

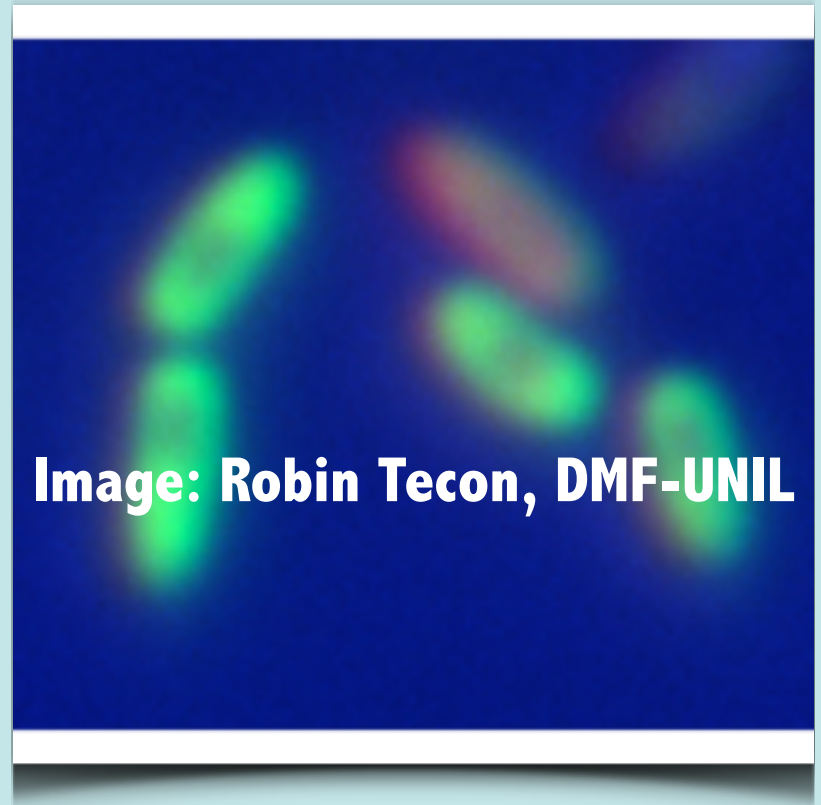
Engineered Bacteria as Pollutant Bioreporters

Jan Roelof van der Meer

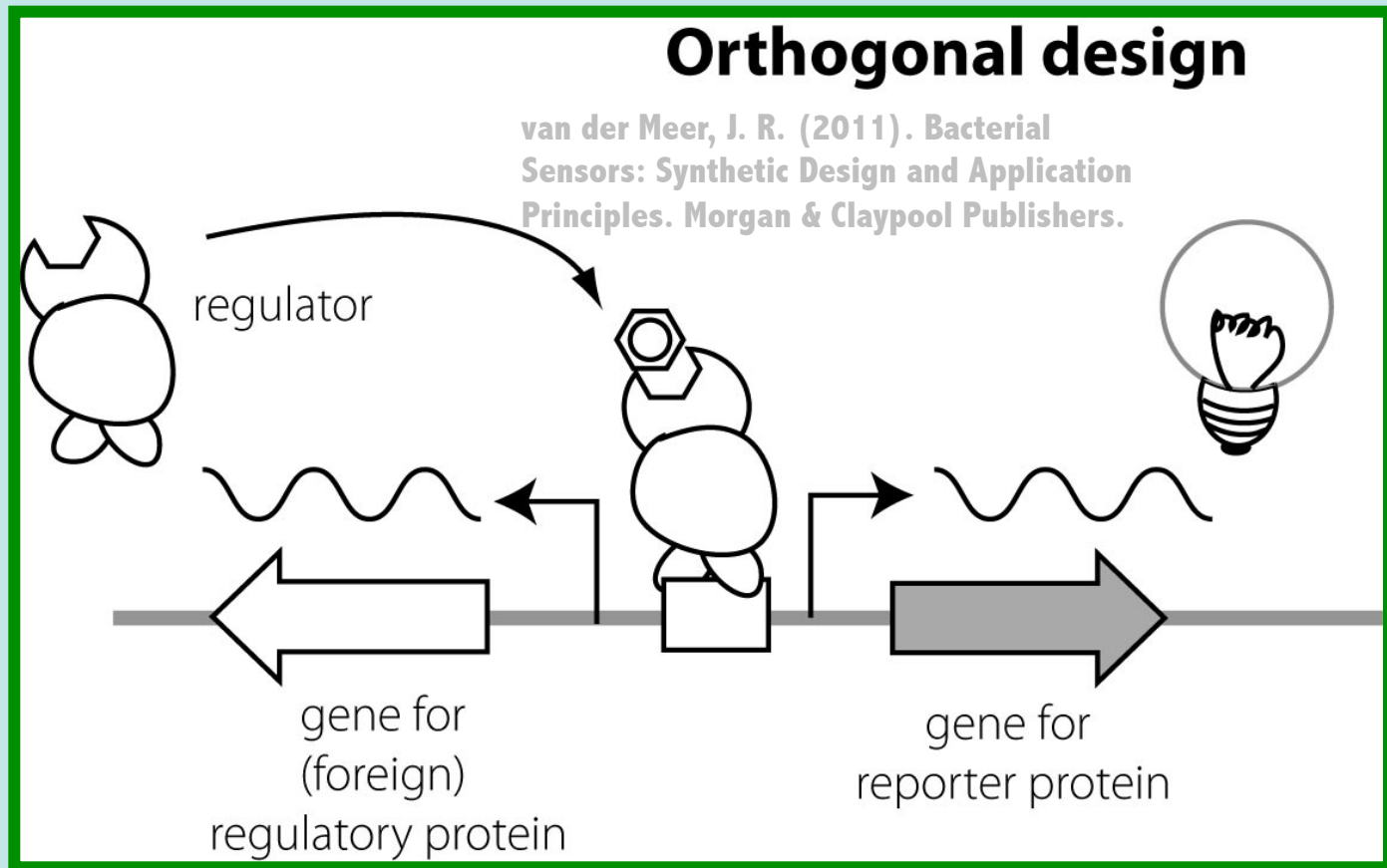
Dept. of Fundamental Microbiology, Univ Lausanne

