

Development of Reflection and Fluorescence Hybrid *in-vivo* Confocal Microscope

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1. Introduction

The idea for a confocal microscope was first patented by Minsky in 1957. It is now a very important analysis tool in bio-medical technology, due to its ability of optical sectioning and 3D reconstruction of a specific component in the cell [1]. *In-vivo* confocal microscope has various capabilities which are the acquisition of non-invasive, three dimensional and high resolved images. This technology can be applied to the medical imaging diagnosis, bio-engineering and new drug development.

2. System Configuration

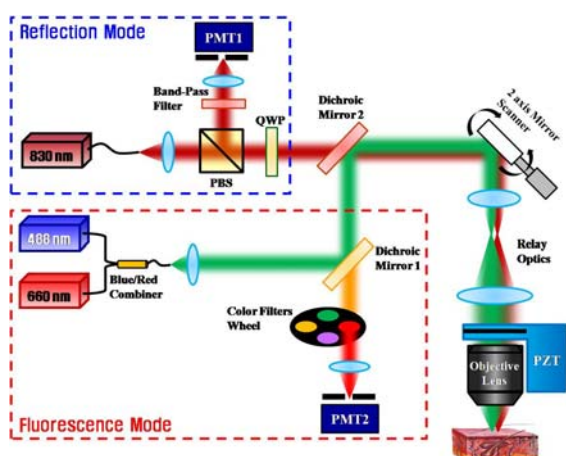


Figure 1 : Schematic diagram of reflection and fluorescence hybrid *in-vivo* confocal microscope

Fig. 1 shows a schematic diagram of reflection and fluorescence hybrid *in-vivo* confocal microscope. To obtain confocal reflection images, we used a linearly polarized diode laser with the wavelength of 830 nm. To acquire confocal fluorescence images, we used two diode lasers with the wavelength of 488 nm and 660 nm, respectively. By using two detectors, we can acquire a confocal reflection image and a confocal fluorescence image independently. Two diode lasers are combined with a fiber-coupler-typed wavelength combiner. Emission signals from a fluorescent specimen are selectively chosen by several band-pass filters. Near infra-red light and visible light are combined or separated with a customized dichroic mirror. With two mirror

scanners which consist of a resonant mirror and a galvano mirror, we can achieve high-speed image acquisition rate. By using an objective PZT scanner, optical sectioning images are able to be acquired. This hybrid system has a broad spectrum from 488 nm to 830 nm. Therefore, optics should correct various optical aberrations. We designed and optimized relay optics with an optical design software (ZEMAX). The three dimensional size of microscope head is 280 mm X 170 mm X 380 mm. In addition, the weight of microscope head is approximately 8 kg. This physical specification is smaller than a conventional table-top optical microscope. In the near future, we will make some basic experiments with bio-specimens. From these experiments, we will acquire various reflection and fluorescence images.

References

[1] C.J.R. Sheppard and D.M. Shotton, Confocal laser scanning microscopy, BIOS Scientific publishers Lim., UK, 1997