Challenges in the Development of (Bio)Chemical Sensors in Rotterdam

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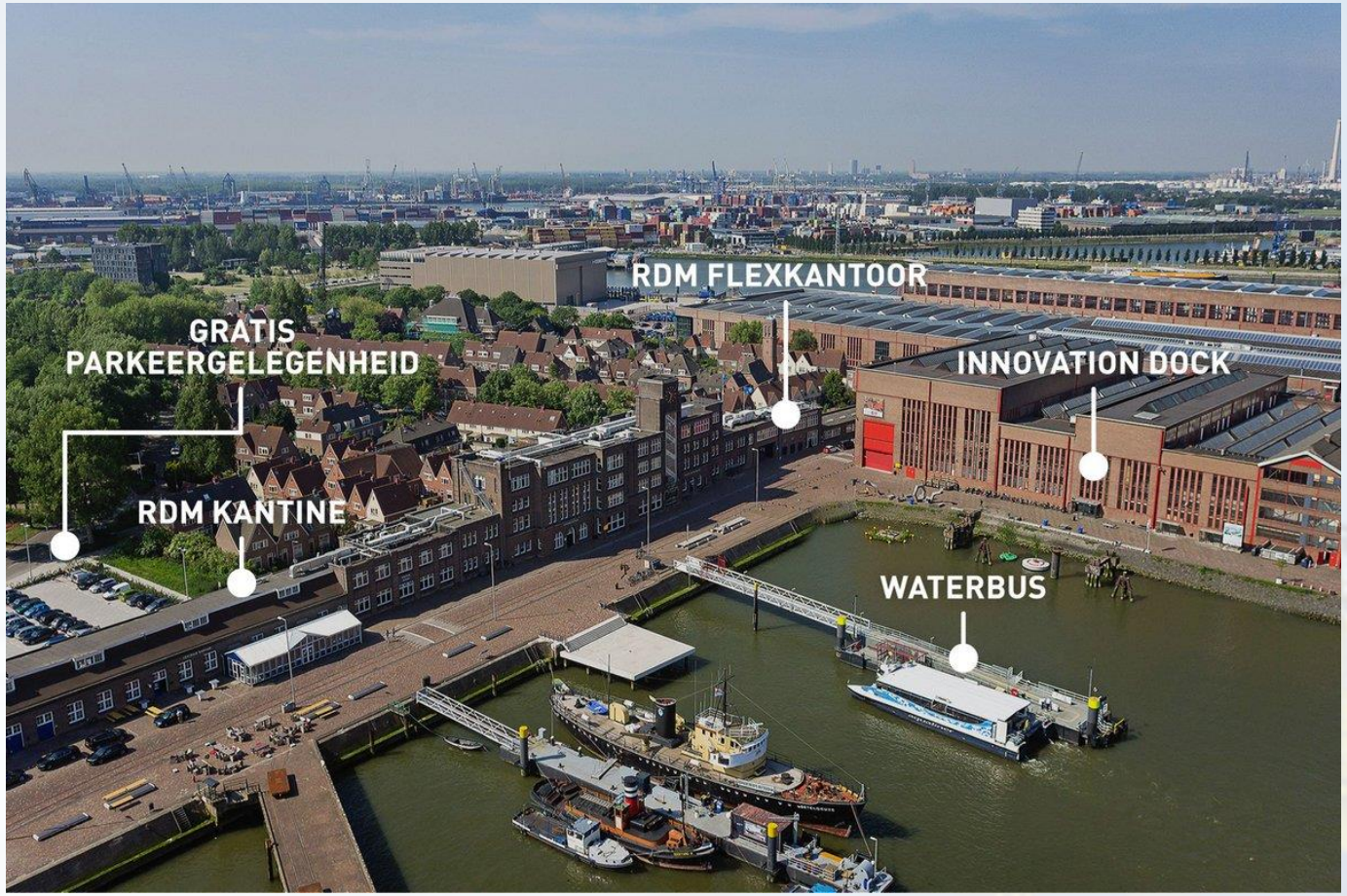
Contents

1. Sensors in the context of Rotterdam for water, sustainability and safety goals
2. Projects on sensors and detection systems

