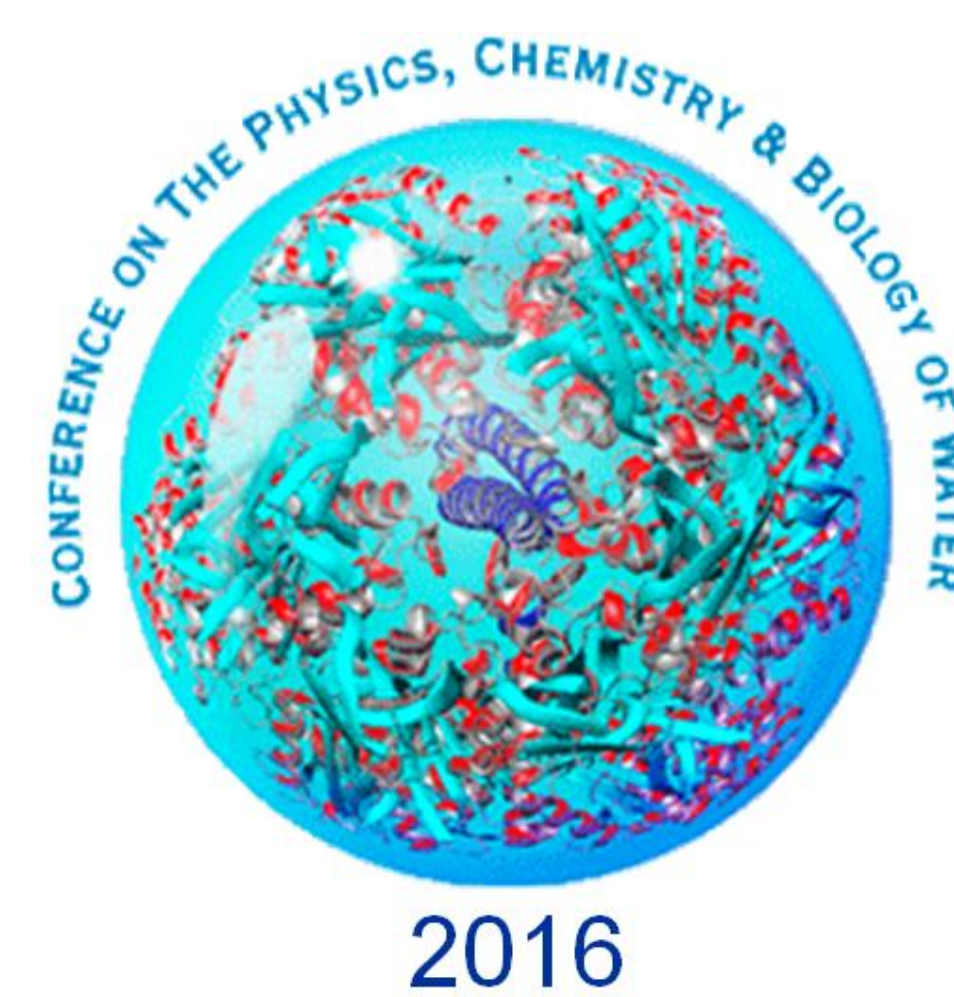


Minimizing Signal Interference from the Biological Sample Matrix in a Biosensor for Sepsis: the Pivotal Role of Water

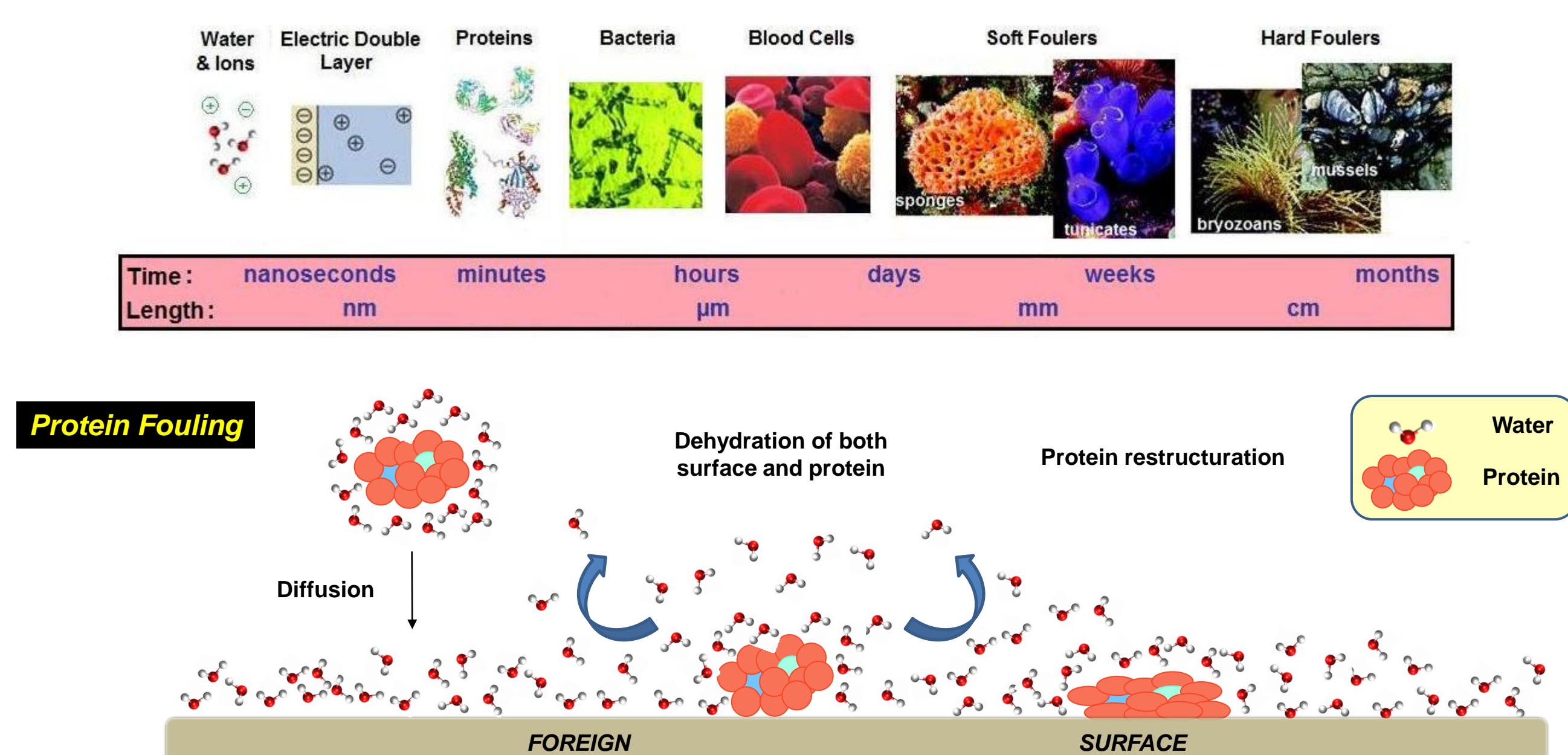
Sonia Sheikh, Christophe Blaszykowski, and Michael Thompson

