AAAS Annual Meeting February 14, 2009

What Nanotechnology Can Do for Your Average Donut

Frans Kampers

WAGENINGEN UR
For quality of life

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

WAGENINGEN UR
For quality of life

University

One of the largest research organisations on food and nutrition in the world

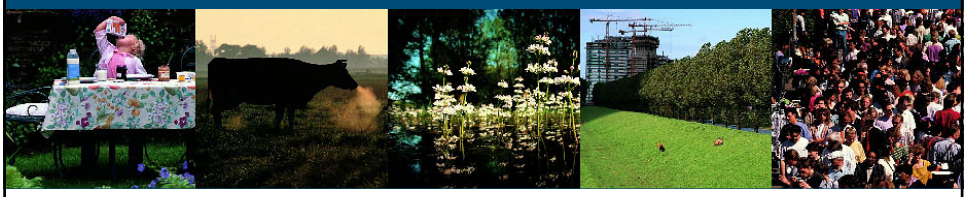
Contract Research Organisation

Facts and Numbers (2007)

Employees:	5427
Students:	5202
Revenues:	643 M€

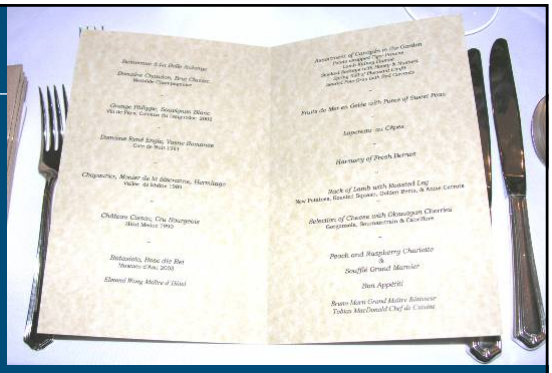
...to explore the potential of nature...

...to improve the quality of life



WAGENINGEN UR

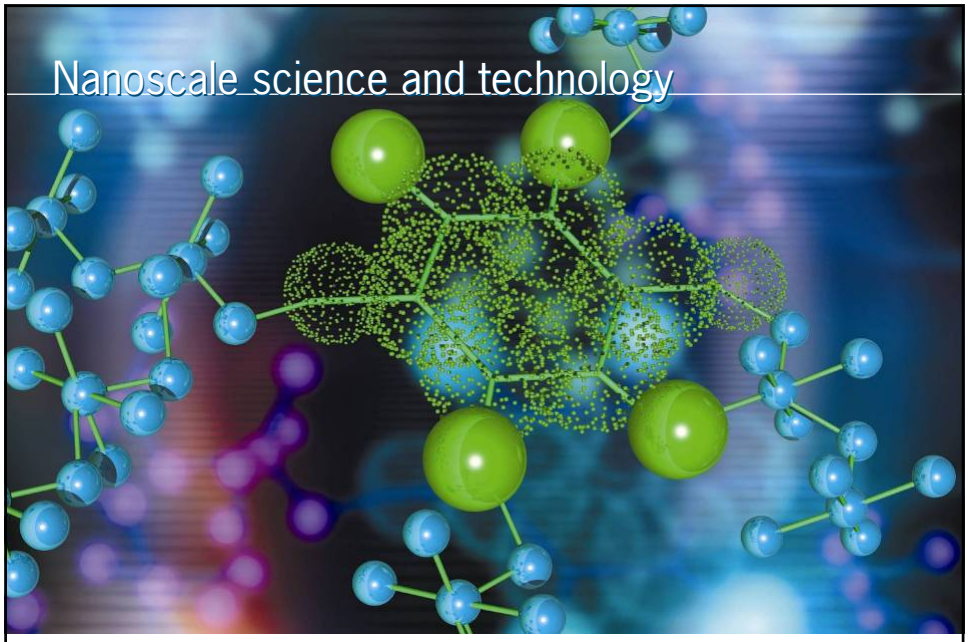
The menu



- Nanotechnology
- Challenges to the food industry
  - Sustainability
  - Food quality
  - Preventive healthcare
  - Satiety and satisfaction
- Societal acceptance

