

4th International Conference on **Electrochemistry**

June 11-12, 2018 | Rome, Italy

S-layer protein lattice as a key component in biosensor development**Bernhard Schuster**

University of Natural Resources and Life Sciences, Austria

Statement of the Problem: Combining biological with electronic components is a very challenging approach because it allows the design of ultra-small biosensors with unsurpassed specificity and sensitivity. However, many biomolecules lose their structure and/or function when randomly immobilized on inorganic surfaces. Hence, there is a strong need for robust self-assembling biomolecules, which attract great attention as surfaces and interfaces can be functionalized and patterned in a bottom-up approach.

Methodology: Crystalline cell surface layer (S-layer) proteins, which constitute the outermost cell envelope structure of bacteria and archaea, are very promising and versatile components in this respect for the fabrication of biosensors. S-layer proteins show the ability to self-assemble *in-vitro* on many surfaces and interfaces to form a crystalline two-dimensional protein lattice.

Findings: The S-layer lattice on the surface of a biosensor becomes part of the interface architecture linking the bioreceptor to the transducer interface, which may cause signal amplification. The S-layer lattice as ultrathin, highly porous structure with functional groups in a well-defined spatial distribution and orientation and an overall anti-fouling characteristics can significantly raise the limit in terms of variety and ease of bioreceptor immobilization, compactness and alignment of molecule arrangement, specificity, and sensitivity. Moreover, mimicking the supramolecular building principle of archaeal cell envelopes, comprising of a plasma membrane and an attached S-layer lattice allow the fabrication of S-layer supported lipid membranes. In the latter, membrane-active peptides and membrane proteins can be reconstituted and utilized as highly sensitive bioreceptors.

Conclusion & Significance: S-layer proteins bridge the biological with the inorganic world and hence, fulfill key requirements as immobilization matrices and patterning elements for the production of biosensors. This presentation summarizes examples for the successful implementation of bacterial S-layer protein lattices on biosensor surfaces in order to give an overview on the application potential of these bioinspired S-layer protein-based biosensors.

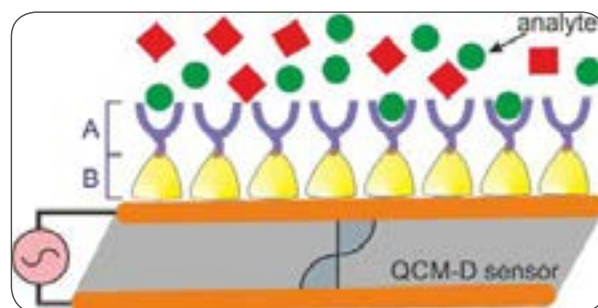


Figure 1: Selected elements of an S-layer protein-based biosensor for combined electrochemical and quartz crystal microbalance (QCM-D) measurements. Bioreceptor (A) immobilized on an S-layer protein lattice (B), which is recrystallized on the gold sensor surface of a QCM-D crystal

Recent Publications

1. Schuster B (2018) S-layer protein-based biosensors. Biosensors DOI:10.3390/bios8020040.
2. Damiati S, Peacock M, Mhannad R, Sjøpstad S, Sleytr U B and Schuster B (2018) Bioinspired detection sensor based on functional nano-structures of S-proteins to target the folate receptors in breast cancer cells. Sensor Actuator B Chem 267:224–230.
3. Damiati S, Peacock M, Leonhardt S, Damiati L, Baghdadi M A, Becker H, Kodzius R and Schuster B (2018) Embedded disposable functionalized electrochemical biosensor with a 3D-printed flow cell for detection of hepatic oval cells (HOCs). Genes DOI: 10.3390/genes9020089.
4. Damiati S, Küpcü, S Peacock, M Eilenberger C, Zamzami M, Qadri I, Choudhry H, Sleytr U B and Schuster B (2017) Acoustic and hybrid 3D-printed electrochemical biosensors for the real-time immunodetection of liver cancer cells (HepG2). Biosens Bioelectron 94:500–506.
5. Schuster B and Sleytr U B (2014) Biomimetic interfaces comprised of S-layer proteins, lipid membranes and membrane proteins. J R Soc Interface DOI:10.1098/rsif.2014.0232.

Biography

Bernhard Schuster holds an Associate Professor position for Molecular Nanotechnology and Biomimetic at the Department of Nanobiotechnology, University of Natural Resources and Life Sciences, Vienna, Austria. His main research interests focus on biomimetics, nanobiotechnology, cell envelope mimics and in particular functional supported lipid membranes and bio-inspired S-layer protein- and membrane protein-based sensors. His skills include recrystallization and modification of S-layer proteins, formation techniques for model lipid membranes, surface-sensitive and electrochemical techniques and the reconstitution and analysis of membrane-active peptides and membrane proteins. He is an Editorial Board Member of seven international peer-reviewed journals and filed two international patents. He published about 100 papers in peer-reviewed journals and book chapters and gave more than 120 (invited) contributions to international conferences. His total citations are 1.808; average citation per item: 27; h-index: 27. He serves as Ad-Hoc Reviewer of more than 20 papers per year.

bernhard.schuster@boku.ac.at

Notes: