Food Allergens Detection

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Food allergens - intro

- 4 % of the total population is affected by food-allergic disorders (millions of people on a yearly basis).
- There are eight foods that account for 90% of all food-allergy reactions:
  - Cow's Milk
  - Egg
  - Peanut
  - Soy
  - Tree nuts
  - Lupine
  - Wheat
  - Fish & Shellfish

Mandatory labeling does not include **cross-contamination**

Insufficient or excessive labelling

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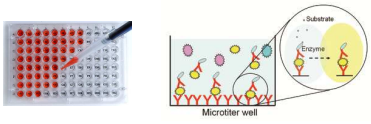
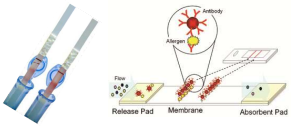
Branum AM, Lukacs SL.,NCHS data brief, no 10. Hyattsville, MD: National Center for Health Statistics, 2008

Routine screening methods

- ELISA- Enzyme linked immunosorbent assay



- LFDs-Lateral Flow Devices



Testing only for one allergen at a time

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Why Multi-Allergen detection is needed?

- Allergenic foods contain *several* allergenic proteins which contain in turn *several* allergenic epitopes
- Sensitized individuals exhibit allergic reactions to *more than one* allergic foods
- Food products are usually contaminated with *more than one or two* allergens

... So, its a complex problem

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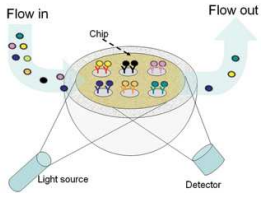
Multi-Allergen detection methods
Imaging Surface Plasmon Resonance



- Label free read out
- Real time measurement
- Quantitative
- Multiple measurement cycles on one chip
- Minimal sample preparation
- Automated

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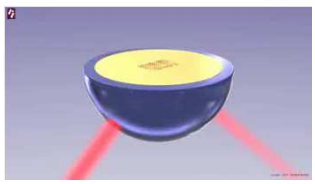
Multi-Allergen detection methods
Imaging Surface Plasmon Resonance

How does it work?



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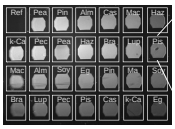
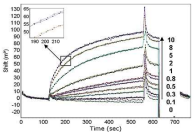
Spotted chip

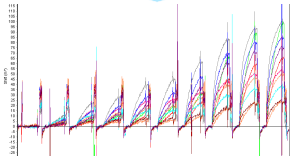
with 13 allergen antibodies





Sensorgrams of

Single calibration curve on a single spot



Sensorgrams of

Multiplexed calibration curve

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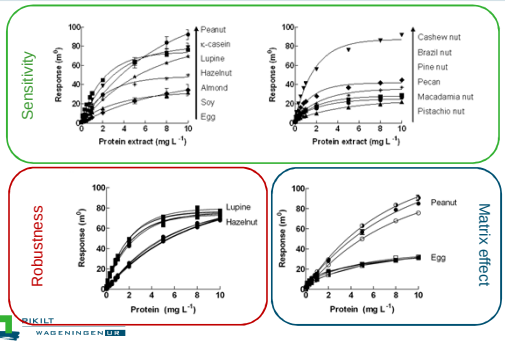

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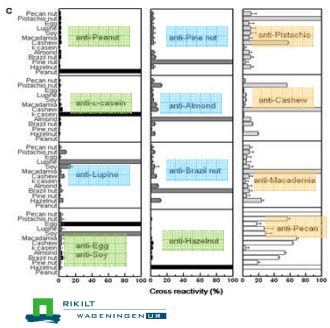

Selective
(CR<1%)

Semi selective
(CR due to common epitopes)

Generic
(CR>10%)

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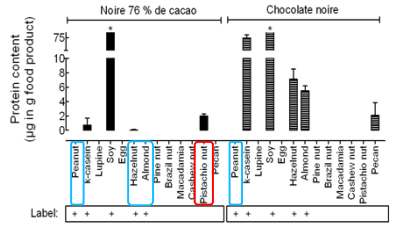
Imaging Surface Plasmon Resonance

- **Allergens profiling in dark chocolates**



Insufficient labelling

Excessive labelling

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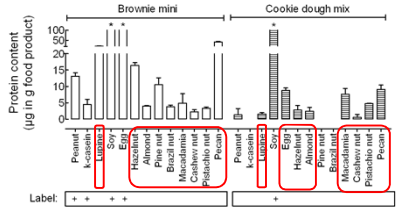
Multi-Allergen detection methods
Imaging Surface Plasmon Resonance

- **Allergens profiling in cookies**



Insufficient labelling

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Multi-Allergen detection methods
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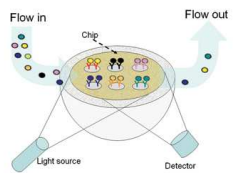

- Provides a profile on the allergen content
- 12 allergens *simultaneously*
- 12 minutes
- in low mg/kg range (ppm) comparable to ELISA
- In a single reagent assay format
- One sensor chip -> more than 200 measurements
- Automated

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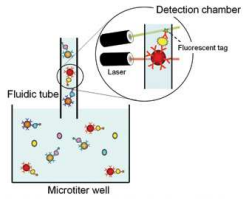
Multi-Allergen detection methods
Microsphere-based Flow-cytometry



- Bead array up to 500-plex
- Fast,
- Robust
- Low cost

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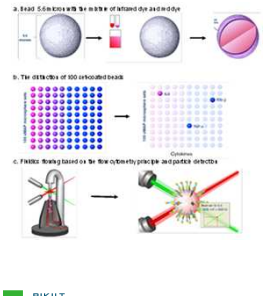
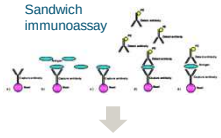
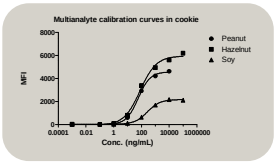
Multi-Allergen detection methods
Microsphere-based Flow-cytometry



Sandwich immunoassay





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Multi-Allergen detection methods
Microsphere-based Flow-cytometry

In house validation

	Peanut	Hazelnut	Soy
LOD (ng/g) 6 cookie samples	10	10	21
LOQ (ng/g) 6 cookie samples	27	18	44
X-reactivity 46 protein extracts	Cashew	-	-

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Screening for Allergens

Summary:

2 new detection methods:

iSPPR biosensor	**Microsphere-based flow cytometry**
Provides a **profile** on the allergen content	
12 allergens simultaneously	**3 allergens** simultaneously
At low **mg/kg** (ppm) range comparable to ELISA	At **µg/kg** (ppb) range
To be **extended** to include **more** allergens	
Validation	

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Challenges in food allergens detection

- Food product **processing** can affect the allergenic proteins and produce new allergenic epitopes
- There is **no threshold** for allergic reaction
- **Absolute amount** of the allergenic food in the product currently cannot be established
- Multi-allergen **confirmatory methods** are missing

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Thank you for your attention

Questions?

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