

**UNIVERSITY OF BOLTON**

**SCHOOL OF CLINICAL AND BIOMEDICAL  
SCIENCES**

**BSC (HONS) MEDICAL BIOLOGY**

**SEMESTER ONE EXAMINATION 2023/2024**

**CANCER BIOLOGY**

**MODULE NO: BIO6009**

Date: Wednesday 10<sup>th</sup> January 2024

Time: 14:00 - 17:00

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**INSTRUCTIONS TO CANDIDATES:**

Candidates are advised that the examiners attach importance to legibility of writing and clarity of expression. **YOU ARE STRONGLY ADVISED TO PLAN YOUR ANSWERS**

There are **TWO** sections in this paper.

**Answer ALL QUESTIONS.**

This examination is **THREE** hours long.

**INSTRUCTIONS TO INVIGILATORS:**

Please ensure all candidates are provided with a copy of the journal article (Section A), and are given access to the notes that they have prepared (Section B). Both of these should be included in the envelope.

Students must not bring in their own copy of the journal article, or their own version of the notes.

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Semester One Examination 2023/2024  
Cancer Biology  
Module No. BIO6009

**Section A: 5 marks per question, 75 marks in total**

Questions in this section relate to the following journal article:

Chen *et al.* (2023). *Plasmodium* immunotherapy combined with gemcitabine has a synergistic inhibitory effect on tumor growth and metastasis in murine Lewis lung cancer models. *Front Oncol.* 2023 Oct 17;13:1181176. (Supplied separately; also provided to you in advance).

If a copy of this article is not provided to you in the examination, please inform an exam invigilator. The answers to the questions below are not necessarily found in the article but are based on topics and methodologies discussed therein. In your answers, please do **not** simply copy sections of the article text to answer the questions.

1. Discuss the rationale for this research. What are the researchers hoping to achieve by carrying out this work?
2. What is the mechanism of action of gemcitabine?
3. The paper states that 'tumor metastasis is a complex process that involves numerous factors and multiple steps'. How does metastasis occur?
4. Describe immunotherapy with a focus on immune checkpoint inhibitors.
5. What is the tumor microenvironment?
6. The paper describes the use of a combination therapy, what is your understanding of combination therapy in cancer treatment and state any potential benefits over monotherapy treatment.

**Please turn the page**

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7. Describe the experimental workflow for the combination therapy of *Plasmodium chabaudi* and gemcitabine in Figure 1(a)?
8. How is SDS-PAGE used to analyse protein samples?
9. The paper describes the use of an allograft murine model. What is an allograft murine model and how does it differ in comparison to a xenograft murine model?
10. Summarise Figure 2(d) in your own words and state what your treatment of choice as tested in the figure would be and why?
11. What is your interpretation of Figure 3(a), what is the purpose of using GAPDH in the Western blots?
12. Discuss the potential mechanism of action of the *Plasmodium chabaudi* and gemcitabine combination therapy in the inhibition of tumor cell EMT as outlined in the study.
13. Describe with the aid of a clearly labelled diagram the antigen-antibody complex formed in Western blotting when using a primary and secondary antibody.
14. In contrast to the present study where *Plasmodium chabaudi* is used for the treatment of cancer, describe using examples how other organisms can promote cancer.
15. In addition to those used in this article, briefly discuss two other therapies that can be used to treat lung cancer.

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**[SECTION A TOTAL: 75 marks]**

## **Section B**

Over the last few months, you have been given introductory lectures in numerous aspects of cancer biology. These can be split into five main themes:

1. The prevention of cancer
2. The onset of cancer
3. The progression of cancer
4. The diagnosis of cancer
5. The treatment of cancer

This can be considered to be a timeline of how a healthy individual can initially be cancer free but can ultimately be in need of treatment for cancer.

With reference to **each** of these aspects, synthesise a detailed narrative of some of the relevant biological aspects for a specific type of cancer of your own choosing.

In your answer, you should include elements of justification (e.g. why was something done?) and critical analysis (e.g. what were the consequences?).

Evidence of extra reading is expected, and you must show evidence of having consulted recent scientific publications in your answer. You are permitted to refer to the **ONE** side of A4 notes (maximum of 200 words) that you made on the topic.

**[SECTION B TOTAL: 75 marks]**

**END OF QUESTIONS**