PHOTOMETRIC DETERMINATION OF THE CONCENTRATION PROFILE IN MICROFLUIDIC DEVICES

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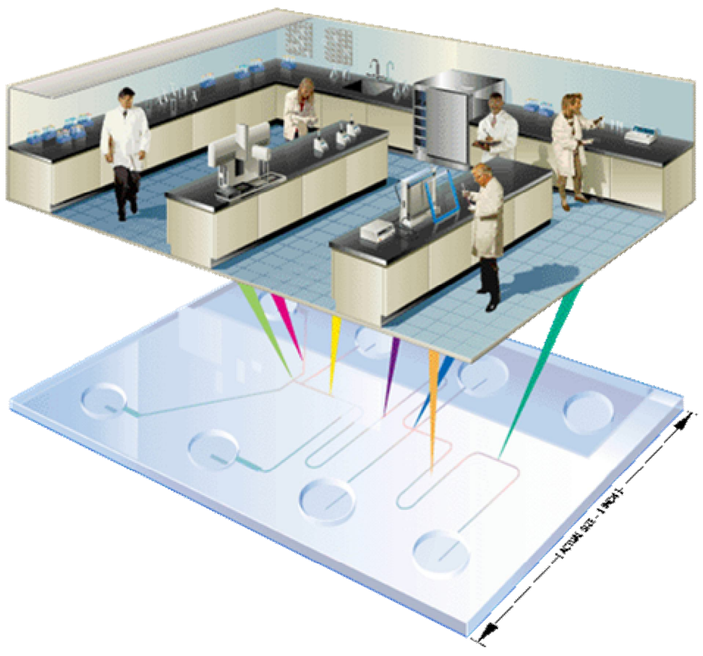


Fig 1. Microfluidics (from Zheng Y. et al, 2012)

What's so special about microfluidics?

- Needs **small amount** of fluids[1] (10^{-9} – 10^{-18} dm^3)
- Is a basis for the **lab-on-a-chip point-of-care diagnostic** devices & applications[2]
- Allows to produce **low-cost hand-held devices** operating with small amount of reagents
- Allows to perform **fast high-throuhput analysis**
- Devices could be assembled from relatively **cheap materials**: modified paper, glass, plastics
- Could easily employ advances of the microeletronic industry, e.g. **photolithograpy**

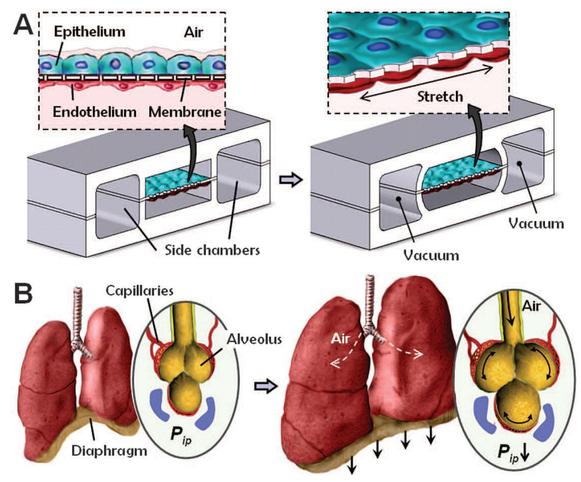


Fig 2. Organ-on-chip platform illustration[3]

Recent advances

• **Suspended microfluidics**[3] introduces fluid-fluid and fluid-air interfaces allowing for development of **organ-on-chip** devices

• **Capillary-based microfluidics**[4] is based on the capillary effect and uses cheap functionalized paper or cotton, which gains attention as a flexible material for creating 2D and 3D patterns in microfluidic devices

• **Regeneration-on-a-chip technology**[5] could be used to create in vivo-like microenvironments to aid the regeneration processes. It allows production of confined system with high degree of control over spatial factors, fluid flow, physical or chemical stimuli, but lacks compatibility with existing equipment and methods

• **High-throughput detection of rare cells**[6] could be used to detect the circulating tumor cells in the blood stream, providing higher accuracy and yield limits than conventional methods

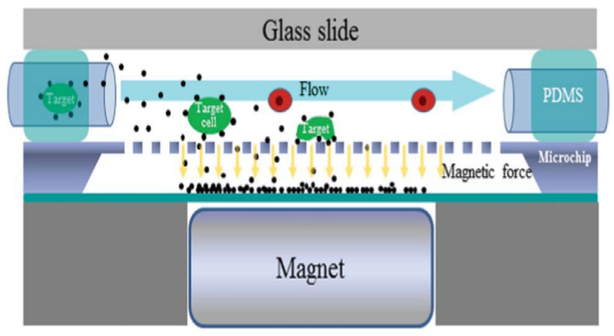


Fig 3. High-throughput rare cell detection[4]

