Photoactuated Ionogel Microvalves for Water Quality on-Chip Analysis

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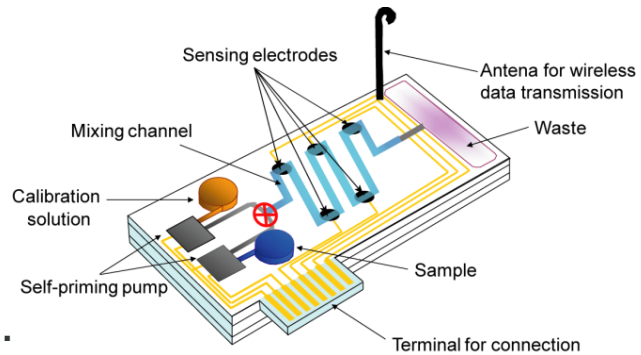
Research Objectives

- **Integration of actuators developed in Task 3.7 into a microfluidic platform:**

-biomimetic structures with detectors
-fluidic manifolds
-integral reagent addition and calibration standards
-integral electronics
-communications and power generation/storage



- **Demonstration of fully functioning analytical platform.**

- **pH and turbidity** - indicate that corrective action and investigation is required before it becomes a potential risk

- associated with outbreaks of *Cryptosporidium* (Carlow in 2006 and Galway City in 2007)

- **nitrite** - in public health terms is essential as prolonged exposure can lead to a potential health risk

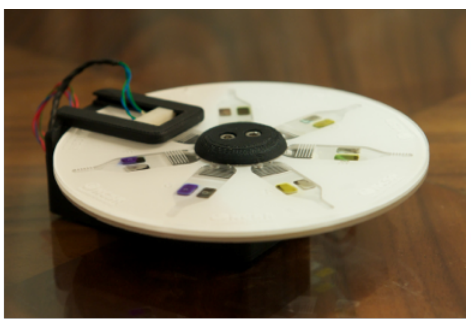
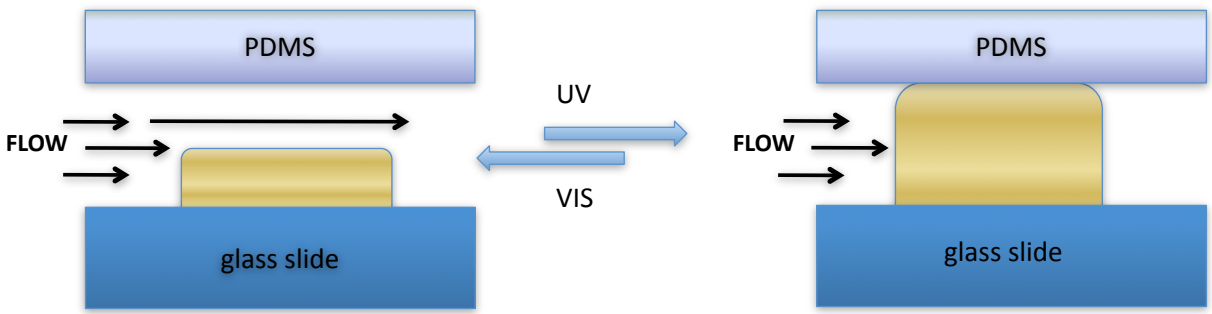
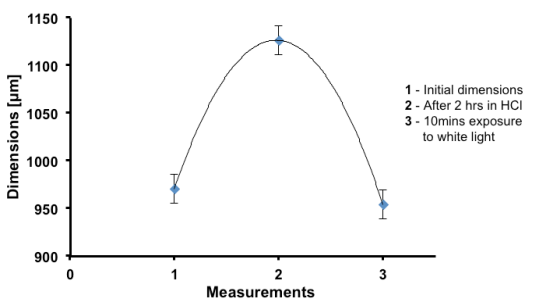
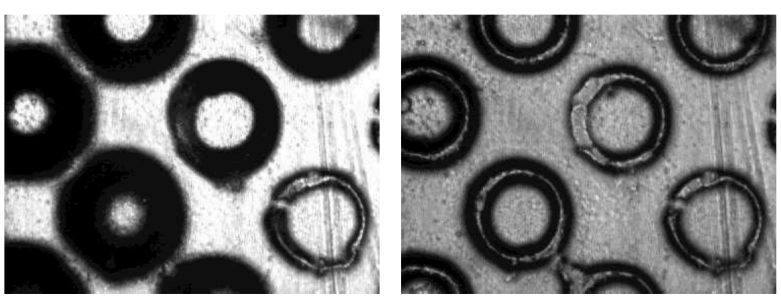


