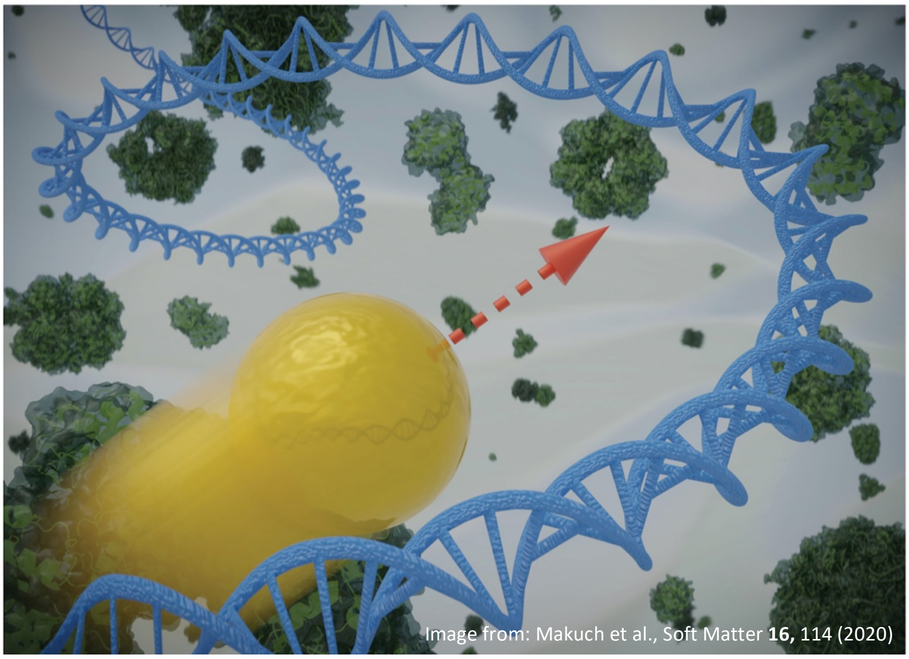
Image from: Makuch et al., Soft Matter **16,** 114 (2020)

A modern view on Brownian motion and its applications

Course summary: After the first experimental observation by Richard Brown on pollen in water and theoretical efforts by Einstein and Langevin, the discovery of Brownian motion proved to have unprecedented relevance for present-day science, which influenced, for example, the theory of statistical thermodynamics, the advent of colloidal sciences, biophysics, and mathematics. Even 100 years after its discovery, its importance cannot be understated, as can be seen in the field of "active matter" -- a hot topic currently in contemporary physics. Furthermore, the methodology associated with Brownian motion had also less obvious applications, such as in electrical networks (Johnson-Nyquist noise) and quantum systems, such as lasers.

In this course, we will give a brief introduction to the theory of Brownian motion (from a physics perspective) and discuss relevant experimental techniques to probe these phenomena in a variety of systems. Special attention will be put on open problems in this field and research performed within the Institute of Physical Chemistry.

Practical information: February-May, 7 lectures (2h each). The course participants are required to have basic knowledge on math (calculus, probability theory, differential equations), thermodynamics, and statistical mechanics. Grading will be based on hand-in exercises and a written exam.

Registration deadline: 31 January 2023 (Please state during registration how comfortable you are with the requested prior knowledge, see practical information)

Lecturer: dr. J. C. Everts, jeverts@ichf.edu.pl

Course syllabus: 1. Introduction to Brownian motion; 2-3. Translational diffusion from the Langevin and Smoluchowski point of view, fluctuation-dissipation theorem; 4. Experimental techniques**;** 5-6. Diffusion in complex fluids**;** 7. Open problems in current research

Course material: Lecture notes