# Aziza Sudirman

## PhD thesis defence

**Time:** Wed 2014-05-21 10.00 - 12.30

**Lecturer:** Aziza Sudirman

**Location:** AlbaNova, Sal FD5

**Title**

Increased functionality of optical fibers for life-science applications

**Abstract**

The objective of this thesis work is to increase the functionality of optical fibers for possible applications in life-sciences. Optical fibers are a promising technology for use in biology and medicine. They are low-cost waveguides, flexible and have a small cross-section. They can guide high-power light with low loss in a micrometer coresize. These features make fibers attractive for minimally-invasive, in vivo studies. The backwards guidance of the optical signal allows for real-time monitoring of the distance to the scattering targets and to study the environment through Raman scattering and fluorescence excitation. The longitudinal holes introduced in the fibers can be used, for instance, for delivery of medicine to a specific region of a body. They could even be used for the extraction of species considered interesting for further analysis, for example, studying cells that may be cancer-related.

This thesis deals with four main topics. First, a demonstration is presented of the combination of high-power light guidance for ablation, low-power light reflectometry for positioning, and for liquid retrieval in a single fiber. It was found that in order to exploit the microfluidic possibilities available in optical fibers with holes, one needs to be able to combine fluids and light in a fiber without hindering the low-loss light guidance and fluid flow. Secondly, one should also be able to couple light into the liquids and back out again. This is the subject of another paper in the present thesis. It was also observed that laser excitation through a fiber for the collection of a low-intensity fluorescence signal was often affected by the luminescence noise created by the primary-coating of the fiber. This problem makes it difficult to measure low light-levels, for example, from single-cells. A third paper in this thesis then describes a novel approach to reduce the luminescence from the polymer coating of the fiber, with the use of a nanometer-thick carbon layer on the cladding surface. Finally, exploiting some of the results described earlier, an optical fiber with longitudinal holes is used for the excitation, identification and for the collection of particles considered being of interest. The excitation light is guided in the fiber, the

identification is performed by choosing the fluorescent particles with the appropriate wavelength, and, when a particle of interest is sufficiently near the fibertip, the suction system is activated for collection of the particle with good specificity.

It is believed that the work described in this thesis could open the doors for applications in life-sciences and the future use of optical fibers for in vivo studies.



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