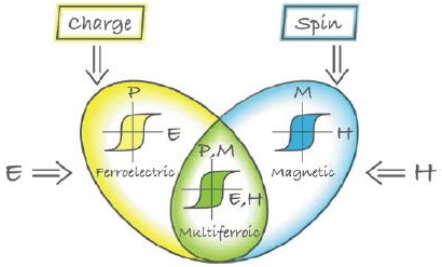
# Soft matter @ LARMOR

**Dr. Ilja Voets**

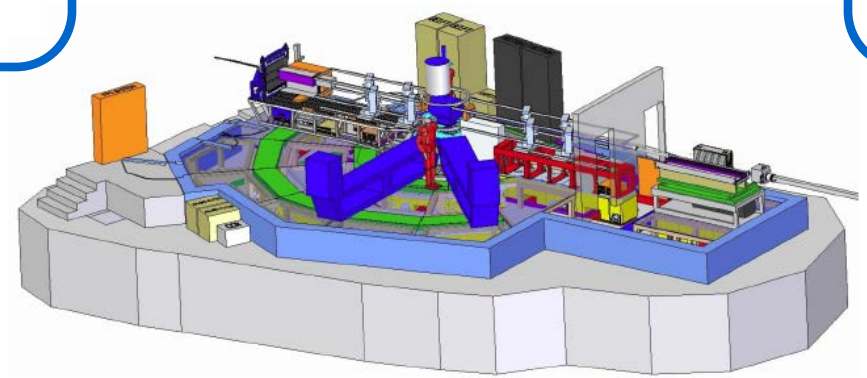
TU/e Technische Universiteit Eindhoven University of Technology

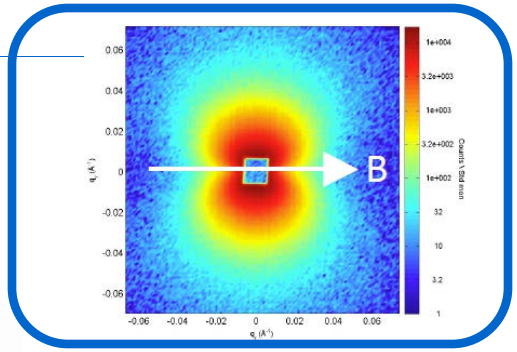
Where innovation starts

# Scientific use of LARMOR

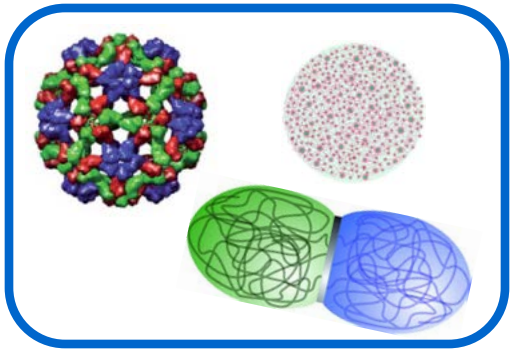



magnetism






materials science



soft matter

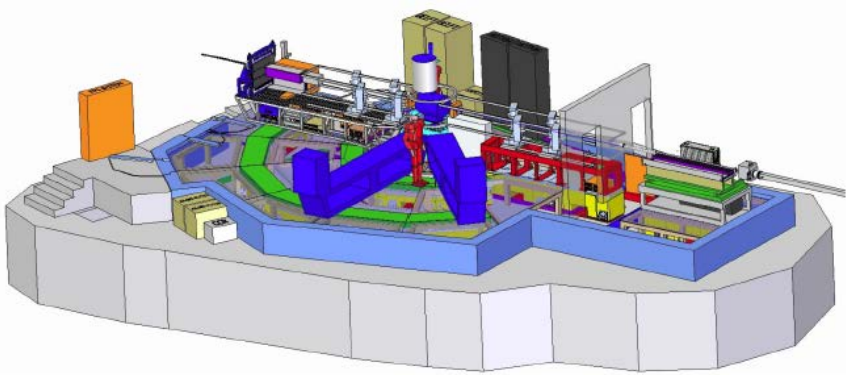
# Using neutrons to study soft matter

✓ Good statistics

✓ In situ, non-destructive experiments

✓ Access to:

- *Structure*
  - size
  - shape
  - molar mass
- *Thermodynamic quantities*
  - osmotic pressure
- *Interactions*
- *Dynamics*
  - local motion within macromolecules, polymer reptation



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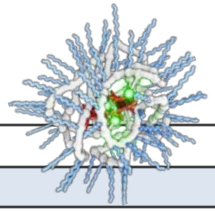
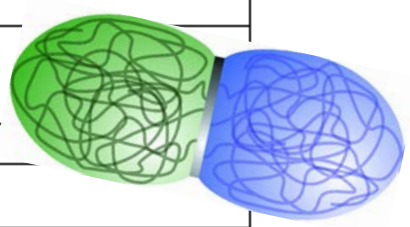
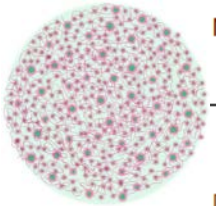
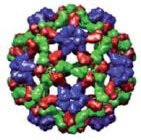


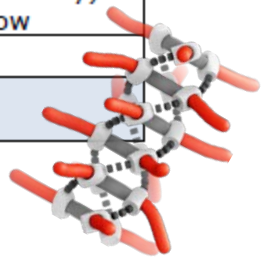
**Soft Matter**

| *Coordinator* | I.K. Voets | |
|---|---|---|
| *Group* | *contact* | *Themes* |
| SMO, TUE | I.K. Voets | Self assembly of (supramolecular) polymers in solution<br>Biological soft matter<br>Chemical biology |
| PCC, WUR | M. Cohen-Stuart | Self assembly of (bio)macromolecules<br>Asemblies of natural proteins<br>Multi-component assemblies of colloidal particles |
| FPG, WUR | E. van der Linden | Food structuring |
| VtHL, UU | A. Petukhov | Sel-assemled photonic crystals<br>Magnetic nanostructures in magnonic materials |
| NIZO | H. Tromp | Molecular structure of cheese<br>Ca distribution in pectin and casein gels by $^{40}Ca/^{44}Ca$ isotope substitution<br>Strucuture of electrospun and electrosprayed fibres and particles<br>Nucleation of air/$CO_2$ bubbles in cheese<br>Structure of coarcevates, using isotope substitution |
| DSM | R. Tuinier | Dispersions containing hyperbranched polymers Waterborne dispersions containing resin particles and pigments<br>Surfactant-polyelectrolyte complexes<br>Studying the encapsulation of compounds into micellar systems<br>Understanding structures in food hydrocolloidal dispersions<br>Characterizing dispersions containing core-shell particles |
| Unilever | J. van Duynhoven | Fine fat crystal networks in spreads and dressings<br>Multi-scale network structures of biopolymers in water |
| IMM, RU | M. Feiters | Structure of self-assembled micelles and polymersomes (drug delivery)<br>Alignment of extremely long polymer chains in hydrodynamic flow |
| BNT, UT | J. Cornelissen | Bio-hybrid polymer systems |
| | | ***support: DPI, NIZO, DSM, Unilever, TIFN*** |