Rotterdam, the city on water

RDM

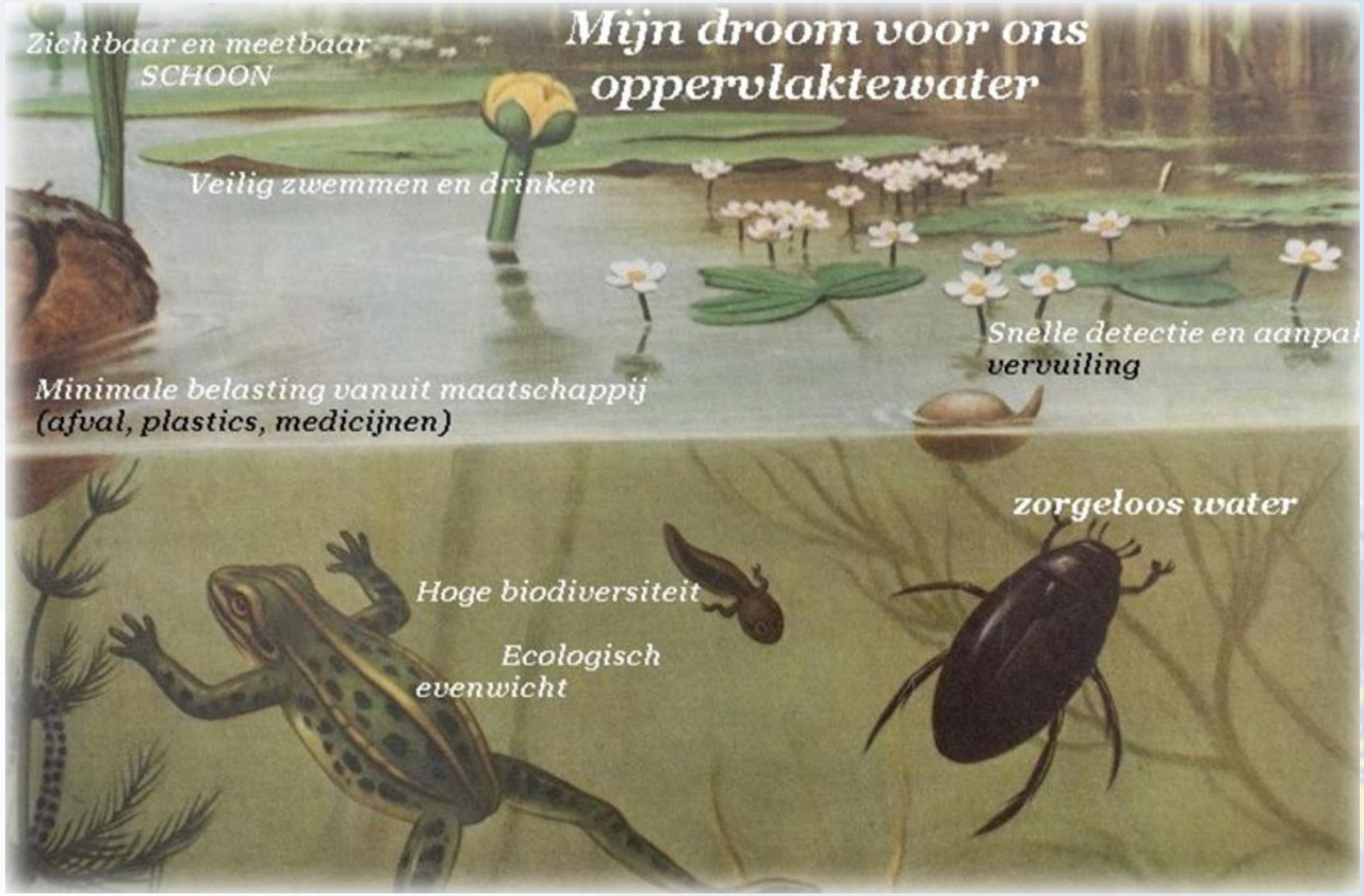


https://www.rdmcoe.nl/rdmrotterdam/

Groene Poort Rotterdam

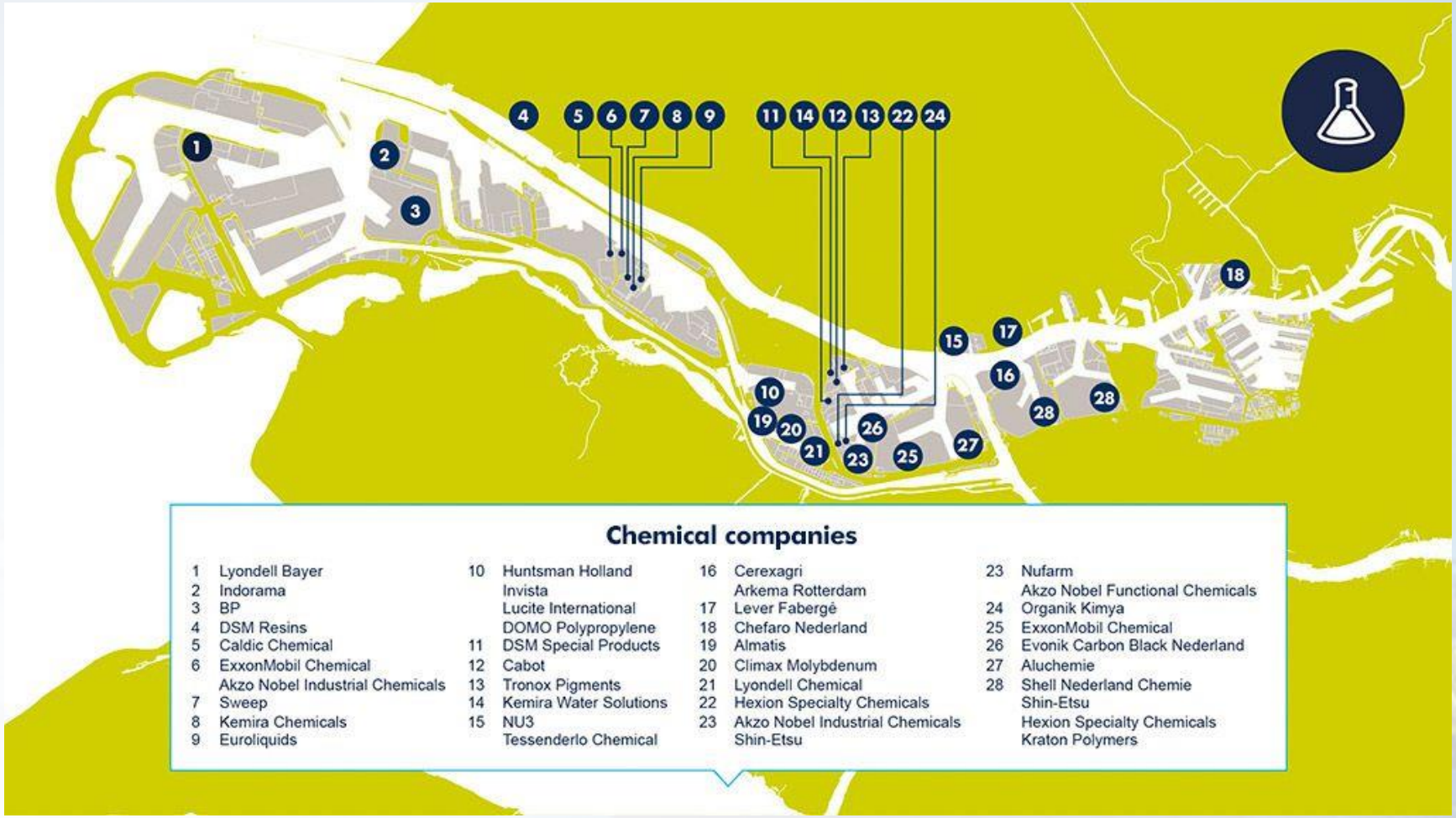
https://rotterdamcirculair.nl/initiatieven/de-groene-poort/

MijnOmgeving



https://mijnomgeving.net/

