Deep-UV microscopy with lanthanide ions for biomolecular imaging

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ABSTRACT

Deep-UV light is highly interactive with materials. This strong interaction allows biological imaging with high contrast by deep-UV microscopy, whereas such interaction unfortunately tends to cause sample photodamage during measurement [1]. In the last decade, it has become possible to suppress the sample photodamage [2,3], thanks to scientific and technological advances in deep-UV photonics and optics. Such advances include uses of terbium ions for suppressing the sample photodamage under light exposure [4]. This sample protection method has enabled deep-UV resonance Raman imaging of a cell [4,5].

Recently we found that terbium ions could fluorescently label ribonucleic acid at deep-UV excitation [6]. Bright fluorescence from terbium ions conjugated to ribonucleic acid highlights such subcellular structures as the nucleolus and cytoplasm. This labeling technique is easy, quick, and reproducible. Furthermore, it allows combinational use with deoxyribonucleic acid stains for multicolor fluorescence imaging at deep-UV excitation. We will discuss potential usefulness of this combinational labeling for rapid cancer detection using a surgical specimen; optical sectioning of an unsliced tissue block is implemented with a wide-field microscope configuration since deep-UV light does not deeply penetrate into a tissue due to the strong interaction.

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