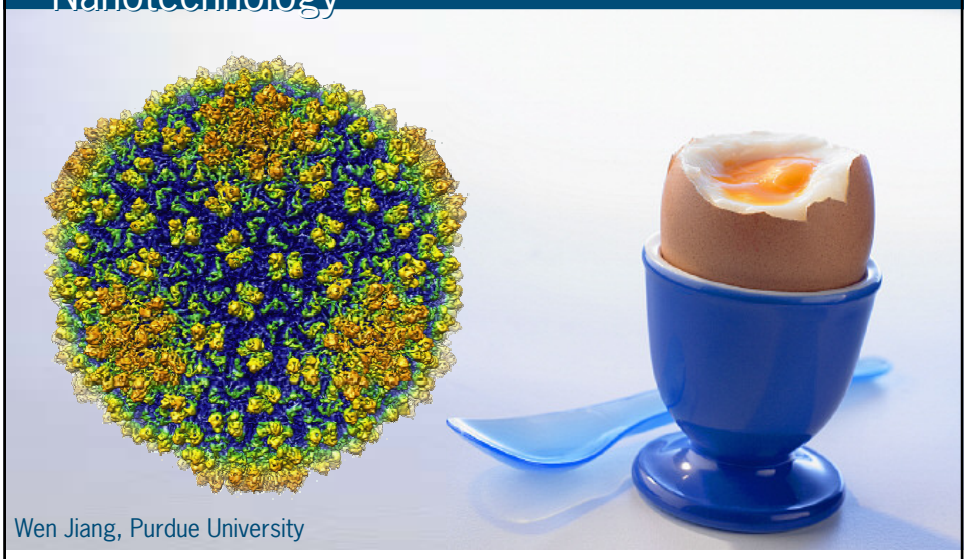
WAGENINGEN UR
For quality of life

Nanoscale science and technology



WAGENINGEN UR
For quality of life

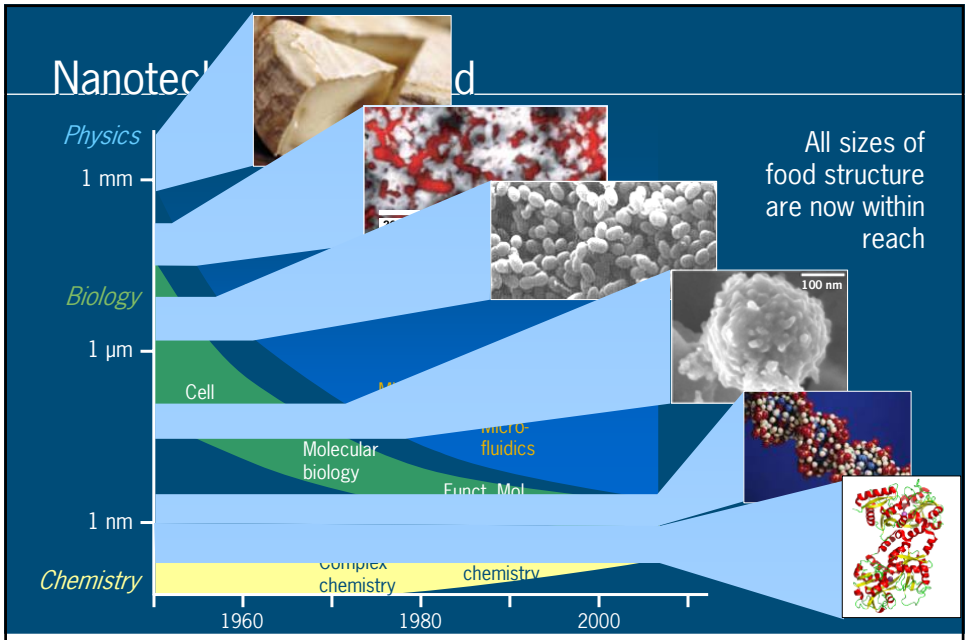
Nanotechnology



Wen Jiang, Purdue University

WAGENINGEN UR
For quality of life

Nanotec d



All sizes of food structure are now within reach

WAGENINGEN UR
For quality of life

Global challenges

- Enough food (sustainability)
- Safe food (food quality)
- Healthy food (nutritious)
- Good food (satiety)

WAGENINGEN UR For quality of life

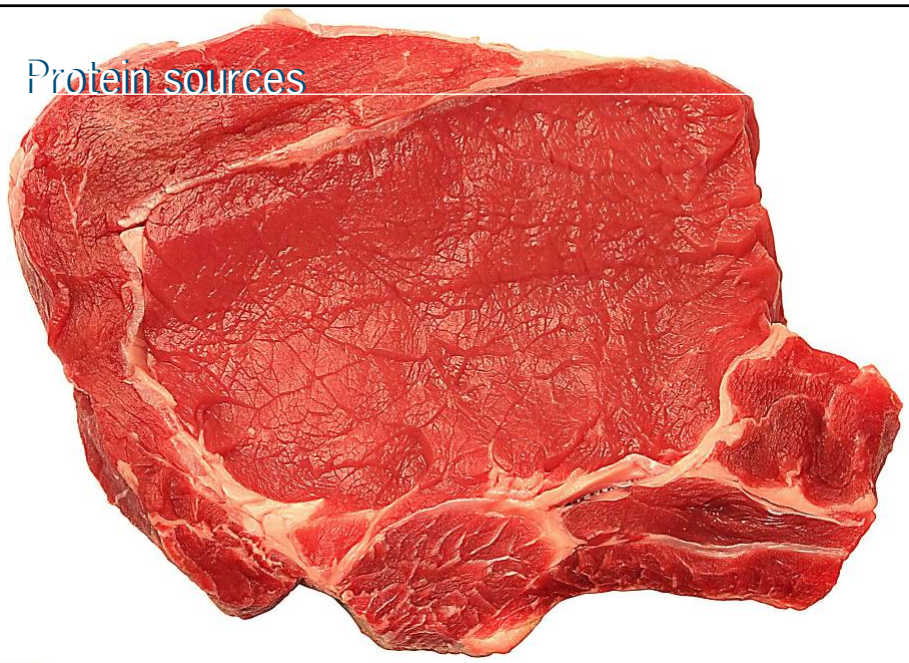
Enough food

WAGENINGEN UR For quality of life

Competition for food

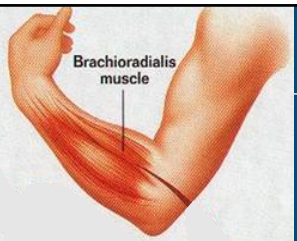
WAGENINGEN UR
For quality of life

Protein sources



WAGENINGEN UR
For quality of life

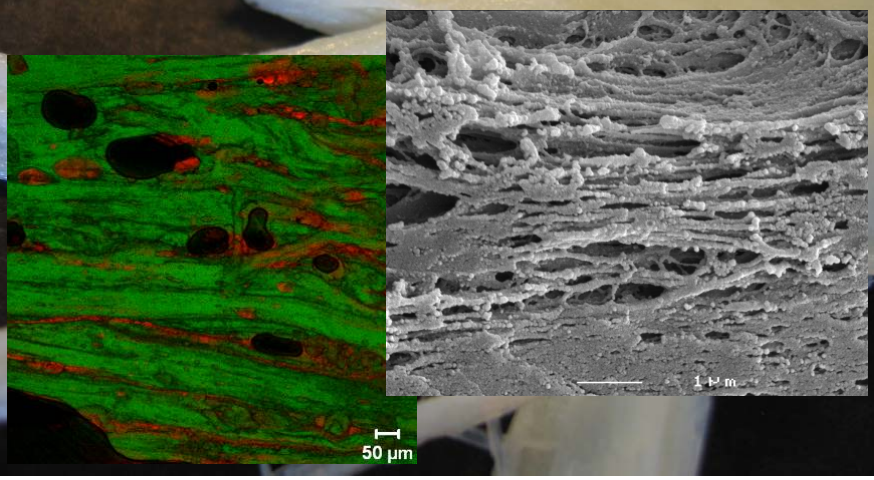
Protein sources



WAGENINGEN UR
For quality of life

Protein sources

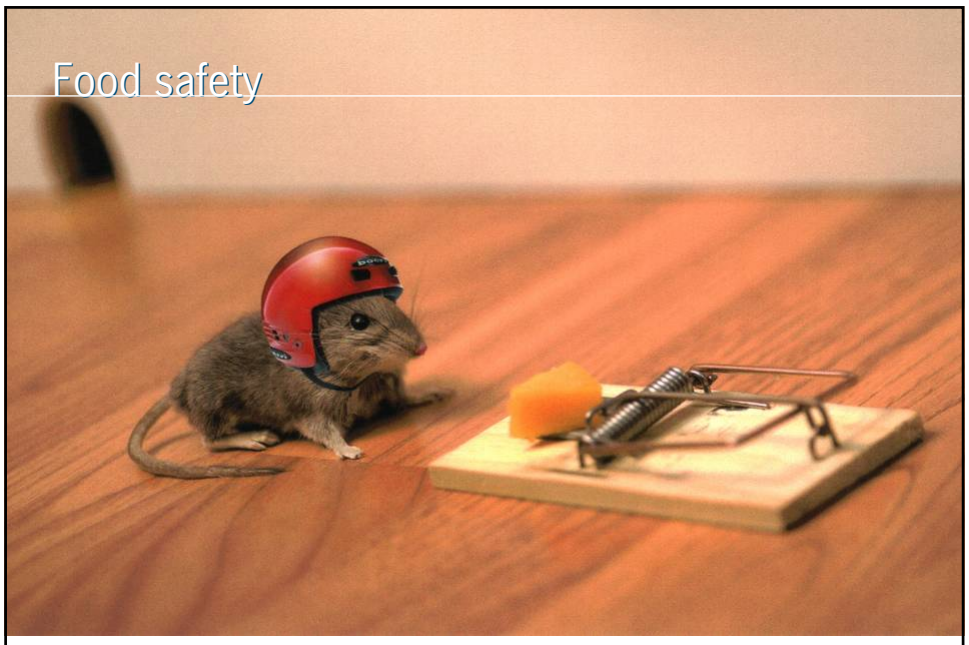
Ca-caseinate / fat



WAGENINGEN UR
For quality of life

Atze Jan van der Goot
Food and Bioprocess Engineering

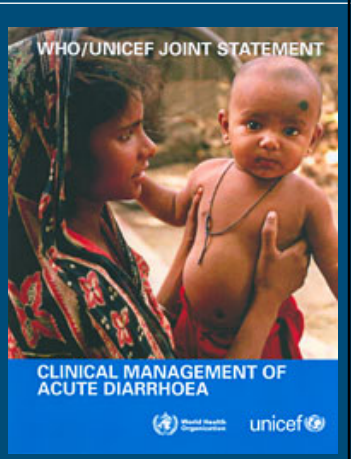
Food safety



WAGENINGEN UR
For quality of life

Food safety: a global challenge

- Developing countries:
  As high as 2-4 Million children die every year of diarrhoea-type diseases
- Industrialised world:
  Costs are >10-15 G$/ year for hospitalisation and medical treatment



