



# Research projects for MSc @ RaffaLab™ 2019/2020

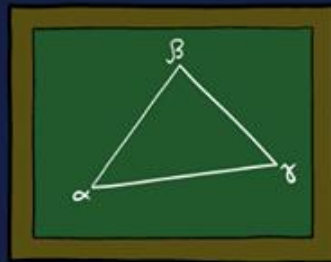
Dr. Patrizio Raffa  
Assistant Professor  
Polymeric Products



## WHAT RESEARCHERS STUDY

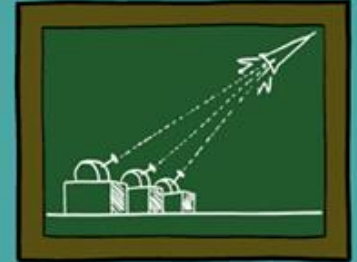
MATHEMATICIAN:

WHAT IS.



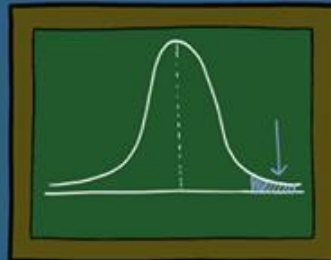
ENGINEER:

WHAT ISN'T YET.



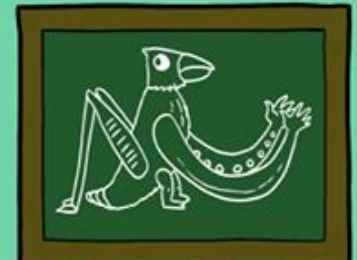
SCIENTIST:

WHAT PROBABLY IS.



BIOENGINEER:

WHAT NEVER  
SHOULD HAVE  
BEEN.

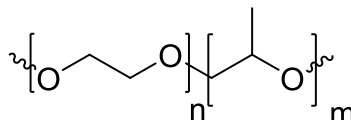


# Amphiphilic polymers (Polymeric surfactants)



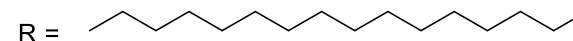
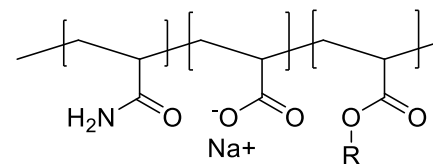
block structures

