

系級:

姓名:

學號:

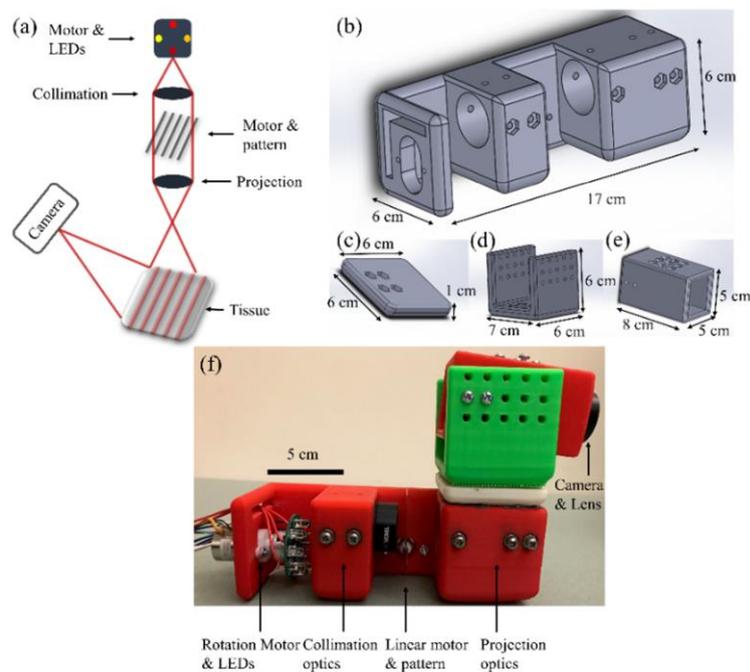
生醫光子學導論 期中考試題

2018/11/07

所有試題參考文獻請務必註明，回答若能以圖表輔助表達為佳。撰寫答案時請使用中文(except you are native speaker of English)，回答問題時勿將參考文獻內容直接複製貼上，須自己理解整理後再行作答。考卷答案請於 2018/11/14 PM 01:20 前繳交。勿牽扯與題目無關之內容，檔名請以系級姓名命名。電子檔請寄至：chiaweisun@nctu.edu.tw 以及 welly.eo06g@g2.nctu.edu.tw。

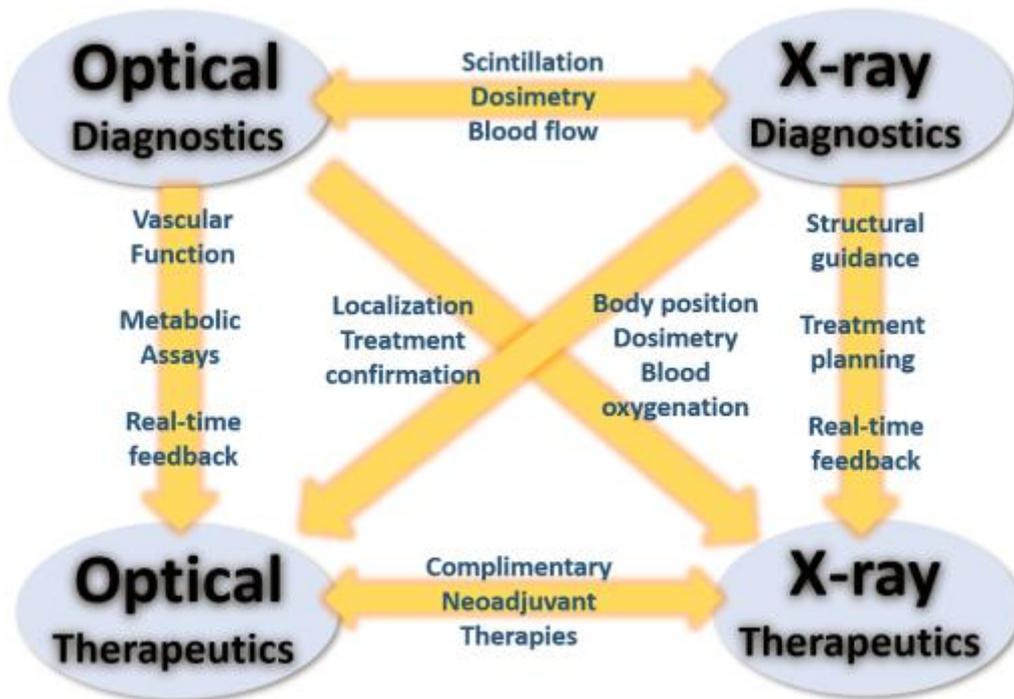
Please send your answer sheet via email to chiaweisun@nctu.edu.tw and welly.eo06g@g2.nctu.edu.tw before 11/14 PM 01:20.