Rotterdam, de stad van Grote Industrie



Gemeente Rotterdam

POLITIE

BRANDWEER

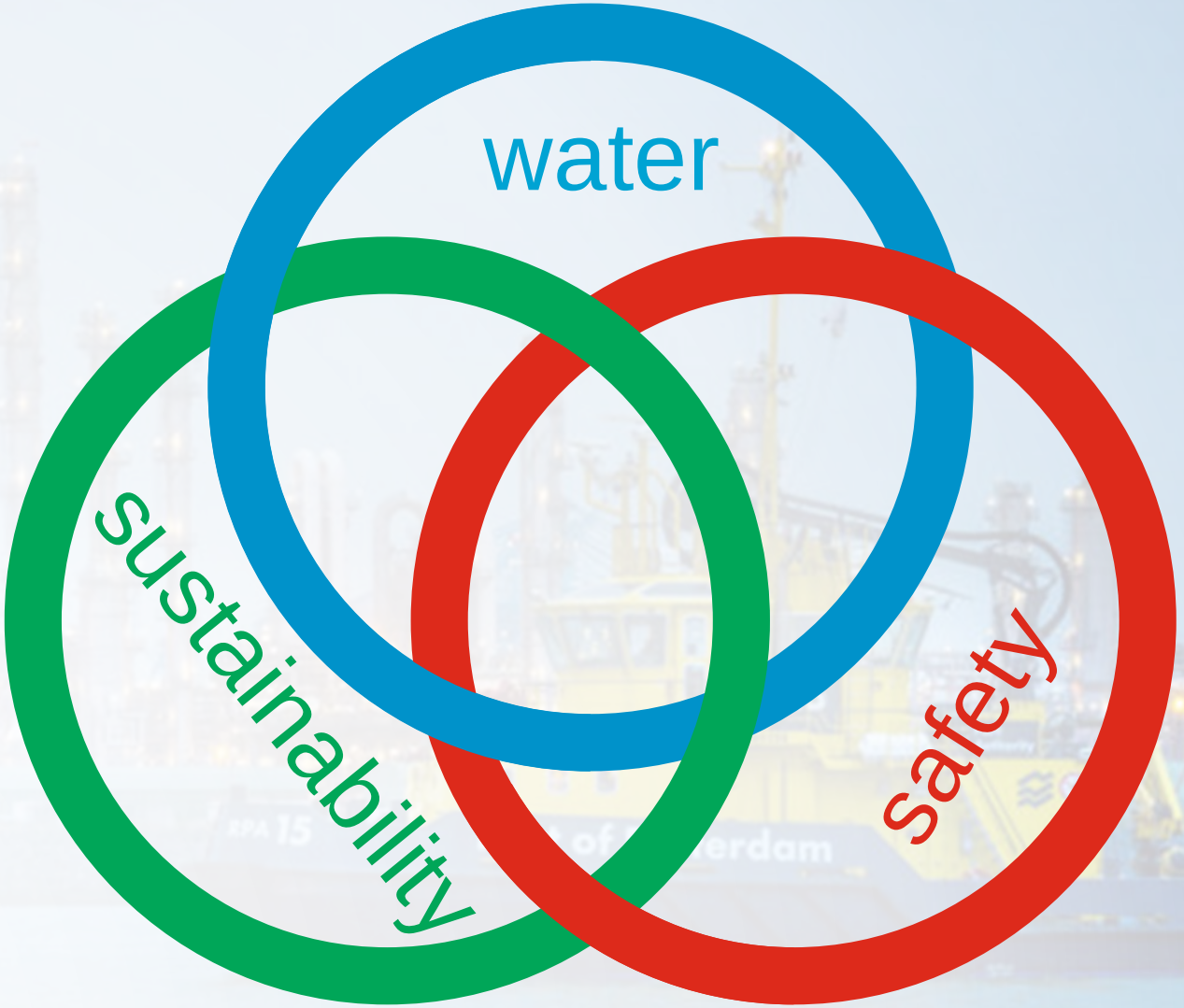
Erasmus MC
Universitair Medisch Centrum Rotterdam

‘Domino’ danger in the industry

Landucci, G. et. al. *Reliab. Eng. Syst. Saf.* **2015**, *143*, 53–62.

Harbours of Rotterdam

Key Subjects



Project lines

- Sensors, Detection systems en Sensor Arrays
- Green, Sustainable and Circular (Bio)Chemistry

Sensors

Public Safety
Smart Home/Smart City
Environmental Monitoring &Protection
Industrial (& Agricultural) Monitoring
Medical & Diagnostics Applications/POC testing

Question

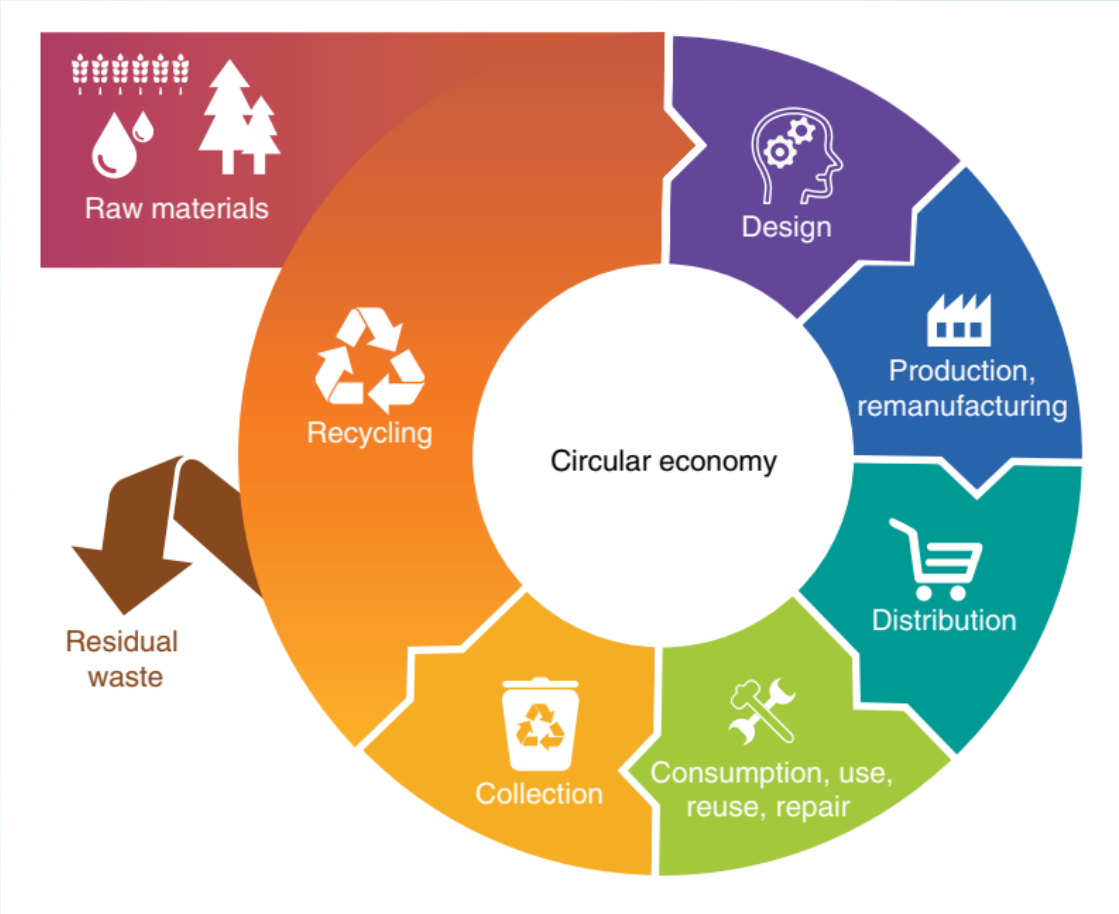
- Do sensors provide a solution for our sustainability and circularity goals?

Analysis with Classical Techniques

Consumables ending up as waste:

- Reagents for the sample preparations
- High Quality Organic Solvents

Circular economy & circular chemistry



Keijer, T.; Bakker, V.; Slootweg, J. C., Circular chemistry to enable a circular economy. *Nature Chemistry* **2019,** *11* (3), 190-195

Threats

2 x 2 = 5
human error

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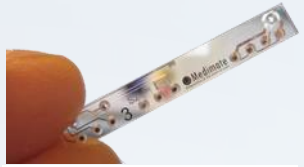
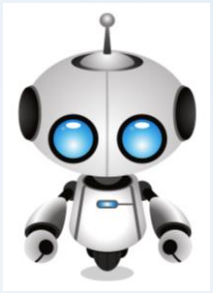
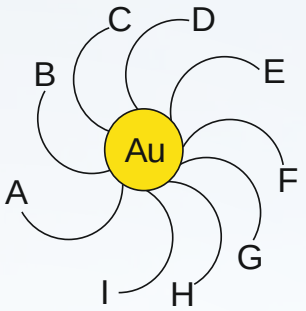
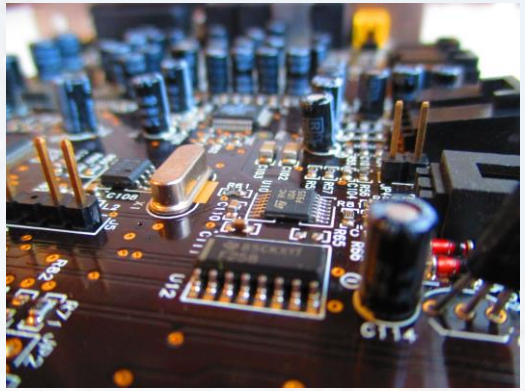
Sensors Development & Applications

