Dissolved oxygen sensing using an optical fibre long period grating coated with hemoglobin

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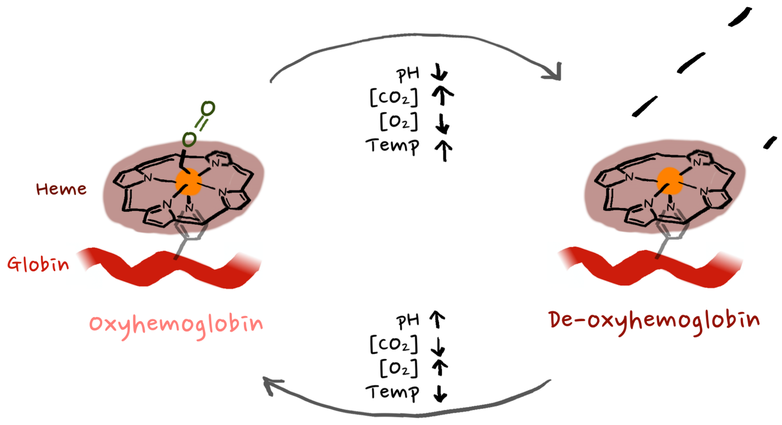
Hemoglobin chemistry

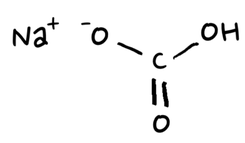
Hemoglobin is a biological carrier of both oxygen and carbon dioxide through the blood stream. In clinical practice this can be tracked using Pulse Oximetry to measure blood oxygenation.

However, pulse oximetry measures only O_2 content not the other factors affecting hemoglobin's ability to carry oxygen.

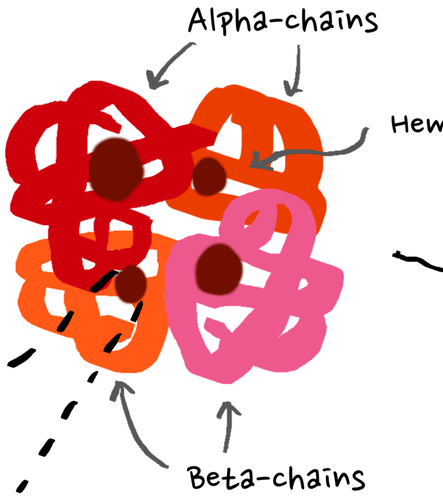
Using hemoglobin itself as the sensing component aims to take all other factors into account.



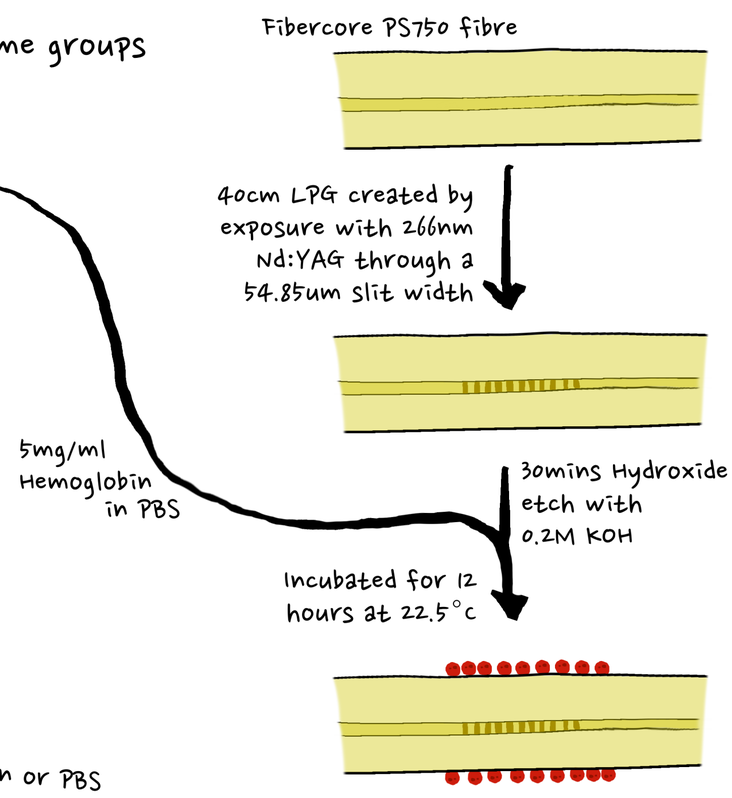
One well established method for changing this relationship is via the addition of sodium bicarbonate.

