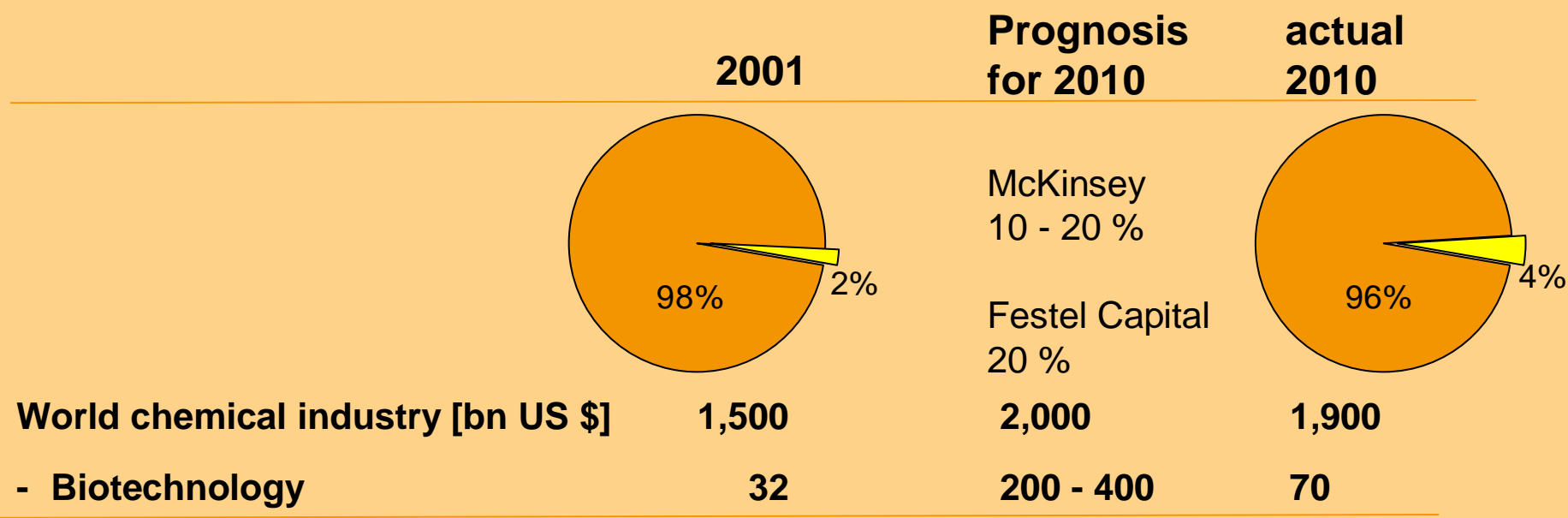




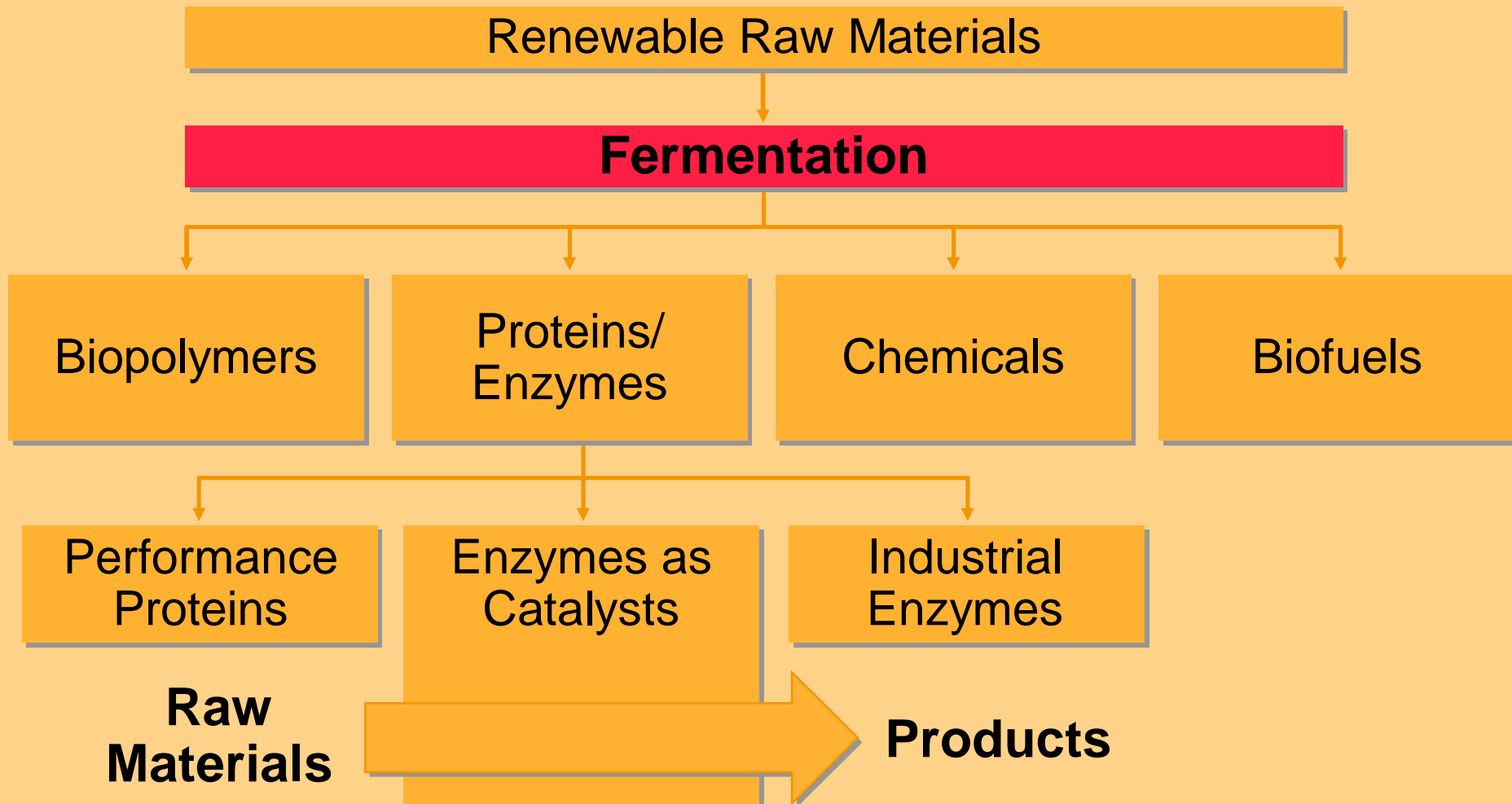
# Move biocatalysis out of the niche!

**Kai Baldenius**  
BASF SE, Ludwigshafen  
Fine Chemicals & Biocatalysis Research

# White Biotech Market



# White Biotechnology



# The “Chemis-tree”



**About 8,000 commercial products**

**Major basic products and intermediates**  
about 200

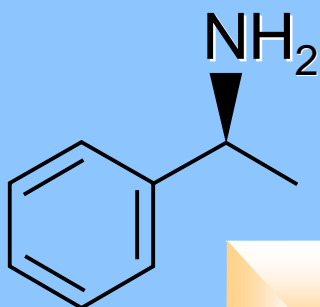
**Raw materials**

Crude oil      Natural gas      Coal      Ores  
Rock salt      Phosphate      Sulfur      Water      Air

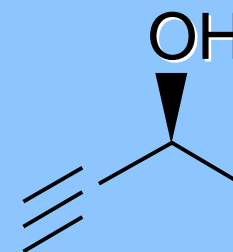
# ChiPros made by BASF with a little help of: Lipases, Esterases, Nitrilases, Dehydrogenases