1. Optical properties of tissue may vary in healthy and diseased conditions, therefore optical imaging modalities capable of providing quantitative maps of absorption and scattering properties can assist in characterization of healthy versus diseased tissue. Spatial frequency domain imaging (SFDI) is a wide-field diffuse optical imaging modality that can quantitatively map various optical properties of tissue and has shown potentials in differentiating benign and malignant tissue (shown as figure below).



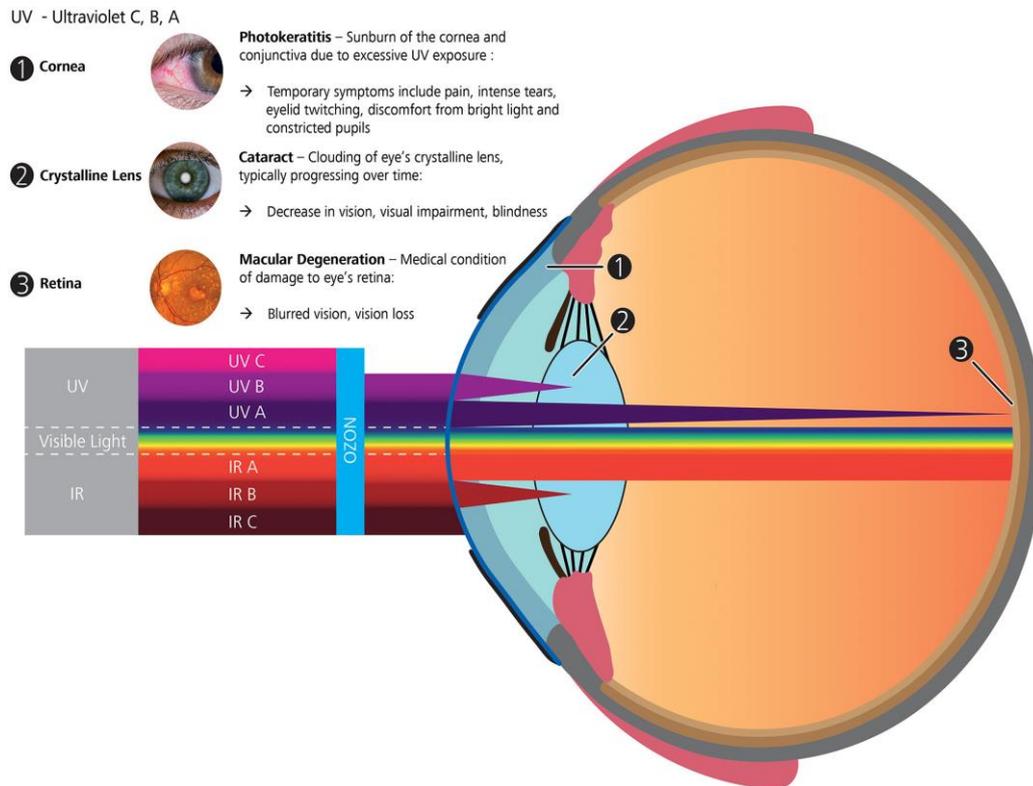
Please describe the **principle** and **applications** of this optical system in detail.
(20 %)

2. X-ray and optical technologies are the two central pillars for human imaging and therapy. The ways in which x-rays can enable optical procedures, or optics can enable x-ray procedures, provide a range of new opportunities in both diagnostic and therapeutic medicine. Taken together, these two technologies form the basis for the vast majority of diagnostics and therapeutics in use in clinical medicine. The figure below illustrates the approaches of the x-ray and optical domains cooperation.