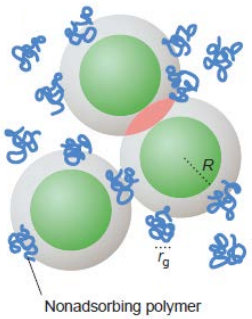


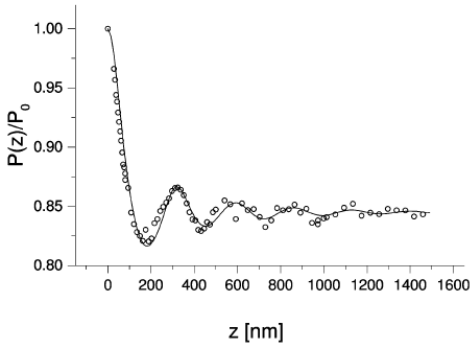


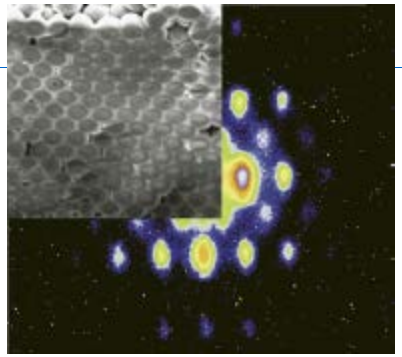


# Neutrons in soft matter research

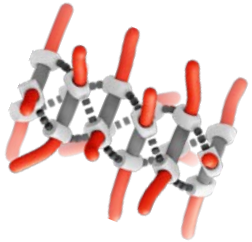
## Colloids

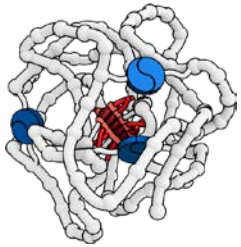


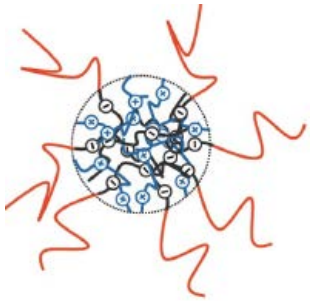



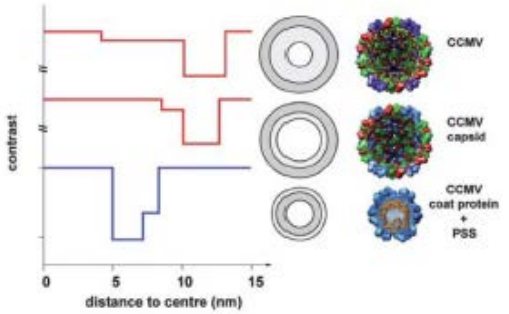



## Complex molecular systems

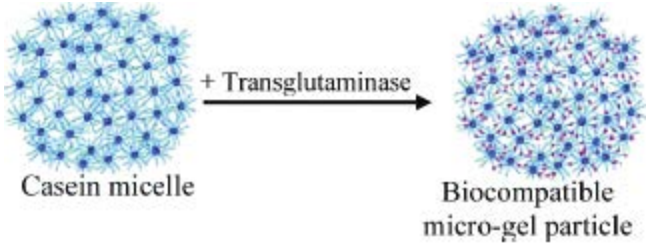