e.g.: poloxamers

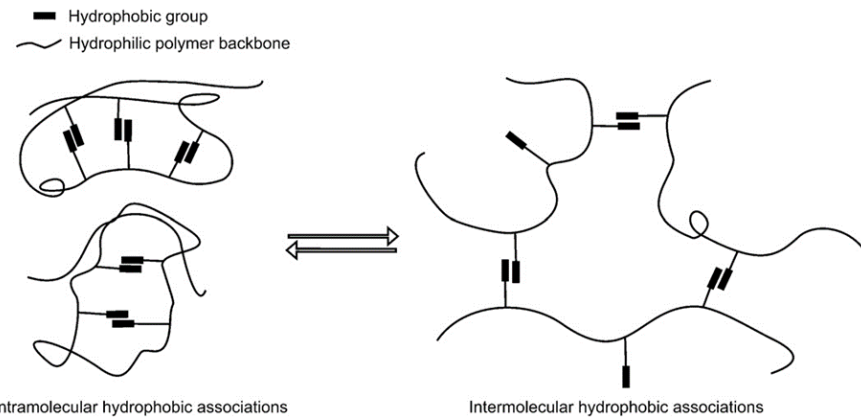


statistic structures

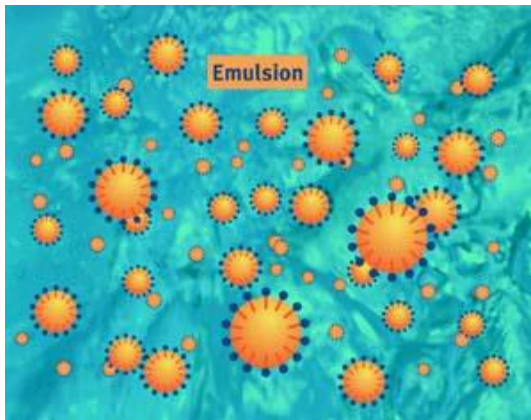
e.g: hydrophobically modified HPAM



# Polymeric Surfactants



Rheology (viscosity) control



IFT decrease and Emulsion stability



# Applications



Detergents



Hydrogels



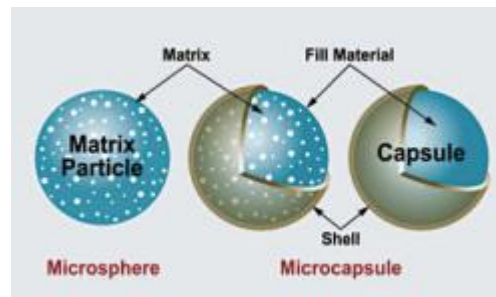
Paints



Crop protection agents



Protective coatings

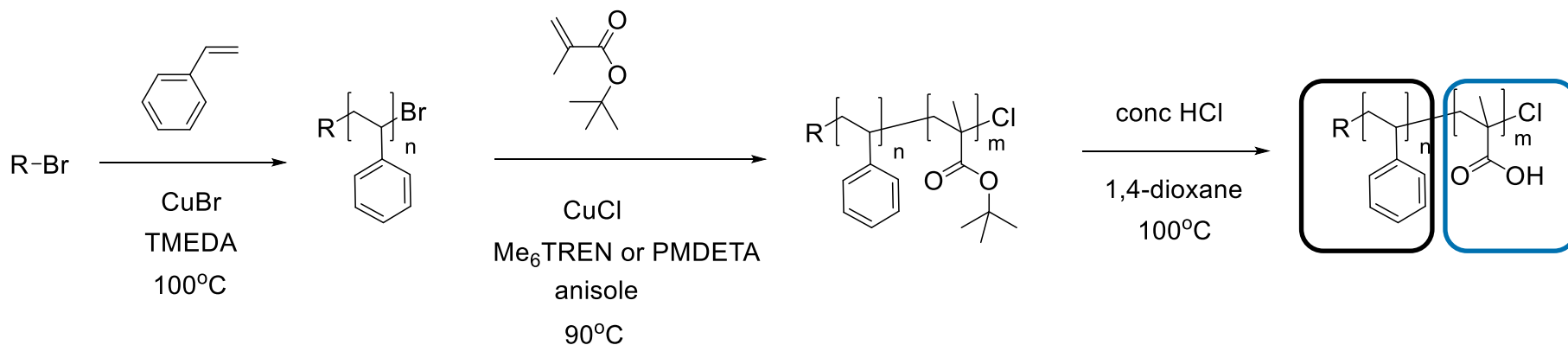


Micro- nano-encapsulation gels



Pharmaceutical /  
 cosmetic  
 emulsions

# Structure-properties study



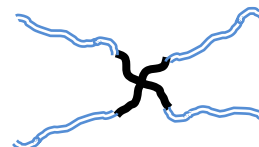
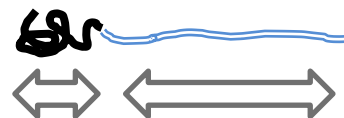
Structure-properties relationships  
(more fundamental research)

