ASSESSMENT FUND

for discipline «Medical biology»

The level of higher education

SPECIALTY

Direction of preparation

560001 - KR General medicine

(the code and Direction of preparation)

2022

№ 1: STUDENTS' COMPETENCIES, RESULTING FROM THE COURCE UNIT (MODULE)

Competencies Formation	Planned learning outcomes for the discipline, characterizing the stages of competency development	Types of Assessment Tools/ section code in this document
IC-l - is able and ready to analyze socially significant problems and processes, use the methods of natural sciences, mathematics and the humanities in various types of professional and social activities **PC-10 - able and ready to carry out preventive measures to prevent infectious, parasitic and non-communicable diseases**	**After study of the discipline the STUDENT MUST** ***To know:*** Fundamental professional definitions, categories, and signs (symptoms) Elementary methods of work and safety instructions for laboratory equipment and chemical reagents in biological, physical and chemical laboratories; general safety rules for handling computers.	**Block A, D** - tasks of the reproductive level - Oral answers, - interview, attendance, - Formative assessment, Survey & Questioning of 1st Module. - MCQS Testing , Control work
	After study of the discipline the STUDENT MUST: **be able to:** Use biomedical terminology, information and communication technologies, incl. Research methods for solving standard problems of professional activity. Apply basic research methods to solve professional problems. Apply information, bibliographic resources, processing methods, search for scientific and technical information using general and specialized databases and use specialized software when carrying out theoretical calculations and processing experimental data to solve standard problems of professional activity	**Block *B, D* -** tasks of the reconstructive level: - Solving situational cases-Report - Cytogenetical analysis of karyotypes - Formative assessment, - - MCQS Testing, - Control work
	After study of the discipline the STUDENT MUST have : ***own skills:***	**Block D** – practice-oriented and/or research level

	Elementary methods of work and safety instructions for laboratory equipment and chemical reagents in biological, physical and chemical laboratories; general safety rules for handling computers. Fundamental professional definitions, categories, and signs (symptoms) Use fundamental professional definitions, categories, and signs (symptoms) to carry out professional activities, to use educational, scientific, popular science literature, reliable medical electronic resources for research activities, highlight the main thing in the flow of information	assignments- Solving situational cases

№2. Technological chart of the discipline «Medical biology»

Name of the modules discipline according to Academic Curriculum	Control	Form of control	Credit Minimum	Credit maximum	Control Schedule
Module № 1:					
Module №1 Introduction to Medical Biology. Levels of Biological Organization	Formative Assessment	Oral answers, interview, attendance, lecture notes, independent work	**6**	**10**	**13rd week**
	Midterm examination	Formative assessment, Survey & Questioning of 2nd Module. MCQS Testing , Control work	**6**	**12**	
Module № 2					
Module № 2 Introduction to Genetics	Formative assessment	Oral answers, interview, attendance, lecture notes, independent work	**6**	**10**	**19th week**
	Midterm examination	Formative assessment, Survey & Questioning of 2nd Module. MCQS Testing , Control work	**6**	**12**	
Module № 3					
Introduction to Parasitology.	Formative assessment	Oral answers, interview, attendance, lecture notes, independent work	**8**	**12**	**23rd week**
	Midterm examination	Formative assessment, Survey & Questioning of 2nd Module. MCQS Testing , Control work	**8**	**14**	
TOTAL points for the Semester			**40**	**70**	**24th week**
Mindpoint assessment Intermediate control (credit)			**20**	**30**	
Summarative assessment			**60**	**100**	

№ 3: STANDARD CONTROL TASKS AND OTHER MATERIALS IMPORTANT FOR EVALUATING PLANNED LEARNING RESULTS IN THE DISCIPLINE "MEDICAL BIOLOGY" (ASSESSMENT TOOLS)

BLOCK A

A.0 Fund of tests for the discipline.

MULTIPLE CHOISE QUESTIONS (Test control)

Choose one correct answer.

1. **Which of the following is not a characteristic of the fungi?**
   a) They are all absorptive heterotrophs.
   b) They have cell walls made of chitin.
   c) Mitosis takes place within the nuclear membrane.
   d) They are all motile.
2. **Exocytosis involves**
   a) the ingestion of large organic molecules or organisms.
   b) the use of ATP.
   c) the uptake of fluids from the environment.
   d)the discharge of materials from cellular vesicles.
3. **__Which of the following organelles is common to plant & animal cells?**
   a) chloroplasts,
   b)wall made from of cellulose,
   c)mitochondria,
   d) centrioles.
4. **__Identifying organisms by their genus and species epithet is called**
   a) ancestral nomenclature
   b) two name naming
   c) binomial system or nomenclature
   d) trinomial system or nomenclature
   e) homology
5. **Cell products are secreted from the cell through**
   a) facilitated transport
   b) active transport
   c) cotransport
   d) endocytosis
   e) exocytosis
6. **Which of the following organelles contain enzymes that have digestive action?**
   a) ribosomes,
   b) polysomes,
   c) plastids,
   d) lysosomes.
7. **Which best describes the structure of a plasma membrane?**
   a) proteins embedded within two layers of phospholipids
   b) phospholipids sandwiched between two layers of proteins
   c) proteins sandwiched between two layers of phospholipids
   d) a layer of proteins on top of a layer of phospholipids.
8. **Robert Hooke discovered:**
   a) nucleus,
   b) mitochondria,
   c) cell,

d) DNA,
e) Ribosome.

9. Resolution power is the ability to
a) distinguish two close points
b) distinguish two close objects
c) distinguish amongst organelles
d) magnify image

10. On the basis of collected facts, a scientist formulates a statement called:
a) observation,
b) research work,
c) hypothesis,
d) inductive reasoning,
e) general idea

11. Number of Barr bodies in XXXX female is
a) 1,
b) 2,
c) 3,
d) 4.

12. Inheritances of skin colour in humans is an example of
a) point mutation,
b) polygenic inheritance,
c) codominance
d) chromosomal aberration.

13. During which stage of meiosis does crossing over occur?
a) prophase I,
b) anaphase I,
c) prophase II,
d) telophase II.

14. A child is diagnosed with Tat-Sachs disease. Which of the following organelles is most likely affected?
a) lysosome
b) ribosome
c) Golgi apparatus
d) rough endoplasmic reticulum

15. The appearance of an organism is its
a) genotype
b) phenotype
c) genotype ration
d) phenotype ratio

16. Human skin color is determined by three different genes working together to produce a wide range of possible skin tones. This is an example of
a) Blending inheritance,
b) Codominance
c) Polygenic trait
d) Polyploidy
e) Multiple alleles

17. A gene is said to be dominant if
a) it expresses its effect only in homozygous state
b) it expresses its effect only in heterozygous condition
c) it expresses its effect both in homozygous and heterozygous condition.
d) it never expresses its effect in any condition.

18. In a somatic cell cycle, DNA synthesis takes place in

a) G1 phase,
b) prophase of mitosis,
c) S-phase,
d) G2 phase.

19. In DNA guanine always pairs with
a) adenine
b) cytosine
c) guanine
d) thymine
e) uracil

20. A photograph that show chromosomes in homologous pairs is called a what?
a) Karyotype,
b) pedigree,
c) phenotype
d) genotype.

