# Soft and Biological Physics

## Soft:

- Macroscopic materials with weak resistance to mechanical deformation
- Microscopic assemblies driven by thermal ($k_BT$ scale) interactions

## Bio:

- Living biological cells
- Proteins and their assemblies: (un)folding, aggregation into fibrils, cytoskeleton

## Physics:

- Stochastic processes
- Thermodynamics (enthalpic and entropic contributions)
- Electrostatics

## Example systems

- Colloidal dispersions
- Polymer gels
- Biological cells

## Example processes

- Random walks
- Aggregation
- Self-assembly

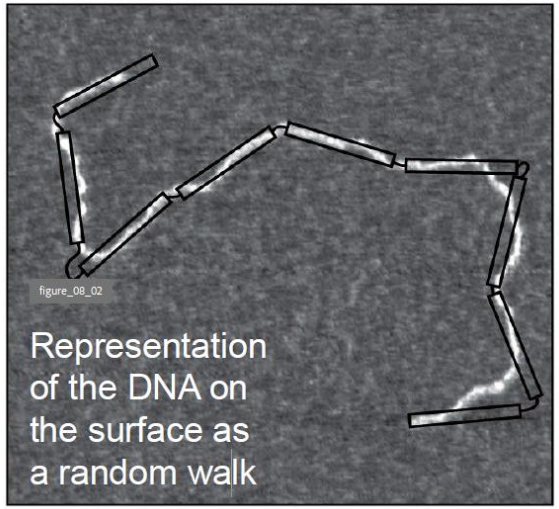
# Soft and Biological Physics

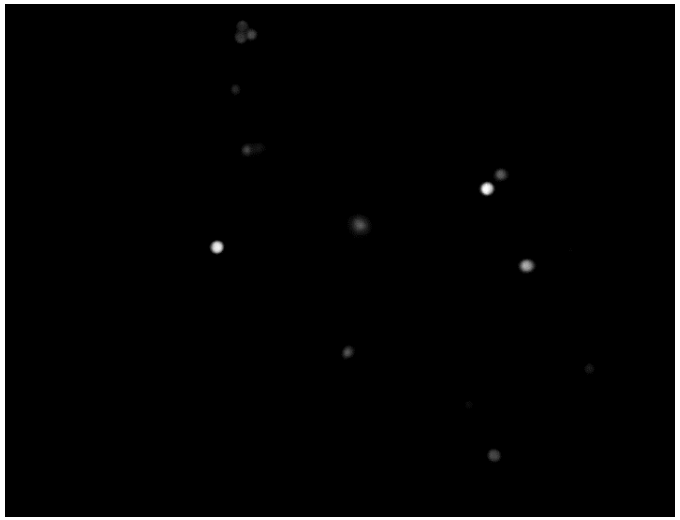
A flavor (1)

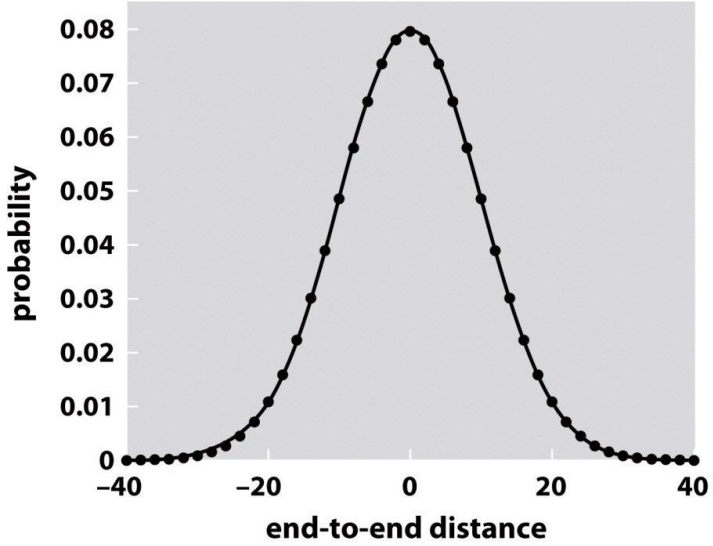
**Random walk/Brownian motion**

describes many processes in physics/chemistry/biology:

- shape and elasticity of biomolecules with a chain-like architecture
- diffusive transport of reactants and products, in tissues, chemical reactors, ...
- assembly or disassembly of molecules and colloids