Photo-responsive micro-valves

- Photoswitchable materials - the use of non-contact, non invasive stimuli.
- Ionogels containing spiropyran moieties with photochromism properties.
- Protonated spiropyran ionogels exhibit a drastic swelling effect.
- Shrinking process of the ionogels happen upon white light irradiation.

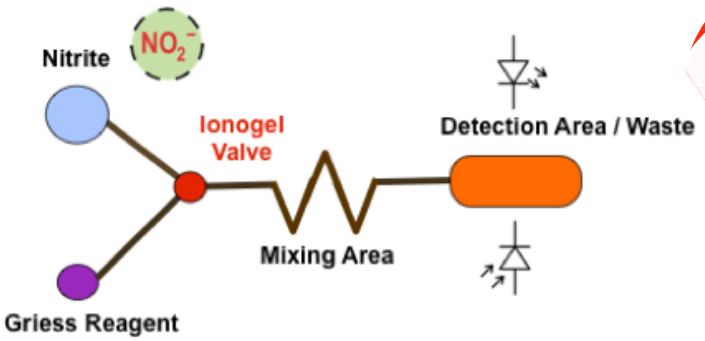


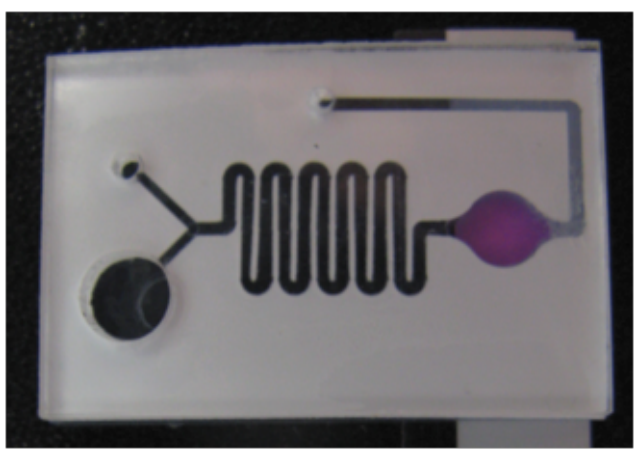


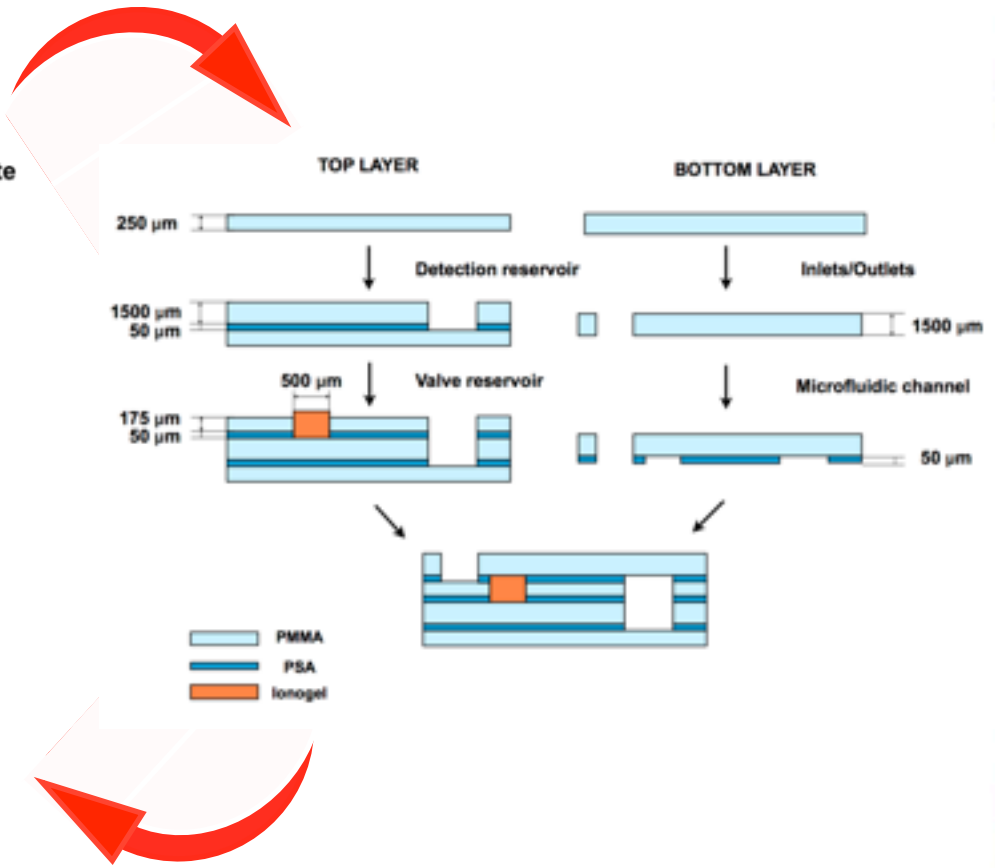


Linear dimension change - 44%

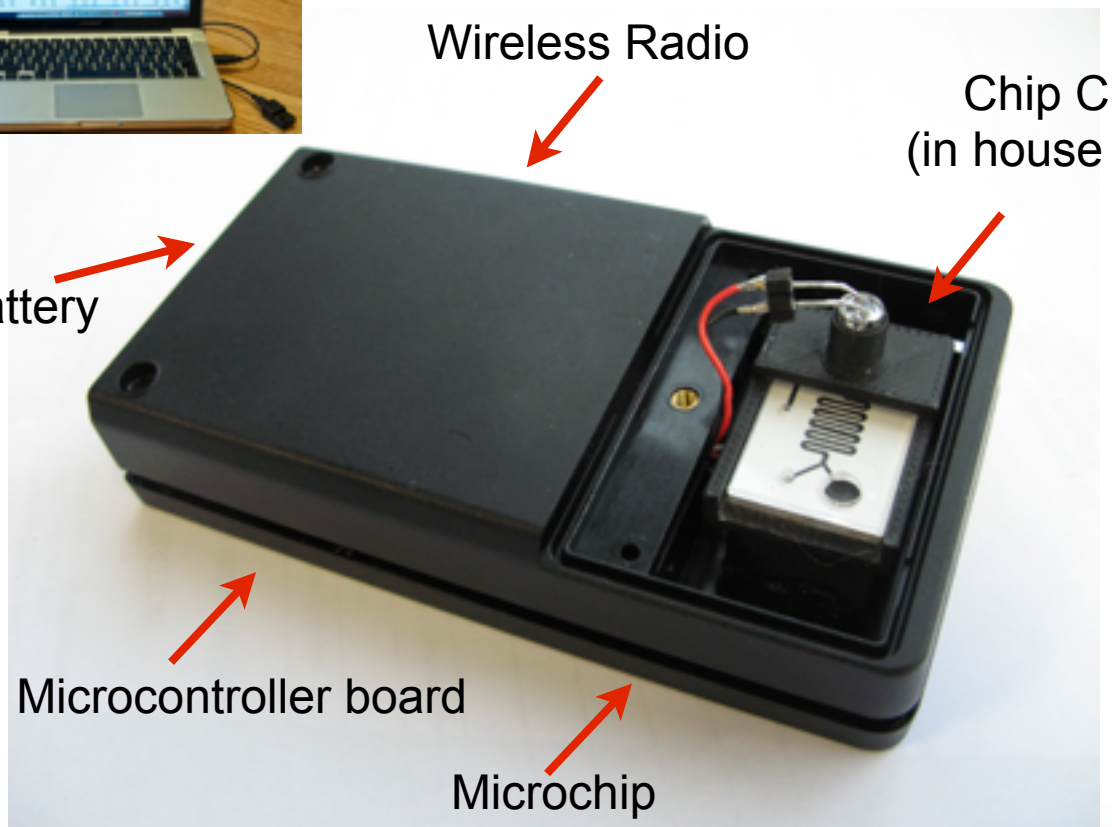