21. DNA replication results in two DNA molecules,
a) each with two new strands,
b) one with two new strands and the other with two original strands**,**
c) each with one new strand and one original strand,
d) each with two original strands

22. During DNA replication, a DNA strand that has the bases CTAGGT produces a strand with the bases
a) TCGAAC,
b) AGCTTG,
c) GATCCA,
d) GAUCCA.

23. A genetic disorder that causes secretion of mucus from some organs is
a) cystic fibrosis,
b) Tay-Sachs disease,
c) Huntington's disease,
d) sickle-cell anemia

24. Sickle cell anaemia has not been eliminated from the African population because
a) it is controlled by dominant genes
b) it is controlled by recessive genes
c) it is not a fatal disease
d) it provides immunity against malaria.

25. In mouse agouti locus is hypostatic to pigment development locus. If C is for pigment development, and A is for agouti, and recessive alleles in agouti locus gives black colour and recessive in pigment locus gives white colour, what will be the phenotype of A/- c/c and a/a c/c.
a) Agouti, white
b) Black, agouti
c) Black, black
d) White, white

26. Dominant epistasis ratio with A as epistatic gene 12:3:1 corresponds to _____
a) A/- B/- : A/- b/b : a/a B/-
b) a/a B/- : a/a b/b : a/a b/-
c) A/A B/-: A/- B/-: a/a b/b
d) A/- -/- : a/a B/-: a/a b/b

27. Tay Sach's disease doesn't agree with which of the following?
a) It causes death in heterozygotes
b) Death occurs within 2-3 years of life

c) HEXA gene is affected
d) Central nervous system is affected

28. In an organism you observe that phenotypes of the progeny are as – 315 H/H R/R, 108 H/-r/r, 101 h/h R/-, 32 h/h r/r. This shows_____
a) Linkage
b) Lethal alleles
c) Epistasis
d) Normal ratio

29. Choose the statement that is not true for Meiosis II.
a) Doubled chromosomes line along equatorial plate
b) Karyokinesis is followed y cytokinesis
c) The chromosome number is reduced
d) The anaphase chromosomes start to spate from the center.

30. The members of each allelic pair separate during _____.
a) meiosis
b) mitosis
c) either meiosis or mitosis
d) fertilization
e) hybridization

31. Each of the following statements concerning Giardia lamblia is correct EXCEPT:
a) Giardia lamblia has both a trophozoite and cyst stage in the its life cycle,
b) Giardia lamblia is transmitted by fecal-oral route from human and animal sources,
c) Giardia lamblia causes hemolytic anemia,
d) Giardia lamblia can be diagnosed by string (intestinal) test.

32. Leishmaniasis transmitted to humans by
a)ingesting cysts in water or food,
b) inhaling trophozoites,
c) sand flies bites,
d) dirty fingers, e)handing cats.

33. Contact with infected cat feces is responsible for the transmission of:
a) Pneumocystis carinii
b) Loa loa,
c) Toxoplasma gondii,
d) Blastocystis hominis.

34. The organism that caused the American Trypanosomiasis (Chagas Disease) is
a) ciliates (Ciliophora),
b) zooflagellates (Mastigophora),
c) sporozoan (Sporozoa (Apicomplexa)),
d) amoebas (Sarcodina)

35. Process resulting in the transformation of a cyst into a trophozoite is known as:
a) Infection
b) Excystation
c) Encystation
d) Infestation

36. ___In the life cycle of malaria, which stage follows the sporozoite:
a) microgamete
b) sporocyst
c) oocyst
d) merozoite
e) schizont

37. The locomotive structures of Balantidium coli are known as:
a) Peripheral chromatin

b)Flagella
c) Pseudopods
d) Cilia

38. Protozoan transmitted by fecal-oral route
a) Trypanosoma species
b) Balantidium coli,
c) Leishmania species,
d) Naegleria species

39. ___Congenital infection with Toxoplasma gondii occurs:
a) only when mother is infected during pregnancy;
b) when mother is infected before pregnancy, but she didn't treat the infection
c) in both cases
d) none of them.

40. ____The branch in which organism's life cycle, mode of transmission and interaction with their hosts are studied is:
a) Anatomy
b) Physiology,
c) Parasitology
d) Social Biology,
e) Microbiology

41. ___An direct life cycle is one where:
a) there is no intermediate host,
b) there is extensive tissue migration
c) there is always more than one definitive host species
d) there is at least one intermediate host
e) there is always an intestinal phase.

42. ___For Trichomonas vaginalis, the primary mode of transmission is:
a) oral-fecal
b) sexual contact
c) contaminated food
d) cysts inhalation

43. Besides erythrocytes, the plasmodium attacks one more type of cells in our body; these are
a) Muscle cells
b) Nerve cells
c) Kidney cells
d) Hepatocytes

44. The following diseases are transmitted by arthropod vector:
a) sleeping disease
b) Schistosomiasis,
c) kala-Azar
d) Hydatid cyst
e) A and C

45. Schizogony takes place in:
a) human blood
b) the liver
c) human intestine,
d) mosquito intestine.

46. The following parasites are sporozoan:
a) Toxoplasma gondii
b) Plasmodium species

c)Trypanosoma species
d) Balantidium coli.

47. 'Plasmodium' in the human blood comes from:
a)Urine of mosquito
b)Blood of mosquito
c) Saliva of mosquito
d) Tears of mosquito

48. Contact with infected bed bugs' feces is responsible for the transmission of:
a) Pneumocystis carinii;
b) Loa loa;
c) Toxoplasma gondii;
d) Trypanosoma cruzi

49. Which is mismatched?
a) trypanosome – African sleeping disease,
b) Plasmodium vivax - malaria,
c) amoeboid – severe diarrhea,
d) Balantidiasis – Giardia lamblia.

50. Leishmania species:
a) Produces leishmaniasis
b) Are multiplying in the cells of reticuloendothelian system
c) They have developing stages inside the red blood cells,
d) They have fecal-oral transmission

A.1 QUESTIONS FOR ORAL DISCUSSION:

Questions for Mid-term Control of 1st MODULE

1. Describe and define the Science of biology. Describe and define the Science and scientific method.
2. Outline a set of steps that might be used in the scientific method of investigating a problem.
3. Define the Theories Contributing to Modern Biology.
4. Define the Characteristics of living things
5. Describe and define Describe and define the Levels of Organization.
6. Describe and define Biosphere, Ecosystem: Community.
7. Describe and define Species, Populations, Individuals:
8. Describe and define Organ System, Organ, Tissue.
9. Describe and define Cell, Organelle.
10. Describe the types of microscopes and the types of information scientists can obtain using each one.
11. Describe the Light microscopes: Compound Microscope, Stereo Microscope:
12. Describe the Electron microscopes: Transmission Electron Microscope (TEM); Scanning Electron Microscope (SEM):
13. Describe and define Biological Diversity and Classification.
14. Describe and define the Binomial nomenclature.
15. Describe and define the Principles of classification of living things today.
16. Define "The cell is as fundamental to biology".
17. Describe the General characteristics of cells.
18. Describe and define Types of Cells.
19. Describe and define Prokaryotic cell.
20. Describe the basic structure of prokaryotic cells and cite an example of these cells.
21. Describe Summary of the Differences Between Prokaryotic and Eukaryotic Cells.

