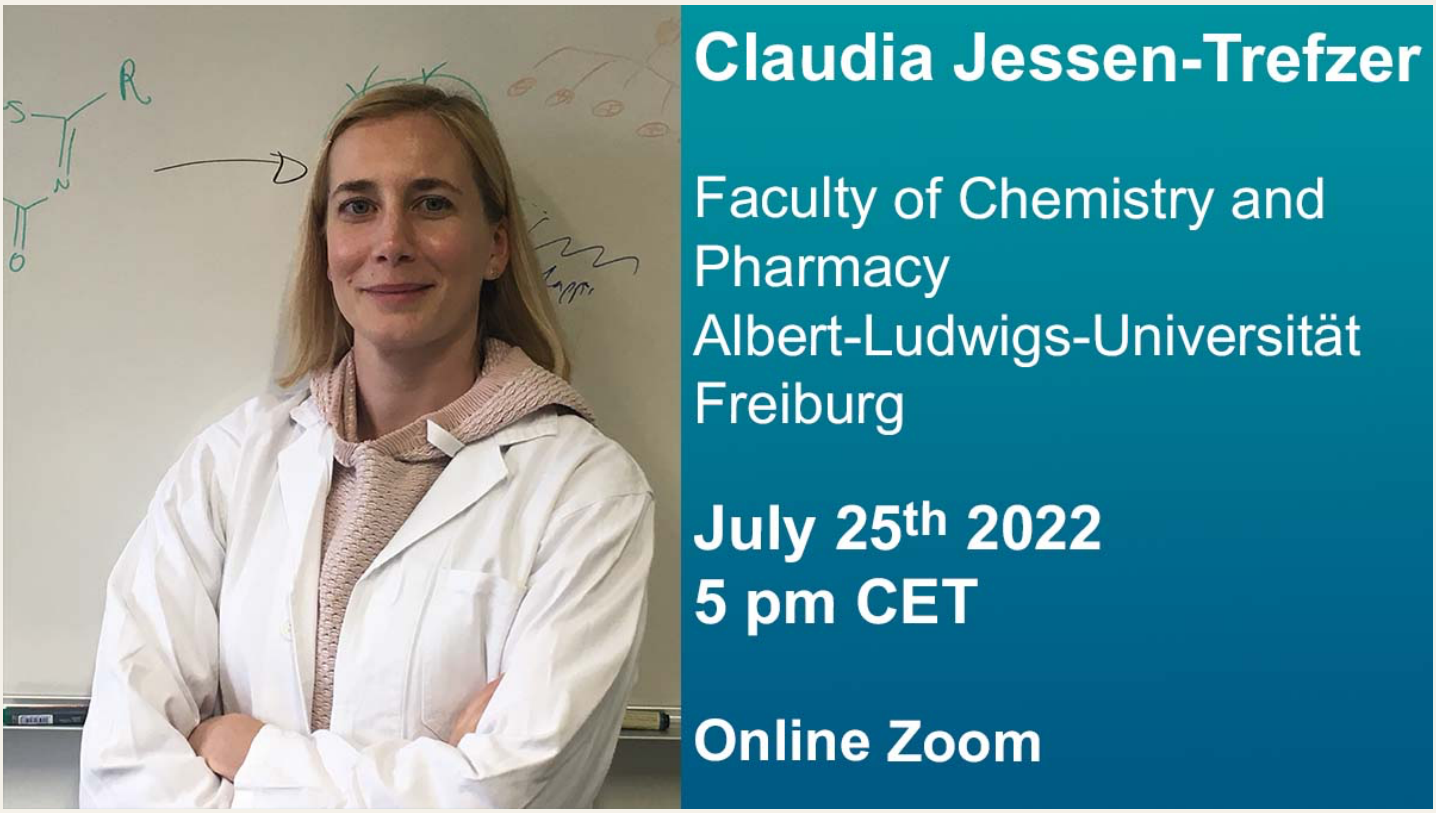
FLAGSHIP INITIATIVE
ENGINEERING
MOLECULAR SYSTEMS

UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386

COLLOQUIUM
ENGINEERING MOLECULAR SYSTEMS
- Online -

CLAUDIA JESSEN-TREFZER will talk about **A DUAL FUNCTIONAL ARTIFICIAL METALLOENZYME INSIDE ENCAPSULIN** in the “Engineering Molecular Systems” colloquium on **July 25th 2022** at **5 p.m.** (CET) hosted by the Flagship Initiative Engineering Molecular Systems of Heidelberg University. The colloquium will be an **online** meeting via Zoom. Please register.