Nitrite detection micro-fluidic device

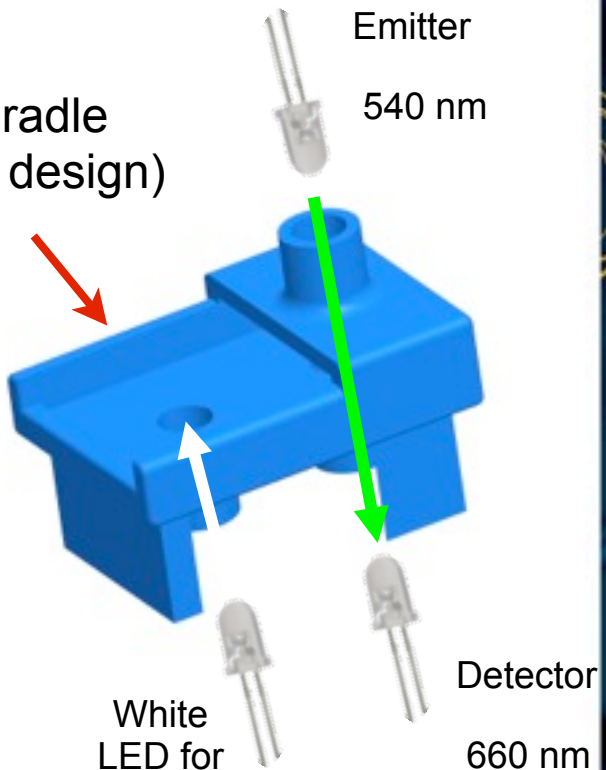






Nitrite detection system





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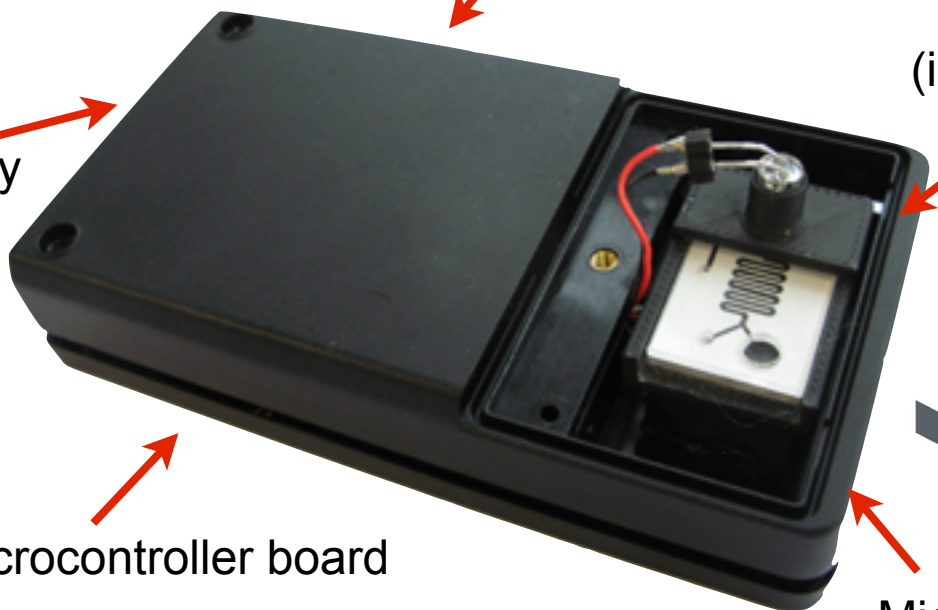
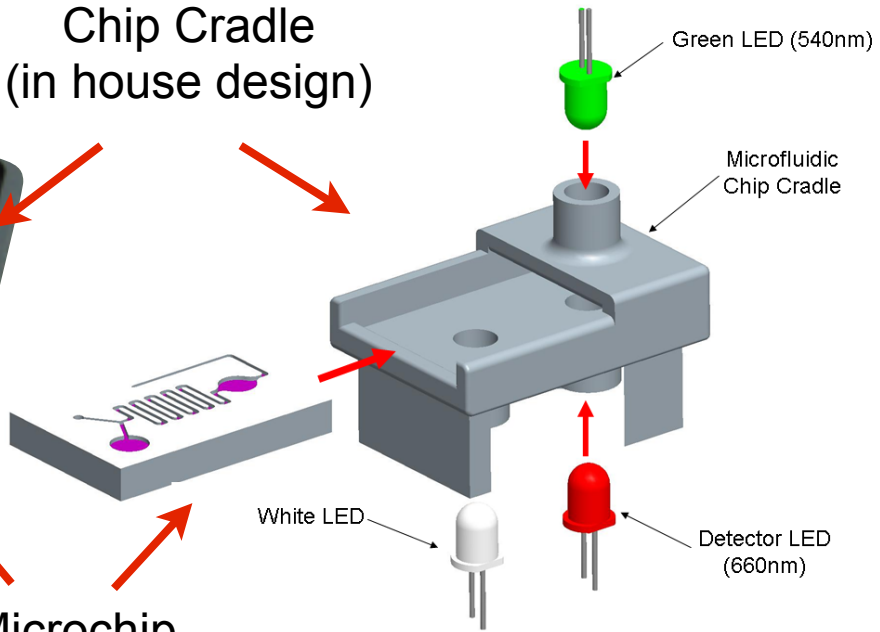
Nitrite detection system