22. Describe these basic cellular features and their functions: plasma membrane, cytoplasm, and nucleus (nucleoid in prokaryotes).
23. Describe these basic cellular feature and its functions: Mitochondrion (pl. Mitochondria).
24. Describe and define types of chromoplasts and its functions.
25. Describe these basic cellular features and their functions: Ribosomes, Smooth Endoplasmic Reticulum, Rough Endoplasmic Reticulum (RER).
26. Describe these basic cellular features and their functions: Golgi Body (or Golgi Apparatus), Vacuoles, Lysosomes.
27. Describe these basic cellular features and their functions: Cytoskeleton, Centriole.
28. Describe these cellular features and their functions: Cilium and Flagellum, Microvilli.
29. Describe these basic cellular features and their functions: Cell Membrane (or Plasma Membrane), Cell Wall.
30. Describe Types of Transport Across The Membrane.
31. Describe and define Simple Diffusion
32. Describe and define Osmosis.
33. Describe and define Water Potential & Cells and Osmosis.
34. Describe and define Facilitated Diffusion and its types.
35. Describe and define Active Transport (or Pumping).
36. Describe and define Vesicles, Endocytosis, Exocytosis, Pynocytosis.
37. Describe and define The Cell Cycle.
38. Describe and define Cytokinesis in Plant cells and Animal cells.
39. Describe Prokaryotic Cell Division.
40. Describe the Structure of Eukaryotic chromosomes.
41. Describe Prophase of Mitosis.
42. Describe Metaphase of Mitosis.
43. Describe Anaphase of Mitosis.
44. Describe Telophase of Mitosis.

Questions for Mid-term Control of 2nd MODULE

45. Describe Heredity, Historical Perspective.
46. Gregor Mendel & his works.
47. Describe Principle of Segregation.
48. Describe Summary of Mendel's Results.
49. Describe Principle of Independent Assortment.
50. Describe and define Meiosis and sexual life cycles.
51. Describe general stages of Meiosis.
52. Describe Prophase I. of Meiosis I.
53. Describe and define Homologous chromosomes, Genetic recombination Synapsis.
54. Describe and define Crossing-over, Chiasma.
55. Describe Metaphase I, Anaphase I of Meiosis.
56. Describe Telophase I: Interphase of Meiosis.
57. Describe Prophase II of Meiosis.
58. Describe Telophase II of Meiosis.
59. Describe Metaphase II of Meiosis.
60. Describe Anaphase II of Meiosis.
61. Define Ploidy, Haploid, Polyploid.
62. Describe Forms of Asexual Reproduction.
63. Describe Natural Methods of Asexual Reproduction.
64. Describe Artificial Methods of Asexual Reproduction (Plants): Tissue Culture, Grafting, Cuttings.
65. Describe Artificial Methods of Asexual Reproduction (Animals): Cell Culture, Nuclear Transfer, Embryo Cloning, Parthenogenesis.

66. Describe History of Finding the Genes.
67. Describe Characteristics of X-linked Traits.
68. Describe The Modern View of the Gene.
69. Describe Codominant alleles.
70. Describe Incomplete dominance, Multiple alleles.
71. Describe types of Interactions among genes.
72. Describe Epistasis.
73. Describe Environment and Gene Expression.
74. Define Polygenic Inheritance.
75. Define Pleiotropy.
76. Describe and define Chromosome Abnormalities: Deletion, Insertion Translocation
77. Describe and define Human chromosomal abnormalities:
    - Sex-chromosome abnormalities 1.Turner syndrome 2. Klinefelter syndrome**)**
    - Chromosome nondisjunction: Down's syndrome
78. Describe Human Allelic Recessive Disorders (Albinism , Tay-Sachs Disease Phenylketonuria (PKU) Cystic Fibrosis Sickle-cell anemia)
79. Describe Human Allelic Dominant Disorders (Huntington's disease , Neurofibromatosis Polydactly)
80. Describe Sex-linked disorders of Human (Hemophilia , Color blindness Muscular dystrophy)
81. Developmental biology: definition; Core concepts:
82. Describe Core concepts of Developmental biology: Embryogenesis, Cell differentiation; Specialized cell type.
83. Describe Core concepts of Developmental biology: Pattern formation, Morphogenesis; Organogenesis.
84. Describe The central dogma of molecular biologyas the flow of genetic information from DNA to RNA to protein.
85. Describe Replication: DNA to DNA. Purpose & Process.
86. Describe Transcription: DNA to RNA. Purpose & Process
87. Describe Translation: RNA to Protein. Purpose & Process.

Questions for Mid-term Control of 3rd MODULE

88. Introduction to Parasitology.
89. Foundational concepts. Parasite classifications and types
90. What are the three major groups of animals traditionally studied in medical parasitology?
91. Define the following terms: Parasite, Host, Symbiosis, Commensalism, Mutualism, Parasitism
92. Describe differences between ectoparasites and endoparasites. Provide an example for each.
93. . Explain the difference between an obligate parasite and a facultative parasite. Provide an example for each.
94. Differentiate between a definitive host and an intermediate host. Provide an example for each.
95. What is a paratenic (or transport) host? What is a reservoir host? Provide an example for each.
96. Provide an example of a human disease caused by a parasite from each group.
97. How are protozoa classified based on their method of locomotion? Provide an example for each type.
98. Parasites and Parasitism.
99. Classification of Protists. Phylum Protozoa.
100. Life Cycle Stages of Protists.
101. Types of Reproduction of Protists.
102. Types of Nutrition of Protists.

103. Parasitic Protozoa. Describe Morphologic stages of flagellate.
104. Describe the major characteristics of Phylum Carcodina (Rhizopoda or Amoebas).
105. Major characteristics of Phylum Sporozoa (or Apicomplexa).
106. Major characteristics of Phylum Mastigophora (Flagellates).
107. Major characteristics of Phylum Ciliophora.
108. Types of locomotion Protozoa.
109. Describe the major characteristics of *Balantidium coli.*
110. Describe the major characteristics of *Giagdia intestinalis*.
111. Describe the major characteristics of *Trichomonas vaginalis*.
112. Describe the major characteristics species of *Naeugleria Fowleri*.
113. Describe the major characteristics of *Plasmodium vivax*.
114. Describe the major characteristics of *Toxoplasma gondii*.
115. Describe the major characteristics of *Entamoeba Histolytica.*
116. Describe the major characteristics of *Acanthamoeba Species.*
117. Describe African Trypanosomiasis (Sleeping Sickness)
118. Describe Cutaneous and Mucocutaneous Leishmaniasis.
119. Describe Visceral Leishmaniasis (Kala-Azar).

BLOCK B

B. Situational cases:

CASE STUDIES IN MEDICAL BIOLOGY

CASE STUDY ON GENETICS

1. DEALING WITH INFERTILITY

Mark and Elizabeth have been married for six years. Ever since they were married they have been talking about having a baby. Both are professionals - she is a teacher and he is a software designer. They seriously began trying to have a baby about two years ago. For the past year they have been seeing an infertility specialist, Dr. Katz.

After an initial interview, Dr. Katz suggested that they first check Mark's sperm count. He explained that sperm counts are declining and some men are having trouble conceiving a baby. Mark gave a sample, and when the doctor called he told the couple that Mark's sperm count was indeed extremely low.

Mark had been born with an undescended testicle, which was removed from his abdomen at age 11. At that time his mother had been told that there would be no problem with fertility because he still had one functioning testicle. This was obviously not true.

