



**LUND**  
UNIVERSITY

# Packaging Logistics

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# Why packaging for food? → Important roles

- Protects
  - ❖ Tight materials
  - ❖ Strong materials
  - ❖ Undesirable transfers
- Keeps shelf life
  - ❖ Tight
  - ❖ Modified atmospheres
- Information
  - ❖ New sensors
  - ❖ Intelligence
- Makes it convenient
  - ❖ Easy to open
  - ❖ Easy to reclose
  - ❖ Easy to use

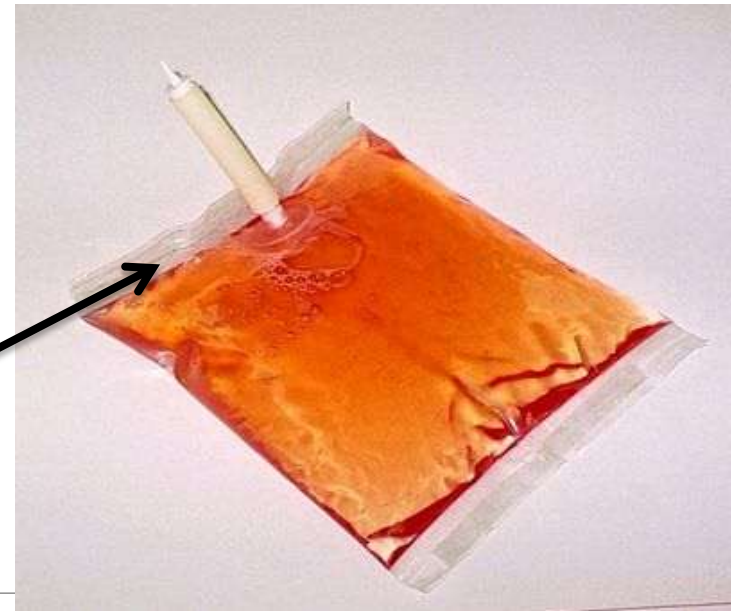


# Tight, light and strong materials



Carbohydrate + Protein +  
Lipids + Vitamin +  
Mineral + Pigment + Water +  
Enzyme + Aroma

**Micropores – tight seal?**



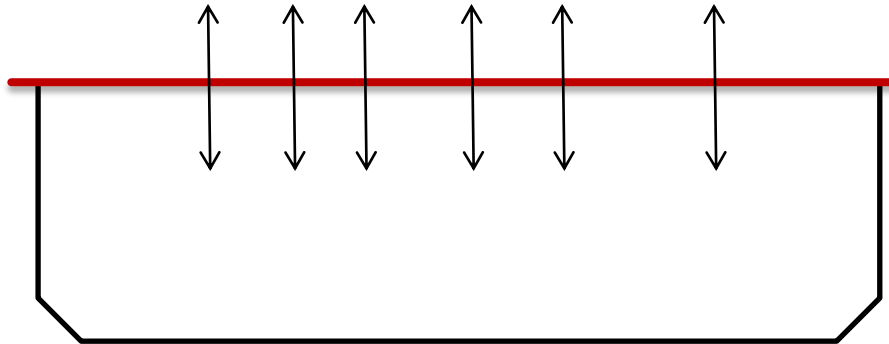
# Shelf Life – tight packaging

## *Degrades food*

- Temperature
- Light
- O<sub>2</sub>

## *Protects food*

- N<sub>2</sub>
- CO<sub>2</sub>
- Anti microbiological surfaces



Difference in partial pressure,  $DP$ , is the driving force for gas movements in and out of the package



# But also breathing material – semipermeable films

Packaging of fruit and vegetables can increase shelf life  
1-7 days compared to unpacked fruit





