# UNIVERSITY COLLEGE LONDON

## University of London

## EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualification:–

*M.Sc.*

**M.Sc. Radiation Biology: Paper 2**

COURSE CODE      :  **RDBL0002**

DATE            :  **29–APR–05**

TIME            :  **10.00**

TIME ALLOWED     :  **3 Hours**

**TURN OVER**

**Please use a SEPARATE ANSWER BOOK for EACH QUESTION**

Standard electronic calculators may by used.

**Answer FIVE questions**

1. Describe the multistage model of carcinogenesis. Describe the role of oncogenes and tumour suppressor genes in the development of cancer. Which types of molecular and cellular effects would you expect after radiation exposure to contribute to the carcinogenic process?

2. What is understood by the term "Bystander effect". Which experimental methods and endpoints have been used to study the bystander effect. Why is it regarded as a paradigm shift in radiation protection?

3. Hypoxia remains one of the major causes of failure of radiation therapy in the radical treatment of head & neck cancer. This appears to be partially overcome during fractionated radiotherapy by re-oxygenation of tumour cells. Describe the possible mechanisms of re-oxygenation in tumours and give the approximate time scale of each. Describe the biological rationale for the use of hypoxic cell radiosensitisers in clinical radiotherapy

4. Describe the principles of antibody-directed therapy. Discuss the potential advantages and technical problems of this approach.

5. Describe the exposure pathway of radon and its daughters in the lung. What is meant by the terms "equilibrium equivalent radon concentration" and the "F-value"? Describe the various methods used for measuring radon and its daughter products in domestic and in occupational environments. What is meant by the term "working level" and "working level months" and how do these relate to lung dose and effective dose?

6. After the Chernobyl accident, the major health consequences were caused by the uptake of radioiodines by very young children. Describe the radioecological processes leading to radiation exposure of the thyroid and the methods used to determine this exposure in the population near Chernobyl. Outline the age dependencies of exposure and of risk of radiation-induced thyroid cancer.

7. Outline the general principles of the comet assay for the measurement of DNA damage. Describe how the assay can be used to measure strand breaks (single and double), interstrand crosslinks and base damage.

8. Define the biologically effective dose in fractionated radiotherapy by its derivation from the linear quadratic dose response curve. In the Chart trial of head and neck cancer, 66 Gy given in daily fractions of 2 Gy resulted in the same local control rate as 54 Gy given in three 1.5 Gy fractions per day to avoid the effect of repopulation. Estimate the tumour stem cell repopulation rate in the conventional daily irradiation protocol assuming that the surviving fraction after a BED of 2 Gy is 0.5 and that accelerated repopulation only takes place after day 28 of conventional radiotherapy.

**END OF PAPER**