Rapid methods for food quality and safety control; the CON*ff*IDENCE project

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www.con*ff*idence.eu

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CON*ff*IDENCE

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  ▪ **What ?**

CON*ff*IDENCE in a nutshell

Chemical CONtaminants

CONffIDENCE in a nutshell

CONtaminants in food and feed:

Inexpensive DEtectioN
for Control of Exposure

CON*ff*IDENCE passport

- FP7 Collaborative Project; first call "Food, Agriculture & Fisheries, and Biotechnology"
- Duration: May 2008 – April 2012
- 17 partners from 10 countries, representing universities, research institutes, industry and SMEs
- Budget: 7.5 Mio €
- Co-ordinator: RIKILT - Institute of Food Safety, part of Wageningen UR (NL)

The objectives

➢ Development and validation of new simplified inexpensive detection methods for chemical contaminants from farm to fork

➢ Improved exposure assessment through monitoring of selected contaminants

➢ Dissemination and training of new detection methods to all relevant stakeholders, to advance technology exploitation

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The commodities

Food   **&**   **Feed**

➢ Fish/shellfish   Fish feed

➢ Cereals   Cereal-based feed

➢ Potatoes/vegetables

➢ Honey

➢ Eggs

➢ Meat

➢ Dairy products

The target contaminants

➢ POPs: - dioxin-like PCBs + metabolites
              - brominated flame retardants
              - polycyclic aromatic hydrocarbons (PAH)

➢ Perfluorinated compounds (PFCs)

➢ Pesticides: paraquat/diquat, dithiocabamates

➢ Veterinary drugs: - antibiotics, e.g. tetracyclines
                         - coccidiostats, e.g. ionophores

➢ Heavy metals speciation: inorganic arsenic, methyl mercury

➢ Biotoxins: - alkaloids
               - marine biotoxins

               - mycotoxins

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➢ Introduction to CON*ff*IDENCE

- ■ What ?
- ■ **Why ?**

Why CON*ff*IDENCE (1) ?

➢ To assure chemical safety and quality in the European food supply; support of EC policies and competitiveness of food and feed industries

➢ To improve multi-detection ("multiplex") possibilities

➢ To improve inexpensive screening possibilities, e.g. for metal speciation

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Why CON*ff*IDENCE (2) ?

➤ To speed-up analysis for factory approval of lots

➤ To contribute to the assessment of risks of emerging contaminants

  ▪ e.g. plant toxins such as pyrrolizidine alkaloids

Why CON*ff*IDENCE (3) ?

➢ To contribute to the generation of data for exposure assessment, e.g. for PFC's:

Perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and their salts
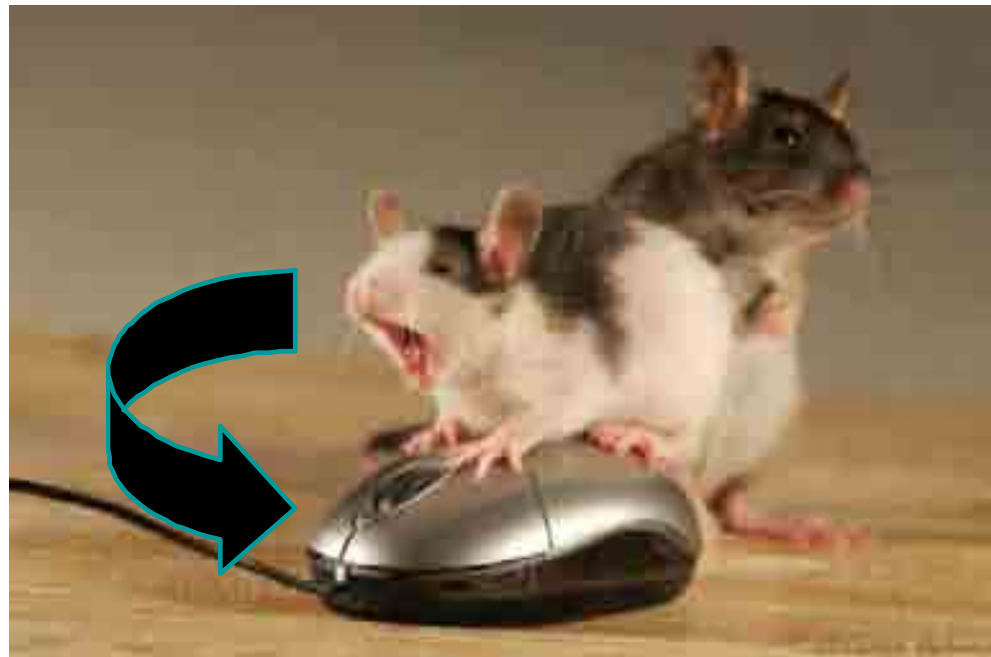Scientific Opinion of the Panel on Contaminants in the Food chain
Adopted on 21 February 2008

"Due to the substantial lack of suitable analytical data, many assumptions have been made in order to derive exposure estimates."