Because Mark's sperm count was so low, it was unlikely most of the assisted reproductive techniques would work. But, Dr. Katz explained, there was a new procedure, called intracytoplasmic sperm injection (ICSI) that could work along with in vitro fertilization. In this procedure Elizabeth's eggs would be harvested and only ONE sperm would be needed for injection. But there was a problem.

After going through the long process of hormone injections and egg retrieval Elizabeth had 10 eggs harvested, but Mark's sample had NO sperm.

It was heartbreaking. Dr. Katz suggested that they try again with a sperm donor as a back up. Then, if Mark's sample had no sperm, they could fertilize with the donor's sperm.

1. Should Mark and Elizabeth use a donor sperm? Why or why not? Give three reasons to support your opinion.
2. What characteristics should they look for in a sperm donor?
3. Should their child be told that their father was a sperm donor? Why or why not?

4. Should their child be allowed to try to find the donor?
5. Some think that using ICSI perpetuates infertility. They reason that if Mark's undescended testicle were a hereditary defect, he might pass this trait to his male children. Should infertile men use this technique? Why or why not?

2. BIOLOGY PHENOMENON- PROTEIN SYNTHESIS - SICKLE CELL GENETICS & DNA MUTATIONS

Description:

Looking for a way to make your DNA or genetics unit relevant to high school students? This Biology case study can help you incorporate a real-world situation into your course. The problem-based lesson provides a great example of real NGSS phenomena.

Sickle cell anemia is a genetic disorder caused by one incorrect nucleotide in a DNA sequence. It is an excellent example of how a tiny mutation can change protein structure and wreak havoc on the body. Students learn about symptoms, inheritance patterns, and treatments for this disease.

Case studies are perfect for extending thinking on a topic or for use as sub plans. Answer keys are included.

Topics addressed: pedigrees, autosomal recessive disorders, Punnett squares, genotypes, DNA sequences, nucleotides, DNA replication, transcription, translation, mRNA, amino acids, mutations (point mutation, frameshift mutation, silent mutation, missense mutation, nonsense mutation)

Please note: Students will need an understanding of pedigrees, Punnett squares, DNA, protein synthesis, and DNA mutations prior to completion of this case study. My Biology Unit 6: Intro to Genetics and Biology Unit 7: DNA and Protein Synthesis provide this knowledge and are a perfect companion to this case study.

Please note: To determine if this case study fits with the difficulty level of your course, please click on the PREVIEW above.

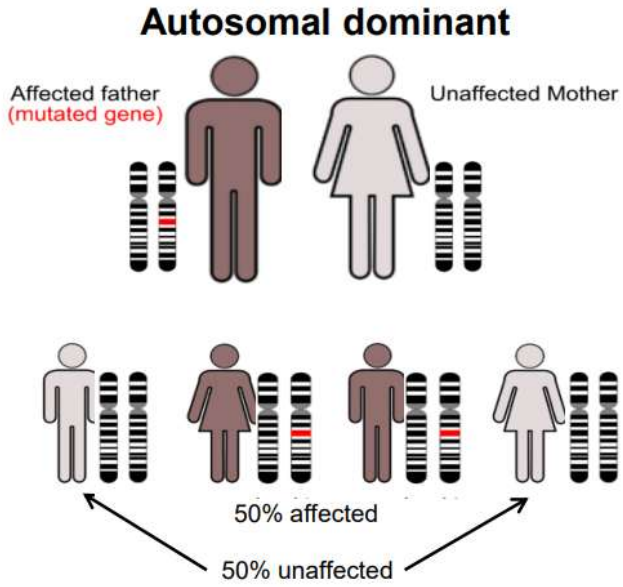
Three versions are included:

1. **Guided Case Study-** Students are presented with initial information, and then led through the related information about the case. Questions are presented as a reading comprehension-style assignment. This is a great choice for struggling students or as a quick supplement to your unit.
2**. Research-based Case Study**- Students are presented with the initial information and only a few necessary details of the case. Websites are provided for additional information

in order to answer the related questions about the case. This is a great choice for more advanced/independent students or if you have more available class time.
3. **Digital Case Study-** Students are provided the same links as the research-based study, but they are live websites for easy internet searching and questions are provided in a Google Slides format. This is a great choice for 1:1 classrooms or independent learners that are familiar with Google Classroom.

3. OTHER INHERITED BLOOD DISORDERS

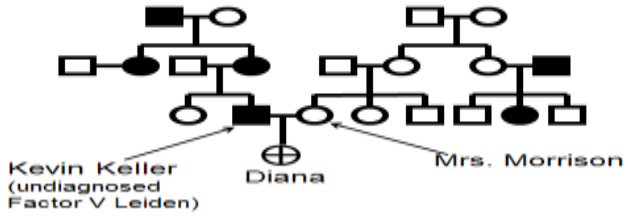
Hemophilia causes a lack of blood clotting, but Diana apparently died from overactive blood clotting (hypercoagulation). The most common inherited disorder that produces hypercoagulation is Factor V Leiden, which follows an autosomal dominant inheritance pattern (like Huntington's Disease). About 5% of Caucasians in North America are affected by it. A dominant mutation of a gene located on chromosome 1 causes the body to produce too much of a clotting factor. This leads to deep vein thrombosis, pain, strokes, and heart attacks. Miscarriages and pulmonary embolisms can also result. The autosomal dominant inherited pattern is shown on the next page.



Question 1: Using B (uppercase) for the dominant allele and b (lowercase) for the recessive allele for Factor V Leiden, construct a Punnett square to show the parents from this page and their predicted offspring.

Question 2: Mr. Keller (Diana's biological father) investigates his family medical history when he is made aware of concerns about Factor V Leiden. Mrs. Morrison looks into her family history, too.

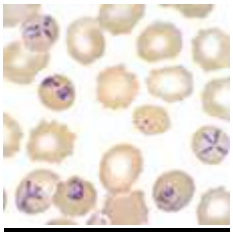
Mrs. Morrison's aunt's husband and cousin died of heart attacks, but her mother and sister are fine. Mr. Keller's aunt had multiple miscarriages; his mother suffered from deep vein thrombosis; and his grandfather died of a heart attack. Based on this information, do you think Mr. Keller or Mrs. Morrison is more likely to be the source of Diana's Factor V Leiden mutation? **Explain why.**



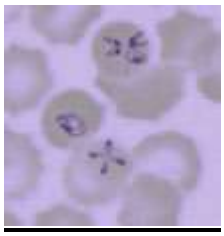
4. CASE STUDY ON PARASITOLOGY

A 64-year-old male presented to his physician with a history of symptoms, beginning about 10 days before. Symptoms included general malaise, followed by fever, shaking chills, profuse sweating, arthralgias, myalgias, fatigue, and weakness. The man lived in eastern Long Island and owned property which had not yet been developed. He, his wife, and three dogs went hiking on the property quite often.

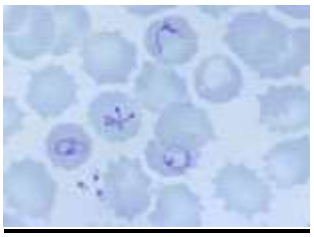
Although both the man and his wife were aware of the presence of deer ticks, *Ixodes scapularis*, on the property, neither could remember seeing any ticks or being bitten. On presentation to the physician, initial tests did not confirm any particular infection or illness. Hepatosplenomegaly was present and the patient had slightly elevated bilirubin and transaminase levels as a result of hemolytic anemia.
Blood film examinations were initially negative; however, after an additional 5 days, the following images were seen during microscopic review of thin blood films.
Please comment on the possible diagnosis.