Synthesis



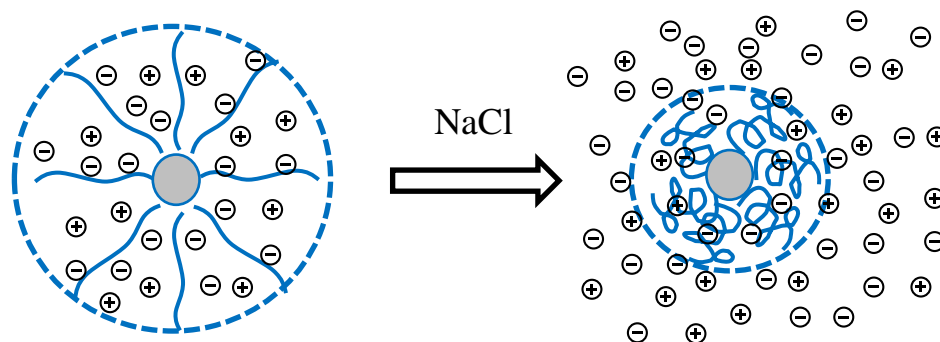
Rheology

Surface activity

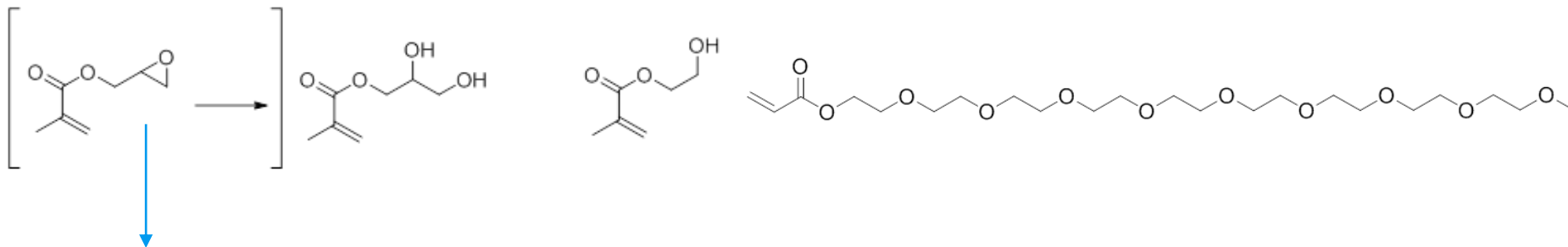


# Structure-properties study

Reduce salt-sensitivity  
(for EOR or other applications)



Use of neutral hydrophilic partners



can be used for cross-linking / functionalization (e.g pyrene = fluorescent)



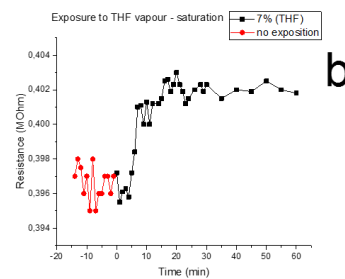
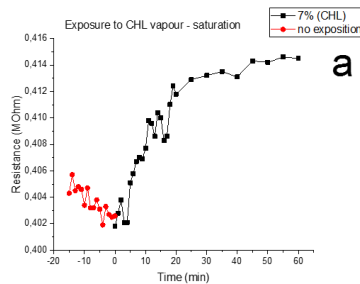


# Structure-properties study

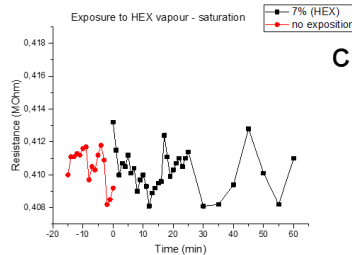
- › More fundamental / less applied
- › More freedom
- › Available after April 2020
  