REGISTRATION:

https://zoom.us/meeting/register/tJwpduGorD8qGNH6-S9W-R9YOoAlxSQYWaRB

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ABSTRACT:

Encapsulins (Enc) are virus-like particles and conserved prokaryotic compartments. They self-assemble inside the cell from protein monomers and present a highly attractive platform for intracellular compartmentalization of chemical reactions by design. The smallest representatives of Encs assemble into 60-subunit icosahedral nanocompartments (~240 Å) and are therefore the smallest example of bacterial compartments identified to date. Enc nanocompartments usually have a 5-, 3-, or 2-fold symmetry, where at each point of symmetry uncharged, positively charged, and negatively charged pores are formed, respectively. Interestingly, co-expressed genes are targeted to the interior of Enc, via a conserved c-terminal sequence. We have previously isolated the Enc orthologue from Mycobacterium smegmatis and successfully installed non-natural guest proteins inside Enc. Additionally, we investigate the covalent targeting of small molecules inside Enc, by co-expressing HaloTag and a monomeric rizavidin variant. By equipping these guest-proteins with two synthetic organometallic catalysts, encapsulin serves as a host for a fully bioorthogonal, linear, two-step reaction cascade. A ruthenium catalyzed alloc deprotection is followed by a gold-catalyzed, ring-closing hydroamination reaction leading to indoles and phenanthridines with up to 67 % overall yield in aqueous solutions. We are able to perform this reaction cascade inside a proteinaceous capsid opening up exciting possibilities in the field of designing artificial organelles with compartmentalized reaction pathways or pro-drug activation purposes.

References

[1] Lohner P, Zmyslia M, Thurn J, Pape JK, Gerasimaité R, Keller-Findeisen J, Groeer S, Deuringer B, Süss R, Walther A, Lukinavičius G, Hell SW, Hugel T, Jessen-Trefzer C, Inside a shell - Organometallic catalysis inside encapsulin nano-reactors, Angew.Chem.Int.Ed. 2021, 60, 23835–23841.
[2] Ebensperger P, Jessen-Trefzer C, Artificial Metalloenzymes in a Nutshell: The Quartet for Efficient Catalysis, Biological Chemistry, 2022, 403, 4, 2022, 403-412.
[3] Ebensperger P, Zmyslia M, Lohner P, Braunreuther J, Deuringer B, Becherer A, Süss R, Fischer A, Jessen HJ, Jessen-Trefzer C, Sequential, all-bioorthogonal reaction cascade catalyzed by a dual functional artificial metalloenzyme inside encapsulin, Nature communications under review

BRIEF CV:

Claudia Jessen-Trefzer (birth name Trefzer) was educated at University of Konstanz, the Swiss Federal Institute of Technology Lausanne (EPFL) and the Center for Molecular Medicine in Vienna (CeMM), where she worked with Prof. Dr. Andreas Marx, Prof. Dr. Kai Johnsson, and Prof. Dr. Guilio Superti-Furga. She is a member of the German Pharmaceutical Society (DPhG), the Assosiation of General and Applied Microbiology (VAMM) and a founding member of Academia Meets Industry e.V. Freiburg. Furthermore, she is associated member at BIOSS (Center for Biological Signaling Studies Freiburg) and member of the RTG 2022 “Transport into and across membranes”. Her work has been recognized by a number of awards, including the Eugen-Grätz Award for young scientists from the University of Freiburg and the Maria Gräfin von Linden Award from the VBWW.