Why CON*ff*IDENCE (4) ?

➢ To replace animal based bioassays, e.g. the mouse assay for marine biotoxins
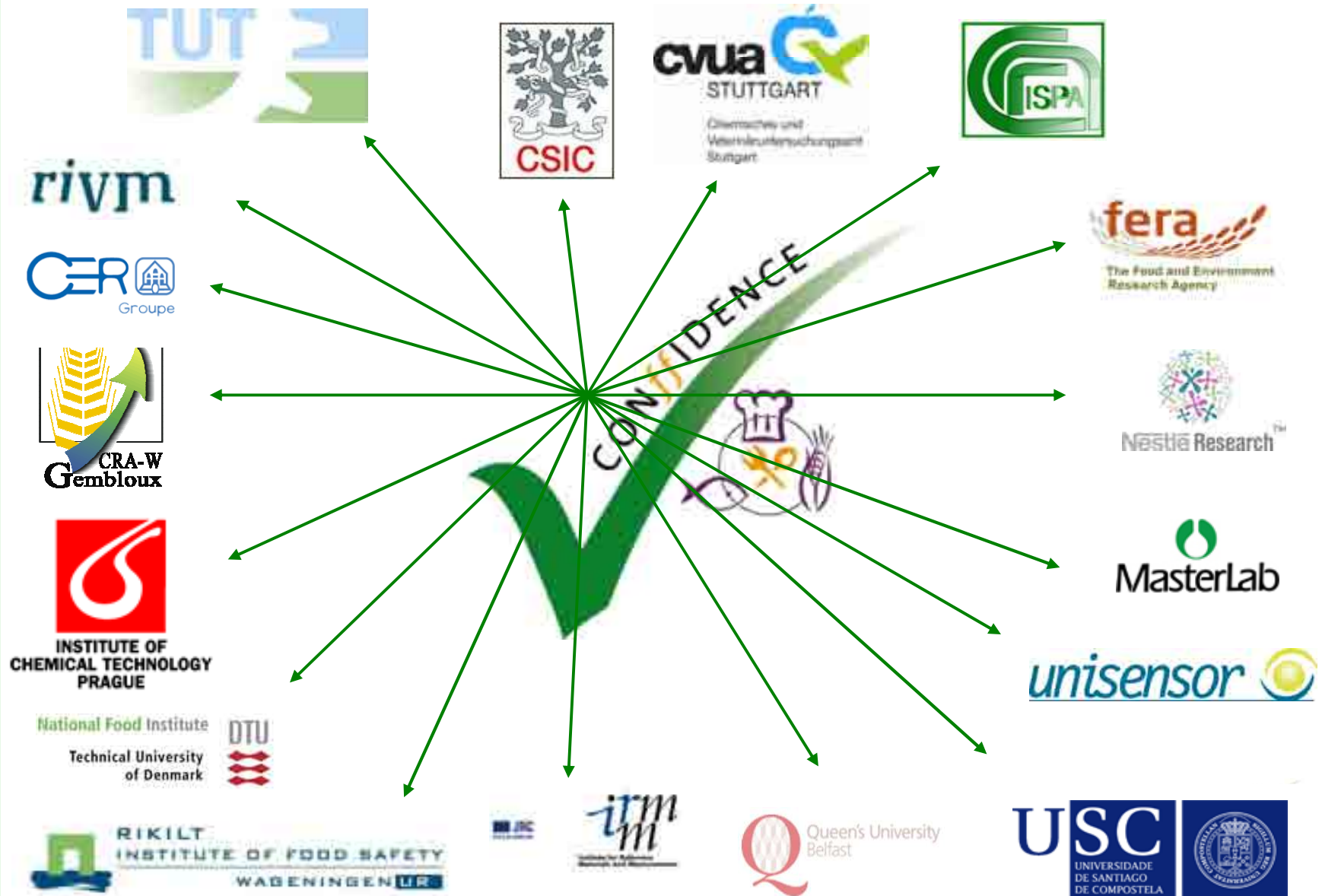
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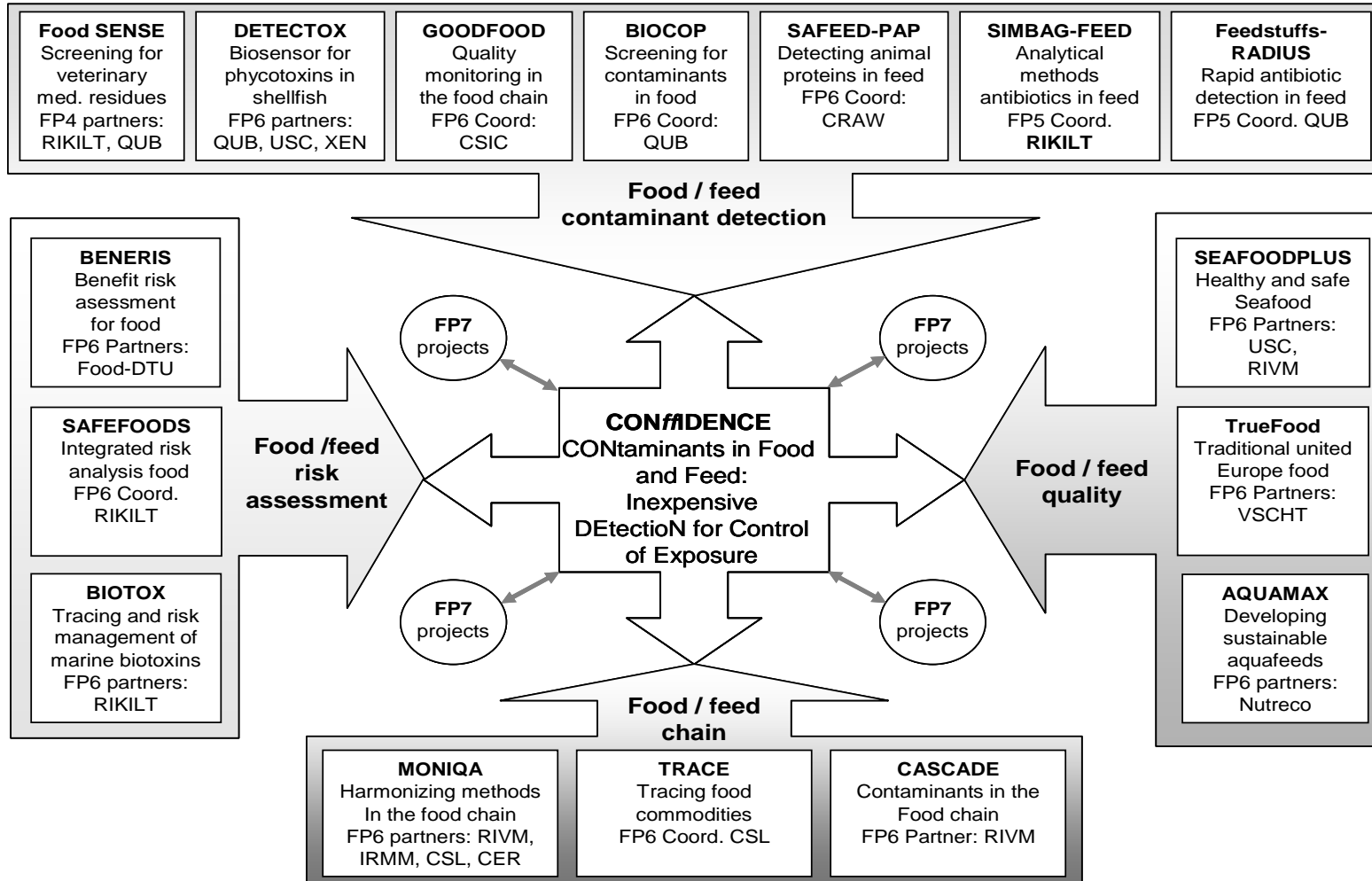
  ▪ What ?
  ▪ Why ?
  ▪ **Who ?**

