[SS05]

UNIVERSITY OF BOLTON

SCHOOL OF CLINICAL AND BIOMEDICAL SCIENCES

BSC (HONS) MEDICAL BIOLOGY

SEMESTER ONE EXAMINATION 2024/2025

CANCER BIOLOGY

MODULE NO: BIO6009

Date: Wednesday 8 January 2025 **Time: 14:00 – 17:00**

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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Section A: 5 marks per question, 75 marks in total (you are advised to spend around 90 minutes on this section).

Questions in this section relate to the following journal article:

Huang *et al*. (2024). Cancer immunogenic cell death via pyroptosis with CXCR4-targeted nanotoxins in hepatocellular carcinoma. Front Bioeng Biotechnol. 2024 Nov 4;12:1433126. (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. Figure 2A refers to the measurement of the IC_{50}. What is this? Also, explain in your own words what the results in Figure 2A show.

3. Why has CXCR4 been chosen as a target in the study?

4. What is a targeted therapy and how does it compare to a non-targeted therapy?

5. What is pyroptosis?

6. Why are the two different mouse models (BALB/c nude mice and C57) used in the study?

7. In Figure 2D, what is shown in the upper right quadrant (Q1-UR) for LM3 cells that have been treated with the T22-PE24 nanotoxin?

Please turn the page

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8. How is Annexin V-FITC/propidium iodide used to analyse cells?

9. Why have the authors used the Western blotting technique to analyse caspase-3 and cleaved caspase-3 in the study?

10. What is being shown in Figure 3A and what is the purpose of using GAPDH in the Western blots?

11. What is your interpretation of the graph in Figure 4A?

12. The authors of this paper have used a technique known as an LDH cytotoxicity assay. Explain how this assay allows scientists to study changes in cell cytotoxicity. What results would be predicted if cellular cytotoxicity is lower in one sample compared to another?

13. Why are the authors interested in $CD3^+$ and $CD8^+$ T cells?

14. Summarise in your own words the proposed mechanism of the T22-PE24 nanotoxin in treating hepatocellular carcinoma.

15. In addition to those used in this article, briefly discuss two other therapies that can be used to treat hepatocellular carcinoma.

[SECTION A TOTAL: 75 marks]

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Section B (you are advised to spend around 90 minutes on this section)

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