ChE-614

# Electron & energy transfer in organic & hybrid systems

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| Cursus | Sem. | Type |
|---|---|---|
| Chemistry and Chemical Engineering | | Opt. |

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| Language of teaching | English |
| Credits | 2 |
| Session | |
| Exam | Oral presentation |
| Workload | 60h |
| **Hours** | **32** |
| Courses | 24 |
| Exercises | 8 |
| **Number of positions** | |

## Frequency

Every year

## Remark

Next time early 2028

## Summary

Electron and energy transfer processes are vital to biological functions. In synthetic molecular and hybrid systems, they are key to device efficiency. Advances in understanding and control of these processes continue to drive innovation across scientific and technological fields.

## Content

**A. Introduction**
- Types of electron and energy transfer
- Biological, synthetic and hybrid systems
- Examples of energy and electron transfer
- Applications and current challenges

**B. Experimental techniques to investigate electron and energy transfer processes**
- Generation of excited molecular states by light absorption: Transition dipole moment and selection rules
- Absorption, fluorescence
- Fluorescence lifetime techniques
- Transient absorption
- Voltammetric and impedance based methods

**C. Theoretical models**
- Fermi's golden rule
- Modeling electronic states and predicting transfer pathways
- Marcus theory of electron transfer
- Energy transfer theories

**D. Biological systems and Applications**
- Photosynthesis and chemiluminescence
- Dye sensitized solar cells
- Perovskite solar cells
- Organic solar cells and photodetectors
- OLEDs

## Note

12.01.2026-16.01.2025

## Keywords

Organic conjugated molecules, conjugated polymers, molecular orbitals, absorption, fluorescence, phosphorescence, electron transfer, energy transfer, photosynthesis, chemiluminescence, solar cells.

## Assessment methods

Presentation of the problems in front of the class.Attendance is mandatory for ail students and will last for about 6h. On Thursday the student have a full day (8h) to prepare for a problem to be presented in class on Friday.

## Resources

### Bibliography

Gilbert, J. Baggott, Essentials of Molecular Photochemistry, Blackwell Sci. Publ., Oxford, 1991.
P. W. Atkins, R. S. Friedmann, Molecular Quantum Mechanics, Oxford University Press, Oxford, 1997.
A. Köhhler and H. Bässler, Electronic Processes in Organic Semiconductors, Wiley-VCH, Weinheim, 2015

### Ressources en bibliothèque

- Find the references at the Library

### Moodle Link

- https://go.epfl.ch/ChE-614