

Al-Farabi Kazakh National University
Faculty of Medicine and Healthcare
Higher School of Medicine
Department of Fundamental Medicine

Schedule for the ISW implementation in the discipline
«Mechanisms of Defense and Health» for 2023-2024 academic year

№	Assignment for the ISW	ISW implementation form	Deadlines (weeks)	Scores
1	Create a case study that includes the concept of three disciplines - biochemistry, microbiology, and immunology.	PPTX (5-6 students in each team)	17 th week	10

For the implementation of the ISW, both the educational literature and sources recommended in the course are used, as well as independently found. ISW is delivered strictly on schedule. In case of good circumstances (if there is documentary evidence), the ISW can be accepted out of schedule.

The case study should consist of:

1. Synopsis/Executive Summary

- Outline the purpose of the case study.
- Describe the field of research.
- Outline the issues and findings of the case study without the specific details.
- Identify the theory that will be used.

2. Findings - identify the problems found in the case by:

- analyzing the problem, supporting your findings with facts given in the case, the relevant theory and course concepts.
- searching for the underlying problems

3. Discussion

- Summarize the major problem/s.
- Identify alternative solutions to this/these major problem/s.
- Briefly outline each alternative solution and evaluate its advantages and disadvantages.

4. Conclusion

- Sum up the main points from the findings and discussion.

5. Recommendations

- Choose which of the alternative solutions should be adopted.
- Briefly justify your choice explaining how it will solve the major problem/s.
- This should be written in a forceful style as this section is intended to be persuasive.
- Here integration of theory and coursework is appropriate.

6. Implementation

- Explain what should be done, by whom and by when.

7. References

- Make sure all references are cited correctly.

8. Appendices (if any)

- Attach any original data that relates to the study but which would have interrupted the flow of the main body

Case study evaluation rubric

Critical elements	Exemplary	Proficient	Needs improvement	Not evident
Main elements	Includes all of the main elements and requirements and cites multiple examples to illustrate each element	Includes most of the main elements and requirements and cites many examples to illustrate each element	Includes some of the main elements and requirements	Does not include any of the main elements and requirements
Inquiry and analysis	Provides in depth analysis that demonstrates complete understanding of multiple concepts	Provides in depth analysis that demonstrates complete understanding of some concepts	Provides in depth analysis that demonstrates complete understanding of minimal concepts	Does not provide any in depth analysis
Integration and application	All of the course concepts are correctly applied	Most of the course concepts are correctly applied	Some of the course concepts are correctly applied	Does not correctly apply any of the course concepts
Critical thinking	Draws insightful conclusions that are thoroughly defended with evidence and examples	Draws informed conclusions that are justified with evidence	Draws logical conclusions, but does not defend with evidence	Does not draw logical conclusions
Problem solving	Actively seeks and suggests solutions to problems	Improves on solutions suggested by other group members	Does not offer solutions, but is willing to try solutions suggested by other group members	Does not to try solve problems or help others solve problems
Research	Incorporates many scholarly resources effectively that reflect depth and breadth of research	Incorporates some scholarly resources effectively that reflect depth and breadth of research	Incorporates very few scholarly resources that reflect depth and breadth of research	Does not incorporate scholarly resources that reflect depth and breadth of research

Example of case

Biological Terrorism: The Anthrax Scare of 2001

Anthrax is a serious infectious disease caused by gram-positive, rod-shaped bacteria known as *Bacillus anthracis*. Although it is rare, people can get sick with anthrax if they come in contact with infected animals or contaminated animal products.

If a bioterrorist attack were to happen, *Bacillus anthracis*, the bacteria that causes anthrax, would be one of the biological agents most likely to be used. Biological agents are germs that can sicken or kill people, livestock, or crops. Anthrax is one of the most likely agents to be used because:

Anthrax spores are easily found in nature, can be produced in a lab, and can last for a long time in the environment.

Anthrax makes a good weapon because it can be released quietly and without anyone knowing. The microscopic spores could be put into powders, sprays, food, and water. Because they are so small, you may not be able to see, smell, or taste them.

Anthrax has been used as a weapon before.

Anthrax has been used as a weapon around the world for nearly a century. In 2001, powdered anthrax spores were deliberately put into letters that were mailed through the U.S. postal system. Twenty-two people, including 12 mail handlers, got anthrax, and five of these 22 people died.

An anthrax attack could take many forms. For example, it could be placed in letters and mailed, as was done in 2001, or it could be put into food or water. Anthrax also could be released into the air from a truck, building, or plane. This type of attack would mean the anthrax spores could easily be blown around by the wind or carried on people's clothes, shoes, and other objects. It only takes a small amount of anthrax to infect a large number of people.

If anthrax spores were released into the air, people could breathe them in and get sick with anthrax. Inhalation anthrax is the most serious form and can kill quickly if not treated immediately. If the attack were not detected by one of the monitoring systems in place in the United States, it might go unnoticed until doctors begin to see unusual patterns of illness among sick people showing up at emergency rooms.

Biochemistry

1. What is the main damaging factor of the anthrax pathogen *Bacillus anthracis*?
2. What components does the exotoxin of this bacterium consist of and what effect do they have on the human body?
3. What is the biochemical structure of the cell wall of the bacterium *Bacillus anthracis*? What explains its incredible resistance to adverse environmental conditions and disinfectants? What substances are capable of destroying it?
3. What antibiotics have ever been developed against *Bacillus anthracis* and which ones are currently being successfully used? Write down their structural formulas and explain their mechanism of action at the molecular level.
4. What inhibitors of the exotoxin of this bacterium exist and how were they developed? Which ones are effective and why?
5. What new potential molecular biological targets (biomolecules) for antibiotics and other drugs can you suggest in this bacterium?

Immunology

1. What type of immune response develops in this pathology? Describe in detail and draw a diagram to show the main steps in the development of the immune response.

2. It is clear that the innate and adaptive arms of the immune response work interdependently to clear pathogens, however key cells also play vital roles in each arm of the response. Indicate a role for the following cells in the immune response in this case.
3. Explain the influence of the treatment of this pathology on the main links of immunity. Draw a diagram to show the main steps in the development of the immune response that occur after treatment.

Conclusion

The lethality of the disease is caused by the bacterium's two principal virulence factors: (i) the polyglutamic acid capsule, which is anti-phagocytic, and (ii) the tripartite protein toxin, called anthrax toxin.

The body's immune system initially detects the presence of anthrax spores by recognizing RNA molecules that coat the spores' surface. But this prompts an unfavorable immune response that hinders the body's fight against anthrax once the spores have germinated into live bacteria, according to a new study.