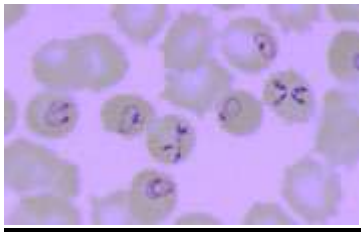
1. Thin blood film



2. Thin blood film



3. Thin blood film



4. Thin blood film

Scroll Down for Answer and Discussion

-
-
-
-
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-

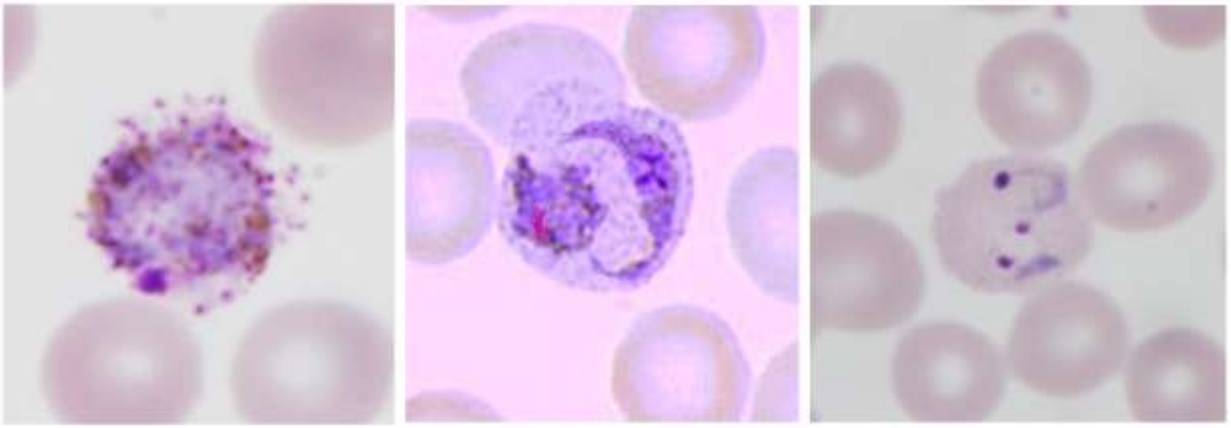
Answer and Discussion of Quiz
The images presented in Diagnostic Quiz #8 are the following:

1. *Babesia microti* ring forms.
2. *B. microti* ring forms with a typical Maltese cross (four rings in cross formation).
3. *B. microti* ring forms; note some of the rings are outside of the red blood cells.

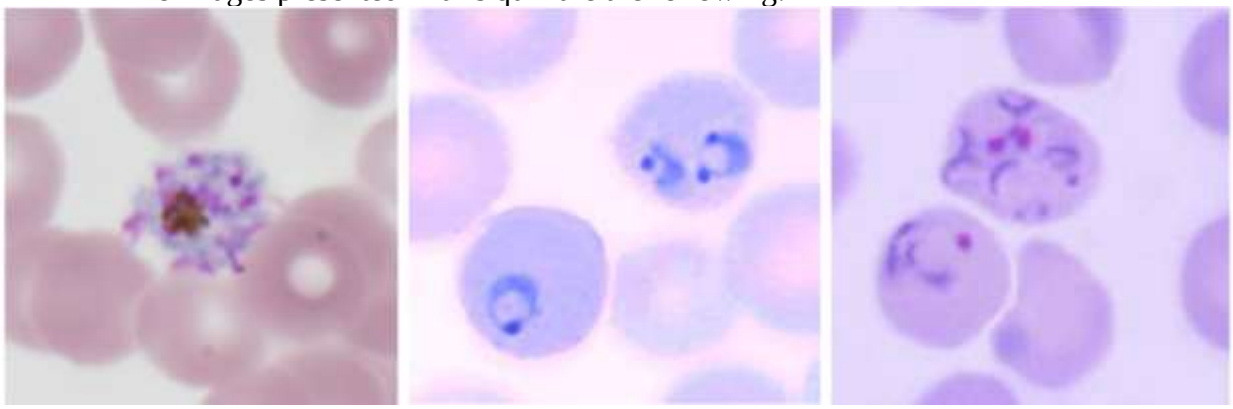
4. *B. microti* ring forms.

5. **PARASITOLOGY CASE HISTORY #1**
(BLOOD PARASITES)
(Lynne S. Garcia) A 47 year old female was seen at a local emergency room with complaints of fevers and chills. She had been traveling in Thailand for approximately three weeks. When she traveled abroad in the past, she had taken malaria prophylaxis from the travel clinic. However, she did not visit the clinic prior to this trip, her most recent trip abroad.

A blood smear examination was ordered, and thick and thin blood films were prepared and stained using one of the rapid blood stains. The following images were seen on the blood films. What infection most likely matches these images? Based on the images seen above why might there be some confusion regarding the species?



Answer and Discussion of Blood Parasite Quiz
#1 The images presented in this quiz are the following:



Plasmodium vivax **Note the key characteristics:**
enlarged RBCs, mature schizont with ~18 merozoites, RBC with two rings (this may be confused with Plasmodium falciparum, but is also seen in P. vivax). In the third frame, there are no visible Schüffner's dots (occurs if blood has been standing in EDTA too long prior to smear preparation).
Comments on the Patient: Of the five species that infect humans, P. vivax and P. falciparum account for 95% of infections. Some estimates indicate that P. vivax may account for 80% of the infections. This species also has the widest distribution, extending throughout the tropics, subtropics, and temperate zones. P. falciparum is generally confined to the tropics, P. malariae is

sporadically distributed, and P. ovale is confined mainly to central West Africa and some South Pacific islands.

We usually associate malaria with patients having a history of travel within an area where malaria is endemic. However, other situations that may result in infection involve the receipt of blood transfusions, use of hypodermic needles contaminated by prior use (as with, for example, drug addicts), possibly congenital infection, and transmission within the United States by indigenous mosquitoes that acquired the parasites from imported infections.

Clinical Disease: The primary clinical attack usually occurs 7 to 10 days after infection, although there are strain differences, with a much longer incubation period being possible. In some patients, symptoms such as headache, photophobia, muscle aches, anorexia, nausea, and sometimes vomiting occur before organisms can be detected in the bloodstream. In other patients, the parasites can be found in the bloodstream several days before symptoms appear.

Key Points - Laboratory Diagnosis:

When requests for malarial smears are received in the laboratory, some patient history information should be made available to the laboratorian. This information should include the following.

1. Where has the patient been, and what was the date of return to the United States? ("Where do you live?" – this has relevance to "airport" malaria)
2. Has malaria ever been diagnosed in the patient before? If so, what species was identified?
3. What medication (prophylaxis or otherwise) has the patient received, and how often? When was the last dose taken?
4. Has the patient ever received a blood transfusion? Is there a possibility of other needle transmission (drug user)?
5. When was the blood specimen drawn, and was the patient symptomatic at the time? Is there any evidence of a fever periodicity?