Wireless Radio

Chip Cradle
(in house design)

Battery





Microcontroller board

Microchip

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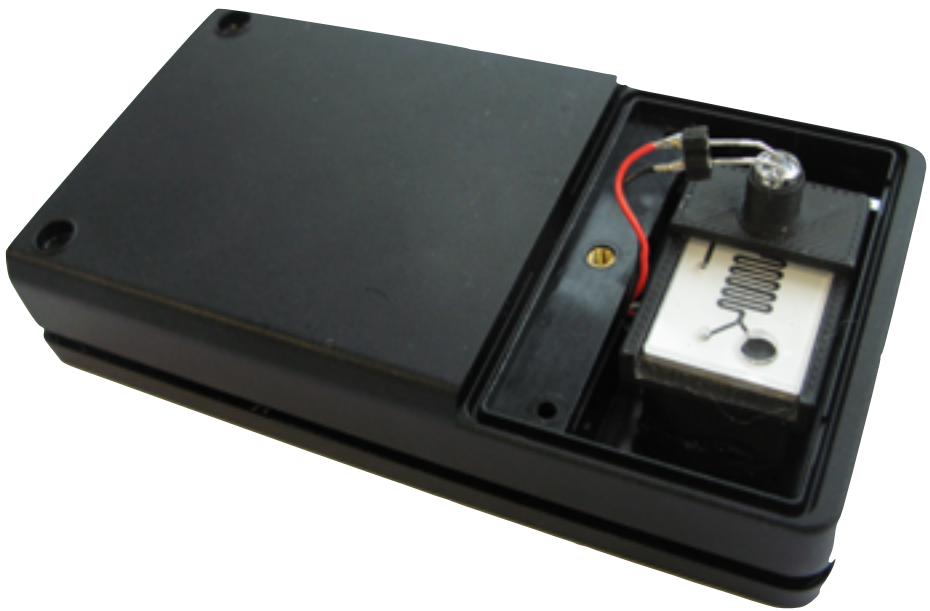