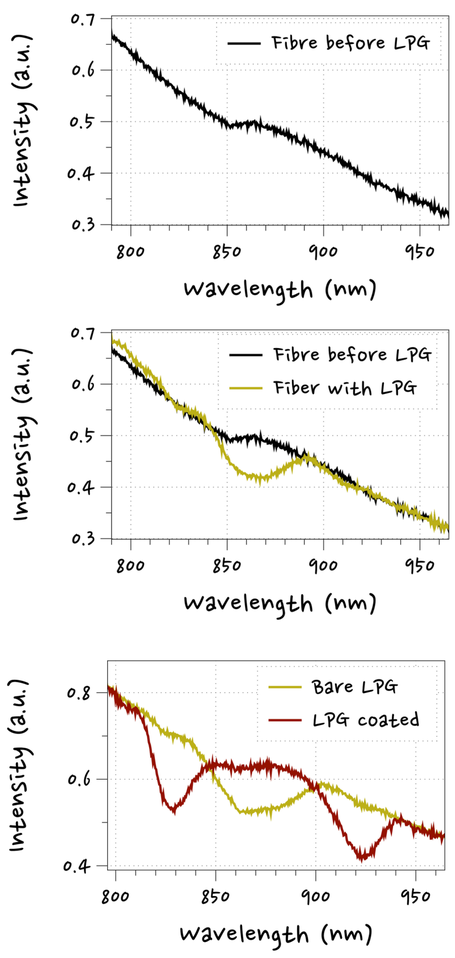


Sodium bicarbonate alters the balance to make oxyhemoglobin more favorable. Solutions without bicarb will have a mix of de-oxy and oxyhemoglobin, where as solutions with bicarb will be mostly oxyhemoglobin.