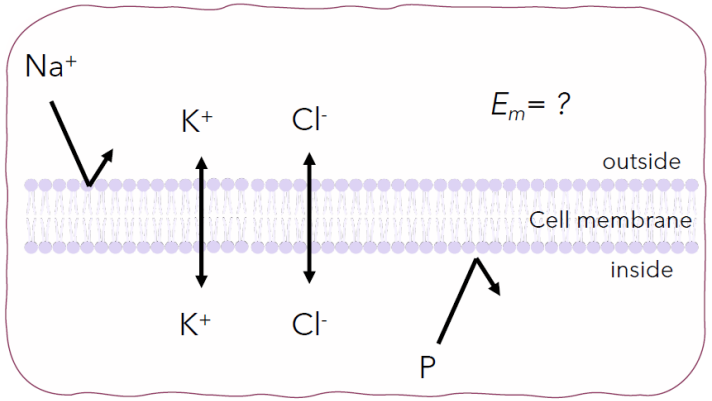
# Soft and Biological Physics

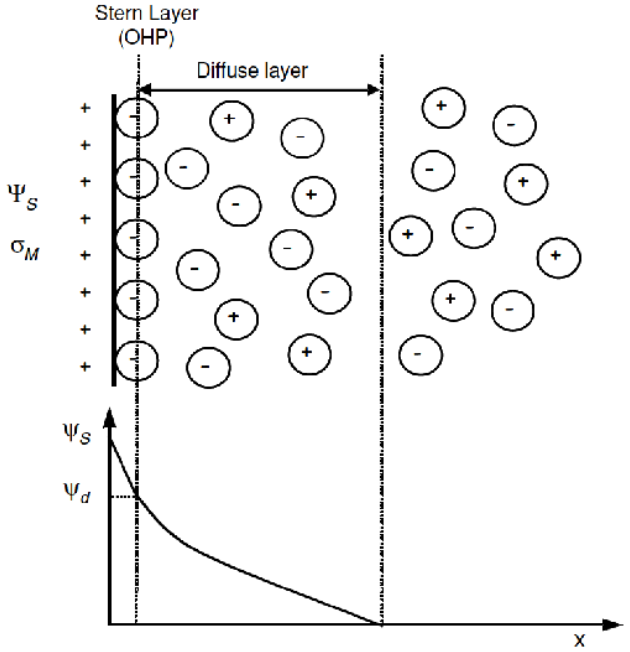
A flavor (2)

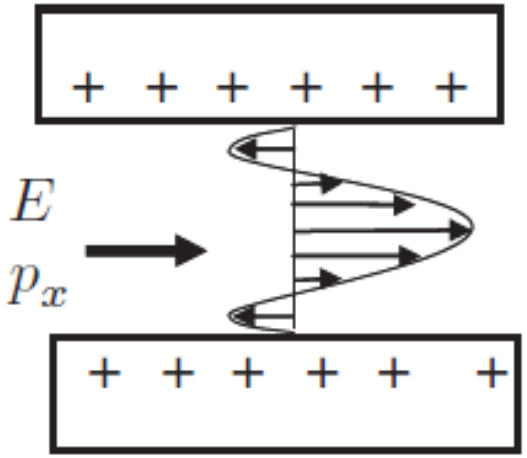
**Electro-statics and dynamics**

are important elements in many processes/phenomena:

- membrane equilibria
- ion transport
- colloidal stability



# Soft and Biological Physics

Topic List

## Physical Biology (5 EC)

1. Building blocks of life
2. Optical Methods
3. Random walks, friction and diffusion
4. Entropy and Free energy (microscopic)
5. Chemical forces and self-assembly
6. Mechanics of beams
7. Enzymes and molecular machines
8. Bioelectricity
9. Hallmarks of cancer
10. Biomechanics of cancer
11. Physics of Cancer metastasis

## Advanced Colloids & Interfaces (5 EC)

1. Lifshitz-van der Waals Interactions
2. Polar/AB Interactions
3. Wetting/Contact Angles
4. Electrostatics
5. DLVO Interactions
6. DLVO II & Non-DLVO Interactions
7. Colloidal Stability
8. Spectacular colloidal phenomena

## Soft & Biological Techniques (5 EC)

1. FRET
2. Cytotoxic activity of docetaxel
3. Electrowetting
4. Protein Unfolding
5. Particle Tracking

# Soft and Biological Physics

Courses and organization

## Physical Biology (5 EC)

- Theory course: lecture/tutorial
- Paper presentations and written exam
- Teachers: Armagan Kocer, Mireille Claessens, Christian Blum




## Advanced Colloids & Interfaces (5 EC)

- Theory course lecture/tutorial
- Team work in tutorials
- Assignments and written exam
- Teachers: Jeff Wood, Michel Duits

## Soft & Biological Techniques (5 EC)

- Five experiments offered (and hosted) by 4 research groups
- Related to the 2 theory courses
- Team work (student groups)
- Written reports
- Teacher: Michel Duits