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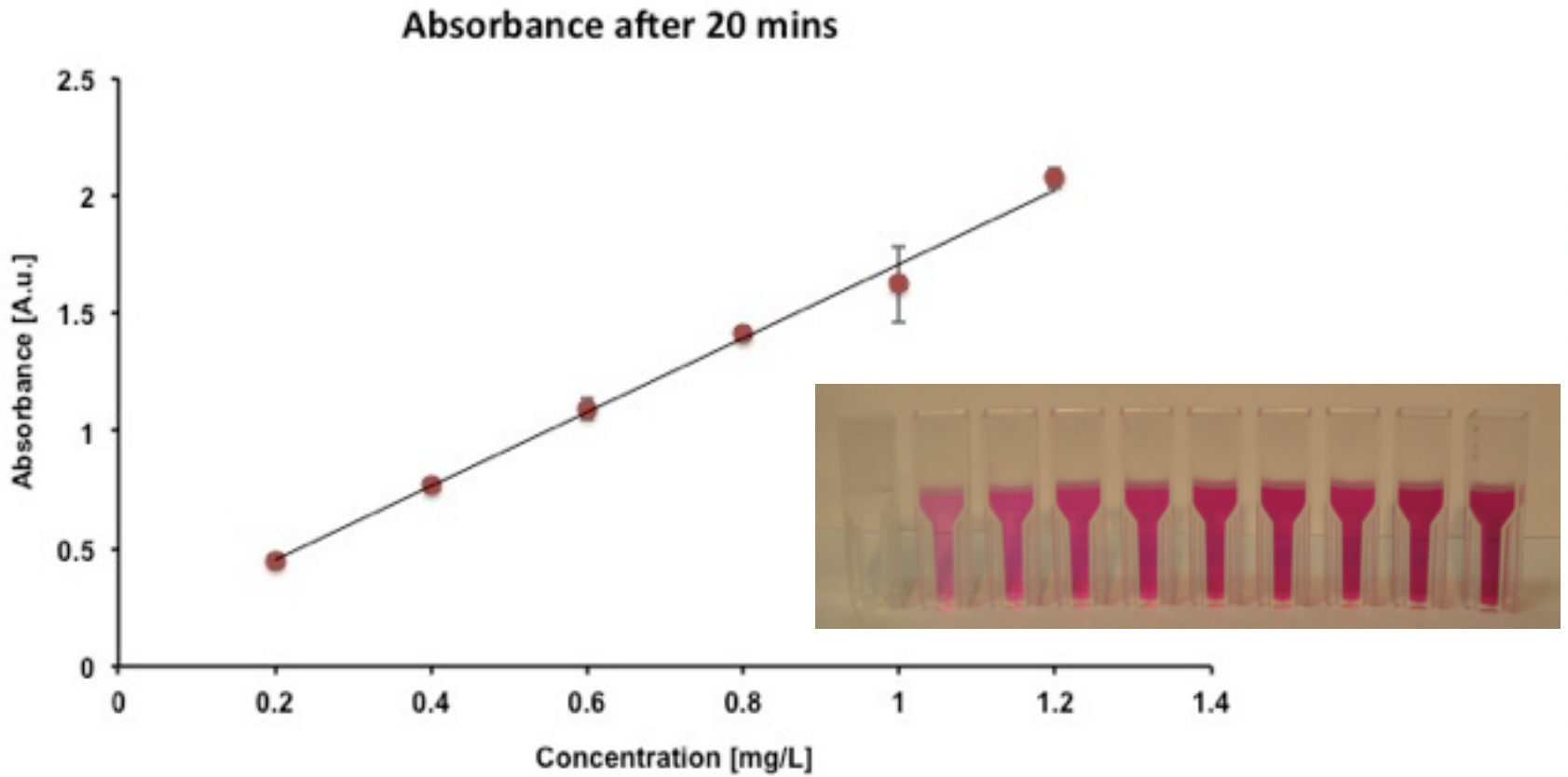