# Modified and controlled atmosphere



Permeability of plastic becomes more important to control

**No taste of deterioration**



# Combined materials - barriers



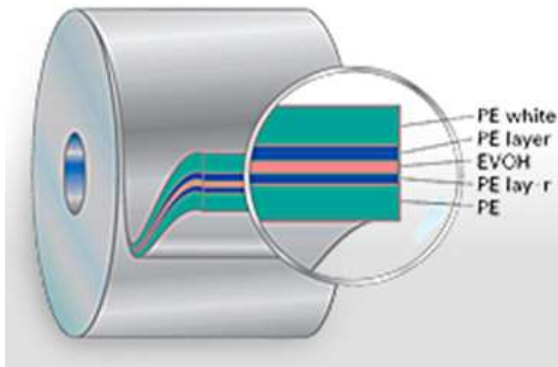
- Glass
- Plastic
- Metal
- Paper
- Minerals
- Wax
- Biopolymers → new how does it work?
- **Nano? → new how does it work?**

## Designed barriers for

- O<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>
- Water
- Light
- Odour & taste
- Organisms



# Barrier challenges

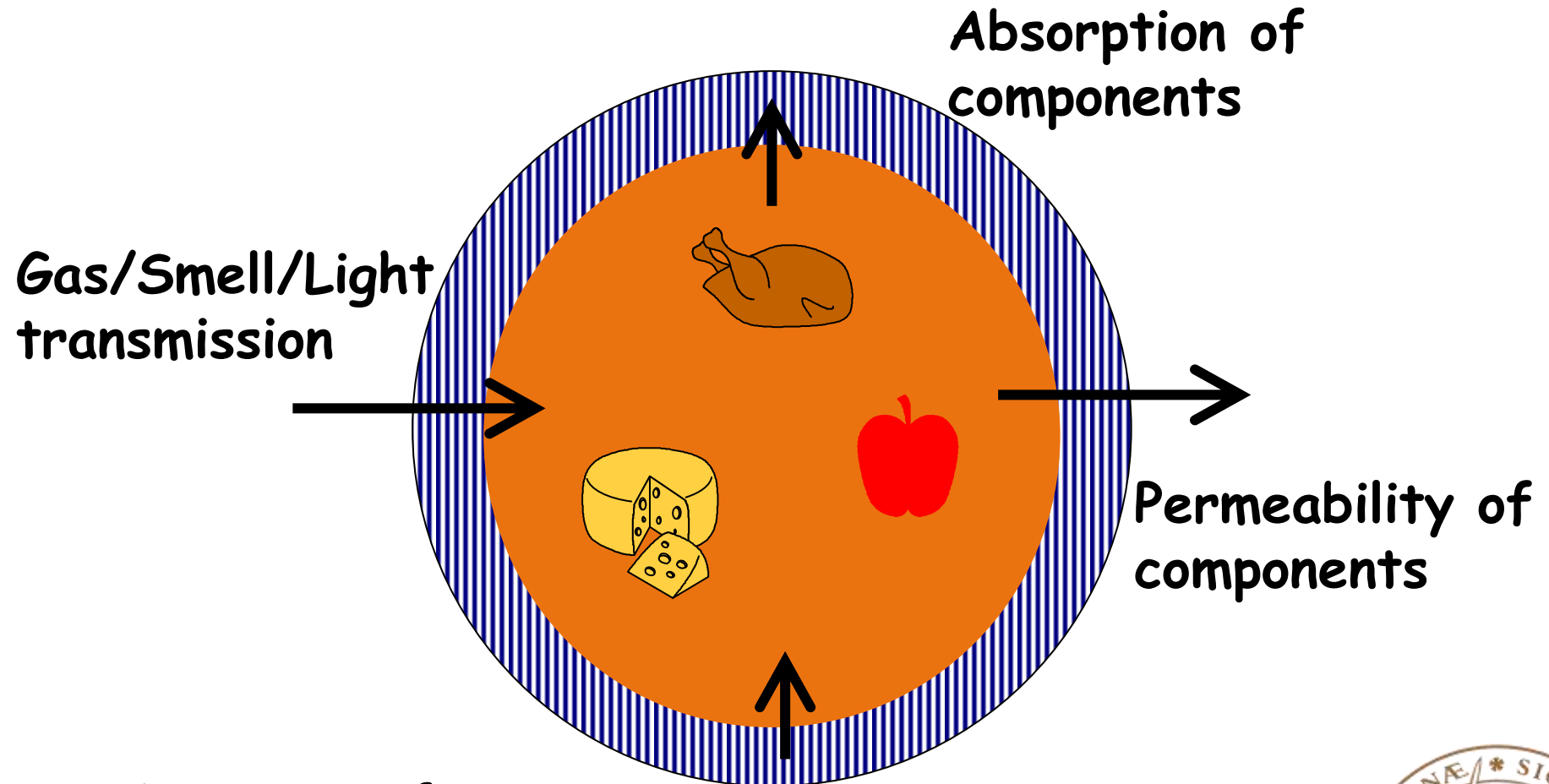


**Micropores**  
**Delamination**  
**New biomaterial interactions**





# Undesired transfers → interesting to know more about



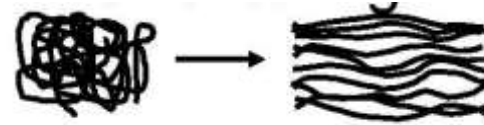
**Migration of components  
from packaging material**



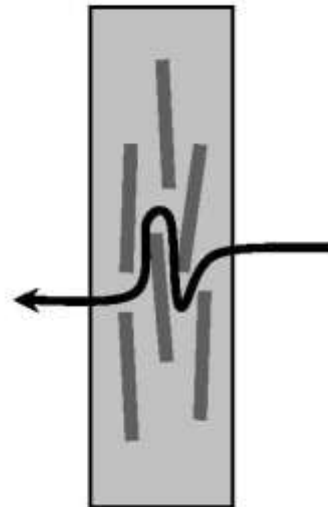
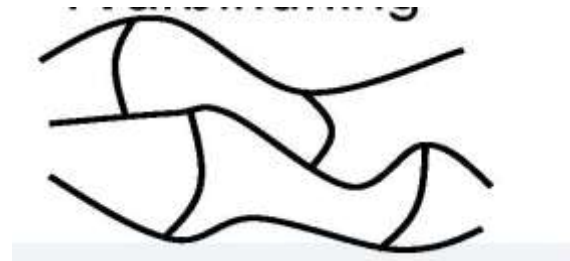
# New biomaterial – neutrons?

- Biobased material biological origin or refined biological raw material

**Orientation**



**Cross-bindings**



**Co-polymerization  
Crystallization**



Ontem fui planta,  
hoje sou PET.



**plantbottle**™

up to **30%** plant-based  