What is a bacterial bioreporter?

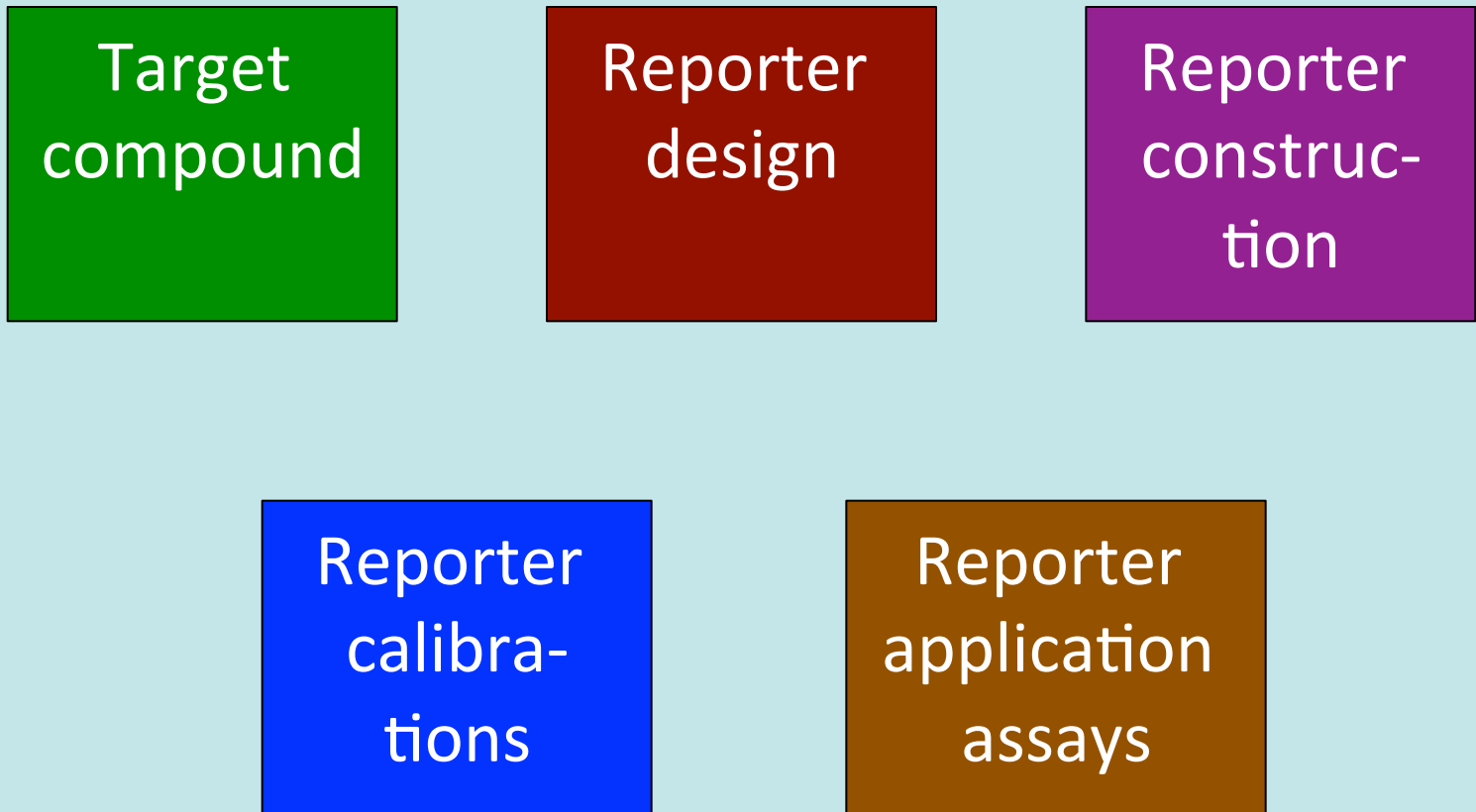
A bacterial strain, which is specifically designed to produce a reporter protein in response to recognition of a target chemical or condition.