- › Sicilian PhD lab supervisor
- › No companies involved



# Exploring new applications



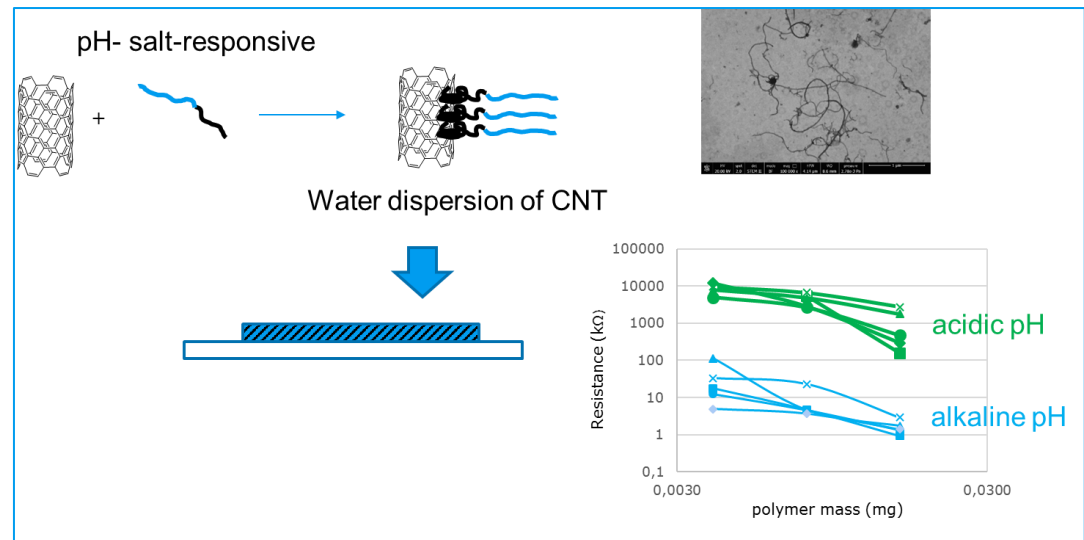
VOC sensing



pH-responsive composites

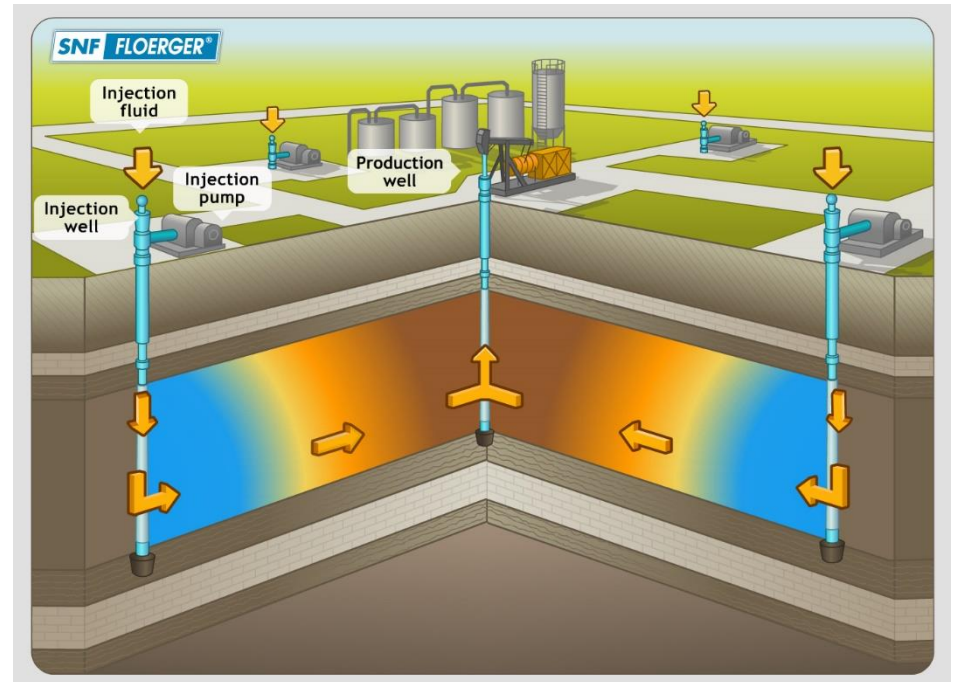
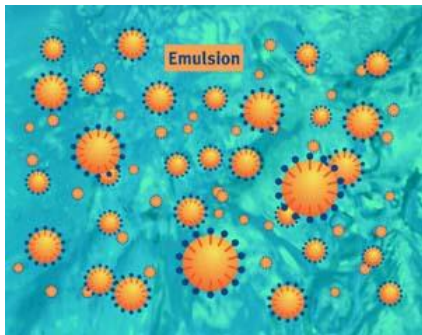
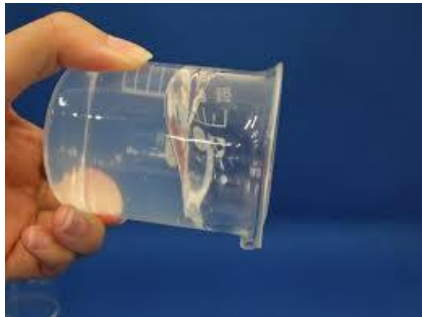
mechanochromic materials

