Examination Candidate Number: _____________

Desk Number: _____________

UNIVERSITY OF YORK
BSc Stage 3 Degree Examinations 2017-18

Department:
BIOLOGY

Title of Exam:
Advanced Topics in Immunology

Time allowed:  2 hours
Total marks available for this paper:  100

This paper has two parts:

Section A: Short Answer / Problem / Experimental Design questions (50 marks)
- Answer all questions in the spaces provided on the examination paper

Section B: Essay question (marked out of 100, weighted 50 marks)
- Answer either question A or question B or question C
- Write your answer on the separate paper provided and attach it to the back of the question paper using the treasury tag provided
- The marks available for each question are indicated on the paper

For marker use only:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total as %


DO NOT WRITE ON THIS BOOKLET BEFORE THE EXAM BEGINS
DO NOT TURN OVER THIS PAGE UNTIL INSTRUCTED TO DO SO BY AN INVIGILATOR

SECTION A: Short Answer / Problem / Experimental Design questions

Answer all questions in the spaces provided
1. Compare and contrast dendritic cells and macrophages by giving three examples each of:

   a) Their similarities: (3 marks)

      1) 

      2) 

      3) 

   b) Their differences: (3 marks)

      1) 

      2) 

      3) 

   the space above this line should be sufficient for your answer

2. T-cell activation is dependent on signal 1 and signal 2. Describe the importance of these two signals in immune tolerance. (4 marks)
3. IgA is the dominant immunoglobulin class at mucosal surfaces.

   a) List three ways by which mucosal IgA participates in host defense in the intestine.  (3 marks)

   b) State two properties of mucosal IgA that make it more suitable than IgG in mucosal immune responses.  (2 marks)

4. Describe the two proposed models by which AIRE induces transcription of tissue-specific antigens.  (4 marks)
5. Explain the concept of epitope spreading in autoimmunity. (5 marks)

6. Immunotherapies are proving promising in the treatment of autoimmune diseases.
   
   a) Discuss the immunological concept that abatacept therapy manipulates. (3 marks)
b) Explain the three principles of human clinical trials that should be adopted into immunotherapy testing in pre-clinical models.

(3 marks)

7. The figure below shows the results of an in vitro assay in which three different populations of ex vivo-isolated CD25+CD4+ cells (A, B, and C) have been tested for their ability to suppress the proliferation of a responder T-cell clone X. As illustrated in the figure, different ratios of T-cell clone X and cells A-C cells have been used.
a) What are the immunological principles of an *in vitro* suppressor assay, i.e. what considerations would you have to take into account when designing an assay as described above? (5 marks)

b) Briefly describe the main findings of the experiment shown in the figure, and explain how you came to your conclusions. (3 marks)
c) Give two reasons that could explain the results with T-cell clone X plus cells C.

8. You wish to investigate whether an immunotherapy that targets follicular T helper cells will prevent type 1 diabetes in humans. You decide to test the immunotherapy in an animal model in which mice have been populated with human immune cells from a type 1 diabetic patient.

a) Of the four animal models shown below, which is the most appropriate for your studies? Explain your reasoning.
b) An ELISA was performed assessing IL-21 concentrations in
serum of animals receiving the placebo or the immunotherapy.

Looking at the data below, explain the rationale for selecting IL-21 as a readout for evaluating the efficacy of the immunotherapy and discuss whether the immunotherapy was successful. (4 marks)

![IL-21 concentration graph]

**c)** As an additional readout for the success of the immunotherapy, you perform immunohistochemical analysis of the pancreas. Considering the data above, what anatomical feature would you expect to be different between the placebo-treated and immunotherapy-treated animals? (1 mark)

**SECTION B: Essay question**

**Answer one question on the separate paper provided**
Remember to write your candidate number at the top of the page and indicate whether you have answered question A or B or C

Mark total for this section: 50

EITHER

A) Discuss why immune responses generated at mucosal sites are distinct from those stimulated elsewhere in the body.

OR

B) Discuss the developmental pathway for B cells and explain how B cells contribute to allergic responses.

OR

C) Discuss the function and role of T regulatory cells and how they can be used in therapeutic approaches against autoimmunity.