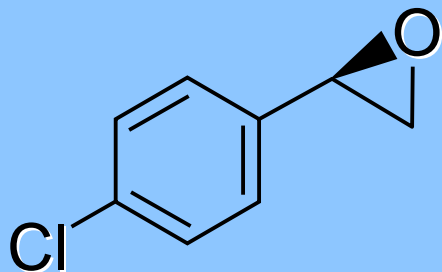
**Amines**



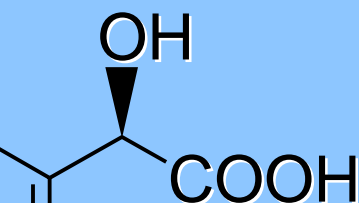
**Alcohols**



**Epoxides**

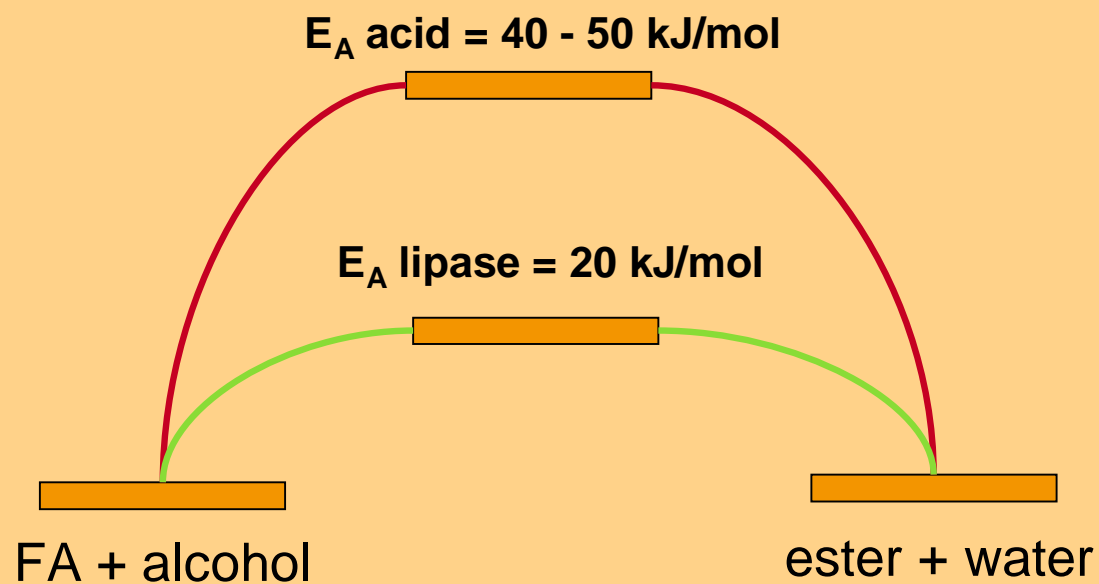
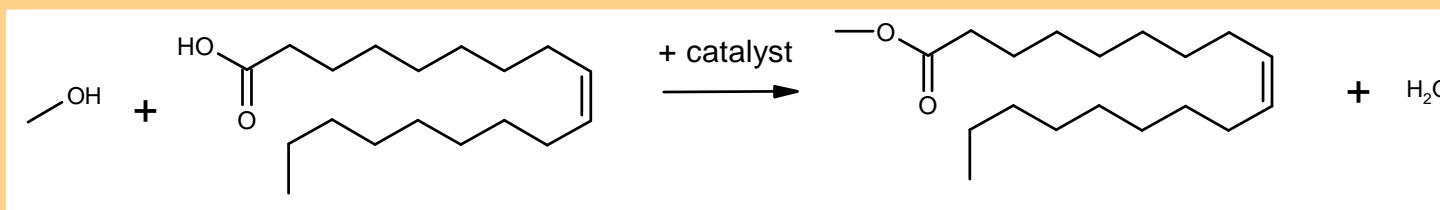