Luciferase microfluidic chip

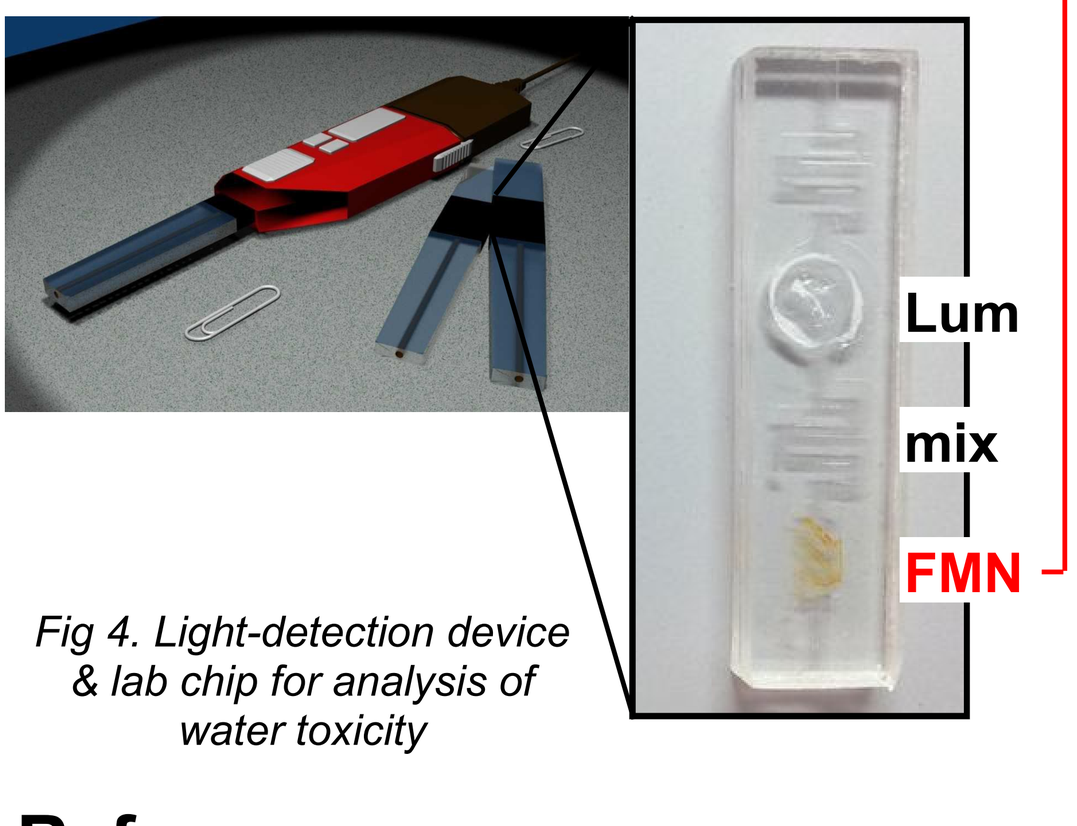
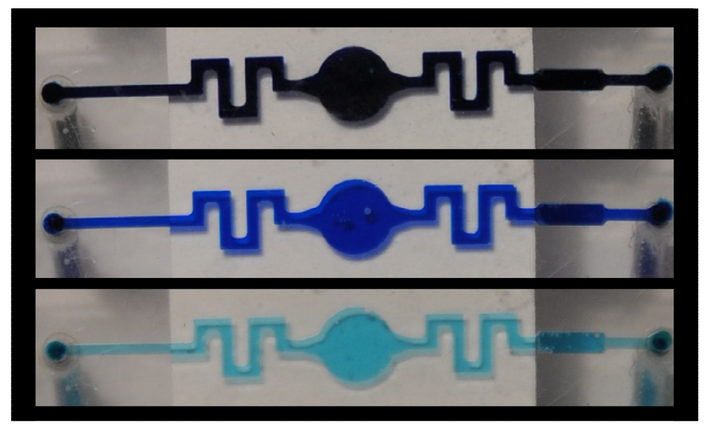
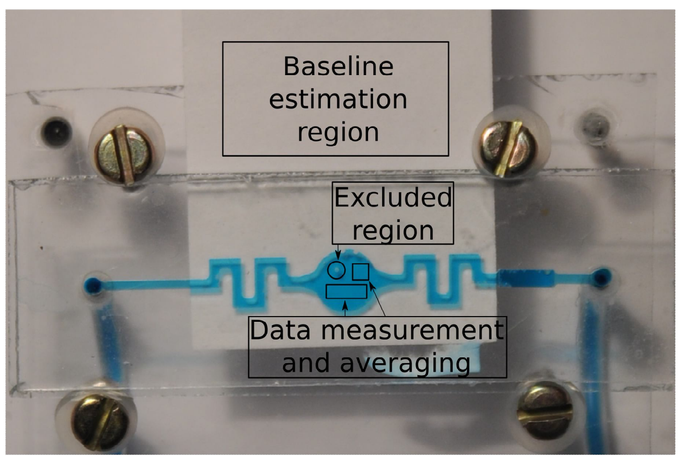


