Reversible sensing with a flip of the switch

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Given the intricate relationship between metal ions and reproductive biology, there is a need to develop new metal ion sensors that can provide rapid/real-time information, are reusable and capable of continuous or repeated measurements. In this context, sensors with 'photoswitchable' properties where ion sensing can be turned 'On' and 'Off' with different wavelengths of light, would allow for multiple measurements to be made on a single sample without the need to change the probe. This is a highly desirable property in biological experiments, where sample availability and volumes often limit the number of experiments that can be performed.

The recent advances made by our group in developing nanoliter-scale regenerable ion sensors, include in particular, sensors that are coupled with microstructured optical fibre (MOF). Here, the air holes of the MOF are functionalized with a specific photochromic molecule, to yield a switchable sensor that can detect metal ions such as zinc and calcium, down to nanoliter-scale volumes, where ion binding is turned on and off on upon irradiation with light. Unbound ions are readily flushed from the fibre in the 'off' state to allow the sensor to be reused. The integration of an ionophore into the sensor paves the way for the development of highly specific light-based sensing platforms that are readily adaptable to sense a particular ion. This work represents advances in both fibre sensing technology and in developing new tools for answering biologically related questions.