BLOCK C

THEMATIC PLAN OF STUDENTS' INDEPENDENT WORKS

1st MODULE

1. Biology is theoretical basic of medicine
2. Biosafety level & Biosecurity in your country
3. Bioethics in your country.
4. Phenomena of transduction at bacteria.
5. Phenomena of transformation at bacteria.
6. Methods of somatic cell hybridization in biomedicine.
7. Biosafety in your country
8. Endomitosis and its' biological significance.
9. Amitosis and its' biological significance.
10. Spontaneous polyploidization and its' biological significance.
11. Classical and Traditional Biotechnology
12. Red Biotechnology and Green Biotechnology
13. Noncellular forms of life on our planet
14. Regeneration of internal organs of mammals
15. Types of sexual reproduction in plants and animals.
16. Cultivation of different mammal and human tissues

2nd MODULE

1. Structure and function of polytene chromosome.
2. Structure and function of lampbrush chromosomes.
3. Structure and function of polytene chromosomes.
4. Structure and function of sex chromosomes.
5. Double fertilization at plants.
6. Forms of variability: modificational variability, mutational variability, potential variability and others.
7. The embryo cloning, embryonic steam & tissue steam cell therapy and ethical problems in biomedicine.
8. How diseases mutate and form new strains
9. Stem Cell Research:
10. The role of specific genes in height determination
11. Benefits and effects of GMOs
12. Future and impact of stem cell technology.
13. Effect of alcohol and marijuana on brain development.
14. Principles of human cloning.
15. Possible risks of usage of genetically modified organisms for human health, the agriculture, the forestry and the Nature.
16. The gene technologies, the farm animals and medicine.
17. The International Scientific Project «Human Genome
18. The human hereditary mitochondrial diseases.
19. Viruses as biological weapons.
20. The world of personalized medicine
21. Influence of specific genes on cancer progression.
22. Role of gene mutation on combating disease.
23. Effects of Radiation on DNA
24. Effects of Radiation on DNA
25. Height and genetics: nature or nurture

3rd MODULE

1. Role of commensalism relationships.
2. Association of microbiomes to human health.
3. Measures of preventive prophylactics and control of parasitic representatives Subphylum *Mastigophora (Flagellates).*
4. Measures of preventive prophylactics and control of parasitic representatives Suphylum Sarcodina.
5. Measures of preventive prophylactics and control of parasitic representatives of a Phylum Ciliophora.
6. The Monitoring for parasitic illnesses.
7. Application of early diagnostic methods of parasitic illnesses.

METHODOLOGICAL INSTRUCTIONS FOR THE IMPLEMENTATION OF INDEPENDENT WORK

on course
MEDICAL BIOLOGY

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In conclusion it may be said: Independent work of students is an integral part of training and aims to consolidate and deepen the acquired knowledge, skills and abilities, search for and acquire new knowledge, perform training tasks, prepare for upcoming classes, ongoing

monitoring of academic performance and intermediate certification.

Case Study
Case studies in medical biology illustrate how biological principles are applied to understand and treat diseases. They can cover a wide range of topics, from genetics and molecular biology to physiology and ethics. (Attachment 2)

BLOCK D

CONTROL QUESTIONS AND ASSIGNMENTS
Questions to check the Students' level of learning TO KNOW:

- Biology subject, the basic methods of scientific researches. Principled relations between biology and medicine.
- . The levels of the biological organization. Principles of the biological nomenclature.
- A structure of prokaryotic and eukaryotic cells.
- Cell Membrane structure and functions, Cell Wall; Types of Transport Across The Membrane. Movement Into and Out of the Cell.
- The various ways that substances move through the cell membrane.
- The Cell Cycle. A cell cycle, binary fission, a mitosis, meiosis. Structure and morphology of chromosomes.
- The main genetic concepts. Mendel's laws.
- Natural Methods of Asexual Reproduction. Artificial Methods of Asexual Reproduction: Cell Culture, Nuclear Transfer, Embryo Cloning, Parthenogenesis.
- Gene Interactions, Environment and Gene Expression.
- Methods of Human Genetics. Classification of heredity disorders, its main types.
- Molecular basis of inheritance. The Modern View of the Gene.
- Main concepts of the Parasitology, different types of host and parasites.
- The basic taxonomic categories of parasites, its morphology, systematics, life cycles.
- Characteristics of Phylum Sarcomastigophora (Flagellates and Amoebas).
- Characteristics of Phylum Ciliophora.
- characteristics of Phylum Sporozoa (or Apicomplexa).
- characteristics of Phylum Microspora.

BE ABLE TO:

- To work Independently with a microscope; the light microscope, its device and methods of working with it.
- To describe the basic structure of prokaryotic cells; cite an example of these cells.
- To give the function and cellular location of the following basic eukaryotic organelles and structures: cell membrane, nucleus, endoplasmic reticulum, Golgi bodies, lysosomes, mitochondria, ribosomes, chloroplasts, vacuoles, and cell walls.
- Understanding the laws of inheritance and applying them to human pedigrees and gene transmission through mitosis and meiosis.
- To analyze the organization of the human genome into chromosomes
- Understanding multifactorial inheritance, how the environment interacts with genetics, and the genetic basis of complex diseases.
- To define of basic terms in parasitology: parasitology, parasitism, parasite, host; types of biological interactions; morphological and physiological adaptations of parasites to the parasitic lifestyle.
- To classify: systematic position of parasites. Parasite-host interactions. Systems and organs attacked by various species of parasites.

- To explore the biology, pathogenesis, diagnosis of parasitic infections in humans
- Demonstrate knowledge and a critical understanding of key aspects of basic biology as applied to certain global health problems. Apply theoretical, methodological and practical skills in medical biology, genetics and parasitology to study the basic concepts of practical medicine. Apply theoretical knowledge from the field of medical biology for the treatment and implementation of preventive measures among the population. Demonstrate knowledge from a molecular, cellular, biologic, clinical sphere for disease prevention, Health promotion and cure.

TO OWN SKILLS:

- To create Punnett squares for predicting recurrence risks for inherited disorders or traits in families.
- To analyze Pedigree charts depict family relationships and transmission of inherited traits.
- To analyze karyotypes and chromosomal abnormalities, including numerical and structural aberrations, and their clinical implications.
- Applying genetic principles to diagnose genetic disorders, understand the basis of personalized medicine, and evaluate research data in a clinical context.
- Providing patients and families information about how genetic conditions may affect them in the future and their risk for a variety of genetic conditions.
- Calculating genetic risk from human pedigrees and interpreting genetic information using probability rules.
- Demonstrate awareness human parasites common in certain localities and other parts of the world
- Classify parasites of medical importance in its broad scientific taxonomic positions.
- Outline and discuss epidemiologic principles of parasitic disease
- Describe and discuss the common parasitic diseases caused by protozoa as regards infective stage, mode infection and life cycle of parasites of medical importance.
- To identify medically important vectors or intermediary hosts and incriminate them in disease transmission
- Main types of microscopy, Development of practical skills in measuring biological variables in a laboratory, recording, collating and analyzing the data statistically and graphically, and preparing concise summaries of the results. Reviewing, interpreting, integrating and discussing the findings in relation to published evidence, and presenting a referenced report as a project dissertation. Perform calculations using mathematical tools.

