

Nanotech Northern Europe

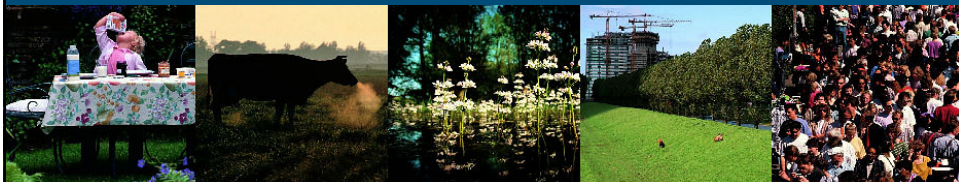
September 24, 2008

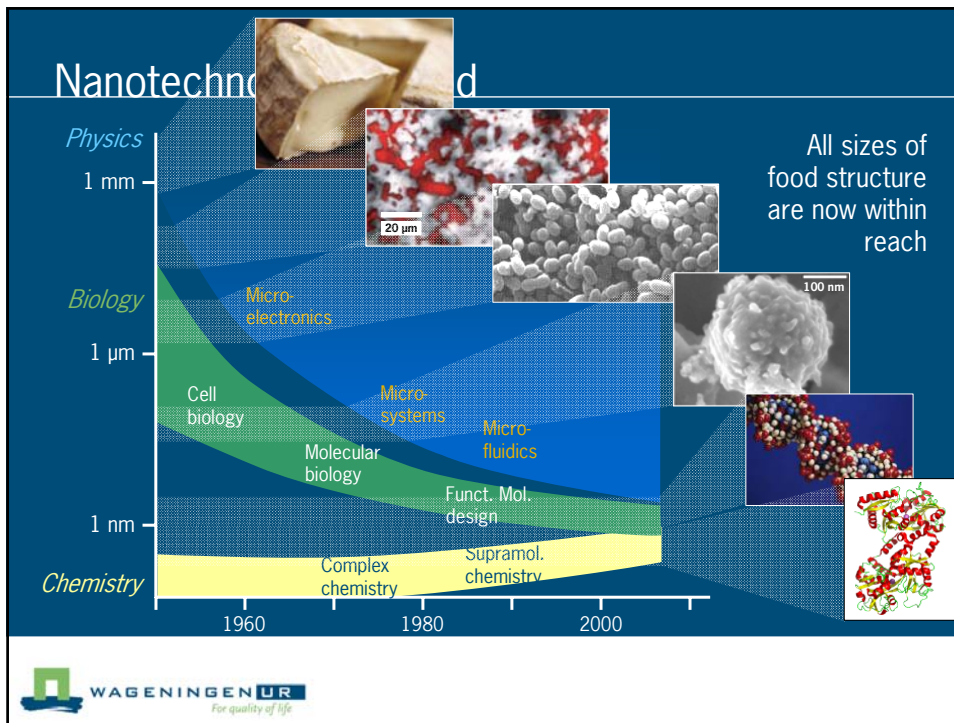
# Nanotechnologies for Food

Frans Kampers



**University** ...to explore the potential of nature  
**Contract Research Organisation** (since 12-2006)  
One of the largest research organisations on food and nutrition in the world  
to improve the quality of life...  
University students 494  
Revenues: € 590 million





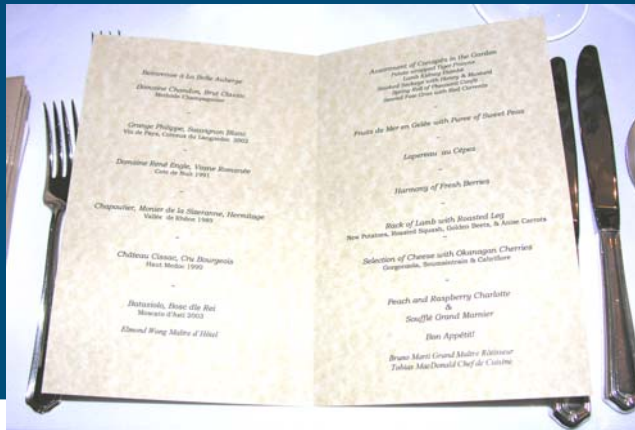
# Aspects of Food

- Provide energy
- Nourish
- Healthy
- Tasty
- Emotion
- Safe
- Transportable
- Convenient
- Cheap
- ...