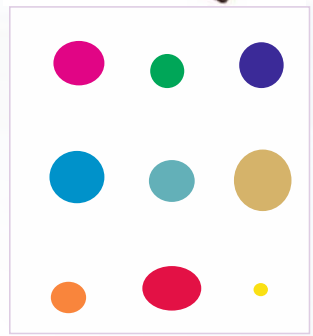








LoRa®



Erasmus MC
Universitair Medisch Centrum Rotterdam

Gemeente Rotterdam

POLITIE

BRANDWEER

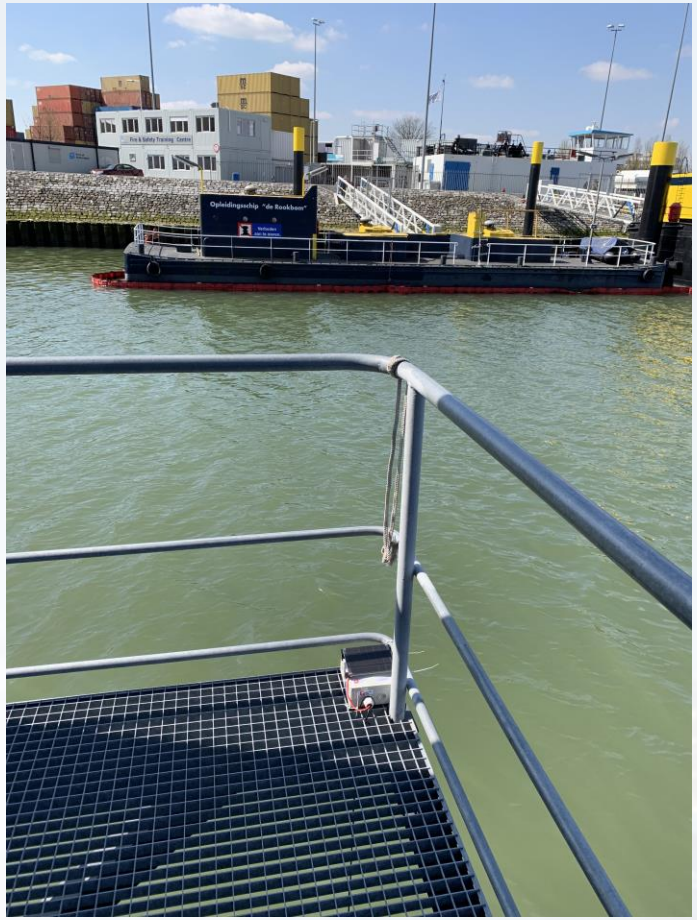
Detection targets

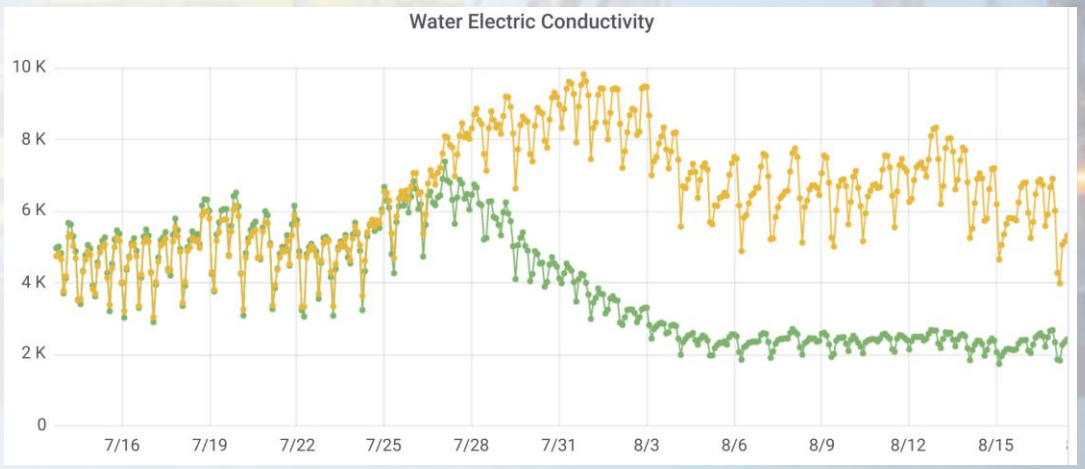
- Complex mixtures: drugs labs, specific chemical wastes, fuels
- Volatile Organic Compounds, especially ketones
- Intermediates in the synthesis of illegal drugs
- Forensic targets
- Inorganic fertilizers
- Perchlorates
- Fluoroorganic compounds, especially GenX
- Biomarkers (applied in diagnostics, disease related)

- Study selectivity, sensitivity, reproducibility, influence of interferences, manufacturing techniques.

- Measurements in the air, in water, and ‘on water’

Tests of Existing Sensor Systems

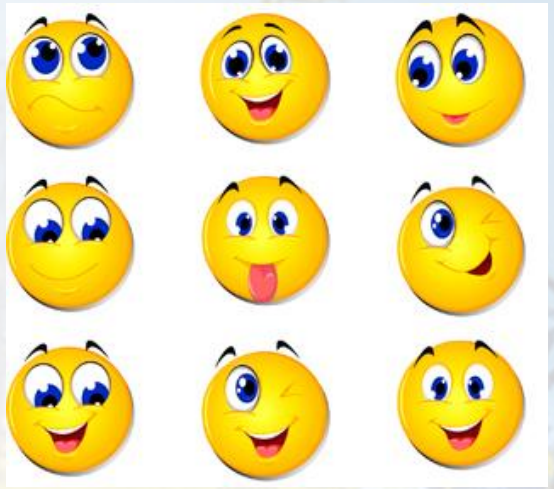




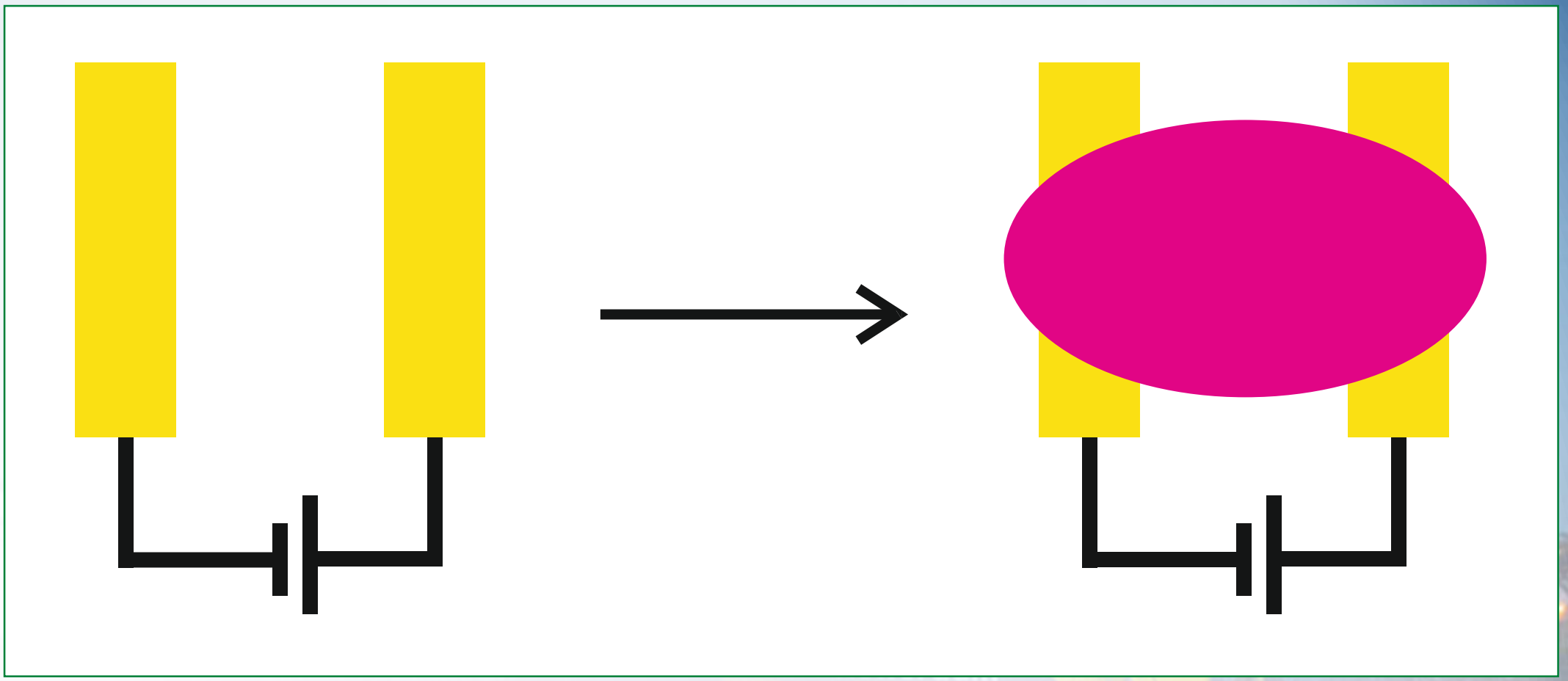
SODAQ: https://sodaq.com/

Sensor Arrays with existing sensors

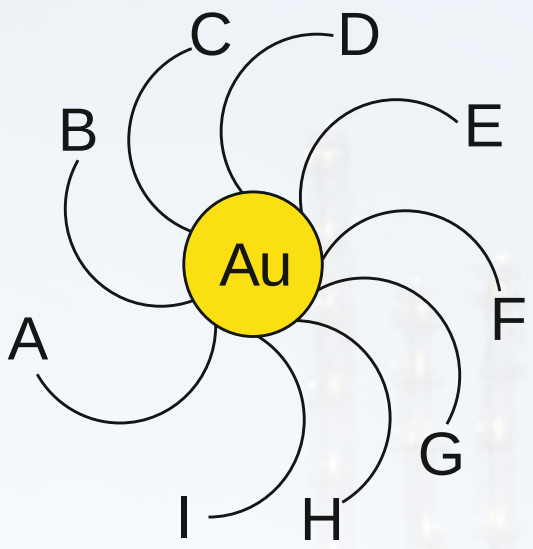
examples: MQ-2, MQ-3, MQ-4, MQ-5, MQ-6, MQ-9, MQ-135, MQ-138