**ChiPros**  
Chiral Products by BASF



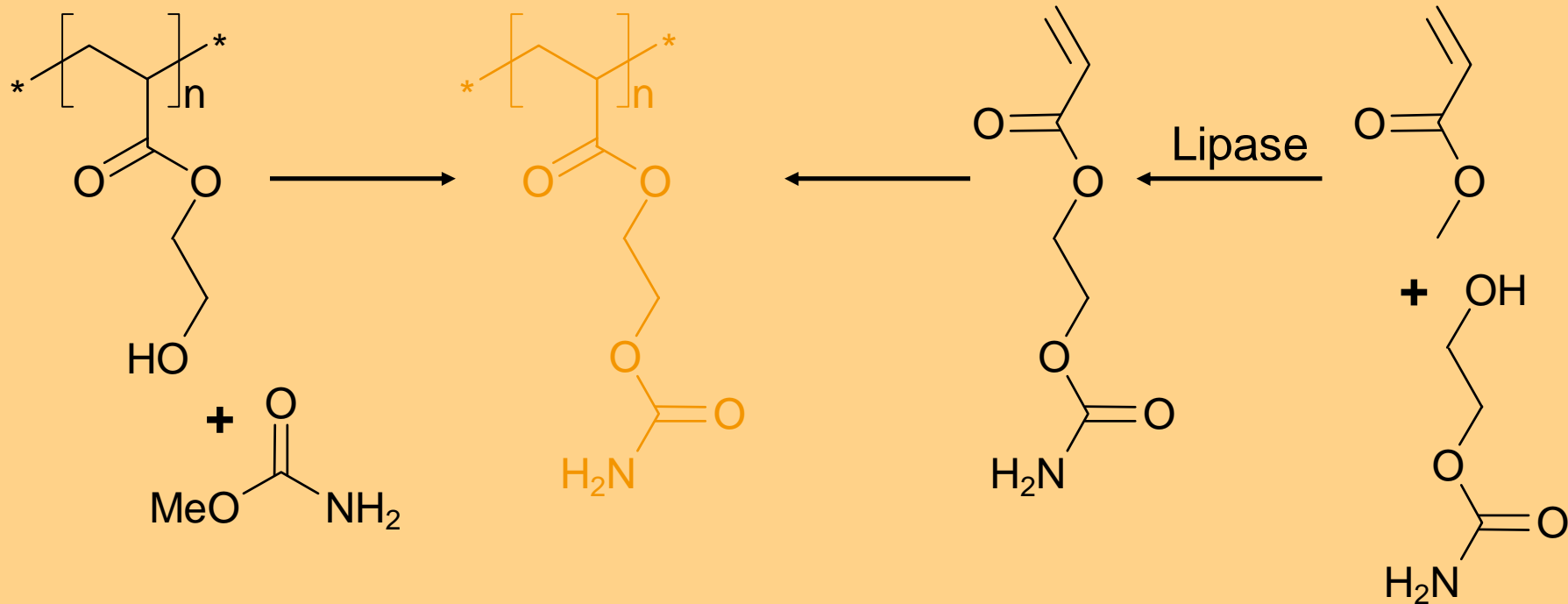
**Carboxylic acids**

# Lipase for achiral substrates?



# Chemicals via Biocatalysis

## Synthesis of New Monomers with Biocatalysis



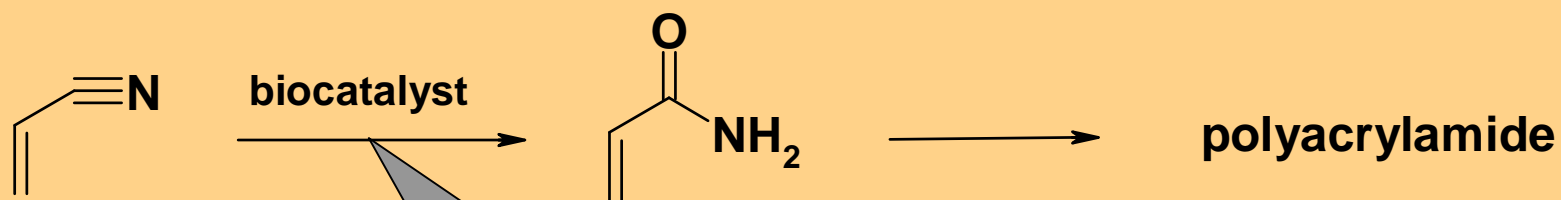
**Classical approach:**  
Modification of polymers