Fig 4. Light-detection device & lab chip for analysis of water toxicity

FMN concentration measurement





Quantitative measure of color intensity: saturation from the HSV transform of the original RGB colorspace

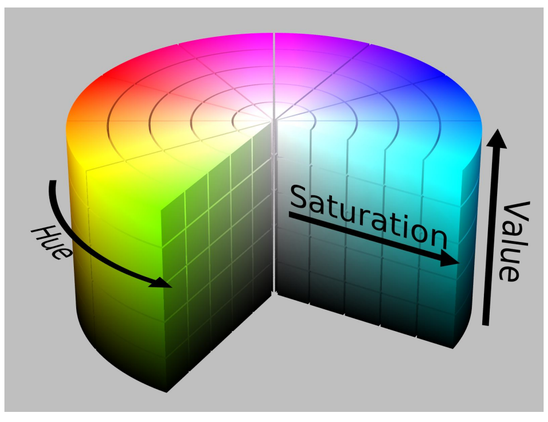
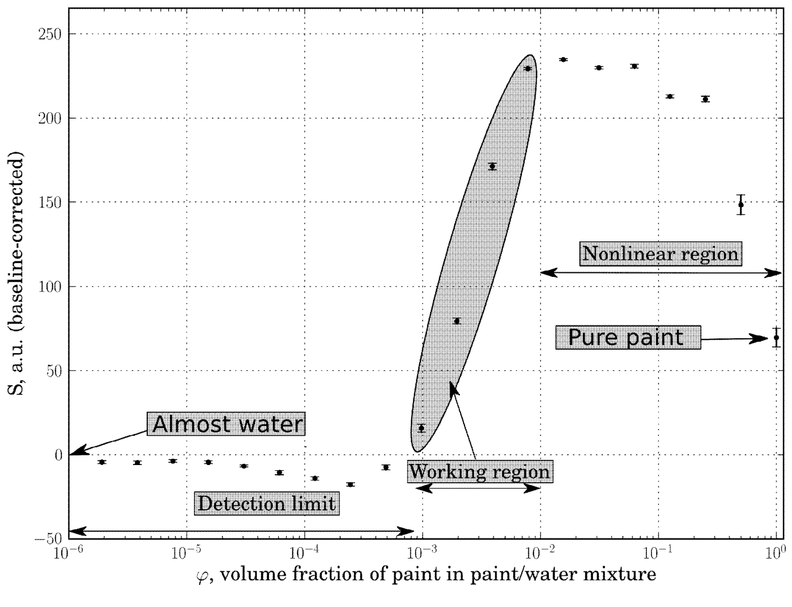


Fig 5. HSV transform of the RGB colorspace scheme



Calibration curve has linear as well as non-linear regions, and careful inspection should be done everytime new substance is investigated

Fig 6. Examples of colored test fluid flow in the lucifi-erase chip and the corre-sponding calibration curve showing applicability of the method

References

[1] G.M. Whitesides, Nature 442, 368 (2006).
[2] H. Jayamohan, H.J. Sant, and B.K. Gale, Methods in Molecular Biology (Clifton, N.J.) 949, 305 (2013).
[3] D. Huh et al, Scince 328, 1662 (2010).
[4] A. Memic, A. Hasan, M. Akbari, M.R. Dokmeci, and A. Khademhosseini, Lab Chip 6 (2013).
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[6] C.-L. Chang et al, IEEE Sensors, 1672–1675 (2012).

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