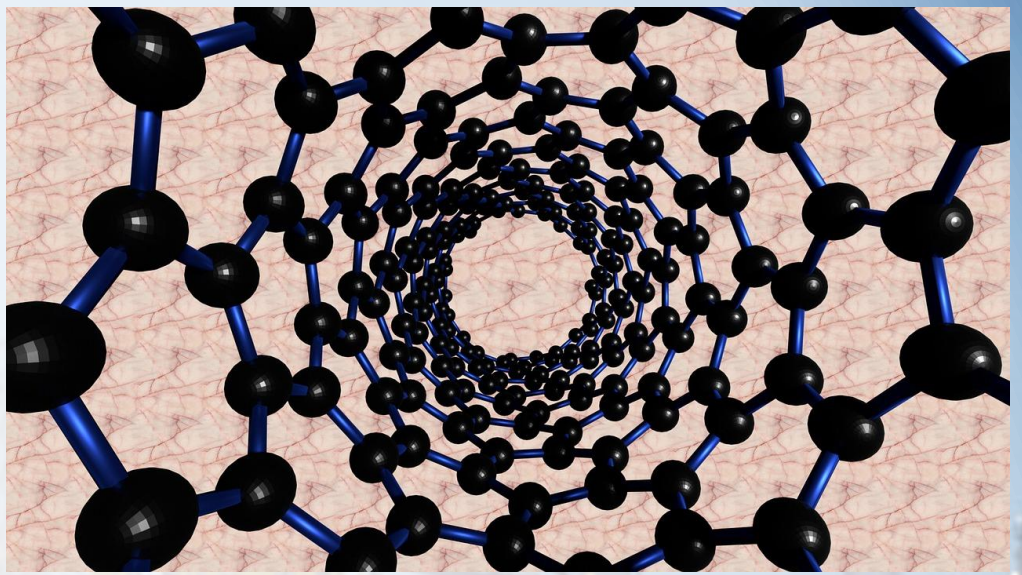


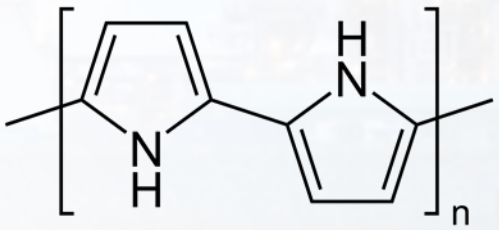
Conductivity Sensors Research

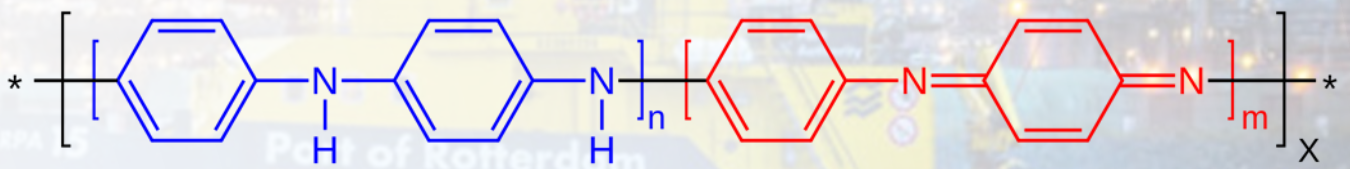


Smart materials for the Conductivity sensors

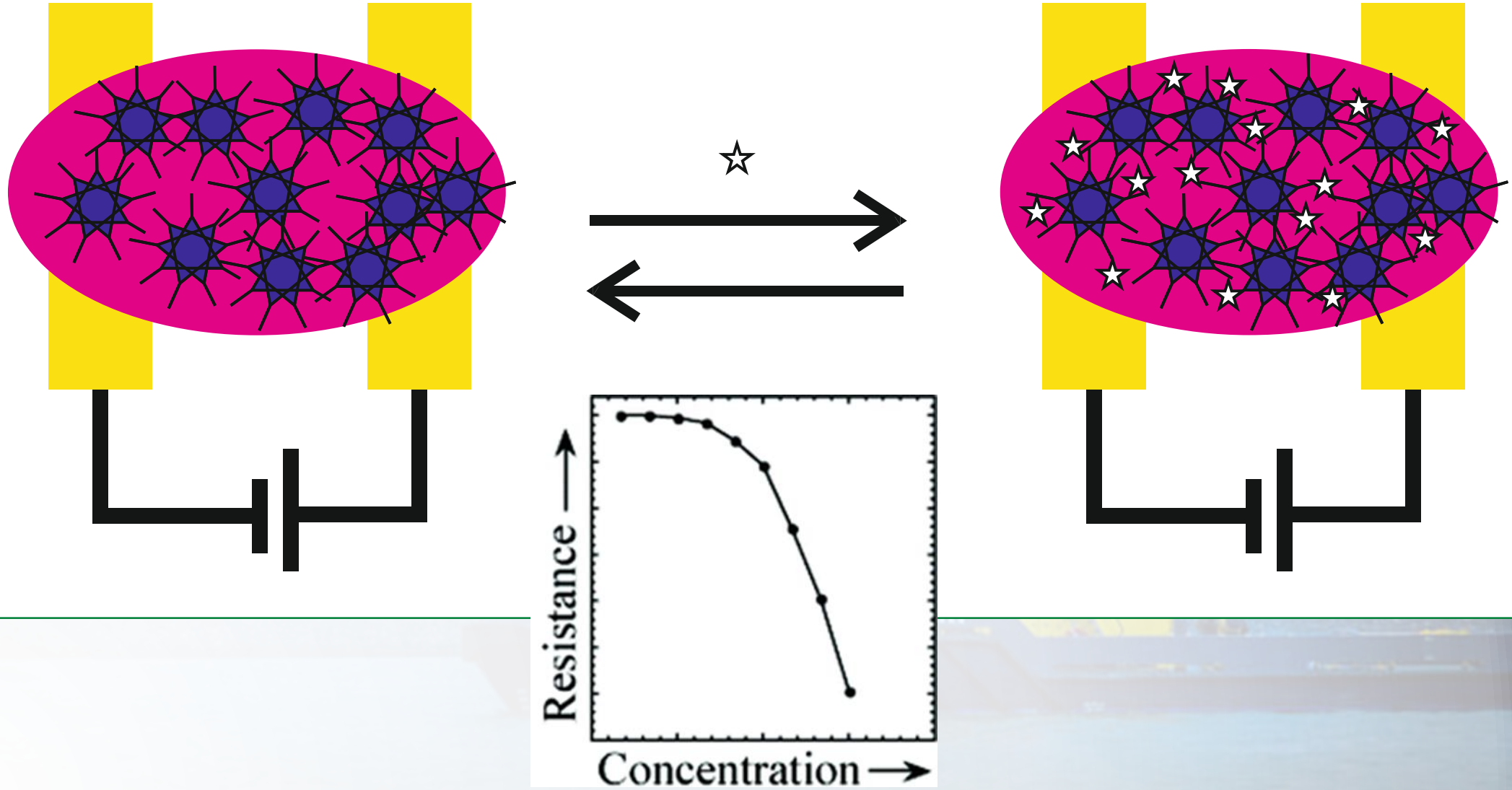




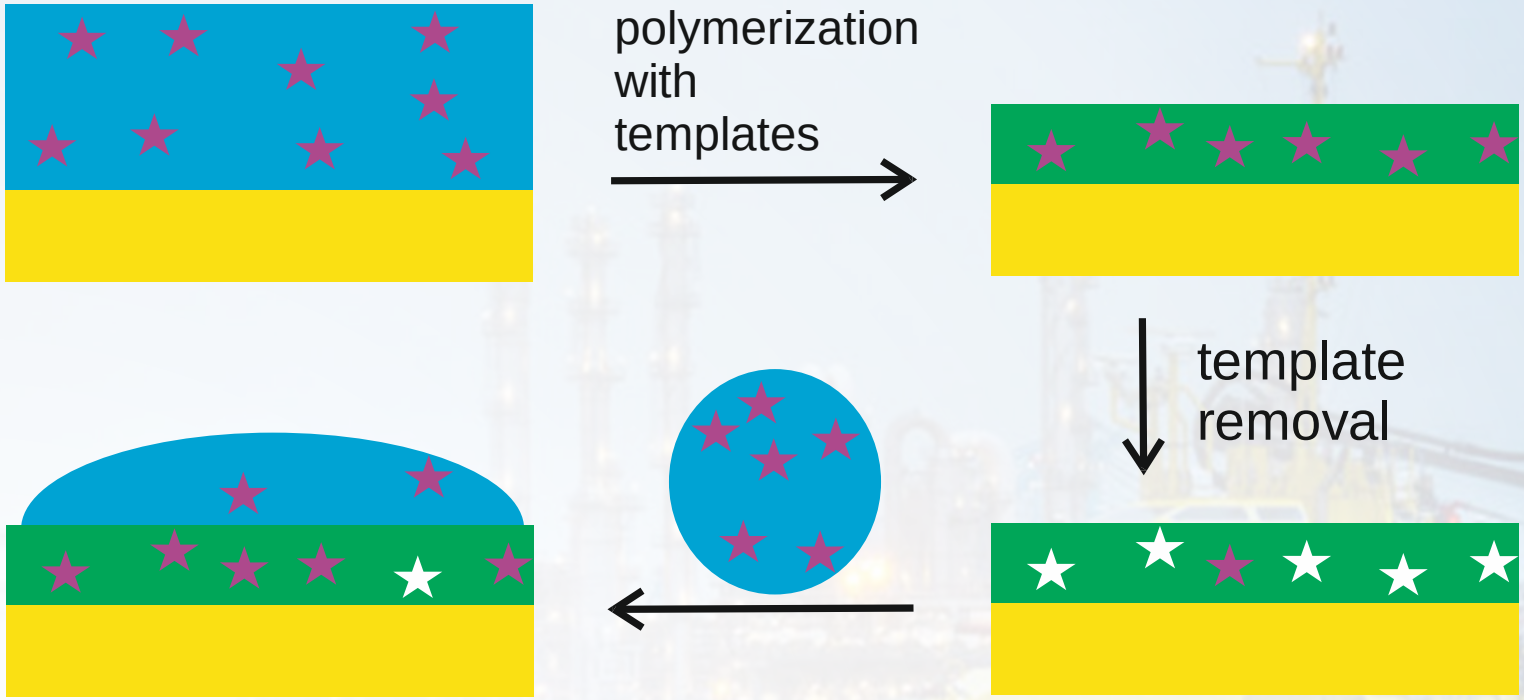


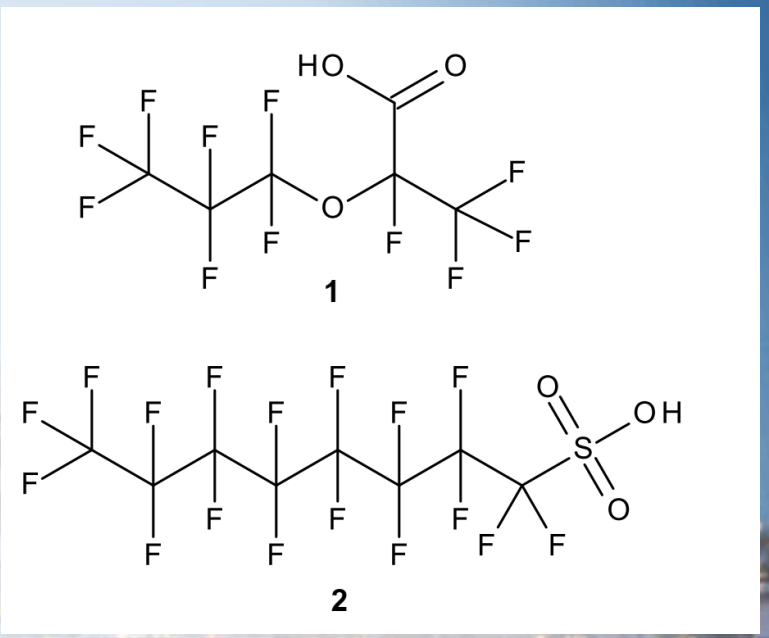


