand of DNA is given;

5 ... CAGATTGAGCGCGCTGGTCGCATAGCTAAATG....3

- Show the template strand;
- Make mRNA;
- Decode mRNA and show the polypeptide;
- Name components responsible for transcription and translation;
- Show the tRNA molecules and their anticodons;
- Name properties of genetic code.

- A mRNA molecule is given:

GpppCAAUUAUGAAACACUGACCAAGCGUCUCUAAAAAA...

- Translate mRNA;
- Show the final product of translation;
- Show the tRNA molecules and their anticodons;
- Name properties of genetic code.

- The following polypeptide is given:

...His-Ser-Leu-Val-Arg

- Show the mRNA used as template;
- Show the sequence of DNA;
- Show possible tRNA molecules involved in translation of given polypeptide;
- Name properties of genetic code.

- A mRNA molecule is given:

GpppACAAGAAUAUGCAAACACUGACCUAAGCGUCUCUAAAAAA...

- Translate mRNA;
- Show the final product of translation;
- Show the tRNA molecules and their anticodons;
- Name properties of genetic code.

- The following polypeptide is given:

... Leu- Ile-His-Tre- Ala-Pro...

- Show the mRNA used as template;
- Show the sequence of DNA;
- Show possible tRNA molecules involved in translation of given polypeptide;
- Name properties of genetic code.

10. Identify the number and length of restriction fragments produced by enzyme HpaI. Choose the correct scheme of electrophoresis of obtained fragments (m – length marker).

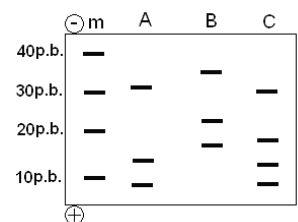
a) restriction site: GTTAAC
CAATTG

b) DNA sequence:

5'-AACATACGATCGTTAACCTTTACCCAGGGATACAGGGAAATAGGTAACTTT-3'

3'-TTGTATGCTAGCAATTGGAAATGGGTCCCTATGT CCC TTTATCCAATTGAAA-5'

c) Electrophoresis of different sets of DNA fragments (choose the correct variant).



11. Fill in the table:

	Total No of genes	Permanently active genes	Genes, active depending on conditions	Non-active genes
Human organism				
Nervous cells				
Epithelial cells in intestine				
Epithelial cells in lungs				
Skeletal muscle cells				
Heart cells				
Hepatic cells				
Renal cells				

12. Classifications - several criteria + examples:

Macromolecules

Nucleic acids

Proteins

Organelles

Genes

Methods of gene analysis

Etc.

13. Comparative characteristic:

DNA vs. RNA

Structure 1st class genes vs. 2nd class genes vs. 3rd class genes

Expression of 1st class genes vs. 2nd class genes vs. 3rd class genes

Replication vs. transcription

Transcription vs. translation

Different synthetases

Reparation vs. replication

Constitutive splicing vs. alternative splicing

in vivo cloning vs. *in vitro* cloning

Mitosis vs. meiosis

Period G1 vs. S vs. G2

Prophase vs. Telophase

Anaphase I vs. Anaphase II

Prophase of mitosis vs. Prophase I of meiosis

Intra-chromosomal recombination vs. Inter-chromosomal recombination

Etc.

14. Analyze pictures from reading material. Name pictures and fill in the legends.