Design of an Implantable Biosensor for Real-Time *in vivo* Measurements in Aquatic Organisms

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Aim of this study

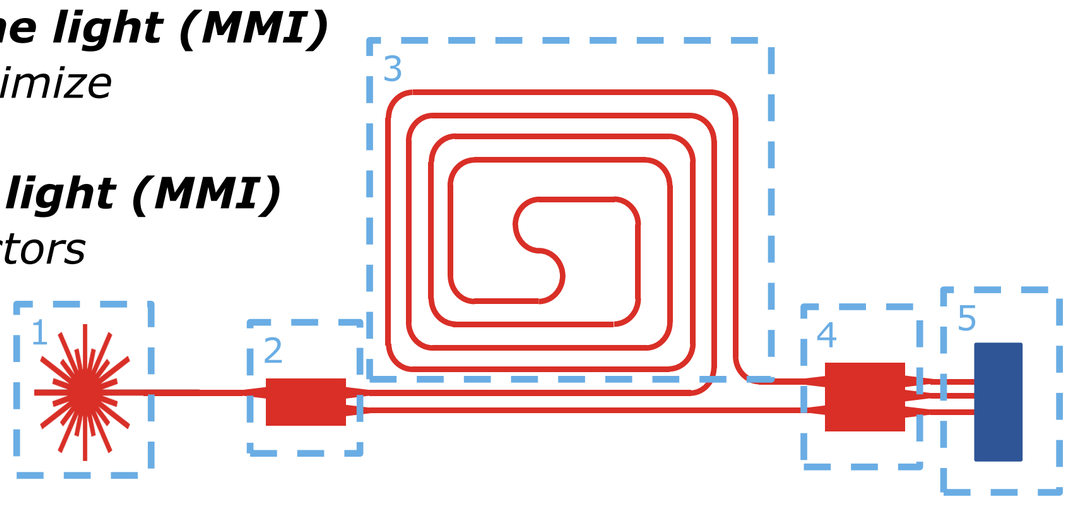
We present a design for a chip that could be integrated on an in vivo biosensor for real-time monitoring of biomarkers in the blood of fish and shellfish. The current design targets IL-6 but the chip can easily be adapted to measure other biomarkers, provided that a suitable receptor is available that is receptive for adequate concentrations, such as cortisol. This implantable sensor would represent a valuable tool for researchers and practitioners in aquaculture and in the field.

Why photonic integrated circuits?

- High emerging field
- Aluminium oxide, supports wavelengths with low absorption in water
- Biocompatible
- High sensitivity
- Low limit of detections
- Multiplexing capability

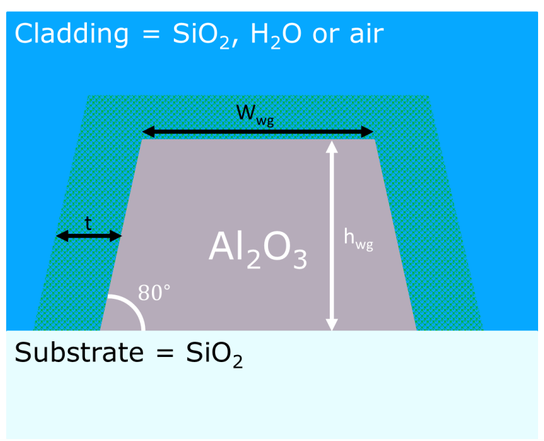
Top view of the photonic integrated circuit of the sensor:

1. *Laser source*
2. ***Splitting of the light (MMI)***
3. ***Spiral**, to maximize sensing area*
4. ***Recombining light (MMI)***
5. *Read out detectors*



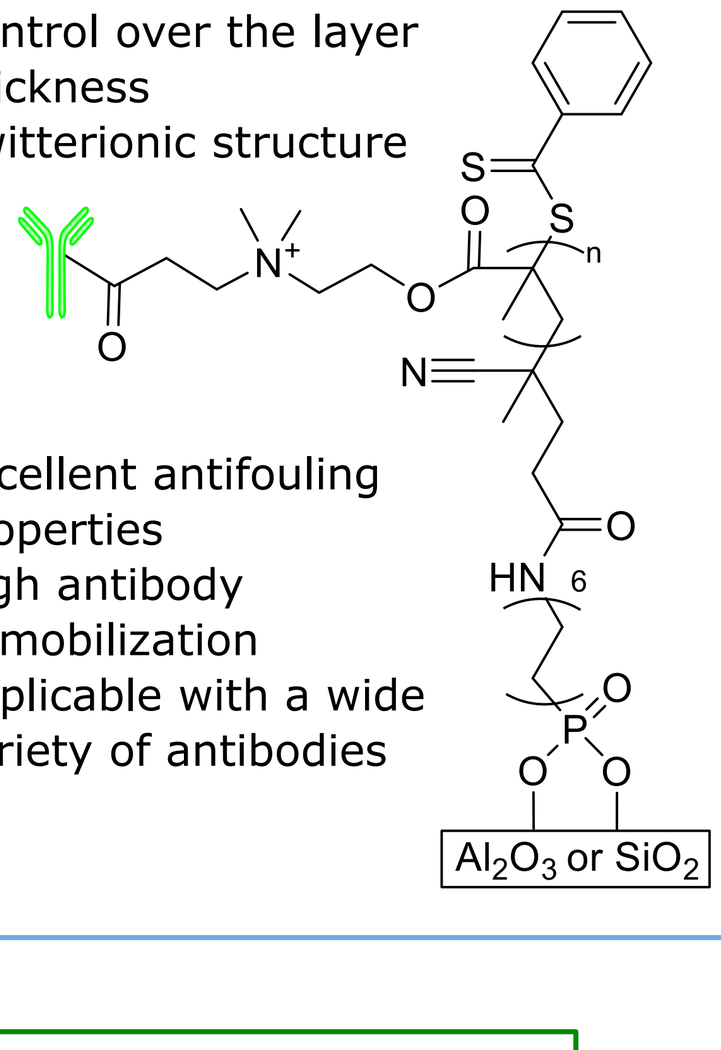
Sketch from the **cross section** of the waveguide →