The 'heart' of a bioreporter: Reporter circuit



Development chain



**Target
compound**

**Sensory parts
available?**

**Which host?
Genetic systems?**

**Which parts?
How to design?**

**Reporter
design**

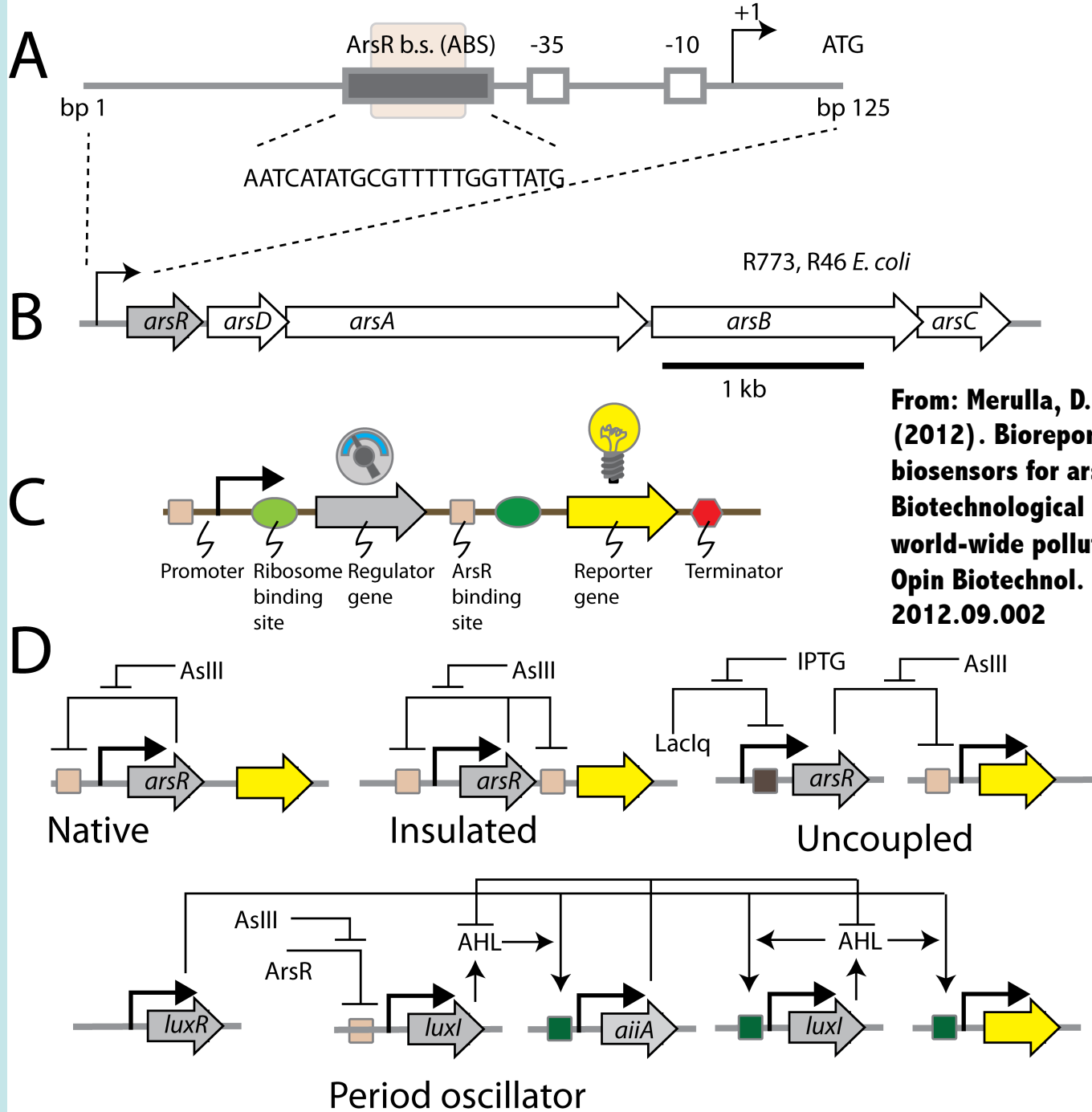
**Reporter
con-
struction**

**Reporter
calibra-
tions**

**Assay form?
Interferences?
Practical issues?
Reproducibility?**

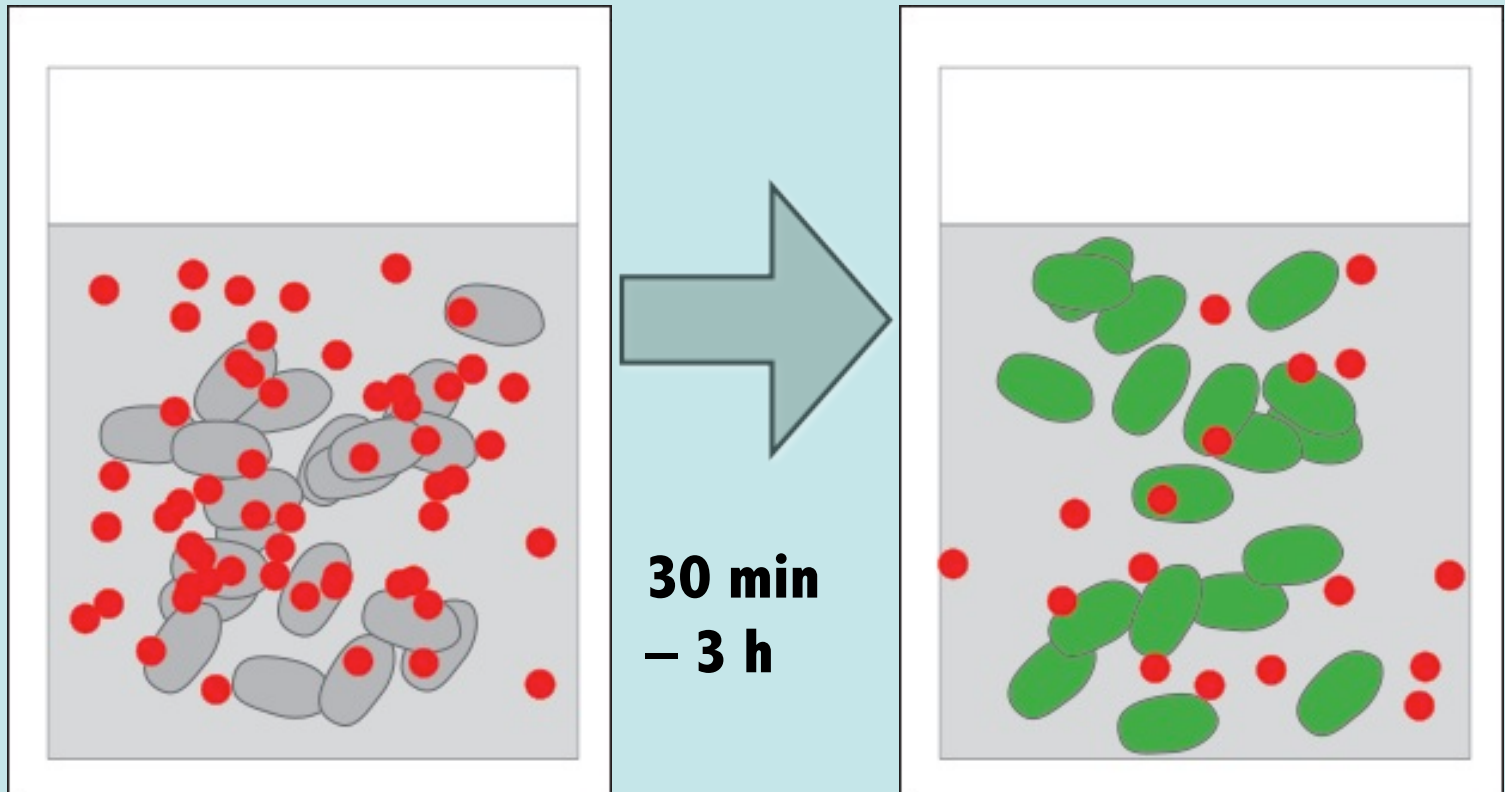
**Reporter
application
assays**

**Sensitivity?
Precision?
Time?**



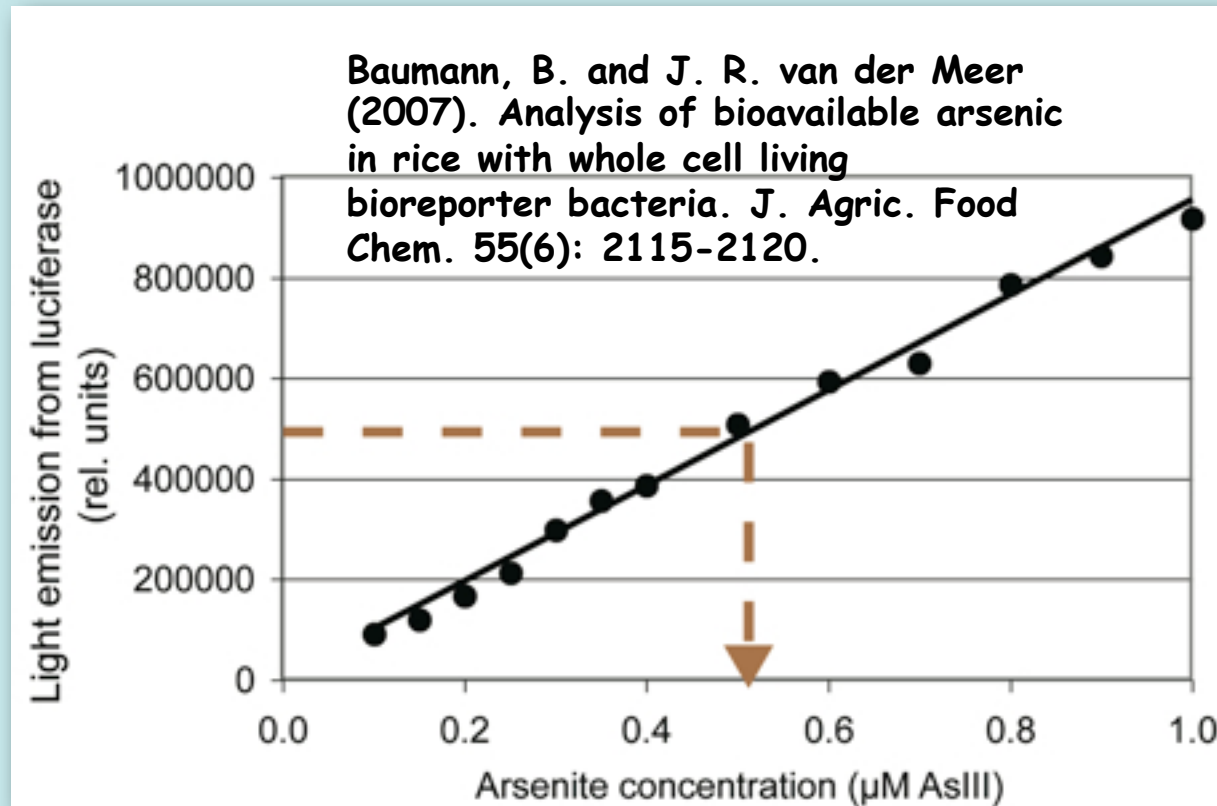
From: Merulla, D., N. Buffi, et al.
(2012). Bioreporters and
biosensors for arsenic detection.
Biotechnological solutions for a
world-wide pollution problem. *Curr
Opin Biotechnol.* 10.1016/j.copbio.
2012.09.002

Bioreporter applications: liquid assays



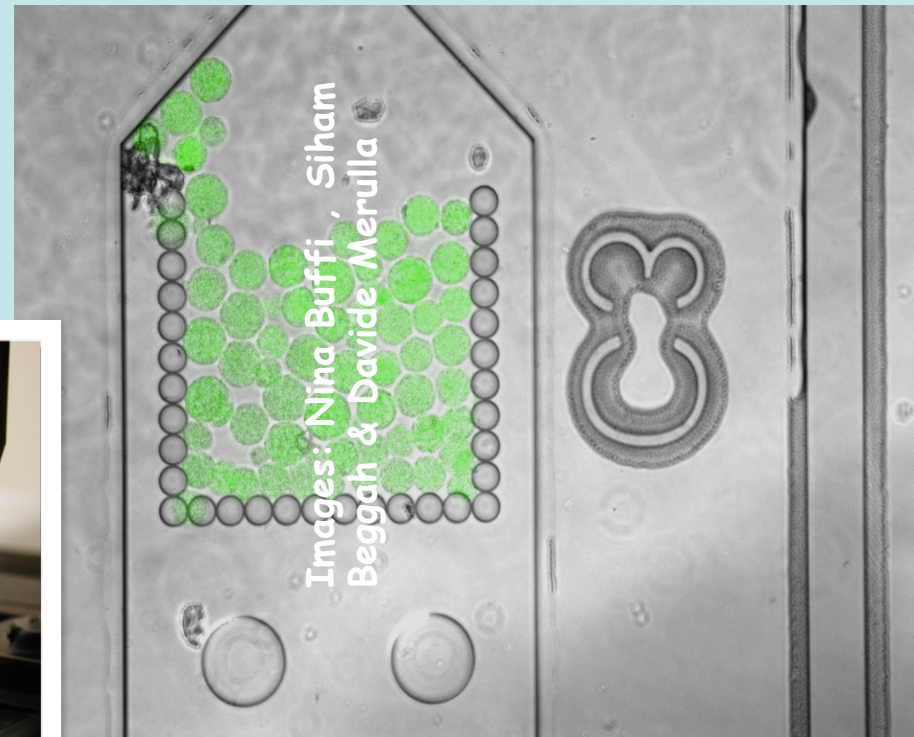
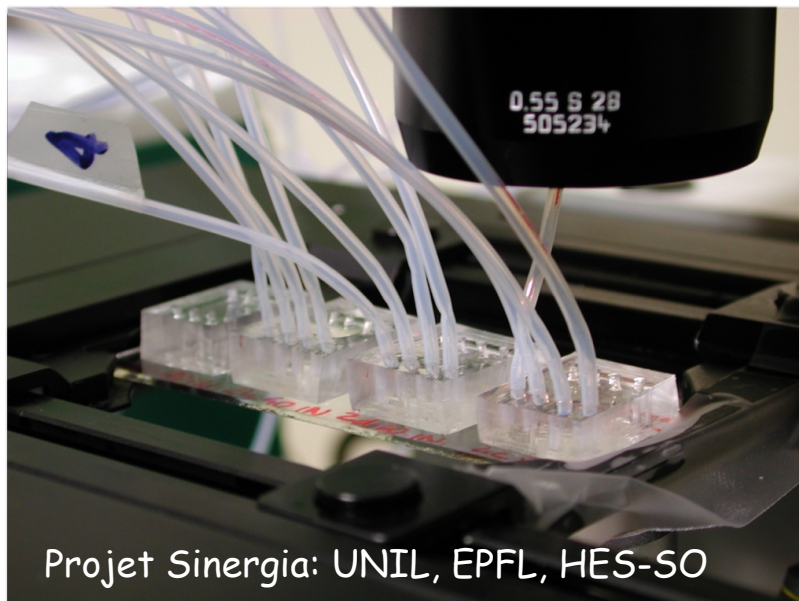
Van der Meer & Belkin,
Nat. Rev. Microbiol. 2010