smart hydrogels





# Polymeric surfactant for EOR





# Polymeric surfactant for EOR

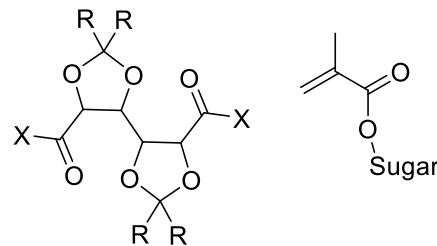
- › synthesis / properties 70 %
- › oil recovery test 30 %
- › available next year
- › Polish PhD supervisor

# Bio-based (amphiphilic) polymers



Sugar beets

Building blocks



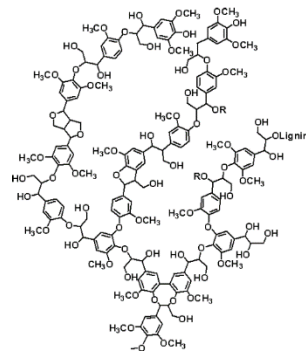
Bio-based thermoplastic



Bio-based polymeric  
surfactants



polysaccharides



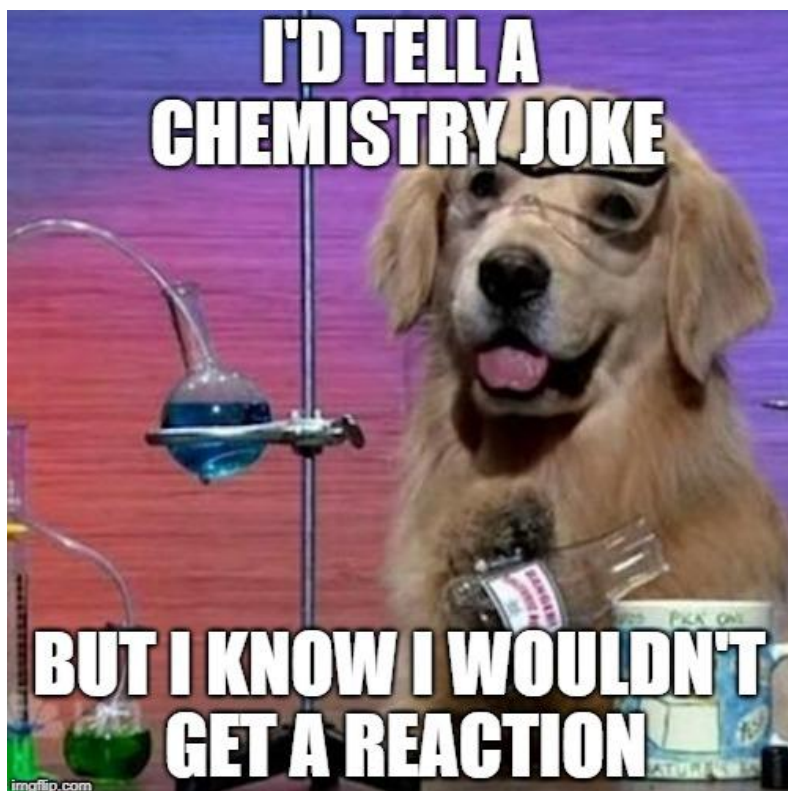
Lignin

Hydrophobic modification



Rheology modifier  
Emulsifier  
Thermoplastics, coatings

# Summarizing



- make polymers
- characterize polymers
- measure properties
- eat
- (get drunk)
- sleep
- repeat