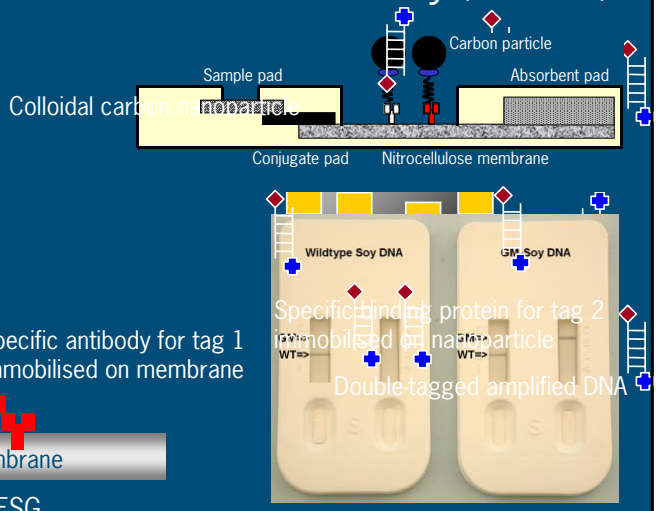
Source: WHO Global Strategy for Food Safety, 2002

WAGENINGEN UR
For quality of life

Food Quality and Safety

WAGENINGEN UR
For quality of life

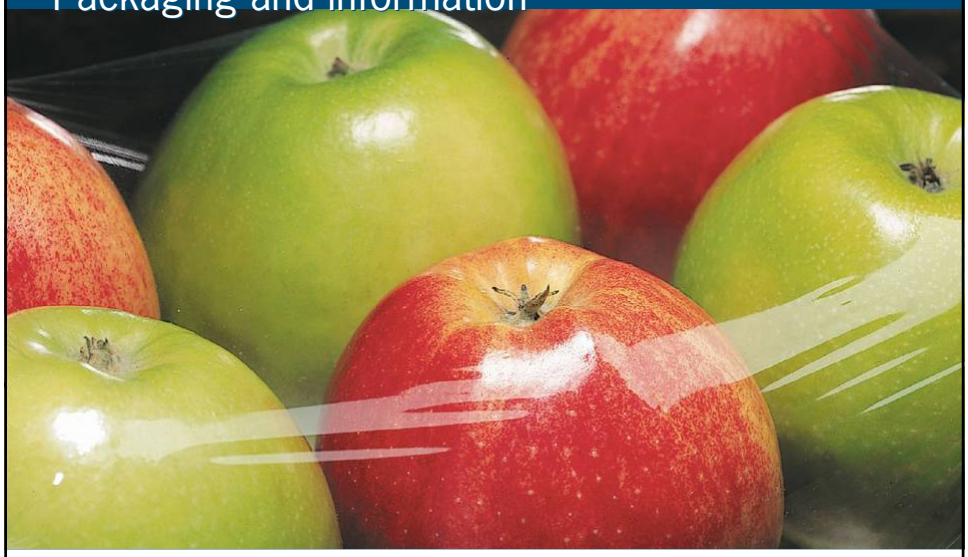
Nucleic Acid Lateral Flow ImmunoAssay (NALFIA)