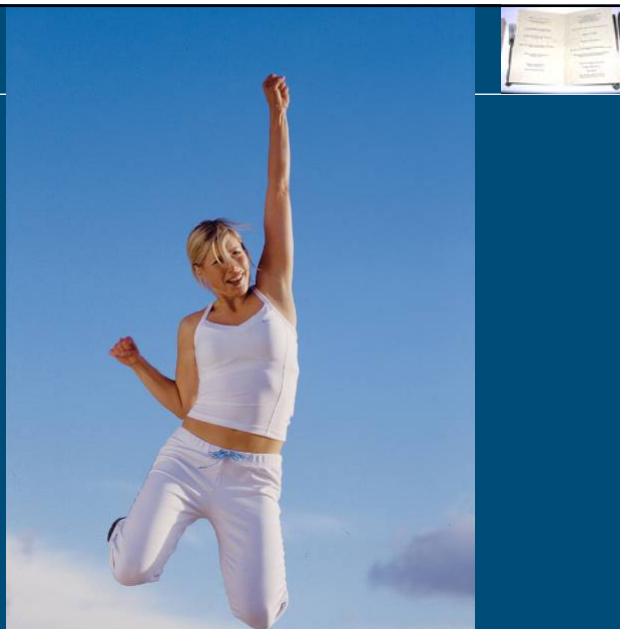
**WAGENINGEN UR**  
For quality of life

## Aspects of Food

- Provide energy
- Nourish
- Healthy
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## Healthy food



