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	:	**28-APR-06**
TIME	:	**14.30**
TIME ALLOWED	:	**3 Hours**

06-N0182-3-30

TURN OVER

Please use a SEPARATE ANSWER BOOK for EACH QUESTION

Standard electronic calculators may be used.

Answer FIVE questions

1. Give a description of the key elements of a particle microbeam. Outline the advantages of using a microbeam to study the effects of single α-particles relative to exposures using a conventional α-particle source. Define the radiation-induced bystander response and give two examples of the experimental evidence for this effect.

2. Describe the key steps of the base excision repair pathway. Outline the difference between short-patch and long-patch repair, giving some examples of the key repair proteins involved. Explain why cells which have deficient ssb repair pathways are more sensitive to radiation exposure.

3. Describe the radiochemical mechanisms of the oxygen effect in radiotherapy and the physiological and anatomical mechanisms of acute perfusion-limited and of chronic diffusion-limited hypoxia. Describe some methods to determine the extent of hypoxia in tumours and methods to determine the hypoxic fraction in tumours. Discuss the impact of hypoxic fractions of clonogenic tumour cells on the one hand and of tumour hypoxia measured with PET or pimonidazole staining on tumour radiosensitivity.

4. Describe the concept of anti-angiogenic therapy of cancer and give examples of the experimental data on which this is based.

5. Cancer of the prostate is commonly treated with daily fractions of 2 Gy to 70 Gy. Based on the assumption that the α/β value of prostate cancer is only 2 Gy, rather than the usually assumed 10 Gy, hypofractionation has been introduced with doses per fraction increased to 3 Gy. Estimate the potential gain for equal risk (BED) with α/β for proctitis of 4 Gy using a γ_{50} of 1. Also estimate the risks to treatment outcome if the assumption on which the new treatment was designed, (i.e. the α/β value of 2) was wrong and not different from the α/β value of other tumours (i.e. 10 Gy).

TURN OVER

6. Discuss the evidence that cancer radiotherapy may cause a second cancer in the cured patient. If a second cancer occurs 5-10 years after radiotherapy of the first cancer, which possible causes of the second cancer should be considered? Describe the design of a study to investigate the risk of radiation-induced second cancers after radiotherapy of the first cancer.

7. What types of radiation damage to intrauterine development has been well documented in humans? Draw the dose response curves for severe mental retardation after irradiation in the different stages of pregnancy. Discuss the evidence for the existence of a dose threshold for radiation damage to the developing embryo.

8. List the basic features of the three major groups of tandemly repetitive sequences in eukaryotic DNA. Outline the technique used to detect expanded simple tandem repeat (ESTR) mutations in mouse cells and microsatellite mutations in human families. Describe the advantages and disadvantages of mutation analysis in repeat sequences as a marker for radiation exposure and genetic risk.

END OF PAPER