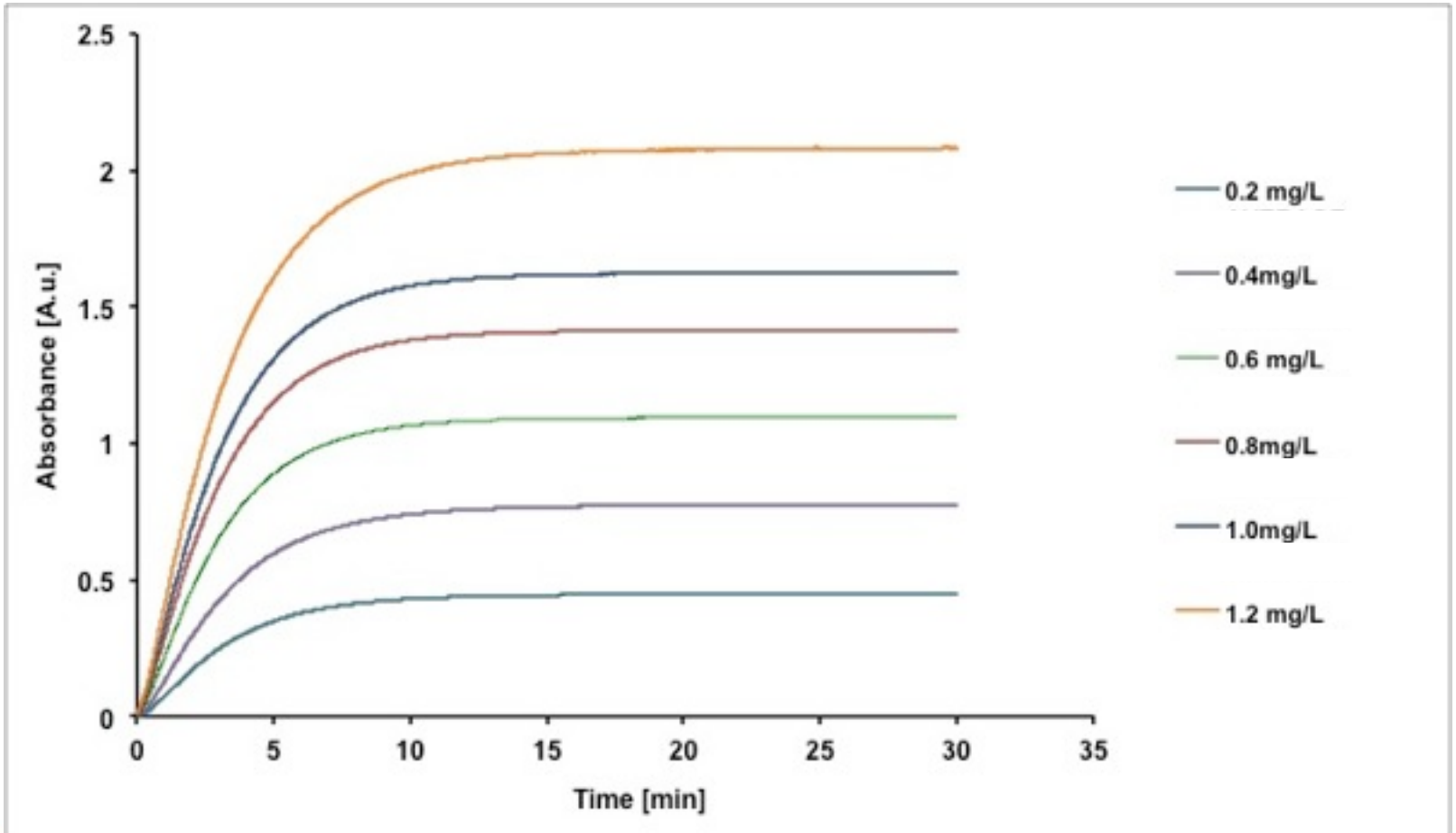
Method validation (off chip)