The consortium

The Advisory Board

Representatives from:

- FAO/IAEA
- DG-SANCO
- EFSA CONTAM panel
- CEN committee Food analysis – Horizontal methods (CEN/ TC 275)

European approach

Food SENSE	DETECTOX	GOODFOOD	BIOCOP	SAFEED-PAP	SIMBAG-FEED	Feedstuffs-RADIUS
Screening for veterinary med. residues FP4 partners: RIKILT, QUB	Biosensor for phycotoxins in shellfish FP6 partners: QUB, USC, XEN	Quality monitoring in the food chain FP6 Coord: CSIC	Screening for contaminants in food FP6 Coord: QUB	Detecting animal proteins in feed FP6 Coord: CRAW	Analytical methods antibiotics in feed FP5 Coord. **RIKILT**	Rapid antibiotic detection in feed FP5 Coord. QUB

Food / feed contaminant detection

BENERIS
Benefit risk asessment for food
FP6 Partners: Food-DTU

SAFEFOODS
Integrated risk analysis food
FP6 Coord. RIKILT

BIOTOX
Tracing and risk management of marine biotoxins
FP6 partners: RIKILT

Food /feed risk assessment

FP7 projects

FP7 projects

CON*ff*IDENCE
CONtaminants in Food and Feed:
Inexpensive DEtectioN for Control of Exposure

FP7 projects

FP7 projects

Food / feed quality

SEAFOODPLUS
Healthy and safe Seafood
FP6 Partners: USC, RIVM

TrueFood
Traditional united Europe food
FP6 Partners: VSCHT

AQUAMAX
Developing sustainable aquafeeds
FP6 partners: Nutreco

Food / feed chain

MONIQA	TRACE	CASCADE
Harmonizing methods In the food chain FP6 partners: RIVM, IRMM, CSL, CER	Tracing food commodities FP6 Coord. CSL	Contaminants in the Food chain FP6 Partner: RIVM