t (polymer brushes)≈50nm
w_{wg}=800 nm
h_{wg}=450 nm



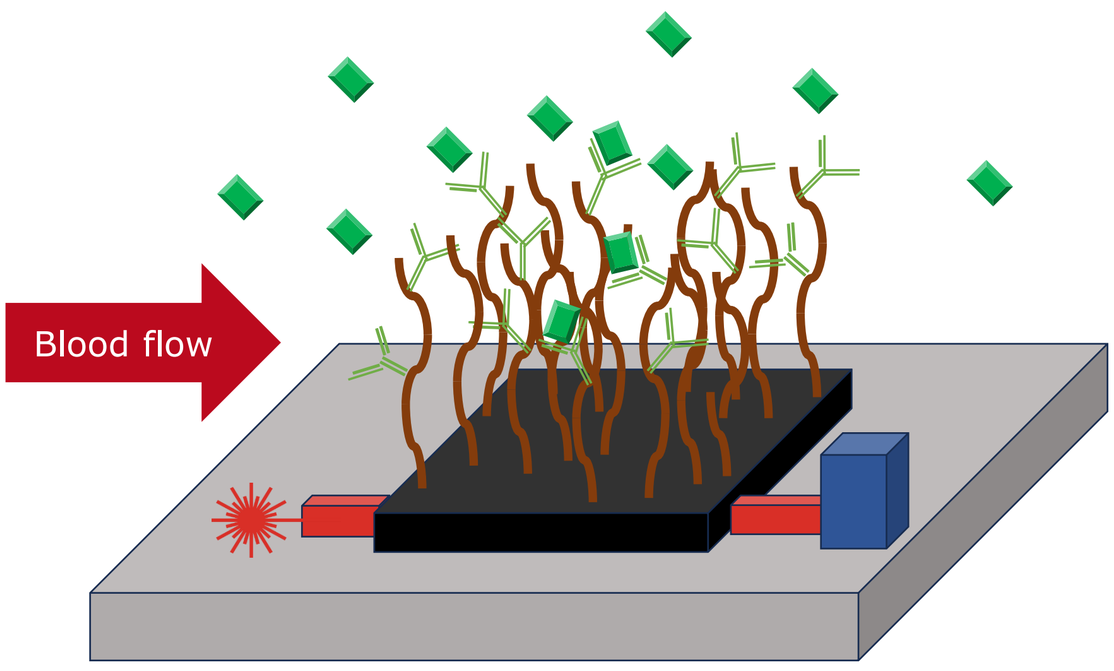
Why this antifouling coating?

- Directly applicable on aluminium oxide
- Control over the layer thickness
- Zwitterionic structure



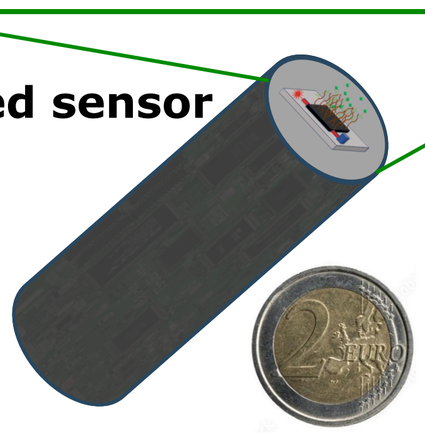
- Excellent antifouling properties
- High antibody immobilization
- Applicable with a wide variety of antibodies

Sketch of the proposed sensor chip



Schematic drawing:	Schematic representation of:
	Antigen (*IL-6*)
	Antibody (*IL-6*)
	Laser source
	Waveguide (Al_2O_3)
	Detector
	Optical system
	Polymer brushes
	Substrate (SiO_2)

Sketch of the proposed sensor



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