Aart van Amerongen – AFSG

WAGENINGEN UR
For quality of life

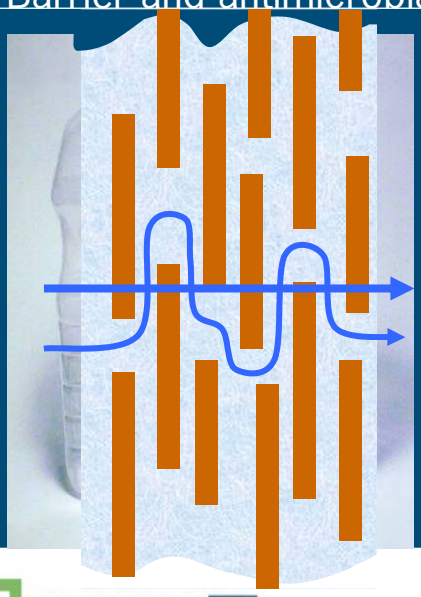
Packaging and information



WAGENINGEN UR
For quality of life

Barrier and antimicrobial properties

FresherLonger

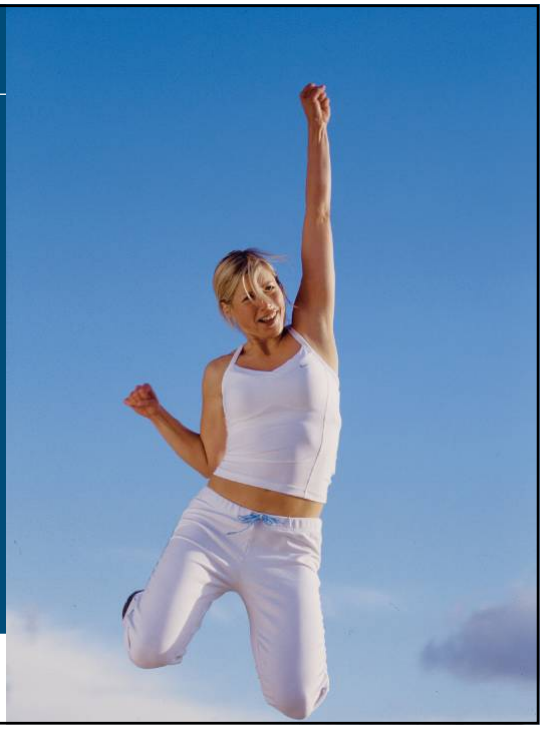


WAGENINGEN UR
For quality of life

Quality assurance and information

WAGENINGEN UR
For quality of life

Healthy food

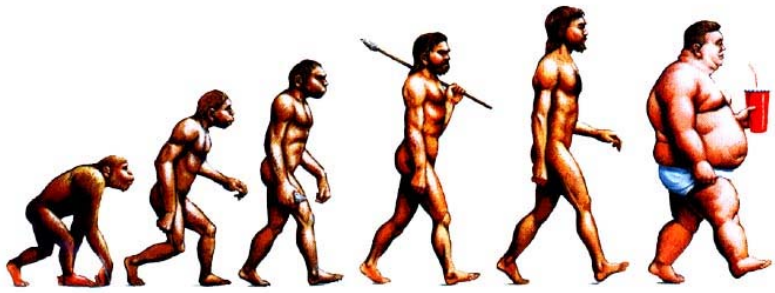


WAGENINGEN UR
For quality of life

Healthy

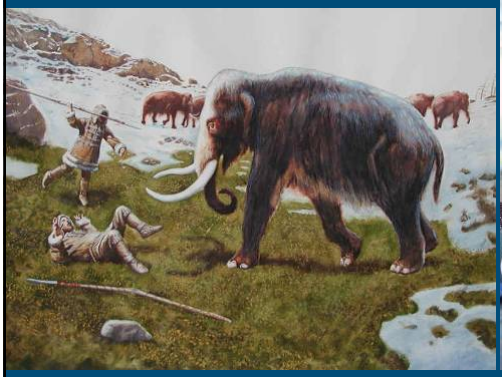
WAGENINGEN UR
For quality of life

We eat too little ! ? !