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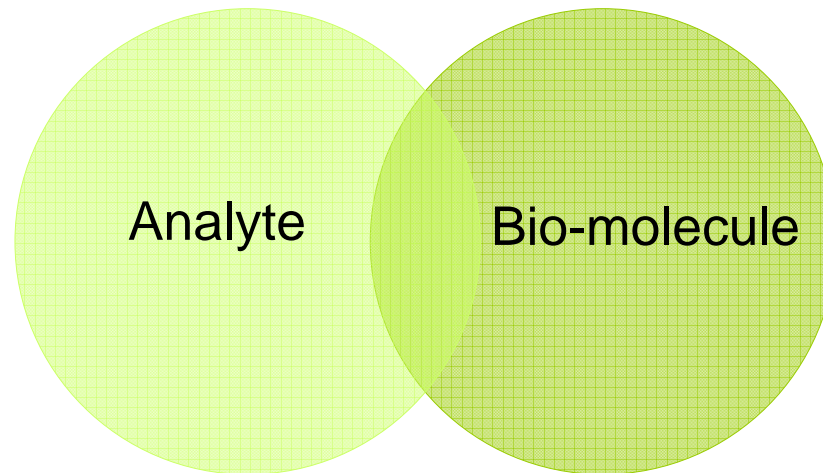 - **Detection modes**

Detection modes

➢ Bio-analytical techniques

➢ MS-based techniques
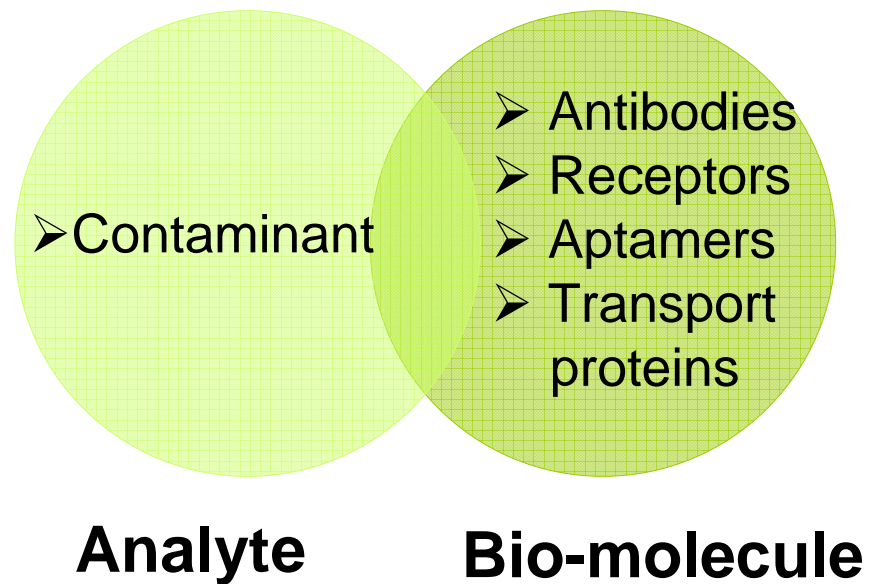
➢ Spectroscopic techniques