- Slow reaction
- Cancerogenic Methylcarbamates
- Undesired side products

**Today:**  
New specialty monomers

- Chemical synthesis not successful
- No undesired side products
- ➔ Improved coating quality

# Acrylamide



# Acrylamide

## acrylamide market data

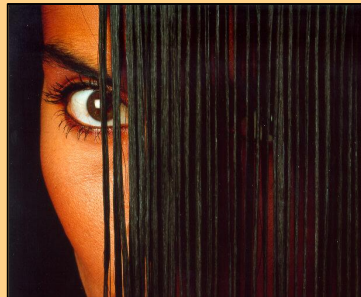
- Very important monomer for non-ionic and ionic polyacrylamides
  - Flocculants for water treatment and mining
  - Thickeners for enhanced oil recovery
  - Retention aids and dry strength improvement in paper making
  
- Global annual production
  - total 500.000 t (calc. 100%)

# Biopolymers from microbes

Polysaccharides from microorganisms as thickeners



cosmetics



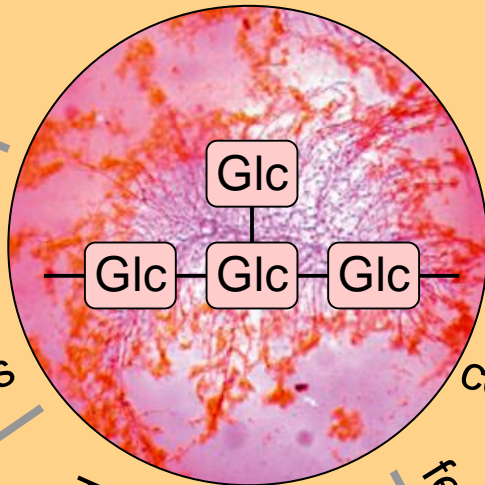
cosmetics



food



feed



oil

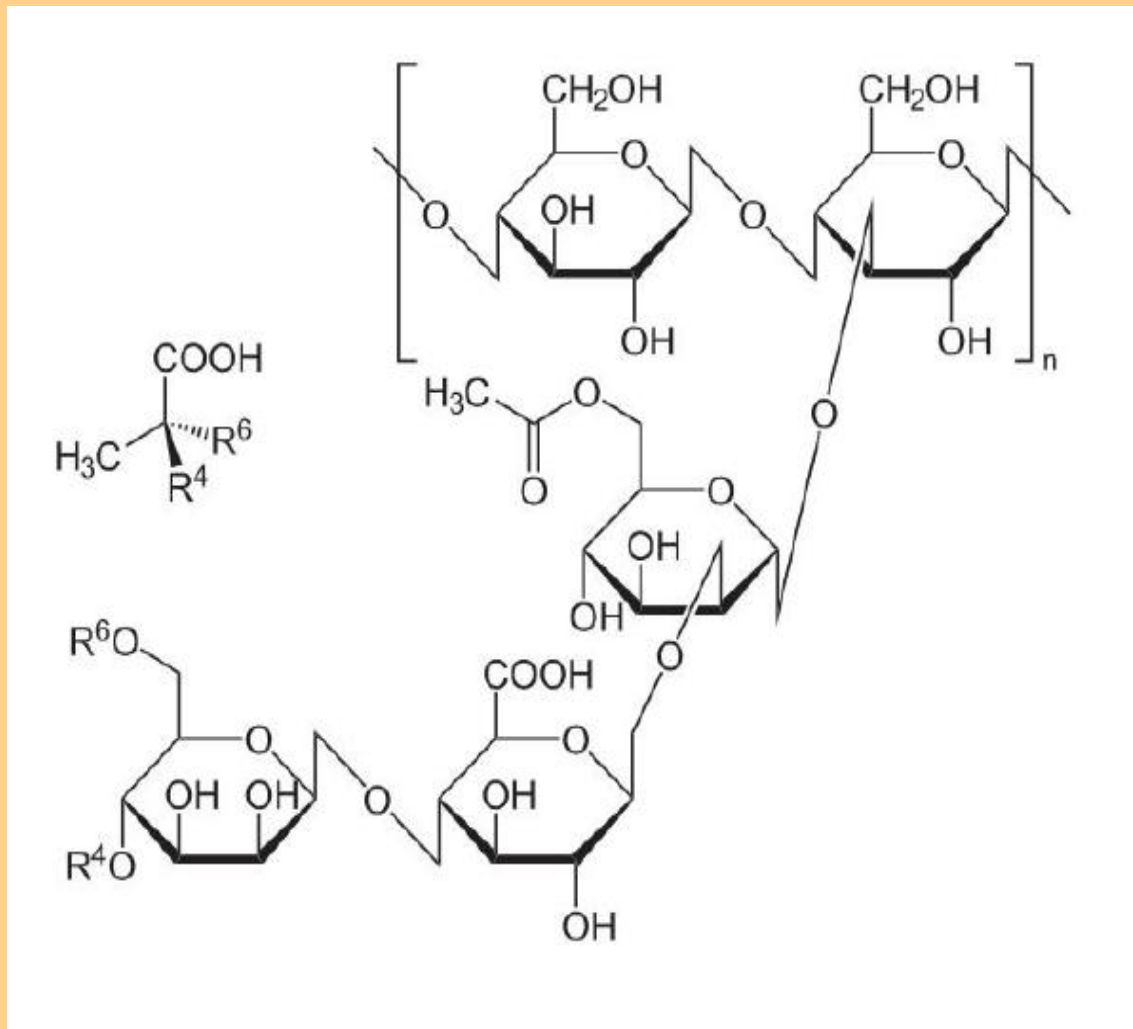


construction



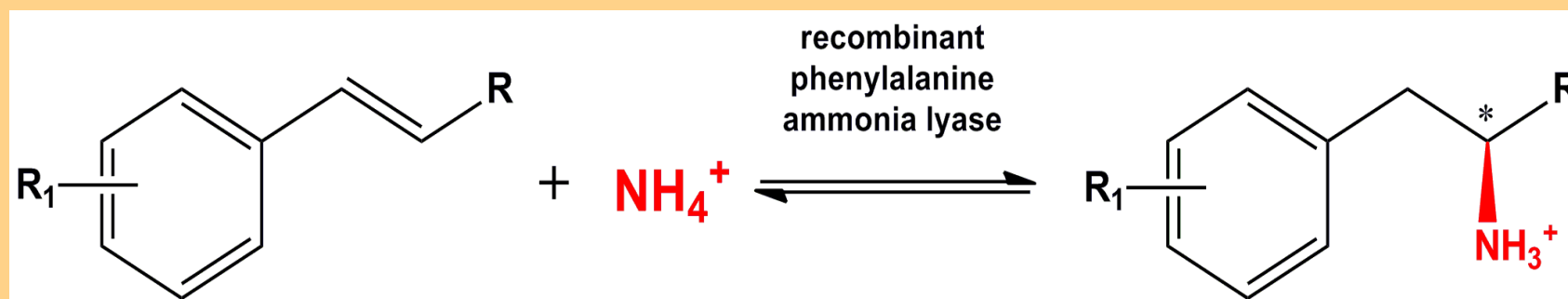
# Xanthan gum

powerful thickener from fermentation



- Powerful thickener
  - Very safe, food approved
- ...but:
- Fermentation product

# Make amines from olefins



Bettina Nestl  
Nick Turner