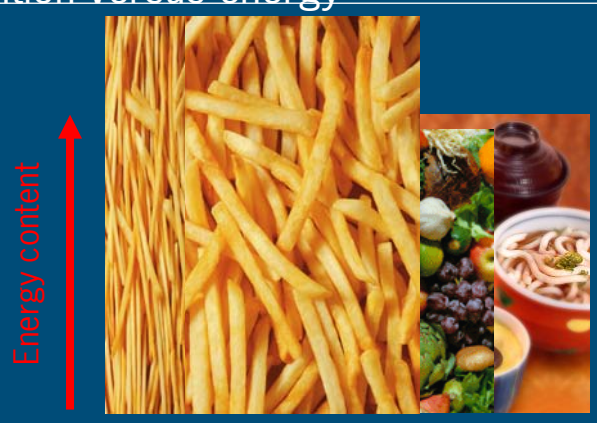


WAGENINGEN UR
For quality of life

Energy requirements

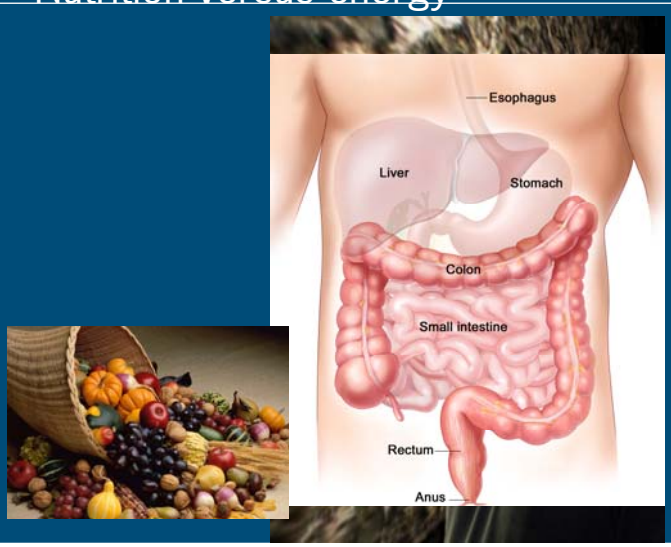


Nutrition versus energy



Nutrition versus energy

Nutrition versus energy

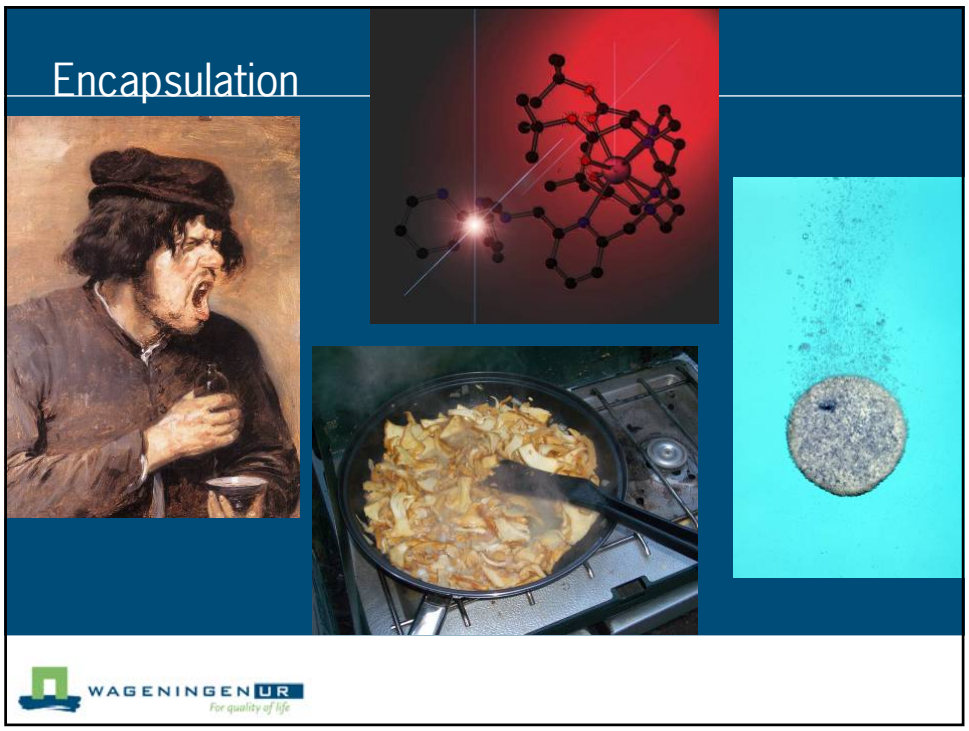


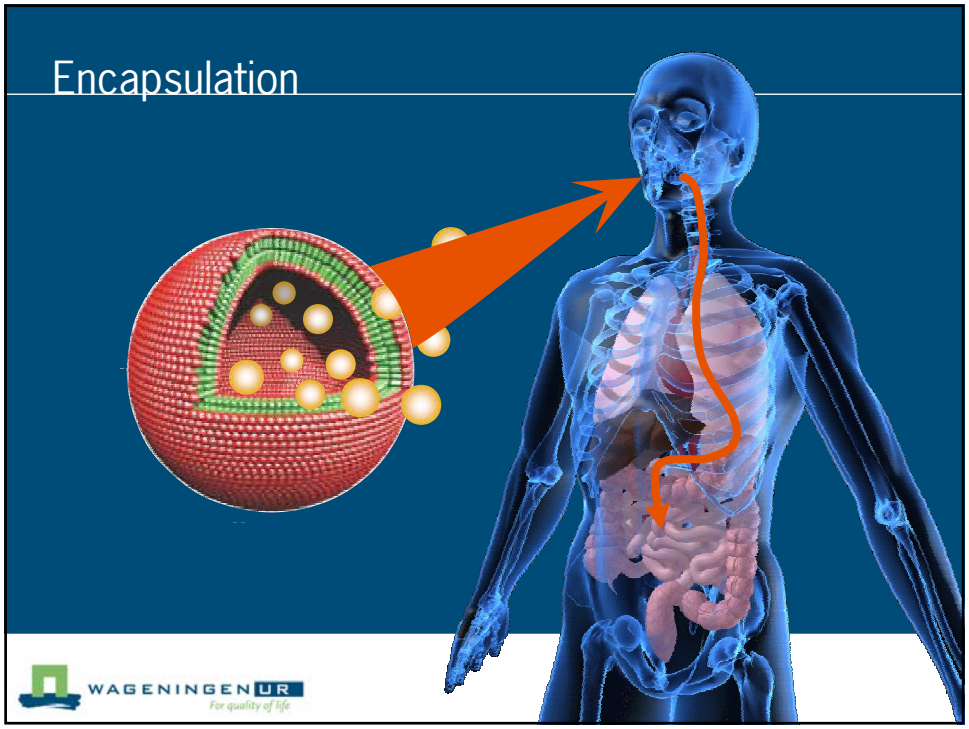
Groups at risk

WAGENINGEN UR
For quality of life

Fortification

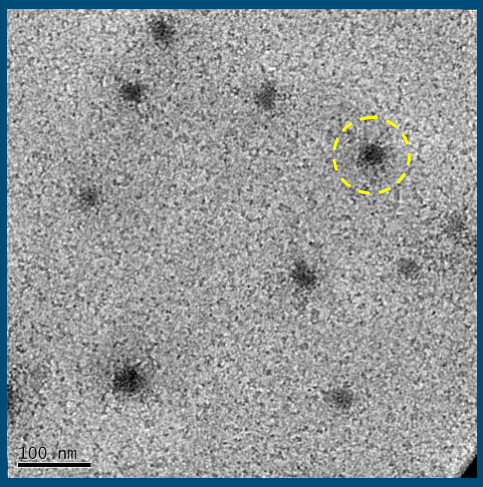
WAGENINGEN UR
For quality of life


Encapsulation
WAGENINGEN UR
For quality of life


Encapsulation
WAGENINGEN UR
For quality of life

Self assembly

Self assembly

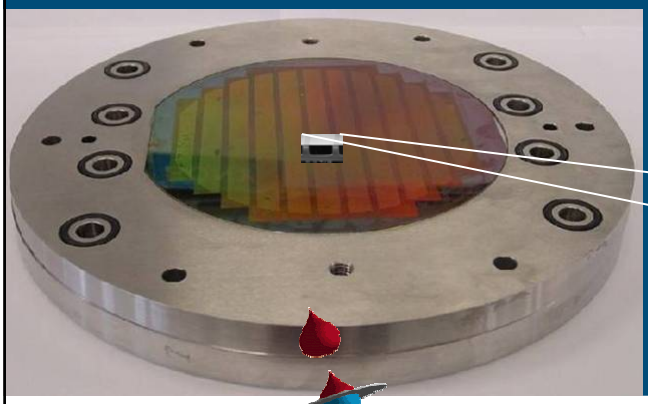


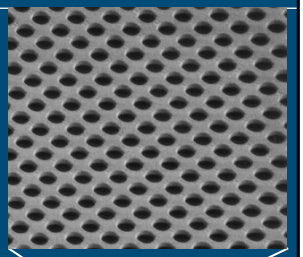
Willem Norde – Physical Chemistry and Colloid Science

