科目ナンバリング	U-LAS12 20022 LE57				
授業科目名<英訳>	Soft Matter Physics-E2 :From Condensed Matter to Life Soft Matter Physics-E2 :From Condensed Matter to Life			担当者所属職名・氏名	理学研究科　講師　BRANDANI, Giovanni・Bruno
群	自然科学科目群	分野(分類)	物理学(発展)	使用言語	英語
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	講義（対面授業科目）
開講年度・開講期	2026・後期	曜時限	水5	配当学年	主として1・2回生	対象学生	理系向

[授業の概要・目的]

Soft matter is a broad term used to describe substances that are neither solid nor liquid. These include many materials that we encounter daily in our life, such as soap, rubber, and ice-cream, but also much of the components of life itself, such as chromosomes and membranes. In this course, we will use the tools of physics to understand how simple components can lead to the complex behavior observed in soft materials and living systems. More specifically, we will see why the properties of soft materials change over time and depending on how the material is manipulated; learn about the physics of polymers and the origin of rubber elasticity; and understand how small molecules can self-assemble into more complex structures. The students will also have many opportunities to apply the theory of soft matter to answer interesting questions in biology. For example, how can proteins adopt their unique folded structure that let them perform their function so well? How difficult is for cells and viruses to organize their long genome into a compact space? How do membranes transform and make complex life possible?

[到達目標]

To recognize the various types of soft materials around us and in living organisms.
To explain the key properties of soft materials using simple theoretical arguments based on thermodynamics.
To explore the science of life from the perspective of soft matter physics.

[授業計画と内容]

Schedule:
1. Introduction to the course
2. Introduction to thermodynamics and statistical physics
3. Colloidal suspensions and the role of entropy in the state of matter
4. Interactions between colloidal particles
5. The response of materials to stress: visco-elasticity and glasses
6. Polymers and their conformation in space
7. The physics of DNA and applications to genome organization
8. The protein folding problem
9. Formation of gels and the origin of rubber elasticity
10. Multi-component fluids: mixed or unmixed?
11. The dynamics of phase separation (also, why it is difficult to make stable emulsions)
12. Understanding crystallization
13. Self-assembly and membranes
14. Extra topic / exam preparation
15. Final exam
16. Feedback

＊15 lectures per semester, the semester yields two credits (including classes for feedback). Note: the above class numbers do not include examinations.

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Soft Matter Physics-E2 :From Condensed Matter to Life(2)

[履修要件]

Course open to all students, but a basic knowledge of classical mechanics is helpful.

[成績評価の方法・観点]

Class attendance and participation (50%), final exam (50%)

[教科書]

Richard A. L. Jones. 『Soft Condensed Matter』 （Oxford University Press（2002/8/15））ISBN: 9780198505891

[授業外学修（予習・復習）等]

Students are encouraged to take notes during class and to review them afterwards.

[その他（オフィスアワー等）]

Please feel free to contact me by email at brandani@biophys.kyoto-u.ac.jp

[主要授業科目（学部・学科名）]

理学部