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# Case Study

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## Probing Metal Ions in the Body

### DEVELOPING METAL IONS SENSORS

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Metal ions are vital in most of life's processes. Their crucial role in cellular function means that a change in the level of metal ions in the body is often associated with diseases.

Fluorescent metal ions sensors offer the potential to answer biological questions e.g. how do metal ion concentrations change in response to cellular events, environmental changes, or onset of disease or how do cells regulate metal dynamics, and how do metal dynamics impact cellular function?

To gain a deeper understanding into the dynamic roles that metal ions play in regulating our health and disease, it is important to develop new sensor technologies that can be used to probe metal ions within the body.

For a sensor to be used within the body, it needs to be non-toxic and small, while requiring only a minute sample, to produce a rapid and accurate response.

In addition, at a real advantage are reversible sensors, where the sensor can be made to turn 'on' and 'off' using a switch of some kind.

Reversibility means that multiple measurements can be made without the need to change the sensor. This permits continual and non-invasive study, while also increasing the sensor's useful lifetime.

In our efforts to investigate these metal ions, we have recently developed new metal ion sensing molecules that have two parts, each with specific functions.

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One part changes its structure, opening to become fluorescent and closing back to its colourless form when exposed to visible light. The other part can be tailored to bind different metal ions. When metal ions are bound, they lock the chemical in the open form, which then fluoresces.

Treating the complex with white light drives off the metal ion and reverts the sensor chemical to its starting state, ready to be used again. This switching can be done many times without losing reliability or sensitivity.

We have also developed ways of combining these molecules with liposomes for biocompatibility. Adding such molecules to our sensing devices is important as it gives us the ability to control our sensing devices with the flip of a light-switch.

Incorporating the custom designed light-driven molecules into sensing platforms such as micro-structured optical fibers and nanoparticles, represent advances in developing fast, sensitive ion sensing methods that will eventually allow us to create exciting new 'windows into the body'