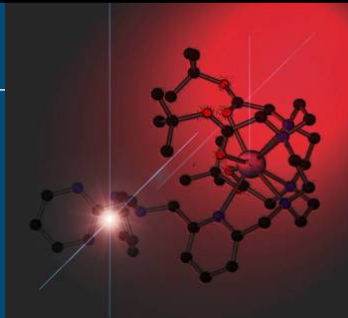
## Healthy



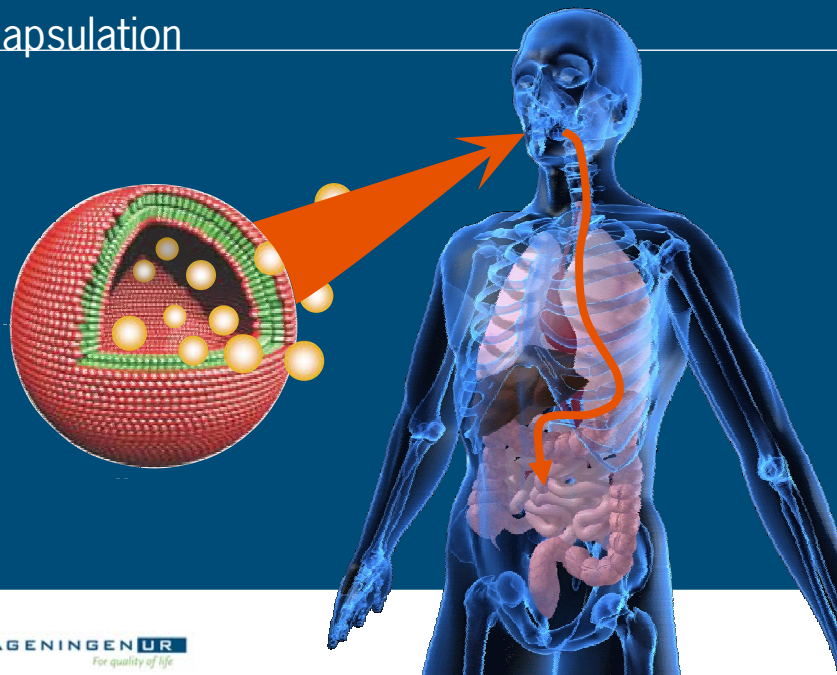
## Fortification



# Encapsulation

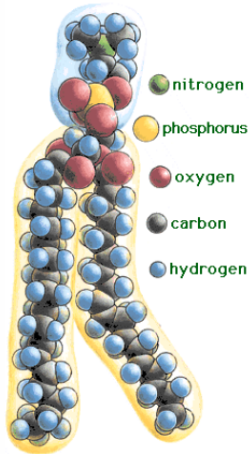


# Encapsulation

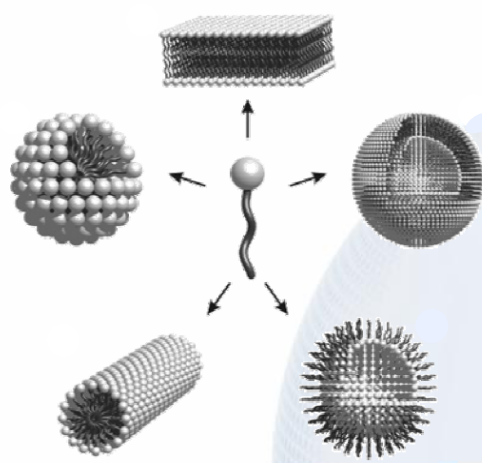


# Self assembly

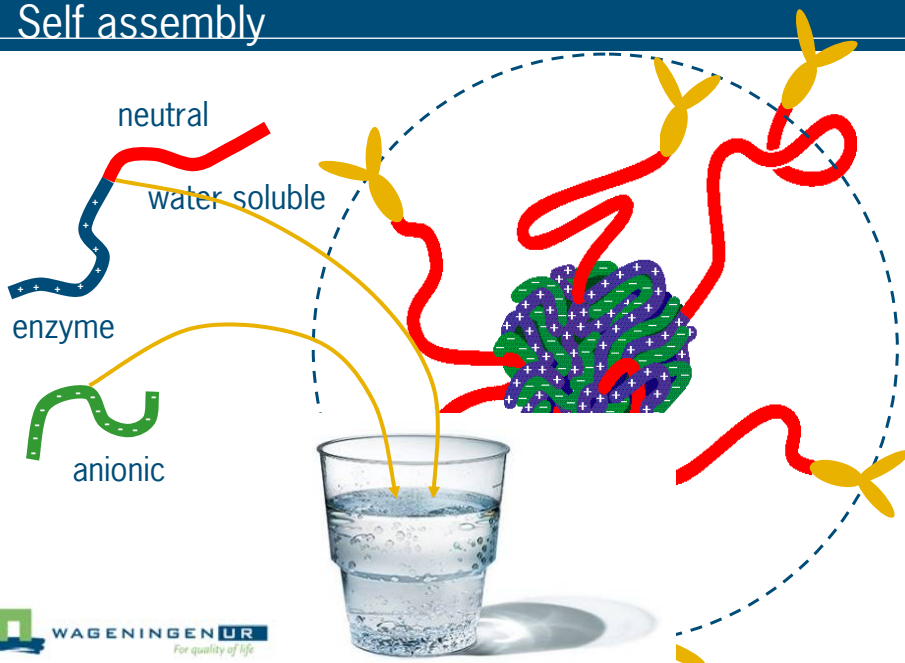
Phospholipid:



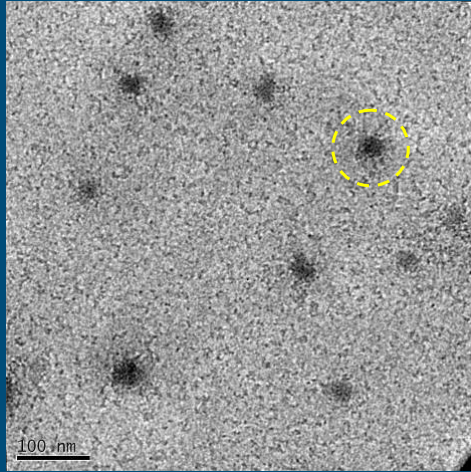
Aggregates:



# Self assembly



## Delivery

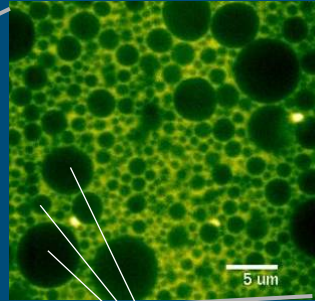


Willem Norde – Physical Chemistry and Colloid Science

## Good food



# Mayonnaise

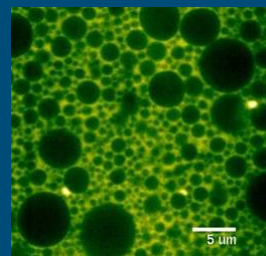
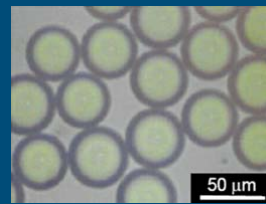
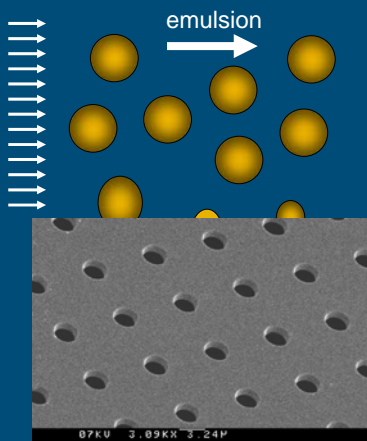


Oil droplets in water

Emulsion

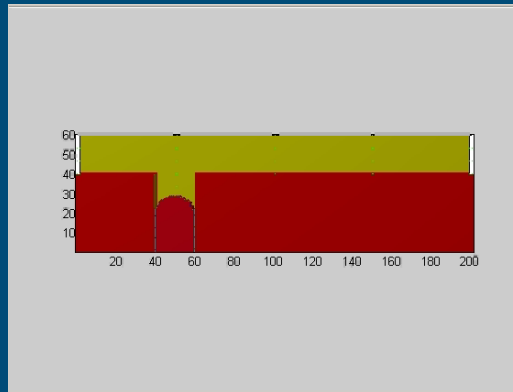
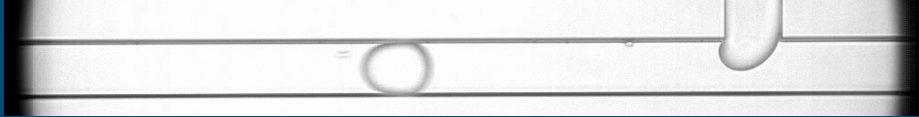


# Membrane emulsification



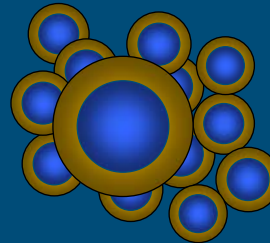


# Computational Fluid Dynamics



Remko Boom – Food and Bioprocess Engineering

# Double Emulsions



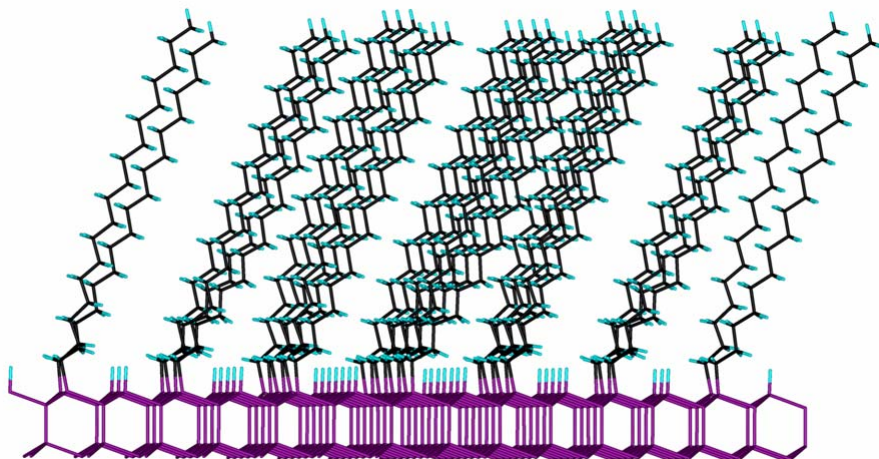
Remko Boom – Food and Bioprocess Engineering



