DEPARTMENT
OF PHARMACEUTICAL SCIENCES

Seminars on Drug Sciences (SDS)

Lecture of

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Sticky Solutions: Engineering Retention for Enhanced Therapeutic Efficacy

A persistent challenge in therapeutic delivery is ensuring that drugs, cells, and microbes accumulate and persist at diseased sites long enough to provide substantial therapeutic benefit.

In the heart, this limitation has constrained the efficacy of therapeutics, such as nanocarriers and cells, for myocardial infarction. To address this, we developed an *in situ* crosslinking strategy where each administered dose of therapeutic acts as a capturing surface for subsequent doses, thereby amplifying targetable surface area and creating localized depots. Using this approach, we engineered Zippersomes, mesenchymal stem cell-derived extracellular vesicles decorated with high-affinity heterodimerizing leucine zippers, which demonstrated increased accumulation, prolonged cardiac retention and yielded substantial improvements in heart function and tissue repair. Similarly, we created ZipperCells, mesenchymal stem cells engineered to present zipper proteins, which migrate to damaged tissue, crosslink in situ, and form “living depots” that sustain therapeutic presence and provide robust regenerative benefits.

Beyond the heart, a similar challenge arises in the gastrointestinal tract, where therapeutic microbes must compete against trillions of resident bacteria and are rapidly cleared. To address this, we engineered the probiotic yeast *Saccharomyces boulardii* to bind extracellular matrix proteins enriched at sites of inflammation. This targeted strategy prolonged gut residence, supported robust microbial persistence, and yielded substantial improvements in both inflammatory markers and histological recovery in models of colitis.

Wednesday, April 29, 2026
17:15 - 18:15
Lecture Hall 1, Pharmacenter, Klingelbergstrasse, 50, Basel

Host: Prof. P. Luciani
University of Bern

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