

# APPLICATIONS OF THE OPTO-FLUIDIC RING RESONATOR FOR DNA METHYLATION ANALYSIS AND MICROFLUIDIC LASER DEVELOPMENT

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## ABSTRACT

For several decades, optical ring resonators have played an important role in the field of telecommunications. Within only the past decade however, ring resonators have been applied for the purposes of biological and chemical detection by means of refractometric signal transduction. The advantage of ring resonator-based sensing is that, unlike fluorescence detection, it is label-free and can yield quantitative data. This document presents the fundamental operation of the versatile opto-fluidic ring resonator (OFRR) and explores its applications in DNA methylation analysis. Using affinity assays based on anti-5-methyl cytosine antibodies as well as the methyl binding protein MBD-2, it is shown that the OFRR is a promising tool for biomedical research that can discriminate the extent of DNA methylation.

As a part of evolving this and other devices towards a practical laboratory and clinical tool, it is important to consider methods for integrating optical functionality onto a compact chip. Towards this end, we also investigate the ability of PDMS-based ring resonators to provide tunable on-chip microfluidic lasers. This idea is explored by looking at two different ring geometries. Very low lasing thresholds are demonstrated.