## Food quality

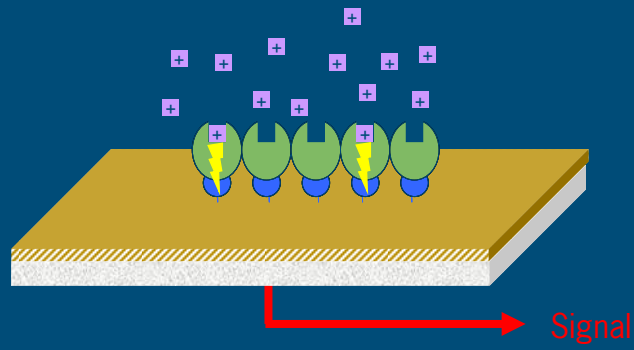


## Organic monolayer on silicon



Han Zuilhof – Organic Chemistry

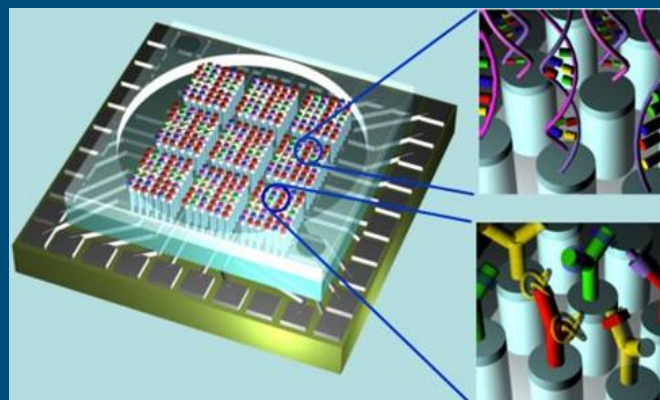
## Food Quality and Safety



Maarten Jongma – PRI



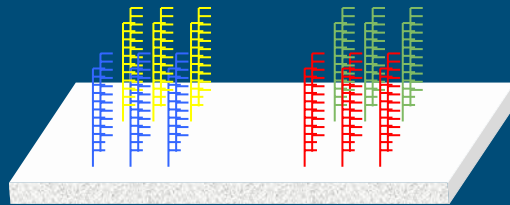
## Sensor array



NASA Ames Research Center



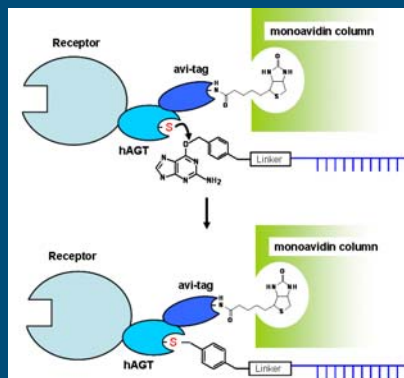
## Writing the addresses



Maarten Jongma – PRI



## Receptors with address label



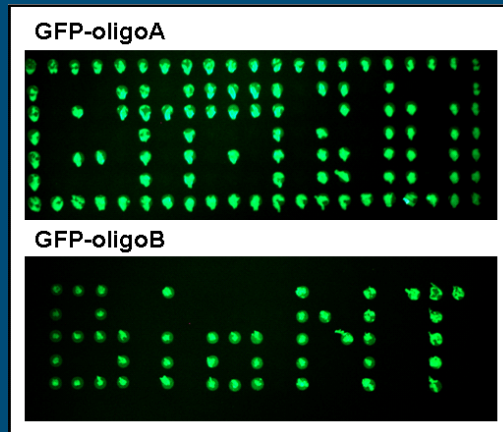
SnapTag: [www.covalys.com](http://www.covalys.com)