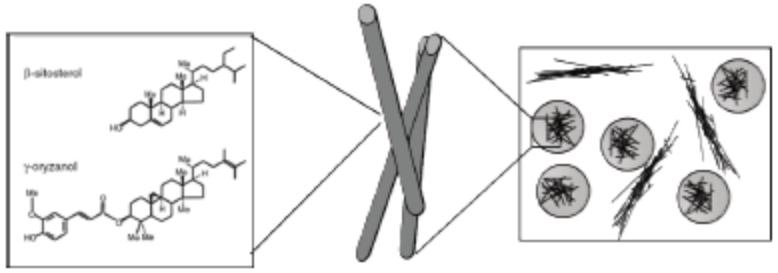







## Food materials

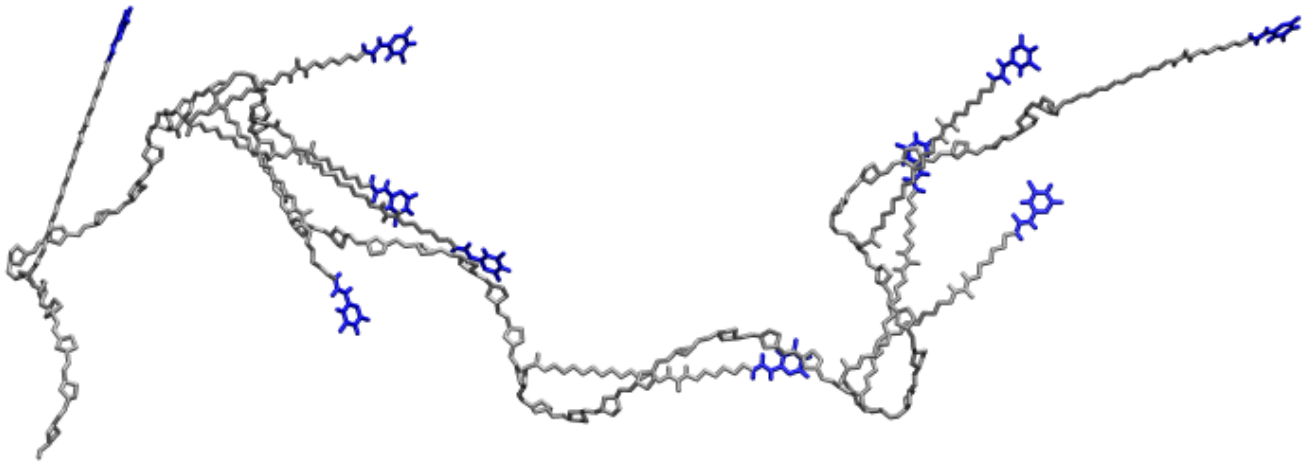


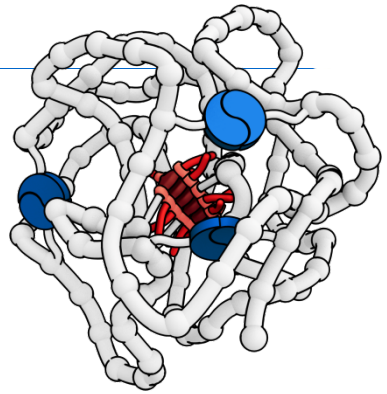
# Neutrons in soft matter research

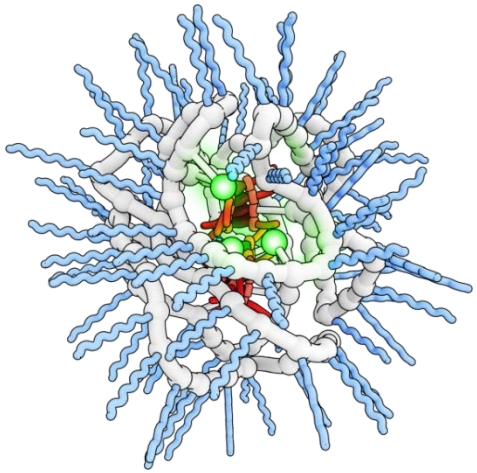
***Example 1: complex molecular systems***

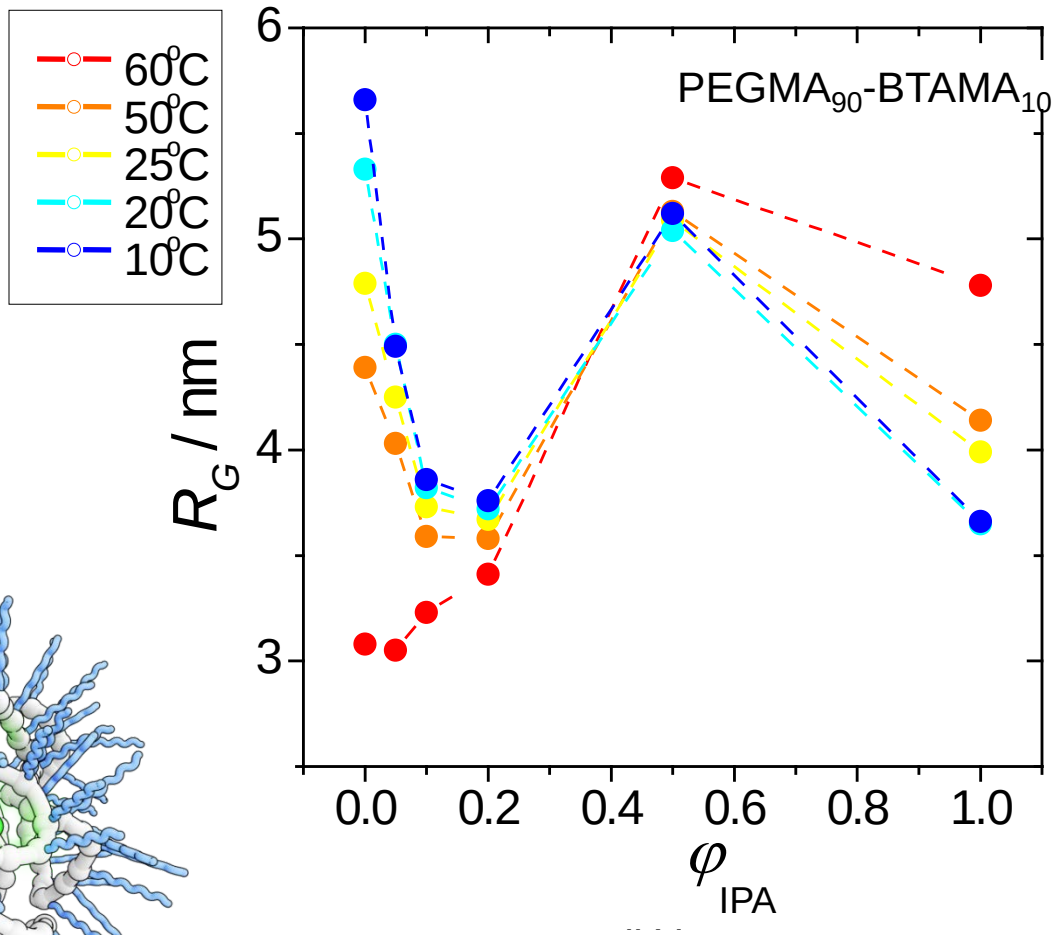
- **intramolecular self-assembly of supramolecular motifs folds polymers into ‘single-chain polymer nanoparticles’ (SCPNs)**



