Associated Junior Research Group "Microfabrication and Microbiology"
Group Leader Dr. Lars D. Renner

TOPICS

1. **Bacteria at interfaces**: We study the interactions of bacterial cells with polymer surfaces of varying physico-chemical characteristics to understand and analyse the strategy of bacterial adsorption, adhesion and biofilm development [**7**]. With this approach we hope to identify surface properties that can be exploited to prevent extensive spreading of pathogens [**5**].

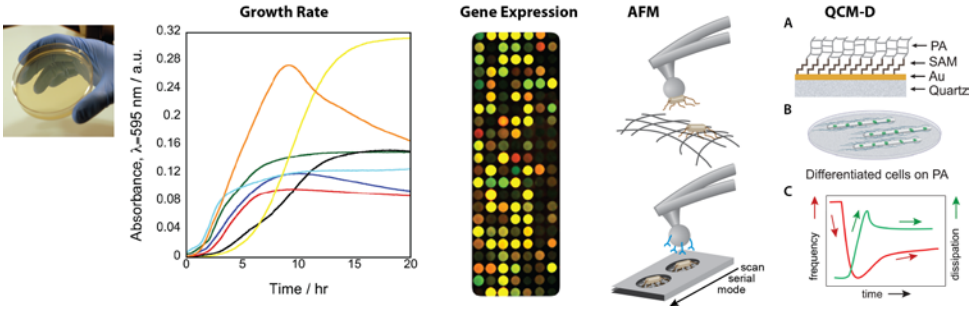

Figure 1. Characterisation of bacterial interactions on surfaces with varying properties.

2. **Bacterial detection using surface/peptide libraries**: We are exploiting the adhesion machinery of bacterial cells to build surface/peptide libraries for the detection of pathogenic strains. Polymer platforms are used as substrates for the successful immobilization of peptides and bacteria [**5,7**].

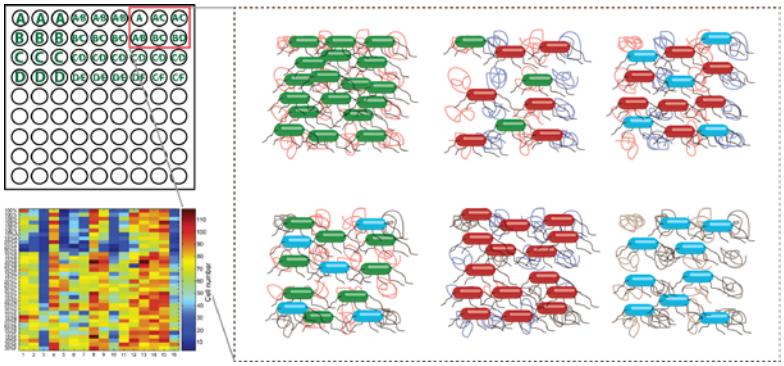

Figure 2. Schematic approach of bacterial detection to surface/peptide libraries.

3. **Bacteria meets Mircofabs**: We study the interactions of bacterial biomolecules with membranes using a range of in vivo and in vitro assays [**1-3,6,9**]. We are developing cell free expression platforms to characterize the behavior of shape-determining and cell division proteins in liposome environments (in collaboration with Dr. Toshihisa Osaki (The University of Tokyo) and Dr. Piotr Garstecki (Polish Academy of Sciences)).

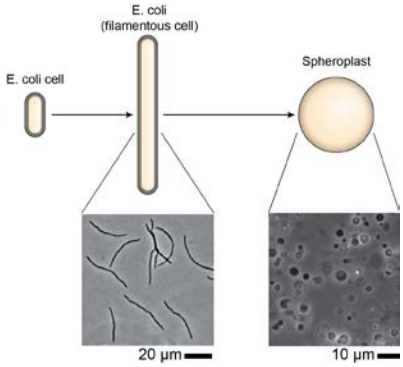

Figure 3. Development of in vivo and in vitro assays to characterize the behavior of biomolecular interactions in bacterial cells: The figure illustrates the transformation of elongated rod-shape bacteria (E. coli) cells into spherical cells maintaining the entire biochemical machinery (minus the peptidoglycan cell wall and the outer membrane) [6].

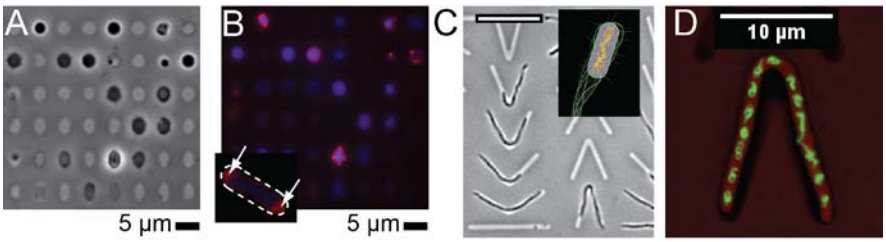

Figure 4. Bacteria can be reshaped and the localization of biomolecules is studied in dependence of curvature. (A) Confinement of spheroplasts from E. coli in microchambers of different curvatures (B) stained with NAO (red) and DAPI (blue) for cardiolipin domains and DNA, respectively [6]. (C) Deformed bacteria cells (E. coli) confined in angular microchambers responding to external force and (D) filaments stained for DNA [1].

PUBLICATIONS

1. Renner, L.D.; Eswaramoorthy, P.; Ramamurthi, K.S.; Weibel, D.B.
Studying biomolecule localization by engineering bacterial cell wall curvature
PLoS One **8** (2013) e84143

2. Renner, L.D.; Weibel, D.B.
MinD and MinE Interact with Anionic Phospholipids and Regulate Division Plane Formation in Escherichia coli
J Biol Chem **287** (2012) 38835–38844

3. Zimmermann, R.; Kuettner, D.; Renner, L.; Kaufmann, M.; Werner, C.
Fluidity modulation of phospholipid bilayers by electrolyte ions: Insights from fluorescence microscopy and microslit electrokinetic experiments
J Phys Chem. A **116** (2012) 6519-6525

4. Tuson, H.H.; Auer, G.K.; Renner, L.D.; Hasebe, M.; Salick, M.; Crone, W.C.; Gopinathan, A.; Huang, K.C.; Weibel, D.B.
Measuring the stiffness of bacterial cells from growth rates in hydrogels of tunable elasticity
Mol. Microbiol. **84** (2012) 874–891

5. Tuson, H.H.; Renner, L.D.; Weibel, D.B.
Polyacrylamide hydrogels as substrates for studying bacteria
Chem. Commun. **48** (2012) 1595–1597

6. Renner, L.D.; Weibel, D.B.
Cardiolipin microdomains localize to negatively curved regions of Escherichia coli membranes
Proc Natl Acad Sci USA **108** (2011) 6264–6269

7. Renner, L.D.; Weibel, D.B.
Physicochemical regulation of biofilm formation
MRS Bulletin 36 (2011) 347–355

8. Renner, L.; Pompe, T.; Lemaitre, R.; Drechsel, D.; Werner, C.
Controlled enhancement of transmembrane enzyme activity in polymer cushioned supported bilayer membranes
Soft Matter 6 (2010) 5382–5389

9. Renner, L.; Osaki, T.; Chiantia, S.; Schwille, P.; Pompe, T.; Werner, C.
Supported lipid bilayers on spacious and pH-responsive polymer cushions with varied hydrophilicity
J Phys Chem. B. 112 (2008) 6373–6378