Quantification by calibration



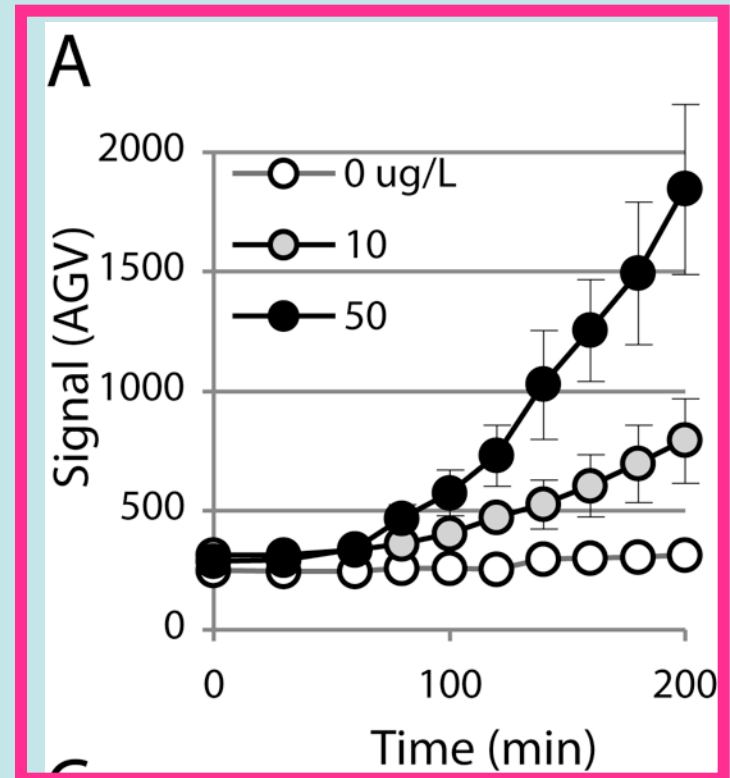
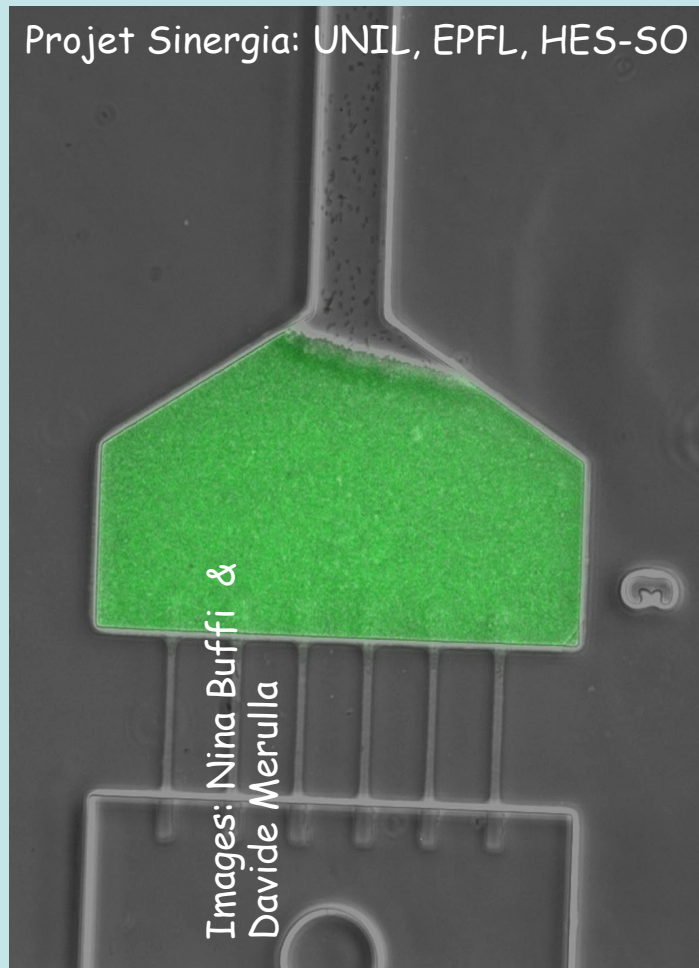
E. coli luciferase bioreporter, sensitive to arsenite/arsenate

