

OLLSCOIL NA hÉIREANN
GAILLIMH

NATIONAL UNIVERSITY OF IRELAND
GALWAY

M.Sc. in Biomedical Science

Spring Examinations 2001

OPTICS and CELL BIOLOGY

Dr. Pat Morgan
Dr. Gerry Morgan

Time allowed: **TWO** hours.
Answer **THREE** questions.

Q.1 Answer (a) **or** (b).

(a) Describe the arrangement of lenses in a primitive compound microscope. Draw a ray diagram to show the position of the intermediate and final images in such a system and calculate the overall magnification. Give a sketch of a typical optical system used to illuminate the sample and describe how the optical parameters of the illuminating and imaging systems are matched.

(b) What devices can be used to detect images in conventional brightfield microscopy. Describe one type of optical detector in detail paying particular attention to its shortcomings and advantages over other detectors.

Q.2 “While the concept of confocal microscopy has been around for several decades, it has required recent advances in laser and computer related technologies to make the technique available practically.” Discuss this statement with particular reference to the construction and control of a confocal microscope and also to the subsequent analysis of image data.

Q.3 Answer (a) **or** (b).

(a) Describe *in detail* the use of fluorescence-based techniques in any specific area of biological research. (Credit will not be given for discussing areas referred to in other questions on this paper.)

(b) Discuss the nature of fluorescence and outline some possible artifacts and measures taken to overcome them.

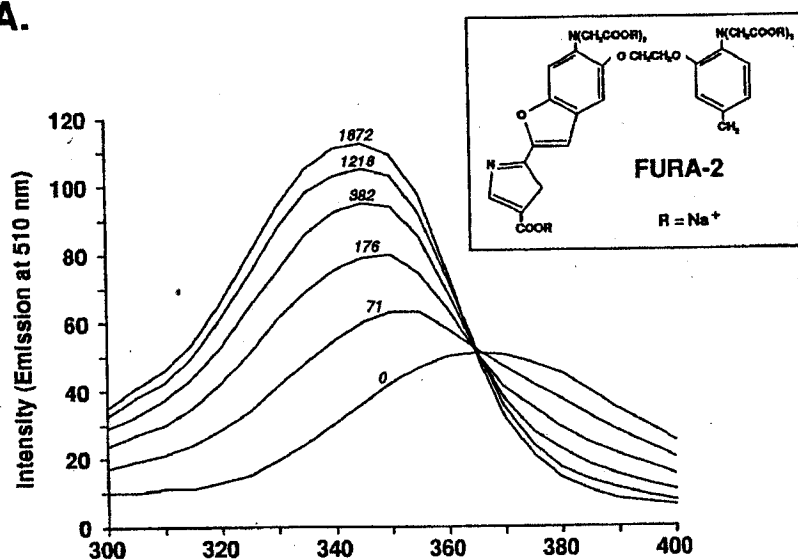
Q.4 "The laser finds many areas of application in biological research apart from its role in confocal microscopy." Discuss with reference to specific examples.

Q.5 Answer (a) or (b).

(a) Discuss in detail the role of the objective lens in optical imaging.

(b) Explain the basis of the standard curves (A and B) in the Figure below for the determination of Ca^{2+} . Outline the important considerations for measurement of Ca^{2+} in cells and discuss the advantages of the ratio method.

A.



B.