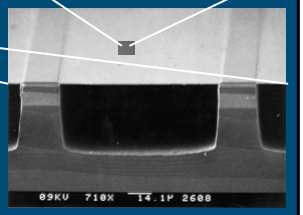
Good food

WAGENINGEN UR
For quality of life

Separation / Fractionation



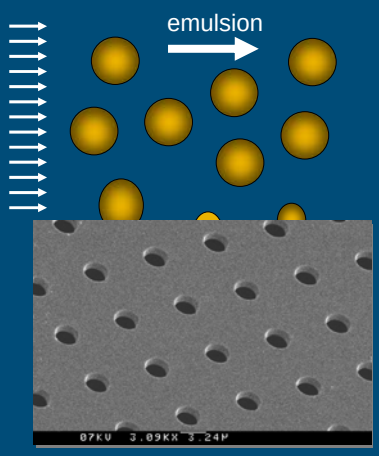


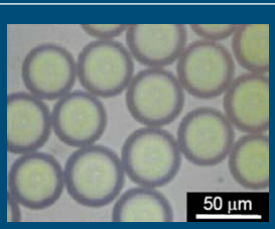


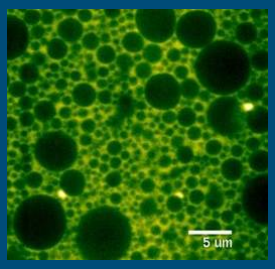
Cees van Rijn – Aquamarijn

WAGENINGEN UR
For quality of life

Membrane emulsification



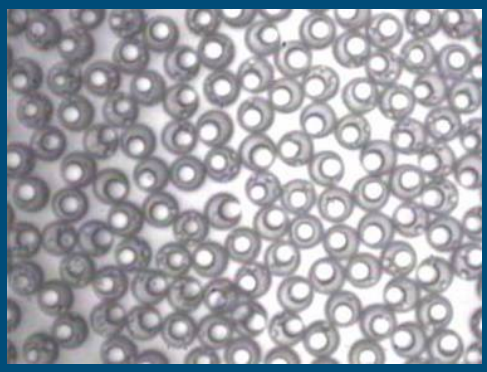


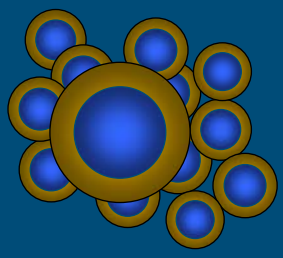


WAGENINGEN UR For quality of life

nanomi emulsification systems

Double Emulsions



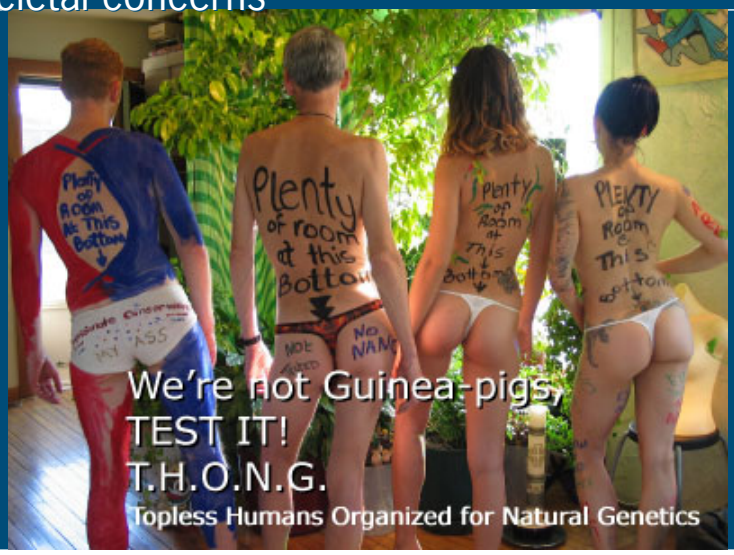


Remko Boom – Food and Bioprocess Engineering

WAGENINGEN UR For quality of life

nanomi emulsification systems

Societal concerns



WAGENINGEN UR
For quality of life

Consumer acceptance

Food industry denies use of nanotechnology

Consumers perceive nanoparticles as unnatural and hazardous

WAGENINGEN UR
For quality of life

Consumer acceptance

- ☺ Healthier
- ☺ Safety
- ☺ Quality
- ☺ Novelty
- ☺ Extended shelf life

- ☹ Cost
- ☹ Unnatural
- ☹ Risks

