SAPIENZA UNIVERSITÀ DI ROMA **Dipartimento di Scienze Biochimiche 'A. Rossi Fanelli'**

PhD Life Sciences

PhD Biochemistry

Seminar notice

November 7th, 2025 **11:00**

Aula B (CU018 – Plesso Tecce)

Dr. Leonhard H. Urner

Independent Group Leader

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Urner lab website: https://ccb.tu-dortmund.de/en/professorships/cb/urner/team/

Hybrid detergents enable biocompatible consumer products and medical research

Earth resources are limited and so is the ability for humanity to grow on Earth. The impact of detergent chemistry goes beyond green chemistry but the holistic impact on Earths resources is rarely understood. To guide future research towards a holistic detergent design, Urner lab leverages the planetary boundary framework to assess systematically the impact of detergent chemistry on the transgression of Earth's resources. Our results identified detergents as key ingredients in cosmetic, cleaning, sanitizer formulations with the shortcoming of solubilizing hydrophobic matter with low selectivity. This leads to cell damage and side effects, like skin irritation, allergies or antimicrobial resistance. To align detergent chemistry with consumer health, we established ionic/non-ionic hybrid detergents with surprising advantages. Compared to established ionic detergents, like sodium dodecyl sulphate or dodecyltrimethylammonium bromide, related ionic/non-ionic hybrid detergents have low critical micelle concentration values, low cytotoxicity, excellent hard water tolerance and good solubilizing properties. Ionic/non-ionic hybrid detergents will enable the development of cleaning products that demand detergents with scalable cell compatibility, while doing the job of cleaning applications. Furthermore, in context with medical research, we designed non-ionic hybrid detergents to control the stabilization of functional membrane proteins and their interactions with membrane lipids in biochemical assays. Membrane proteins are vital molecular machines and targets for most approved drugs on the market. A detailed analysis of their function and drug binding in context with membrane lipids is crucial for drug discovery but exceptionally challenging. Standard detergents poorly replicate relevant membrane lipid compositions surrounding proteins and limit the transfer of drug binding effects obtained on purified proteins into patients. To overcome this innovation hurdle, we designed hybrid detergents with scalable solubilization properties. The trick is to fuse headgroups of non-ionic detergents to precisely tune polarity and conical shape of related hybrid detergents. Our chemical design led to first detergent micelles that gradually remove or retain protein-lipid interactions during purification from membranes. Surprisingly, our hybrid detergent technology enabled new possibilities for down-stream applications in membrane protein drug discovery and uncovered a new type of biomolecular interaction between proteins and glycolipids in cell walls of Gram-negative bacteria with relevance for antibiotic research. The chemistry of hybrid detergents delivers exciting avenues for biocompatible consumer products and medical research.

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