Detection principles



Imprinted polymers voor PFOS&GenX sensors

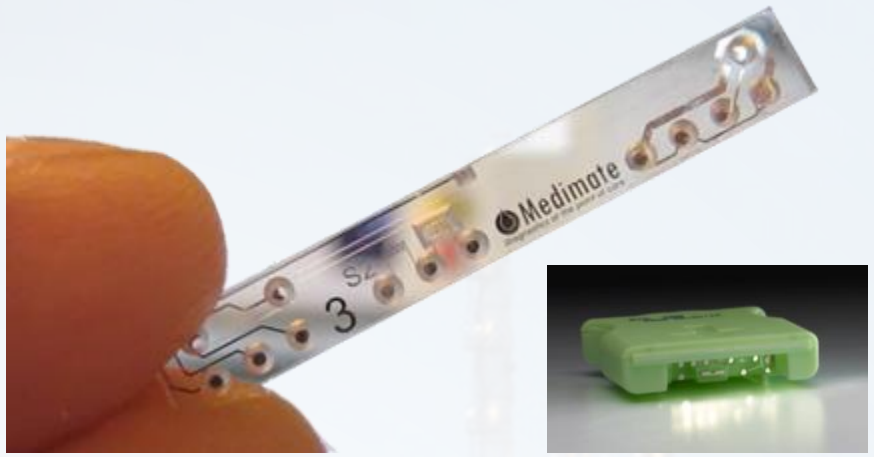


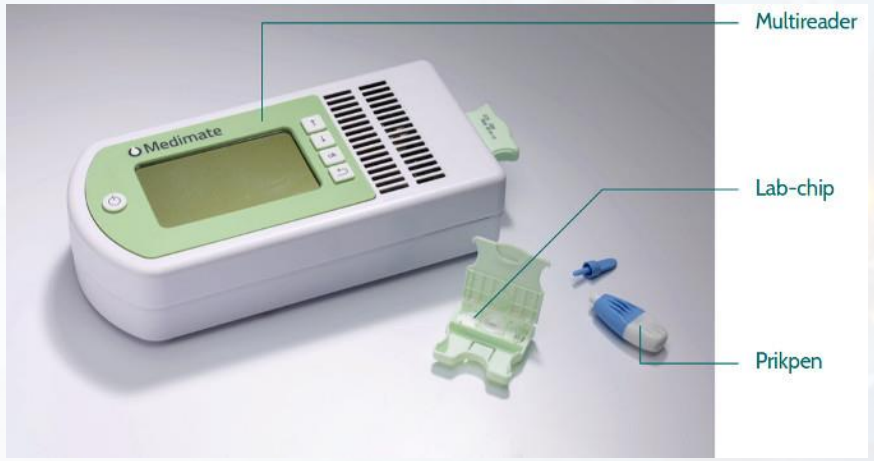


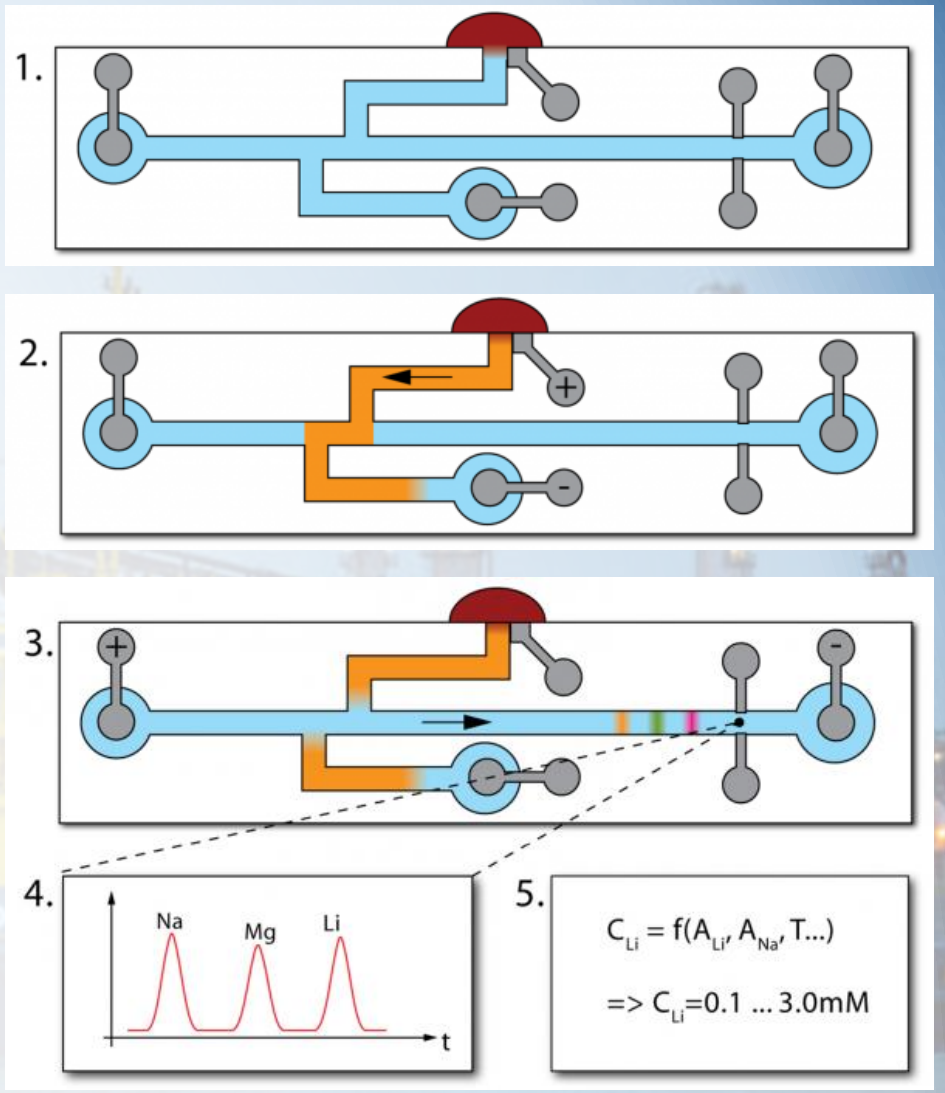
Karimian, N.; Stortini, A.M.; Moretto, L.M.; Costantino, C.; Bogialli, S.; Ugo, P. *ACS Sens.* **2018**, *3*, 1291