Maarten Jongma – PRI



## Proof of principle

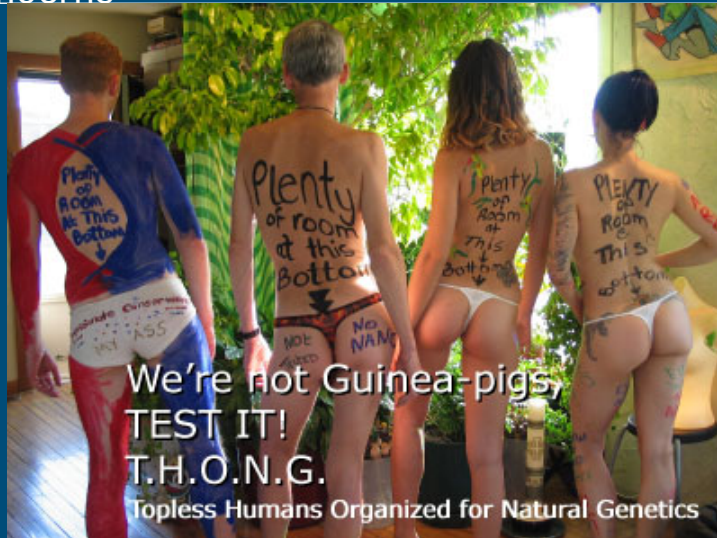


Maarten Jongsma – PRI



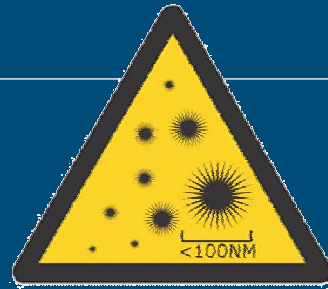
Jongsma and Litjens,  
Proteomics 6: 2650-2655 (2006)

## Concerns



## Consumer acceptance

Food industry denies use of nanotechnology



**Warning**  
Nano Hazard

Consumers perceive nanoparticles as unnatural and hazardous

## Consumer acceptance

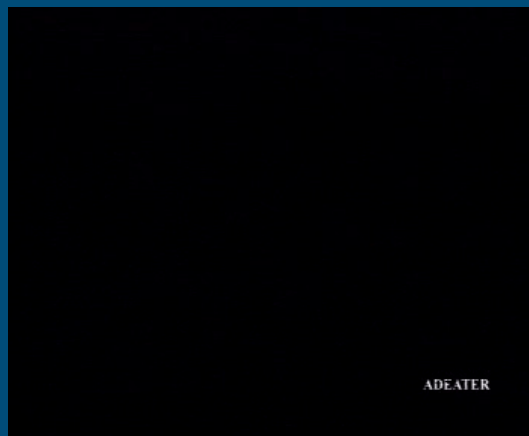
- 😊 Healthier
- 😊 Safety
- 😊 Quality
- 😊 Novelty
- 😊 Extended shelf life
- 😞 Cost
- 😞 Unnatural
- 😞 Risks