# Functional foldable polymers



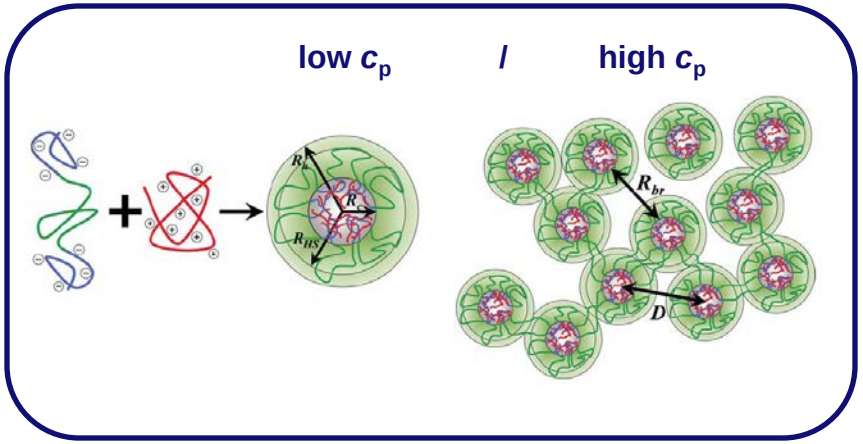




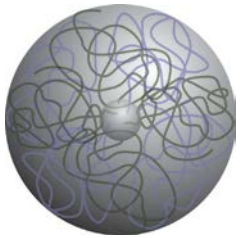
# Neutrons in soft matter research

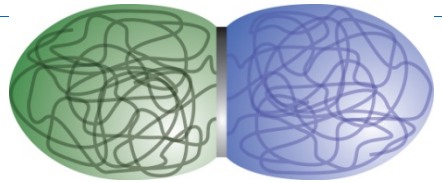
***Example 2: complex molecular systems***

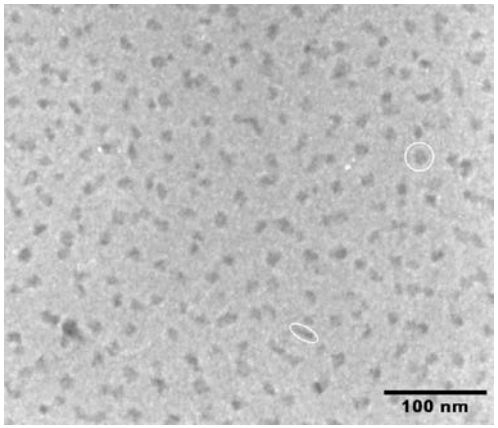
- **multi-component assemblies of hydrocolloids**