Concentration range of NO_2: 0.0 - 1.2

Method validation (off chip)



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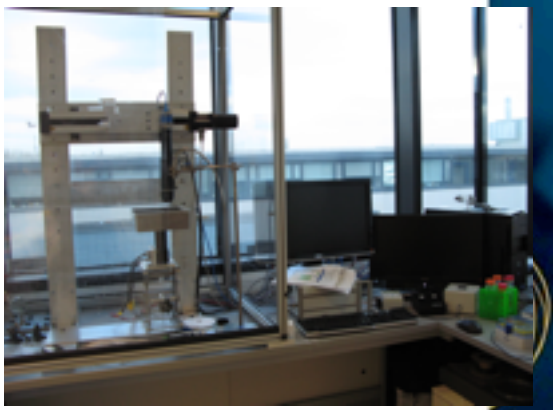
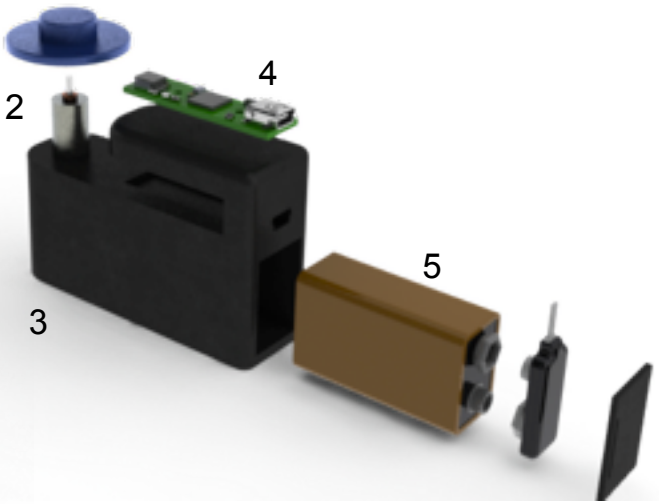
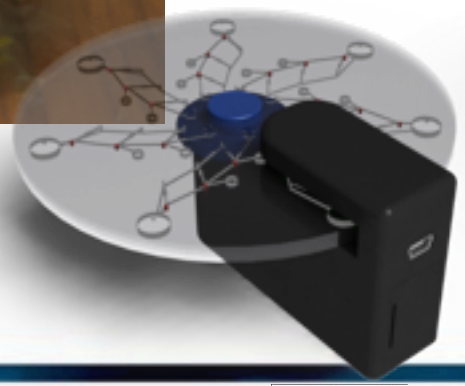
Centrifugal Disc System

- Low cost single use microfluidic device.
- Multiple samples analysis in a single microfluidic device.
- Multiplexing capabilities (pH, turbidity, nitrite,...).
- Portable system: sample analysis at the point of care.
- Wireless communication system.







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Training & Outreach

Conferences

- **MicroTAS**, The 15th International Conference on Miniaturized Systems for Chemistry and Life Sciences, 2-6 Oct 2011, Seattle, USA (ORAL)
- **Marie Curie Researchers Symposium**, SCIENCE – Passion, Mission, Responsibilities, Polish Presidency of the EU Council 25-27 Sept 2011, Warsaw, Poland (POSTER)
- **SPIE-2011**, Nanoscience + Engineering, 21 - 25 August, 2011, San Diego, California, USA, (INVITED TALK)

Anticipated conferences

- **Lab-on-a-Chip European Congress**, 27-28 March 2012, Edinburgh, Scotland (POSTER)
- **6th International Conference on Environmental Science and Technology 2012**, which will be held in June 25-29, Texas, USA (ORAL)
- **MicroTAS**, The 16th International Conference on Miniaturized Systems for Chemistry and Life Sciences, 31 Oct- 3 Nov 2012, Okinawa, Japan

Training & Outreach

Publications

- The Key to Revolutionary Breakthroughs in Micro-fluidic Devices, Proceedings SPIE 8107, 81070C, 2011; doi:10.1117/12.895330 (REVIEW PAPER)
- Integrating Stimulus-Responsive Materials and Microfluidics – The Key to Next Generation Chemical Sensors, JIMMS (in preparation)
- Novel optical sensing system based on wireless paired emitter detector diode device for Lab-on-a-Disc water quality measurements, Lab Chip (in preparation)

Personal Developement

- **Short course**: Lab-on-a-chip technologies for applications in the life sciences, Transducers 2011 Conference,5-9 June 2011, Beijing, China.
- **Short course**: Microfluidics: Device Science and Technology; Transducers 2011 Conference, 5-9 June 2011, Beijing, China.
- Workshop: “Sensing: Changing the way we live our lives”, DCU, 21 Nov 2011, Dublin, Ireland
- Cambridge **Certificate in Advanced English English Course**

Acknowledgments

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