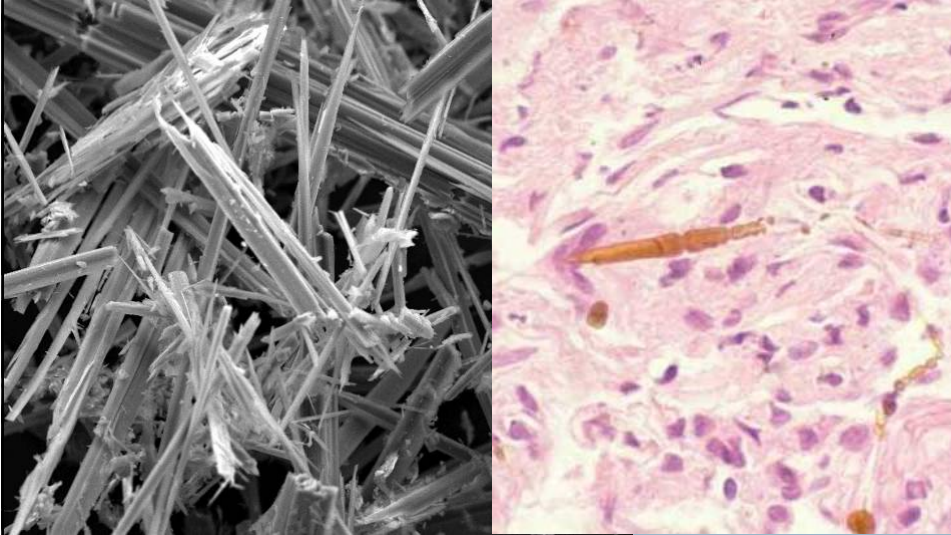
# Hazard and Risk



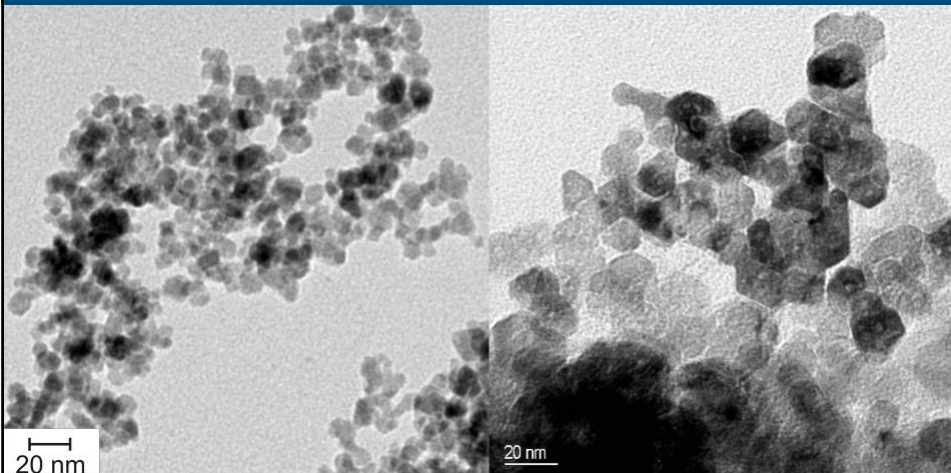
# Risk assessment



## Health hazard



## Hazard characterisation

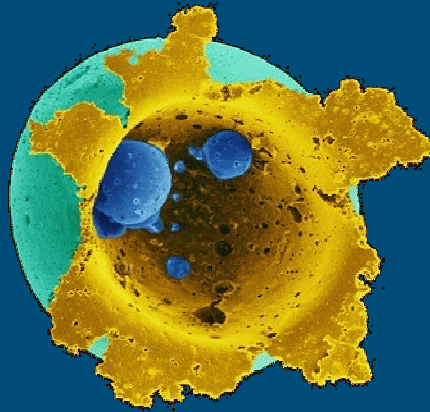


$\text{Fe}_3\text{O}_4$  (9 nm)

ZnO (20 nm)



# Biodegradability



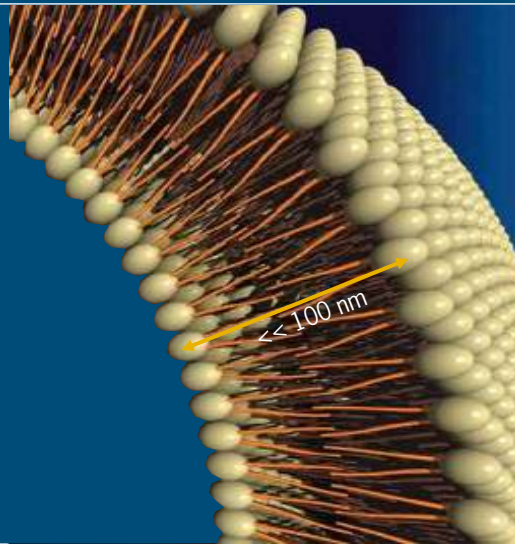
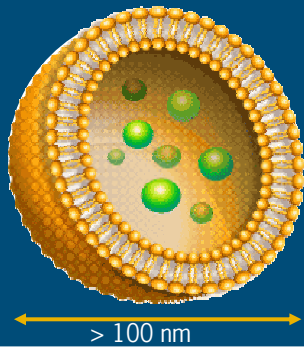
David McCarthy / Science Photo Library



# Communication



## Definition



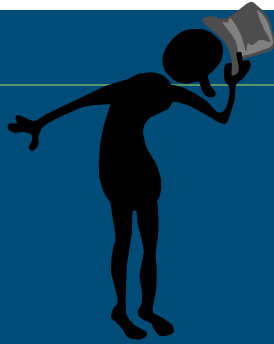
## Acknowledgements

Many researchers  
from the groups led by:

- Remko Boom
- Lynn Frewer
- Maarten Jongsmā
- Willem Norde
- Han Zuilhof

All the people whose pictures I have used





Thanks for your attention  
Questions?