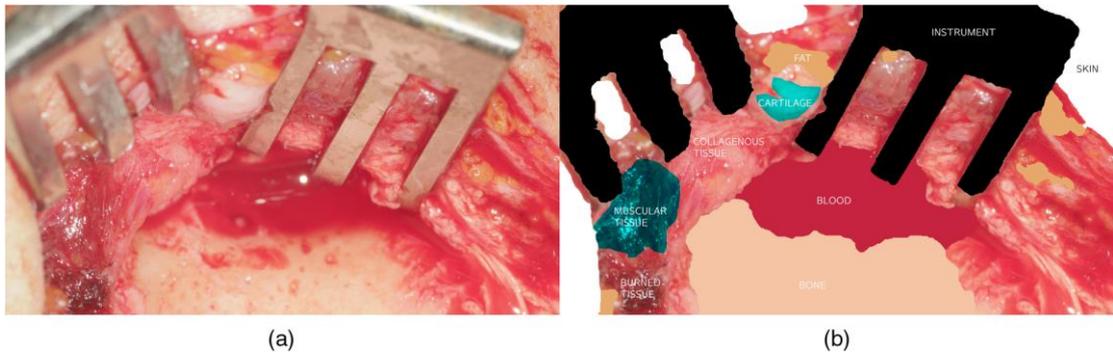
Please discuss the dual-modality theranostics method in detail. (20%)

3. In the eye, ultraviolet radiation (UVR) is not known to contribute to visual perception but to mainly damage multiple structures. UVR carries higher energy than visible light and high dose exposure to UVR causes direct cellular damage, which has an important role in the development of cancer. A schematic diagram of the eye showing the relative propagation of the different optical radiation bands through the ocular tissue.



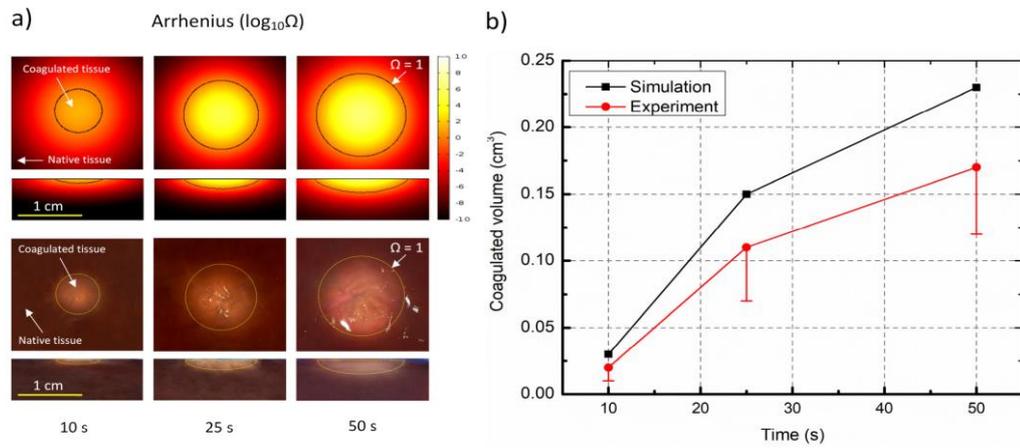
Please discuss the role of the UVR in eye health and its aging process with a main focus on oxidative stress (OA) - induced noncancer diseases in details. (20%)

4. During surgery, a surgeon has to remove pathological lesions, replace abnormal tissue, or reconnect or repair damaged tissue structures, all of this while healthy tissue areas have to be maintained and organs at risk have to stay completely untreated and healthy. The two images below give an impression about the annotation process by the surgeon. (a) The original image is labeled with (b) relevant information for further analysis. Based on the annotation image in (b), the subimages are created for the postprocessing. A similar color used for labeling corresponds to similar tissue types.



Please detailed illustrate why the clinical doctor needs the techniques and what is the operation principle. (20%)

5. Accurate treatment planning and monitoring are critical factors to ensure safe and effective outcomes of laser thermal coagulation (LTC). LTC has been considered a minimally invasive treatment for stereotactic tumors. The figure below demonstrates the coagulated volume expansions with the time when the temperatures were maintained in the pre-determined range.



Please describe the LTC's basic idea and it's application for clinical treatment in detail. (20%)