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Multimodal Photonic Crystal Biosensors

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Photonic Crystals are the culmination of many fascinating developments in Physics, such as Bragg mirrors, Bloch modes, and bandstructures. Their ability to control the flow of light has given rise to many applications, ranging from light emission to optical switching and light trapping in photovoltaics [1]. Here, we discuss a novel sensing & imaging architecture, whereby the localised guided mode resonances of the photonic crystal can be considered the pixel of an image [2]. This combination adds an exciting new imaging modality to the biophotonics toolkit, which allows us to image both cells and the biomarkers they secret in real time. Thinking of each resonance as an imaging pixel also provides a very simple readout mechanism, where we have now demonstrated nanomolar sensitivities with a device that, in principle, can be made for £10 (Fig. 1) [3]. Furthermore, we note that silicon photonic biosensors do not tend to exploit silicon's obvious ability to conduct electricity, and we demonstrate the first hybrid silicon photonic - electrochemical biosensor [4].

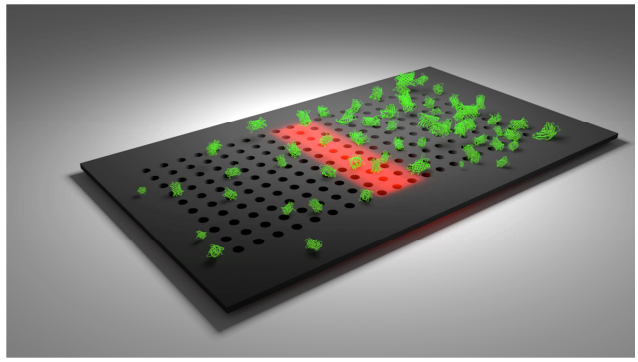

Fig. 6. Artist's impression of a photonic crystal biosensor that affords a simple camera readout, as the resonance is localised in a certain part of the photonic crystal depending on the local refractive index; as the index changes due to, e.g. the attachment of biomolecules, the resonanace moves to a different position on the chip.

References

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