Microfluidics-bioreporter cartridges



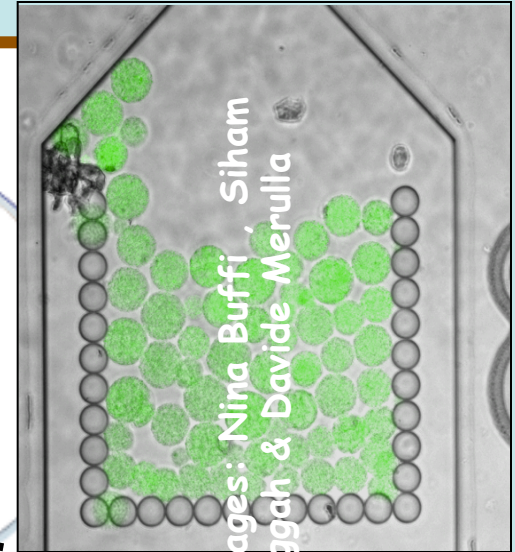
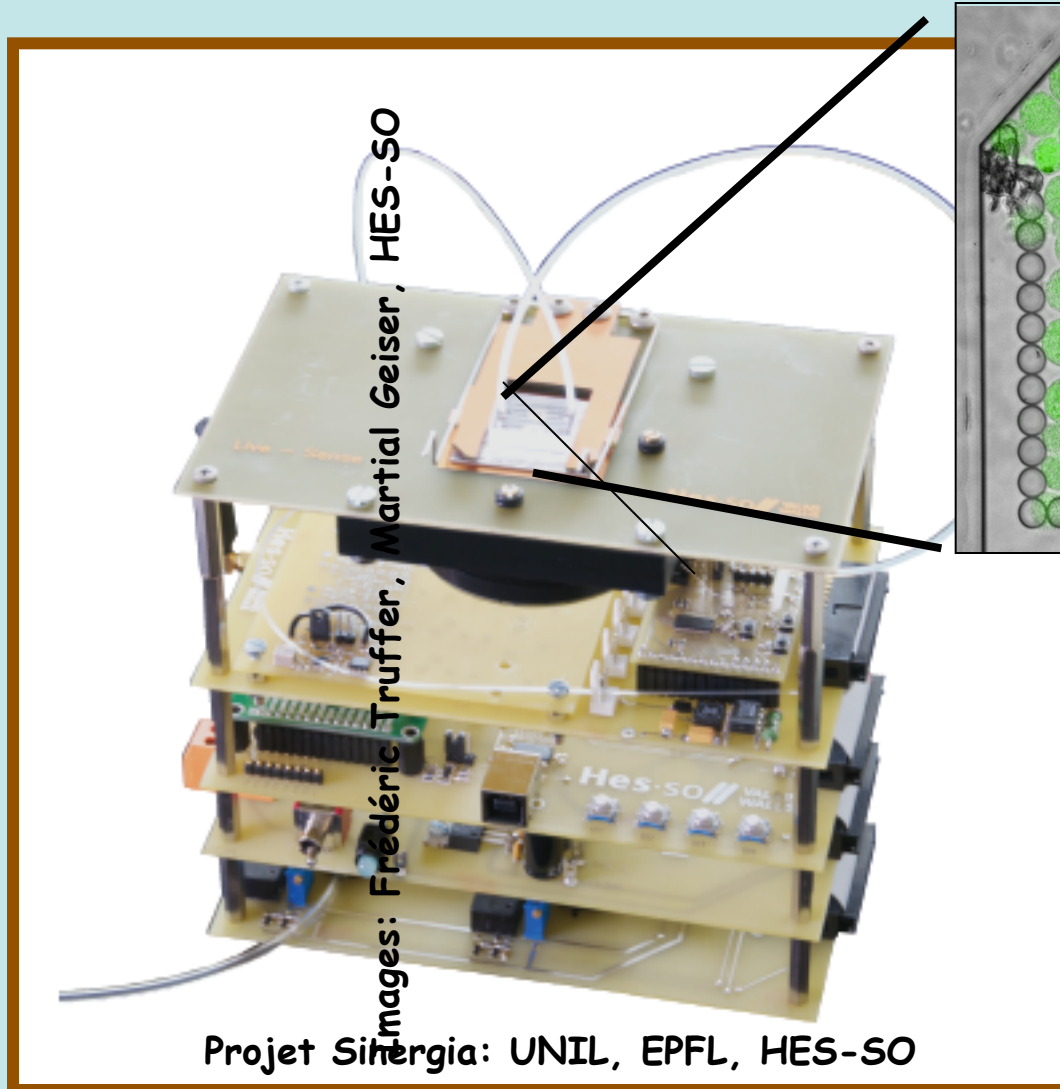
Reporter cells embedded in $\varnothing$ 50 μ m agarose beads and frozen for storage on chips

Beads/cell cartridges increase signal intensity for detector



Buffi, N. et al. (2011). Bioeng Bugs 2: 296-298.
Buffi, N. et al. (2011) Lab Chip 11: 2369-2377.