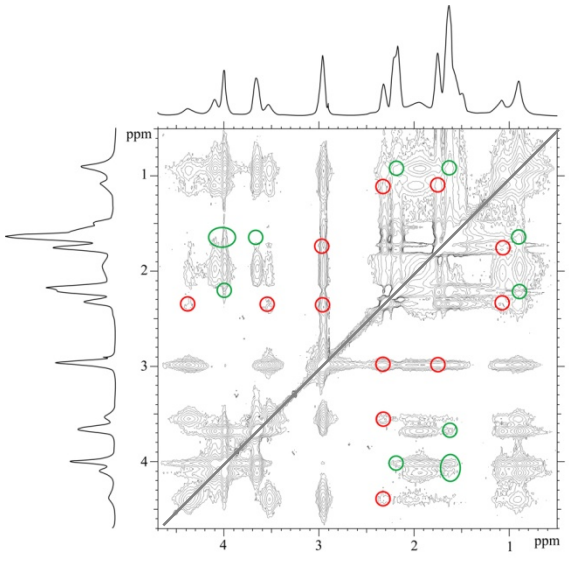
# Polymer micelles



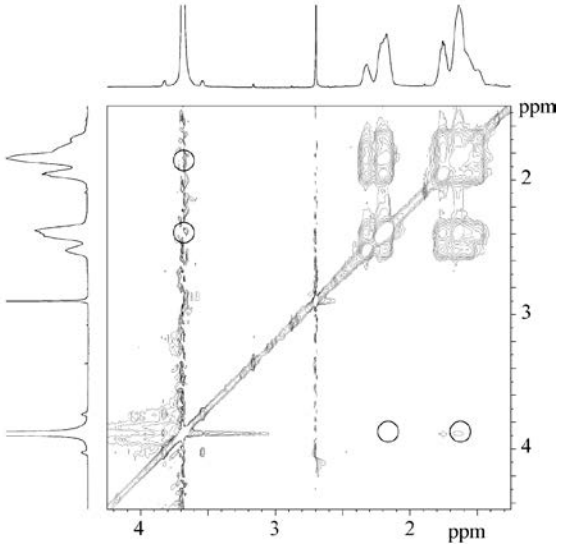


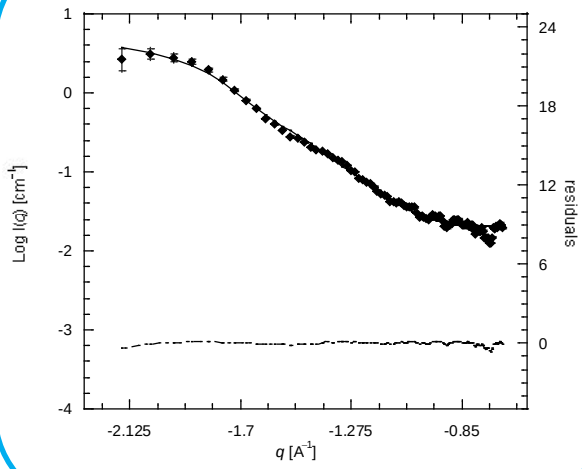



$PAA_{42}$-$PAAm_{417}$ + $PDMAEMA_{45}$-$PGMA_{90}$




$PAA_{42}$-$PAAm_{417}$ + $P2MVP_{42}$-$PEO_{446}$

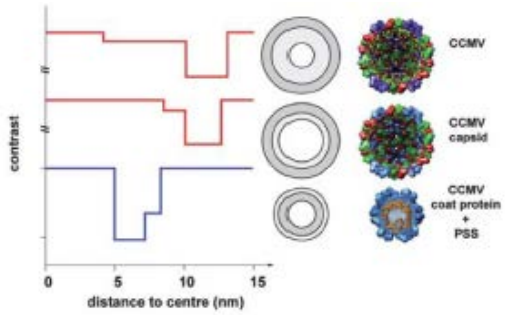


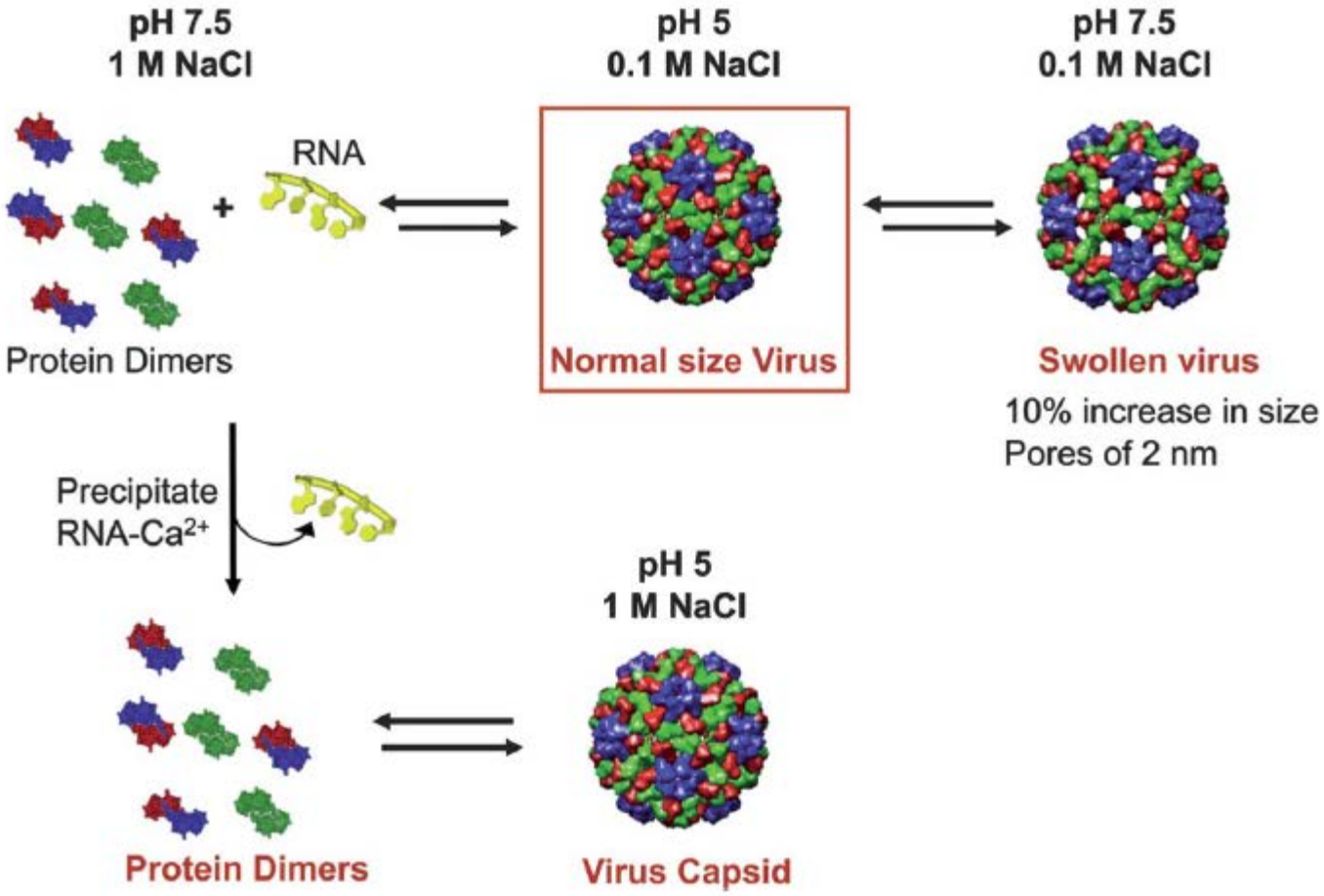
# Neutrons in soft matter research

***Example 3: complex molecular systems***

- **bio-hybrid polymer systems**



# Bio-hybrid polymer systems




Comellas-Aragones *SM* **2011**

# What are your needs?

## *(1) Sample environment*

- sample size
- sample temperature
- pressure
- controlled humidity
- shear

## *(2) Access*

- allocation procedure
- amount of allocated time

## *(3) Support*

- Technical support before, during, after the experiment
- Data reduction, treatment, analysis

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