**100%** recyclable bottle

redesigned plastic,  
recyclable as ever.



A Coca-Cola Brasil inova com a Plant Bottle™. Uma embalagem até 30% à base de cana-de-açúcar, uma fonte renovável, ou seja, diminui a dependência do petróleo e emite menos CO<sub>2</sub>, além de ser 100% reciclável. Um grande passo rumo à garrafa do futuro para você matar a sede de ajudar o mundo.

Saiba mais em  
[www.cocacolabrasil.com.br](http://www.cocacolabrasil.com.br)



Contêm até **30%** do PET originário de cana de açúcar. Garrafa **100%** reciclável.



# Usability



- Easy to open
  - Materials easy to tear
- Easy to use
  - Suitable surfaces
- Possible to empty
  - Suitable surfaces

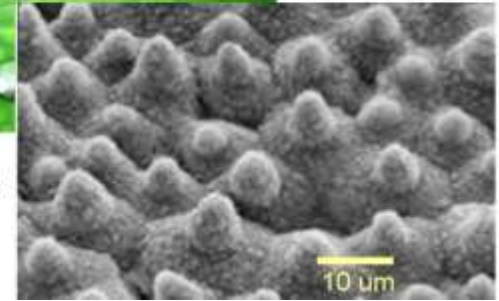




Lotus flower



Water drops on Lotus leaf



• Treated for superhydrofobization



# Sensors



**Electronic ink – how does it affect food and material?  
Sensors integration with food?**





# Approvals and acceptance



## FDA and EFSA

**How can new materials be tested and approved?**

**Implications on interaction between material and food**

**How can material get consumer acceptance?**