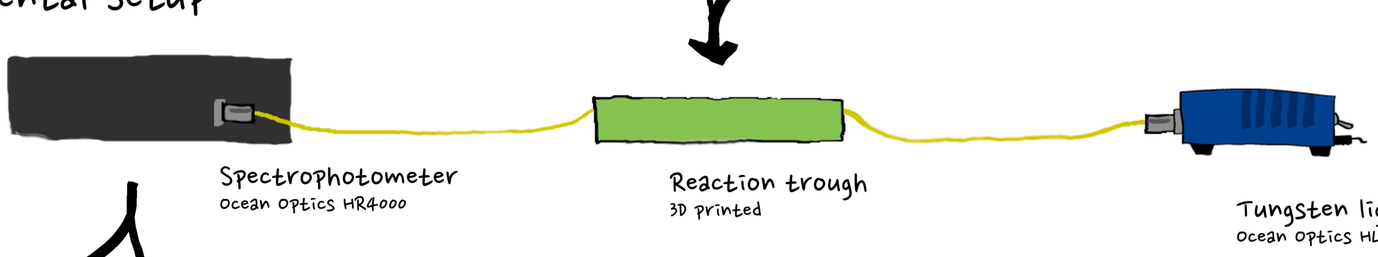


Long period grating (LPG) sensor fabrication

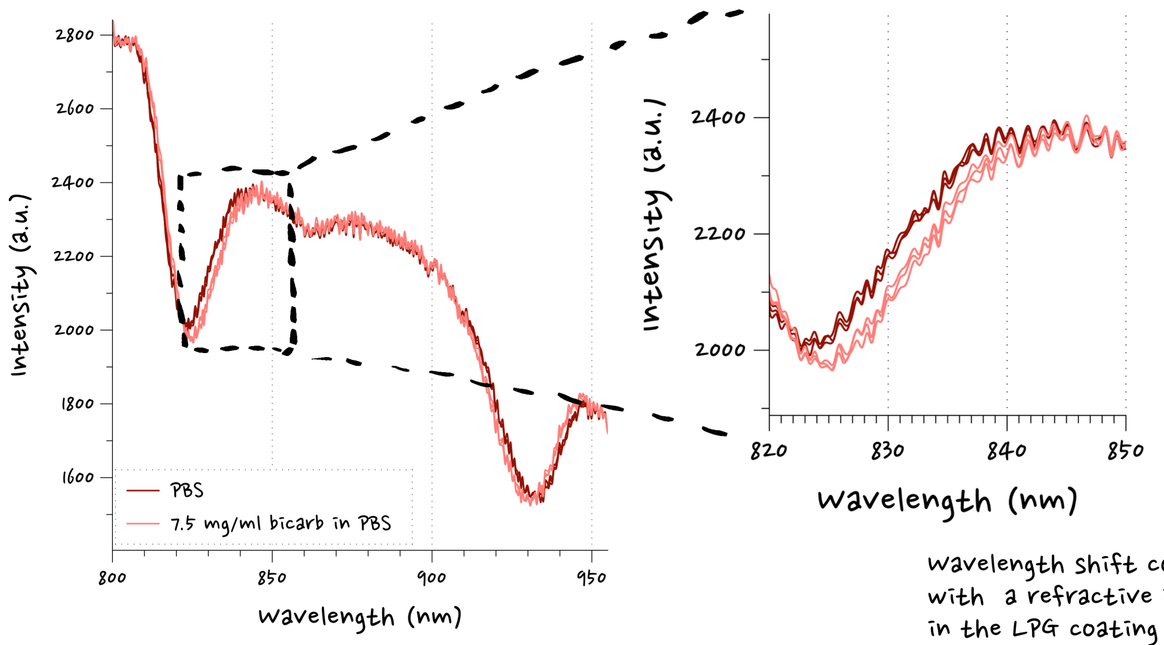




Experimental Setup

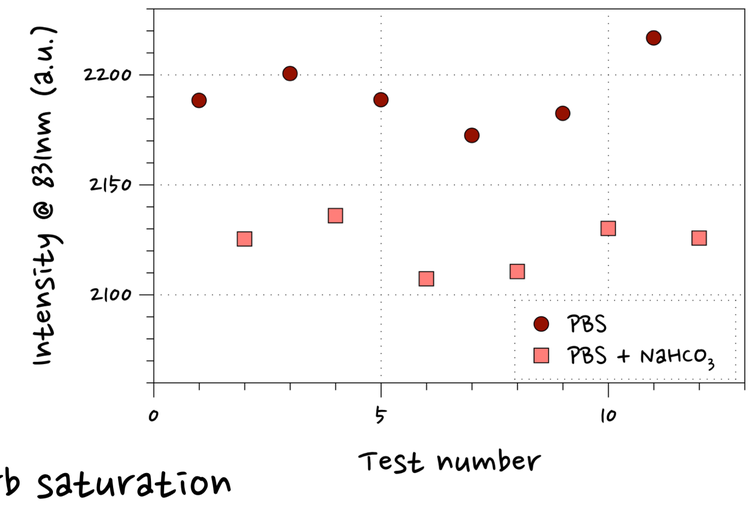


Raw spectral change

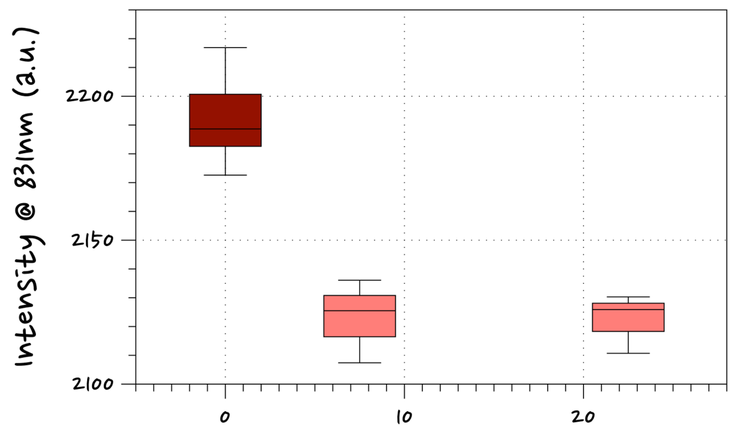


Wavelength shift consistent with a refractive index change in the LPG coating

Re-usability



Bicarb saturation



What's next?

We've demonstrated that a hemoglobin based LPG sensor can work and that we can use hemogoblin as a resusable optical oxygen sensor. At this stage we are looking at the shift from preferntially oxygenated (sodium carbonate) to partial de-oxygenation (PBS).

Future work will now focus on testing this sensor with more conditions (further dilutions of sodium bicarbonate) and other dissovled oxygen based reagents. For example sodium dithionite will produce a shift to de-oxygenated hemoglobin. We also hope to try this sensor in-vitro blood samples. Ideally we hope one day to take this sensor through development to being a live in-vivo sensor than can provide continuous patient monitoring.

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