

UNIVERSITY OF MALTA

LIFE SCIENCE RESEARCH SEMINARS

Web: <http://www.um.edu.mt/events/scisem/>

Email: scisem@um.edu.mt

Abstract form

Title:	Multiphoton imaging in the life sciences
Presenter:	Dr. Mario Valentino
Contact address:	Department of Pathology, University of Malta
Tel:	2340 2775
Fax:	21310577
Email:	mario.valentino@um.edu.mt
Presentation date:	6 th December 2010

Abstract

Microscopists have always desired to look inside various organ tissues to study structure, function and dysfunction of their cellular constituents. In the past, this has frequently required tissue extraction and histological preparation to gain access. Traditional optical microscopy techniques, which use linear (one-photon) absorption processes for contrast generation, are limited to use near the tissue surface (<100µm) for high-resolution imaging because at greater depths strong and multiple light scattering blurs the images. New optical microscopy techniques have been developed that use nonlinear light-matter interactions to generate signal contrast only within a thin raster-scanned plane. Since its first demonstration over a decade ago, MPM has been applied to a variety of imaging tasks and has now become the technique of choice for fluorescence microscopy in thick tissue and in live animals. Specimens as diverse as lymphatic organs, kidney, heart, skin and brain, can now be examined in detail at depths of up to 1mm, while leaving the tissue intact. Neuroscientists have used it to measure Ca²⁺ dynamics and membrane potentials deep in brain slices and in live animals, neuronal plasticity and to monitor neurodegenerative disease progression. MPM has proved invaluable to cancer researchers for *in vivo* studies of angiogenesis and metastasis, to immunologists for investigating lymphocyte trafficking and to embryologists for visualizing developing embryos.

These types of applications define the most important niche for MPM—high-resolution imaging of physiology, morphology and cell-cell interactions in intact tissues or live animals. We will discuss physical principles, with special emphasis on imaging-system parameters important for deep imaging, and show some applications of 2PLSM for high-resolution imaging obtained from our laboratory and others.