Detection modes

➢ **Bio-analytical techniques**

➢ MS-based techniques

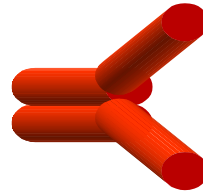➢ Spectroscopic techniques
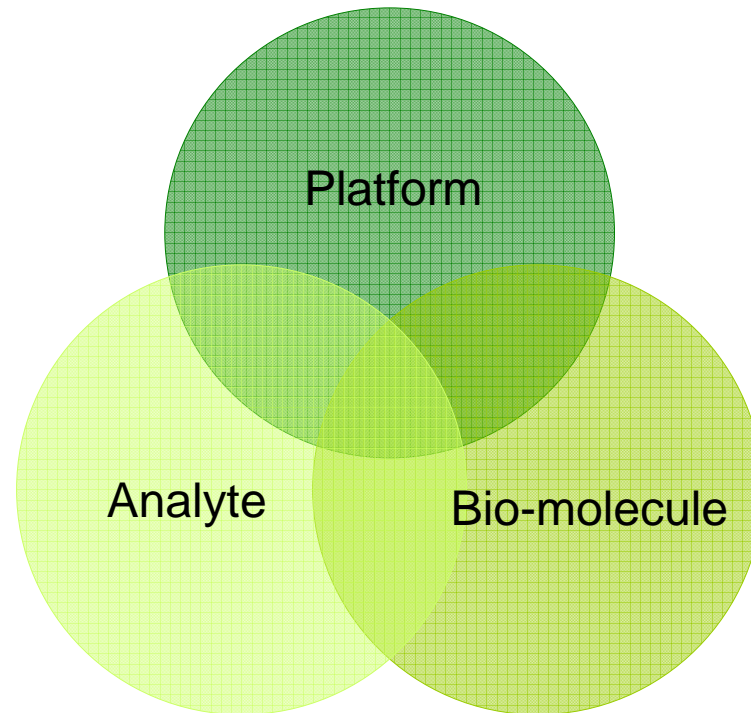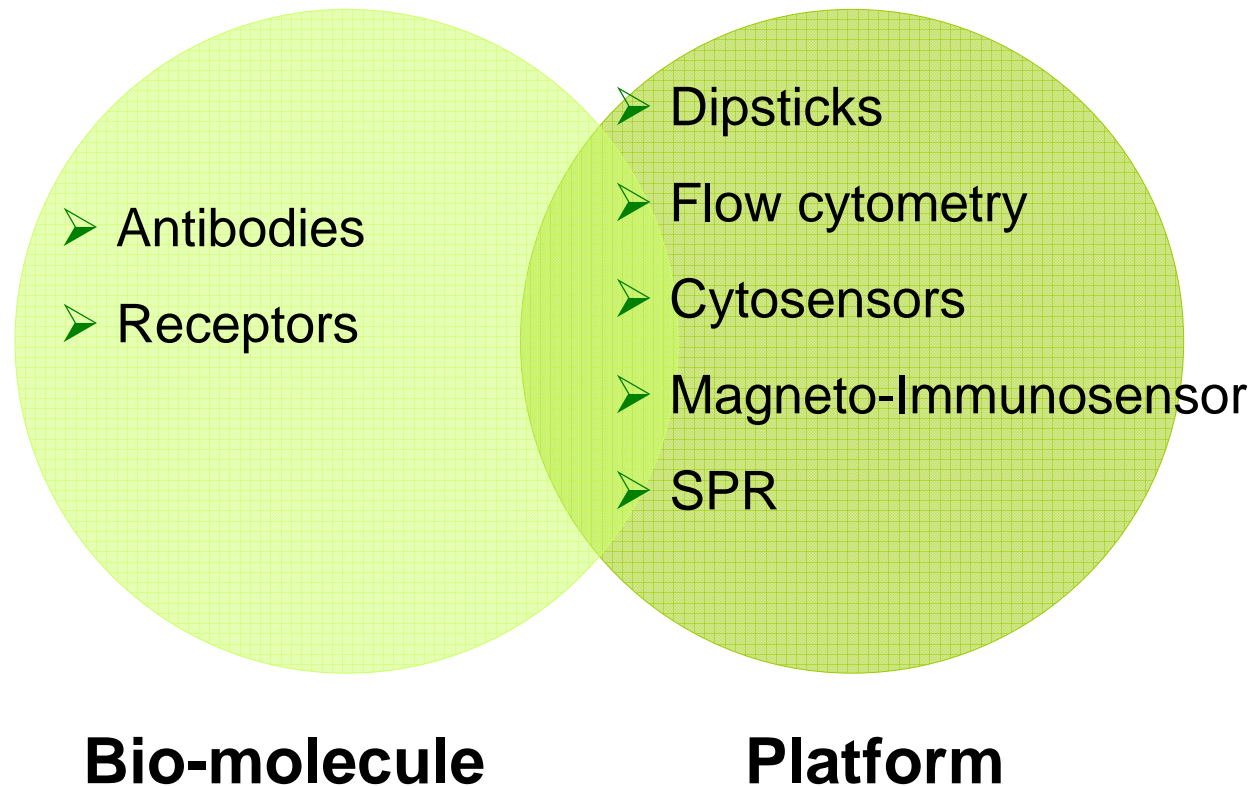
Bio-analytical detection

Analyte   Bio-molecule

Bio-analytical detection

> Contaminant

> Antibodies
> Receptors
> Aptamers
> Transport proteins

Analyte   **Bio-molecule**

Antibodies

➢ Polyclonal *and* Monoclonal

➢ Already available *or* produced in CON*ff*IDENCE

➢ Much effort in the first part; already successful for several antibiotics, coccidiostats and plant alkaloids

Bio-analytical detection

Bio-analytical detection

> Antibodies

> Receptors

> Dipsticks

> Flow cytometry

> Cytosensors

> Magneto-Immunosensor

> SPR

**Bio-molecule**   **Platform**

SULFASENSOR dipstick

Rapid test to detect sulfonamides in honey

- Competitive antibody **dipstick** assay

- Detects more than **10** sulfonamides

- **5 min** of sample processing (hydrolysis)