Building a standalone sampling/ detector device



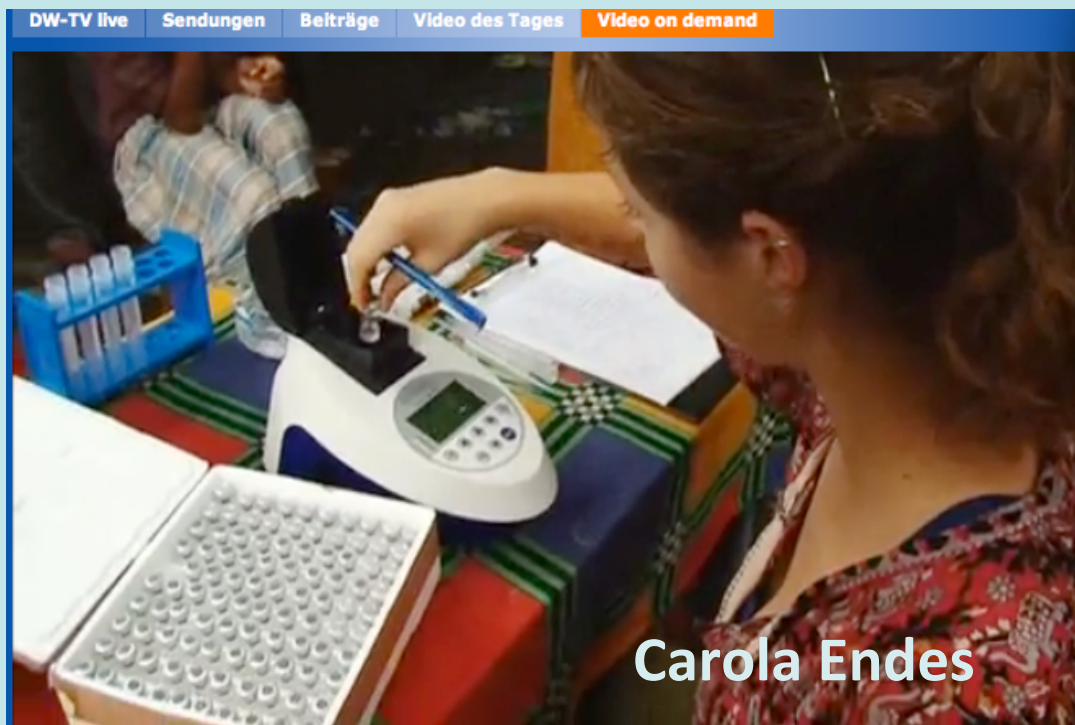
Use of a luciferase-producing *E. coli* bioreporter for arsenic in the field



**ARSOLUX-system.
Collaboration with
UFZ-Leipzig**

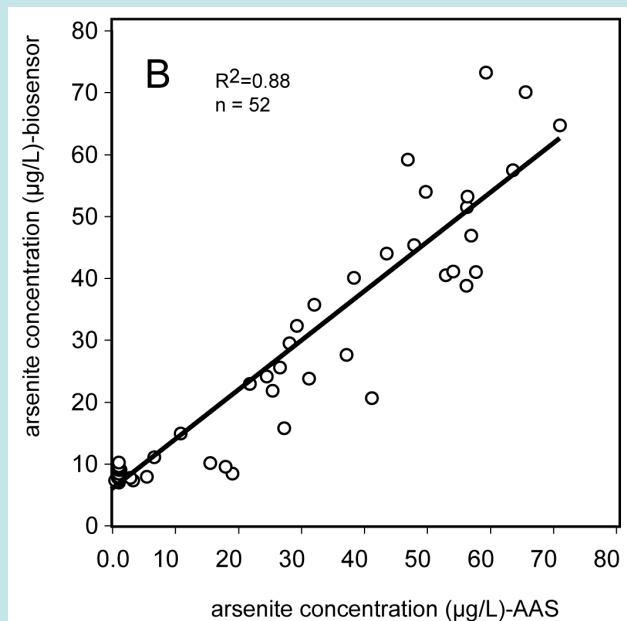
Bild: André Künzelmann

Field testing in Bangladesh, 2011

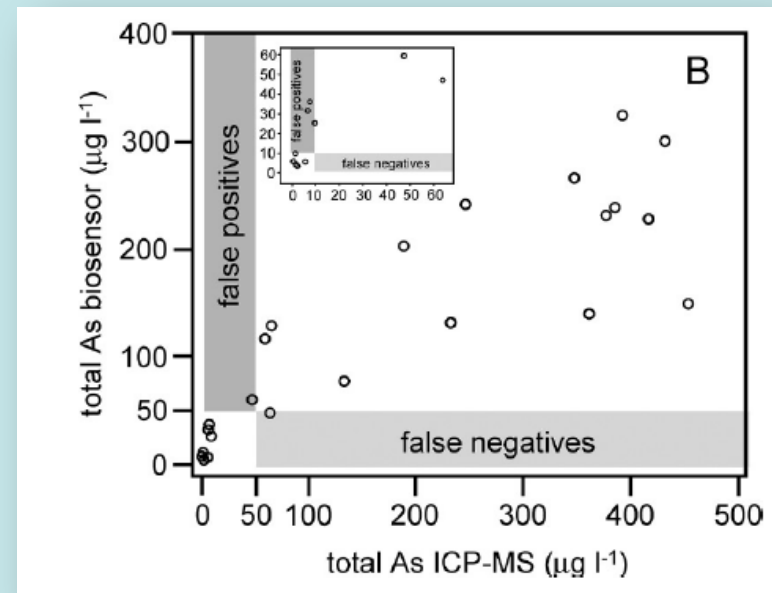


Very good quantitative field performance

Hanoi, Vietnam



Bangladesh



Siegfried, K. et al. (2012) *Environ Sci Technol* 46: 3281-3287.
Stocker, J. et al. (2003). *Environ Sci Technol* 37: 4743-4750.
Trang, P.T. et al. (2005) *Environ Sci Technol* 39: 7625-7630.