Lab-on-a-Chip detection systems

Medimate Minilab





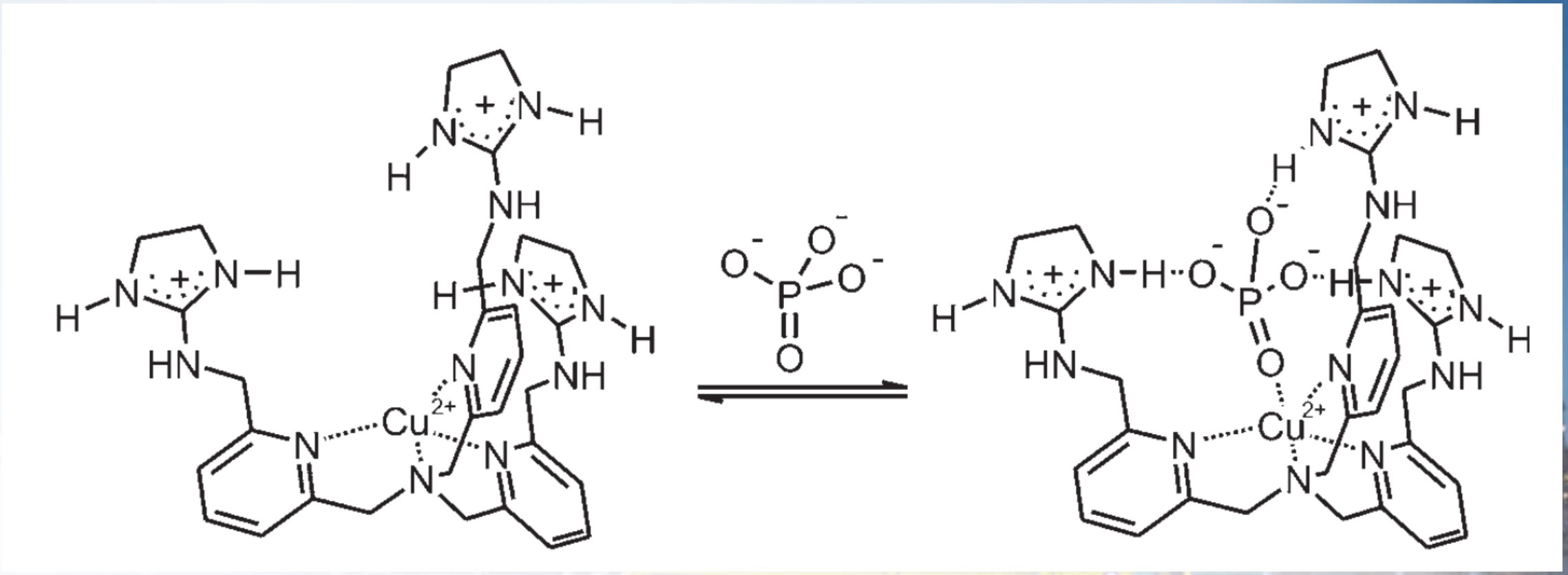


https://www.medimate.com/website/nl

Molecular Receptors for Sensing Applications

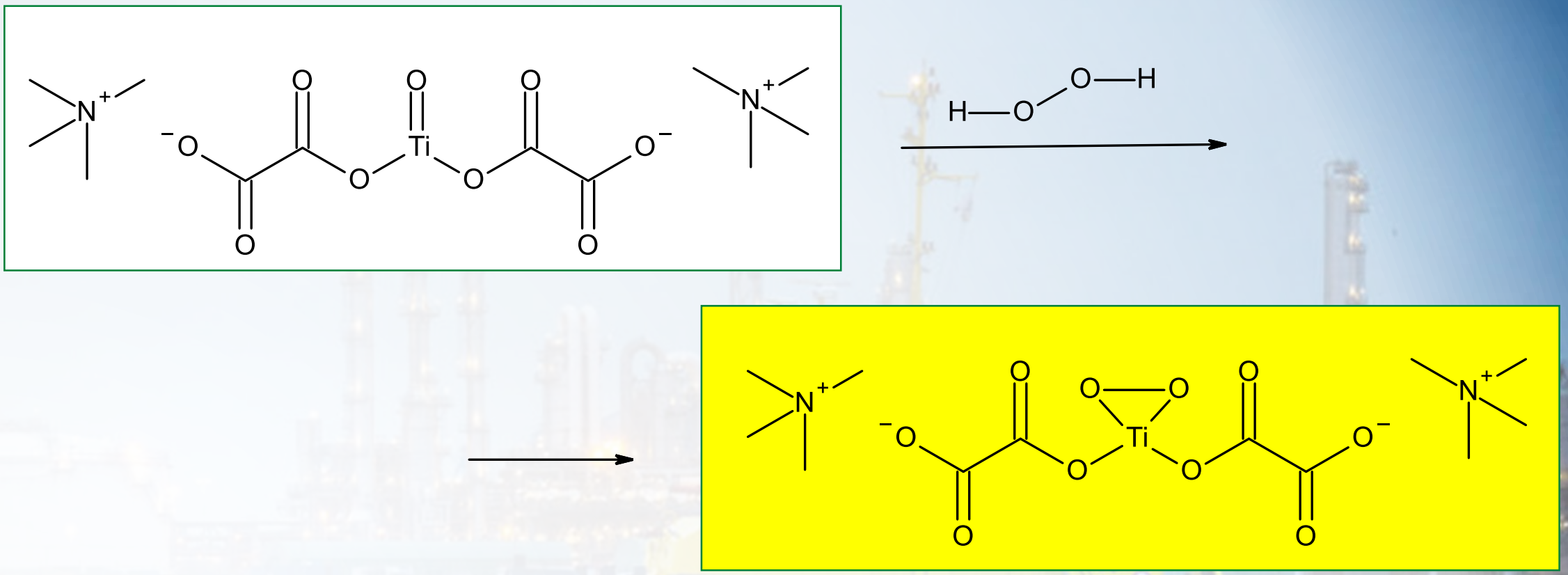
Oshovsky, G.V.; Reinhoudt, D.N.; Verboom, W.
Supramolecular Chemistry in Water.
Angew. Chem. Int. Ed. **2007**, *46*, 2366 – 2393

High Specificity of Molecular Receptors



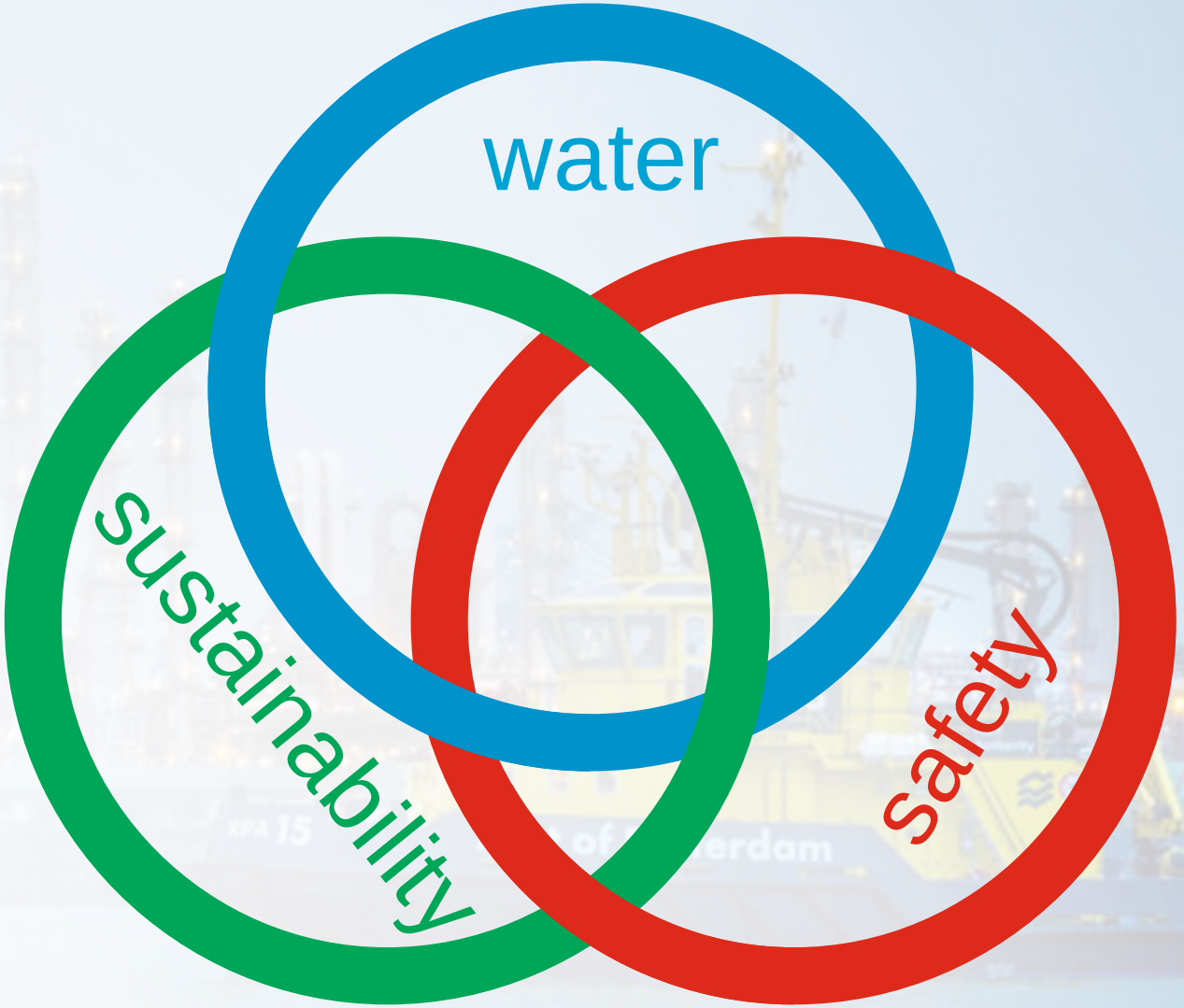
Anslyn receptors for phosphate: Oshovsky, G.V.; Reinhoudt, D.N.; Verboom, W. Supramolecular Chemistry in Water. *Angew. Chem. Int. Ed.* **2007**, *46*, 2366 – 2393

Example of Paper Peroxide sensors

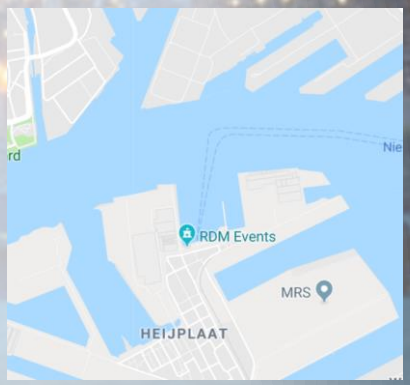


Xu, M.; Bunes, B. R.; Zang, L. *ACS Appl. Mater. Interfaces* **2011**, *3*, 642–647

Key Subjects



Good progress



Team

- dr. Gennady Oshovsky, lector kenniscentrum DHS
- dr. Christophe Minkenberg, opleiding Chemie
- dr. Hens Hijnen, opleiding Chemie
- dr. Niek Heuts, opleiding Chemie
- dr. Monique van der Wardt-Kester, opleiding BML
- dr. Jos Veldscholte, opleiding BML
- dr. Barbara Schrammeijer, opleiding BML
- dr. Christiaan Tempelman, opleiding CT
- dr. Urjan Jacobs, opleiding CT
- Emile Jackson, opleiding Werktuigbouwkunde
- John Roeloffs, opleiding Elektrotechniek
- Harry Broeders, opleiding Elektrotechniek
- Leo Remijn, opleiding Mediatechnologie
- Peter Verheijen, regisseur Next Port Industry

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Questions?