- **20 min** of analysis

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unisensor

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info@unisensor.be

SULFASENSOR sensitivities

- Sulfapyridine: < 25 ppb
- Sulfamethazine: < 25 ppb
- Sulfamethoxypyridazine:< 25 ppb
- Sulfamerazine: < 25 ppb
- Sulfamonomethoxine :   < 25 ppb
- Sulfadiazine: 25 ppb
- Sulfadimethoxine: 25 ppb
- Sulfathiazole: 25 ppb
- Sulfachloropyridazine: 25 ppb
- Sulfaquinoxaline: 150 ppb
- Sulfamethoxazole: 500 ppb
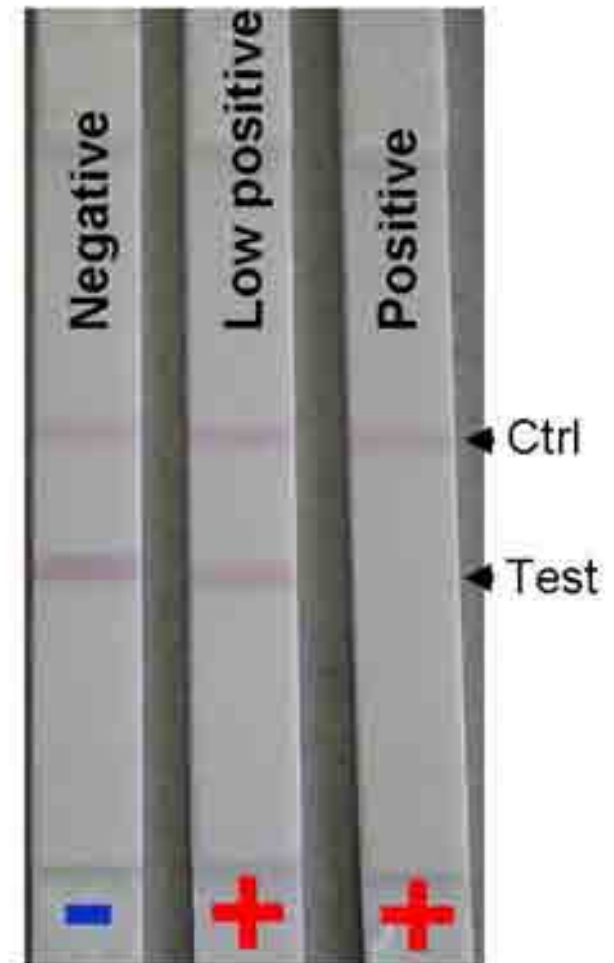
Multi-dipstick *under development:* antibiotics in honey

A) **Sulfonamides**

B) **Quinolones**

C) **Tylosin**

D) **Chloramphenicol**

HONEY
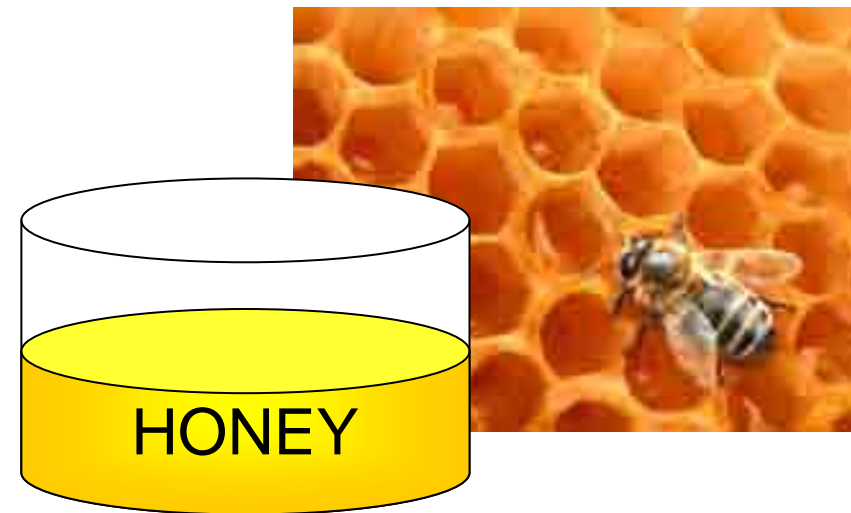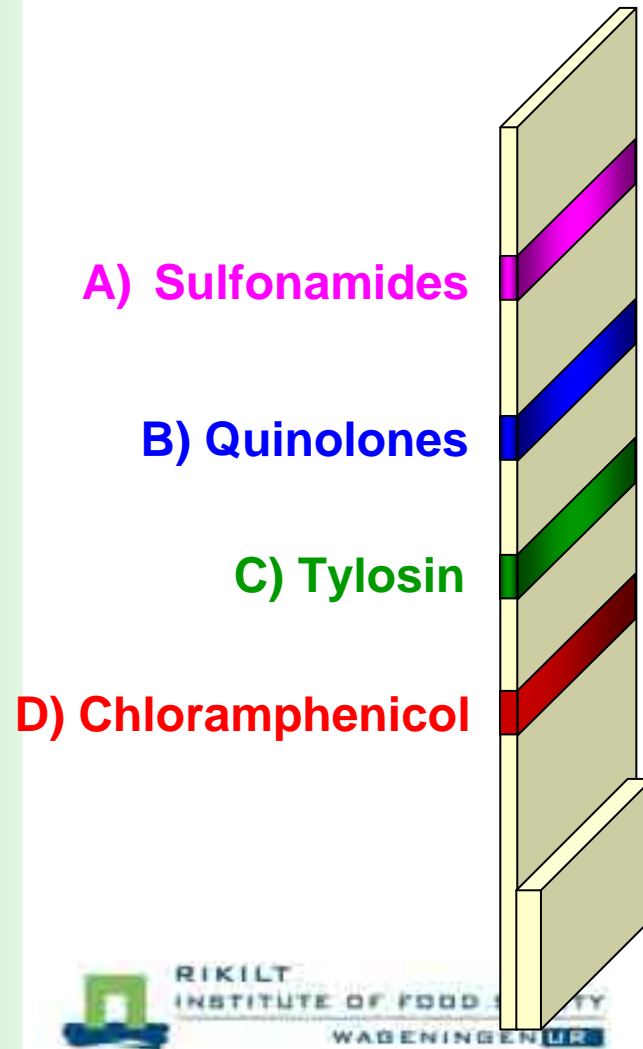
Flow cytometry platform