WAGENINGEN UR
For quality of life

Hazard and Risk

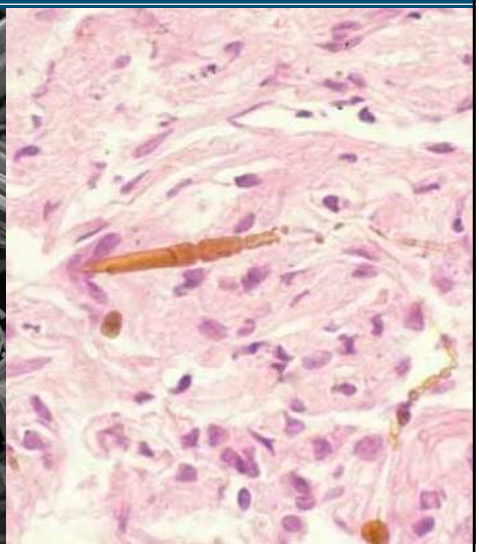
FAO / WHO
Process of risk evaluation

WAGENINGEN UR
For quality of life

Risk assessment

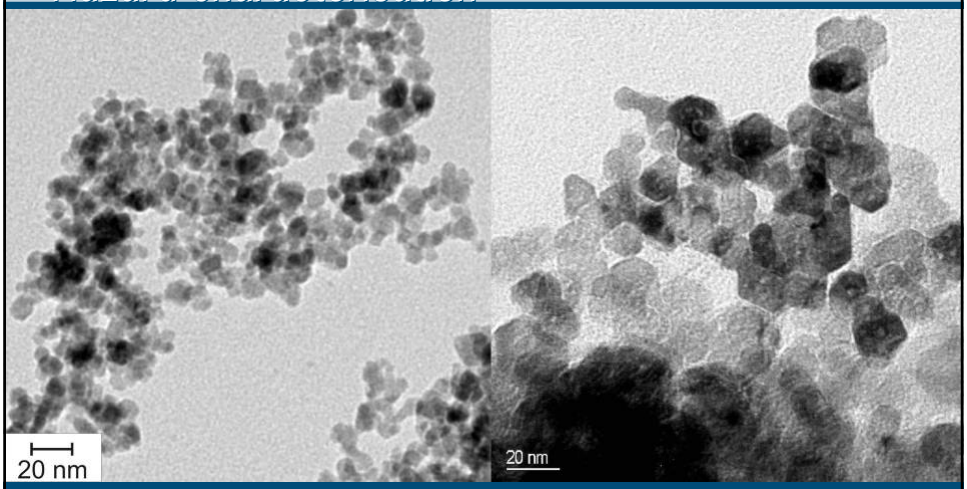
WAGENINGEN UR
For quality of life

Health hazard



WAGENINGEN UR
For quality of life

Hazard characterisation

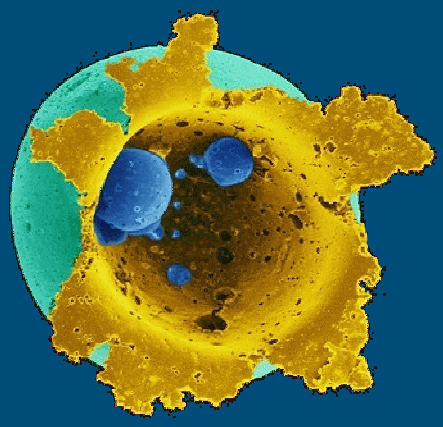


Fe_3O_4 (9 nm) ZnO (20 nm)

WAGENINGEN UR For quality of life

io·li·tec Ionic Liquids Technologies

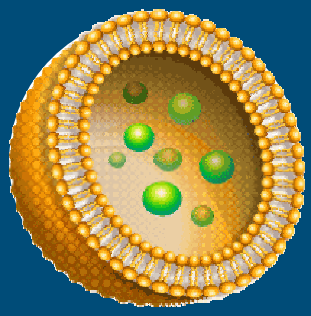
Biodegradability



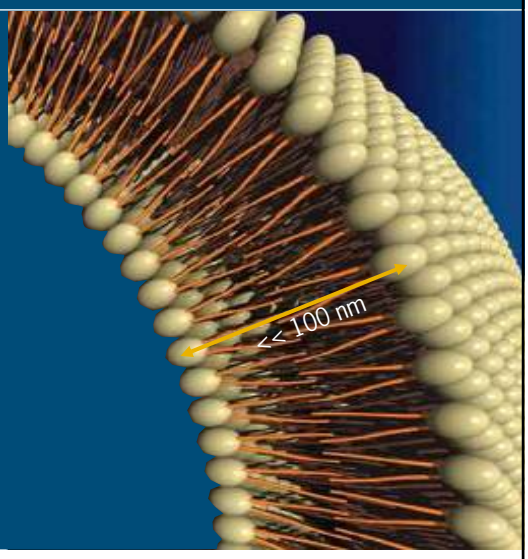
David McCarthy / Science Photo Library

WAGENINGEN UR For quality of life

Nanotechnology ?



> 100 nm



WAGENINGEN UR
For quality of life

Acknowledgements

Many researchers
from the groups of:

- Aart van Amerongen
- Remko Boom
- Dirk Bosch
- Martien Cohen Stuart
- Lynn Frewer
- Maarten Jongsma
- Han Zuilhof

All the people whose pictures I have used

WAGENINGEN UR
For quality of life

frans.kampers@wur.nl
www.biont.wur.nl