Skills:

- Procedures for diagnostic medical parasitology. Apply the acquired knowledge in the analysis of biological information presented in different forms (graphical, presentation, etc.); methods of obtaining and researching natural science knowledge for solving standard tasks of professional medical activity.
- To integrate the results and achievements of medical biology, gene technologies, medical parasitology to medical clinical practice of public health. Development of oral presentation skills within a team setting.

Key Tasks to Assess Biology Levels:

- **To Be Able (Application/Understanding):**
  - **Annotated Diagrams:** Draw and label biological processes (e.g., cell cycle, protein synthesis) from memory, explaining the function of each part.
  - **Data Interpretation:** Analyze tables, graphs, and charts to identify trends, relationships, or anomalies in experimental data.
  - **Process Description:** Explain biological processes (e.g., respiration, photosynthesis) in detail, linking structural, molecular, and physiological aspects.

    - **Foundational Quizzes:** Complete multiple-choice questions focusing on scientific method, cell theory, microscopy, and basic biochemistry (e.g., structure of macromolecules).
- **To Be Proficient (Analysis/Evaluation/Synthesis):**
    - **Experimental Design (Planning):** Develop a complete investigation, including hypotheses, independent/dependent variables, controls, and methodology for a biological phenomenon.
    - **Data Analysis & Evaluation:** Critique research proposals or published findings, evaluating the strength of evidence and reliability of conclusions.
    - **Problem-Solving Activities:** Solve complex scenarios, such as predicting genetic outcomes, analyzing pedigree charts, or determining evolutionary relationships.
    - **Practical Skills Assessment:** Demonstrate proficiency in using laboratory equipment (e.g., microscopes, sensors) and conducting experiments, following safety protocols.
    - **Synthesis Essay Questions:** Write detailed, structured essays linking multiple biological concepts (e.g., how photosynthesis, ecology, and climate change are interrelated)

№ 1: Molecular Biology and Genetics

Section Level	«Able» Level	«Proficient» (Proficient)
Biosynthesis	Can build an mRNA chain from DNA and find tRNA anticodons	I can predict the effects of a point mutation (inversion or deletion) on the protein structure.
Genetics	I solve problems of mono- and dihybrid crossing (Mendelian laws).	I solve problems of linked inheritance and crossing-over (building maps of chromosomes).

№ 2: ***Situation***: **The patient has a malfunction of the potassium-sodium pump in the kidney cells.**

Try to solve this complex problem.:

1. What type of transport does this pump belong to?
2. How will this affect the osmotic pressure inside the cell?
3. Why does this lead to rapid fatigue of the body?

№4 : METHODOLOGICAL MATERIALS
DEFINING ASSESSMENT PROCEDURES FOR KNOWLEDGE, SKILLS, AND (OR) THE EXPERIENCE OF ACTIVITIES THAT CHARACTERIZE THE STAGES COMPETENCE FORMATION DESCRIPTION OF INDICATORS AND EVALUATION CRITERIA COMPETENCIES, DESCRIPTION OF ASSESSMENT SCALES

.

Tasks to check the level of learning to BE ABLE and PROFICIENT

To check medical biology learning, use methods that assess knowledge recall and application, such as multiple-choice questions for basic knowledge, Blank Diagrams: Matching, alongside more complex tasks like patient case studies, simulation exercises, and a portfolio of research and clinical reports for proficiency.

Methods and activities of teaching

- **Integrate theory with practice:**

Connect theoretical knowledge to practical applications through case studies, problem-solving, and projects.

- **Promote creative tasks:**

Assign creative and practical projects that require independent thinking, moving beyond simple memorization.

- **Encourage self-study:**

Guide students to use additional literature and resources to review topics and delve deeper into areas of interest.

- **Incorporate interdisciplinary work:**

Explore how biology connects to other fields to prepare students for the interdisciplinary nature of modern science.

- **Foster a positive attitude:**

Use extracurricular activities to build interest and enthusiasm for biology, which can lead to better academic performance.

Current control (CC)

Current (contemporary) control and assessment in biology lessons move beyond traditional written tests and aim to evaluate a wider range of skills, including conceptual understanding, practical application, and scientific reasoning. A balanced approach combines formative and summative assessments to provide continuous feedback and measure overall achievement.

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- **Active participation:** Observe students during classroom discussions and small group work to gauge their understanding of concepts.
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on course
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GRADING SYSTEM FOR STUDENT'S ACHIEVEMENTS
INDEPENDENT WORKS

«Unsatisfactory level»

The student failed to fully review any of the independent work assignment questions (primary and/or secondary). The student refused to prepare the independent work assignment.

«Satisfactory level»

The student has mastered the required course material within the program, but the answers to the questions are not sufficiently comprehensive and accurate; the answers are based solely on data from the primary literature on the subject.

«Good level»

The student has studied the basic literature and he is known with the additional literature related to the program and uses this knowledge in their answers; when answering additional questions, the material is presented correctly, but without sufficient logical sequence; when answering, the student uses the necessary, carefully executed graphic material (diagrams, drawings, etc.); the instructor sometimes requires additional requests for clarifying answers.

«Excellent level»

The student has studied the basic and additional literature on the discipline and competently uses the knowledge gained when answering; in the answers he uses course materials from related disciplines, provides various examples as justification;

During the preparation process, he performs the necessary diagrams at a high level and uses them when responding;

does not need any help from a teacher;

He strives to independently replenish and update the knowledge necessary in his professional activity.

List of Assessment Tools

- Abstracts
- Situational Problems (Case Study)
- Multiple choice questions (Tests)
- Interviews

Grading scales are provided in Appendix 3 of **MEDICAL BIOLOGY Course Outline.**

ASSESSMENT SCALES
GRADING SYSTEM FOR STUDENT'S ACHIEVEMENTS

Grading criteria per discipline				
Maximum score	**Intervals**			
	«unsatisfactory»	**«satisfactory»**	**«good»**	**«excellent»**
Independent work (Abstract) -5 marks (points)	**0-2**	**3**	**4**	**5**
Interval description	The student failed to fully review any of the independent work assignment questions (primary and/or secondary). The student refused to prepare the independent work assignment.	The student has mastered the required course material within the program, but the answers to the questions are not sufficiently comprehensive and accurate; the answers are based solely on data from the primary literature on the subject.	The student has studied the basic literature and he is known with the additional literature related to the program and uses this knowledge in their answers; when answering additional questions, the material is presented correctly, but without sufficient logical sequence; when answering, the student uses the necessary, carefully executed graphic material (diagrams, drawings, etc.). the instructor sometimes requires additional requests for	The student has studied the basic and additional literature on the discipline and competently uses the knowledge gained when answering; in the answers he uses course materials from related disciplines, provides various examples as justification; During the preparation process, he performs the necessary diagrams at a high level and uses them when responding; does not need any help from a teacher;

			clarifying answers	He strives to independentl y replenish and update the knowledge necessary in his professional activity.
Current control – 5 marks (points)	**0-2**	**3**	**4**	**5**
Interval description	The student does not know a significant part of the program material, makes significant blunders; the main content of the material is not disclosed; poor knowledge of terminology; there is no necessary theoretical knowledge and the ability to apply them to solve practical problems. It will be also marked "unsatisfactory" if the student refuses to answer.	The student has mastered only the basic program material, but does not know individual features and details; admits inaccuracies; violates the sequence in the presentation of the program material; the material is not systematized, incorrectly formulated; speech is mostly literate, but poor; has a minimum sufficient level of competence; solves professional practical problems with errors, mainly justifies the decisions made	The student has demonstrated the formation of competencies, has a sufficient level of professional terminology; correctly, logically and essentially sets out the answer, doesn't allow significant errors and inaccuracies when answering questions, but the presentation is sufficiently systematic and consistent; when solving a practical problem, basically justifies the decisions made correctly.	The student has demonstrate d the formation of competencie s and can apply them in professional activities; exhaustively, consistently, competently and logically harmoniousl y presents the answer, without errors; the answer does not require additional questions; good speech, fluency in professional terminology; does not have difficulties in answering when changing assignments; knows how to solve professional

				practical tasks; correctly justifies the decisions, is able to summarize and present the material independentl y
Control score -5 marks (points)	0-2	3	4	5
Interval descript	The student has identified gaps in his knowledge of the educational material provided by the program and cannot give clear answers to basic, additional, and leading questions.	The student has the necessary educational (study) knowledge within the framework of the program, but the answers to the questions are not complete and accurate enough; only data from the basic literature on the discipline is used in the answer.	The student fully discloses the educational (study) material provided by the program, small mistakes are made, inaccuracies that do not distort the content of the answers to the essence of the questions	The student presents the program material in a deep and complete manner at a high scientific level, answers all questions and additional queries with full understandin g and without errors.

90- 85 % – 5 marks (points)
84 – 71 % – 4 marks (points)
70 – 54 % – 3 marks (points)
Less 54 % – 2 marks (points)

Criteria for evaluating tasks in the MCQs form
5 points – 85 - 100% correct answers
4 points – 76 - 85% correct answers
3 points – 60 - 75% correct answers
2 points – 0 - 59% correct answers
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TO PREPARE FOR A LECTURE, students should review the course outline to understand the topic, complete any pre-reading assignments, and download lecture slides to follow along. They should also review notes from previous lectures to ensure they understand how topics connect, organize their notes with clear headings, and set a goal for what they want to learn, such as specific questions to be answered.

Before the Lecture

- **Know the Topic**:

Check your course outline for the weekly topics to anticipate what the lecture will cover.

- **Do Pre-Reading**:

Engage with any assigned readings to become familiar with the material and new vocabulary.

- **Download Lecture Slides**:

If available, download the lecture slides beforehand. You can print them to write directly on them, or use them as a digital template.

- **Organize Your Notes**:

Set up a document or notebook with clear headings like "Date," "Week/Lecture #," and "Lecture Title" for easy organization.

- **Review Previous Notes**:

Go over notes from past lectures to see how the current topic relates to previous concepts.

- **Set Learning Goals**:

Determine one or two questions you want to explore or concepts you want to understand better to set a focus for the lecture.

During the Lecture

- **Be Present and Attentive**:

Pay close attention to the lecturer and minimize distractions, such as turning off notifications on your devices.

- **Take Effective Notes**:

Don't try to write down every word. Instead, focus on paraphrasing and summarizing the main points in your own words.

- **Use Shorthand and Abbreviations**:

This can help you write faster and capture more information.

- **Be Comfortable**:

Make sure you are in a comfortable position to help you concentrate for the entire lecture.

After the Lecture

- **Review and Revise Your Notes**:

Go back over your notes to make sure you've understood the core concepts and to fill in any gaps.

- **Share and Compare Notes**:

Discuss your notes with classmates to get a different perspective and ensure you've captured all key information,

- **Ask Questions**:

If anything is still unclear, reach out to your instructor or attend Q&A sessions to get your questions answered.

AFTER THE LECTURE

The learning process continues after the lecture ends. Reinforce what you've learned to cement it in your memory.

- **Review your notes within 24 hours.** To prevent yourself from forgetting the information, go over your notes shortly after the lecture while the material is still fresh.
- **Fill in any gaps.** Clarify any parts of your notes that are unclear or incomplete. If necessary, compare notes with a classmate or ask your lecturer for help.
- **Discuss with peers.** Reviewing the lecture with classmates can help you process the information more deeply. You can debate ideas and share different perspectives on the topic.
- **Revisit recordings.** If the lecture was recorded, use the recording to re-listen to confusing parts or to refine your notes. Use the pause function to learn at your own pace.
- **Keep practicing.** Continue building your English skills outside of class by watching movies, reading books, or using a language exchange app. This exposure will help you become more comfortable and fluent.

PREPARE FOR PRACTICE CLASS ON BIOLOGY

Thorough preparation for a biology practical class involves understanding the underlying theory, reviewing procedures, and familiarizing yourself with laboratory equipment and safety measures . This hands-on experience reinforces your understanding of biological concepts and develops essential scientific skills.

BEFORE THE PRACTICAL LESSON

- **Study the theory.** Read your textbook and lab manual to understand the biological concepts behind the experiment. You'll get more out of the lab if you understand the purpose of each procedure and what results to expect.
- **Visualize the procedure.** Read the instructions carefully and mentally walk through each step of the experiment. This helps you understand the flow of the process and identify potential points of error.
- **Familiarize yourself with equipment.** Learn the names and proper usage of all equipment you will use, such as pipettes, microscopes, balances, and thermometers. Knowing how to use them correctly will help you feel more confident and efficient in the lab.
- **Plan your data recording.** Before you begin, create a table in your notebook to organize your data. Label the rows and columns clearly with the variables you need to measure and the units you'll use.
- **Review safety precautions.** Be familiar with all safety protocols, including the location of safety equipment and the proper handling and disposal of hazardous materials. You must always wear appropriate personal protective equipment, like safety goggles and a lab coat.

DURING THE PRACTICAL LESSON

- **Read instructions again.** Re-read the instructions one more time before starting. Take note of any specific details, such as exact measurements or timing.
- **Work safely.** Follow all safety instructions and keep your lab area tidy and organized.
- **Document everything.** Record all observations and measurements neatly and accurately in your lab notebook as you work. For microscopic work or dissections, include detailed, labeled drawings.
- **Collaborate effectively.** If you are working in a group, communicate with your partners to ensure everyone understands the procedure. Share tasks and make sure all results are recorded accurately.
- **Ask questions.** If you are confused about a step or unsure of a result, ask your instructor for clarification. It's better to ask a question than to make a mistake that could compromise the experiment.

AFTER THE PRACTICAL LESSON

- **Review your data.** Immediately after the practical, look over your results to make sure they are complete and accurate. Compare your data with your lab partners if appropriate.
- **Reflect on the experiment.** Think about why you performed each step and whether your results made sense. Consider potential sources of error and how the experiment could be improved.
- **Write your lab report.** When writing your report, provide a clear, concise write-up that includes the aim, procedure, results (tables, graphs, and drawings), and a conclusion.
- **Connect theory to practice.** Analyze how the hands-on experience connected to the theoretical concepts you learned in lectures. This will help you solidify your understanding and move beyond simple memorization.

Distance Learning In Biology offers flexibility through online platforms, allowing students to study at their own pace without commuting. While theoretical aspects can be covered extensively, hands-on laboratory components remain a significant challenge in traditional, in-person biology education and require careful consideration or alternative arrangements. Teaching using web technologies: ZOOM, GOOGLE Classroom Platform, TEAMS, WhatsApp chats.