➢ Flow cytometry in combination with the xMAP technology (Luminex)

➢ <u>Principle</u>: <u>see oral presentation</u> of **Anastasia Meimaridou** (RIKILT)

➢ Applications in CON*ff*IDENCE:

- ▪ PAH's in food
- ▪ Coccidiostats (multiplex !!!): cross-contamination of feed and transfer to eggs

100 Color-codes = 100 Simultaneous Tests

Using this method, over 100 distinct microspheres sets can be created.

http://www.luminexcorp.com/

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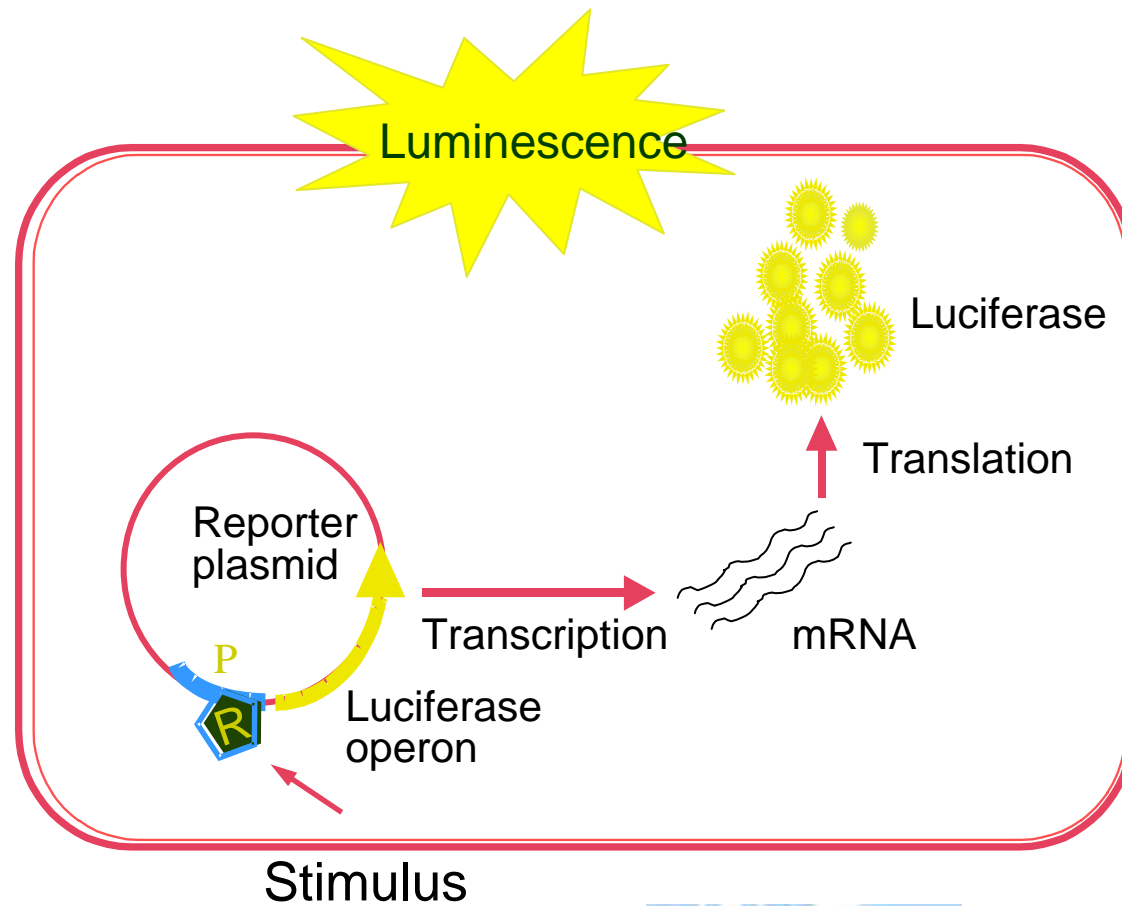INSTITUTE OF FOOD SAFETY
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Cytosensor platform

Application in CON*ff*IDENCE:

➢ Whole-cell, light-emitting microbial sensors for heavy metal speciation

➢ Possible to use freeze-dried microbial cells
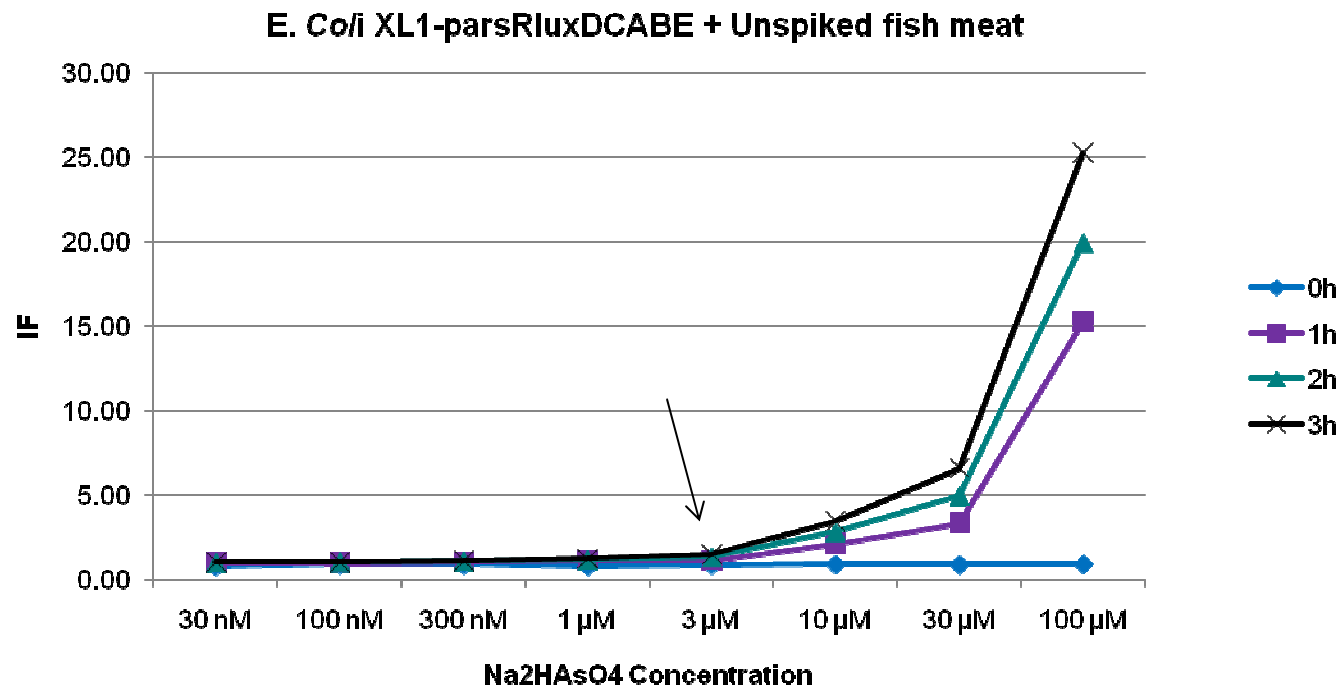
➢ Portable device format

Principle of the luminescence-based sensor strains for specific detection of inorgAs and MeHg

P = promoter
R = regulatory protein

Biosensor for inorganic As

Standard curve with unspiked fish meat (Nutreco) extracted with H_2O

Detection modes

➢ Bio-analytical

➢ MS-based

➢ Spectroscopic

MS-based detection

- Simplified ambient mass spectrometric (MS) methods

- Application in CON*ff*IDENCE: DESI-MS and DART-MS for dithiocarbamates in crops

See oral presentation of:
Jana Hajslova, ICT, Prague

Detection modes

- Bio-analytical
- MS-based
- Spectroscopic

Near Infrared Hyperspectral Imaging

Application in CONffIDENCE:
Detection of ergot in cereals

See oral presentation of:
Vincent Baeten, Walloon
Agricultural Research
Centre (CRA-W), Belgium

The NIR camera

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- **Methods in CON*ff*IDENCE**
  - Detection modes
  - **Sample clean-up**

Sample clean-up

➢ **No** clean-up as far as possible

➢ Fast and simple clean-up, e.g.

- Magnetic beads: integrated sample preparation:
  - Flow cytometry
  - Magneto-Immunosensor
- SPE: separation of inorgAs vs. orgAs: <u>see oral presentation</u> of **Jens Sloth**, DTU Food
- Dispersive solid phase extraction with activated charcoal for PFCs

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  - Sample clean-up
- Conclusions

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Conclusions

➢ Several rapid and high-throughput techniques may be applied for the development of inexpensive *multiplex* screening methods for chemical contaminants in food

➢ Most of these techniques are based on bio-analytical principles with a large choice of bio-molecules and platforms available

➢ First results of CON*ff*IDENCE show good perspectives for application to "real world problems"

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More information

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(registration on website)

Thank you for your attention !