University of Toronto, Department of Chemistry, 80 St. George Street, Toronto, Ontario, Canada M5S 3H6



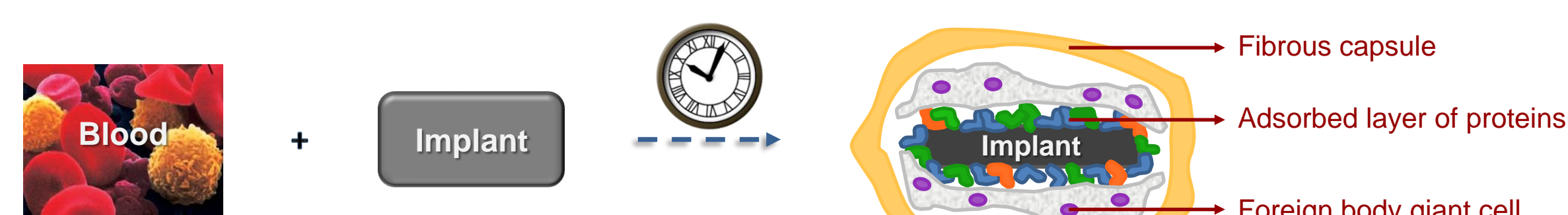
Fouling: a Ubiquitous Phenomenon

Definition: undesirable adsorption of species on surfaces from surrounding environment

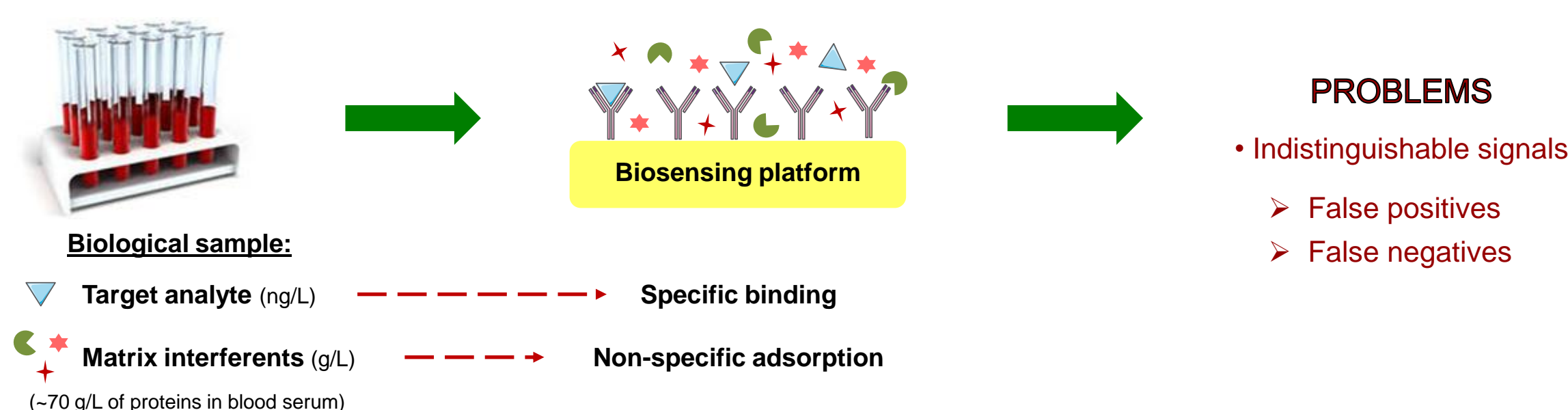


Protein Adsorption: a Plague in Biotechnology

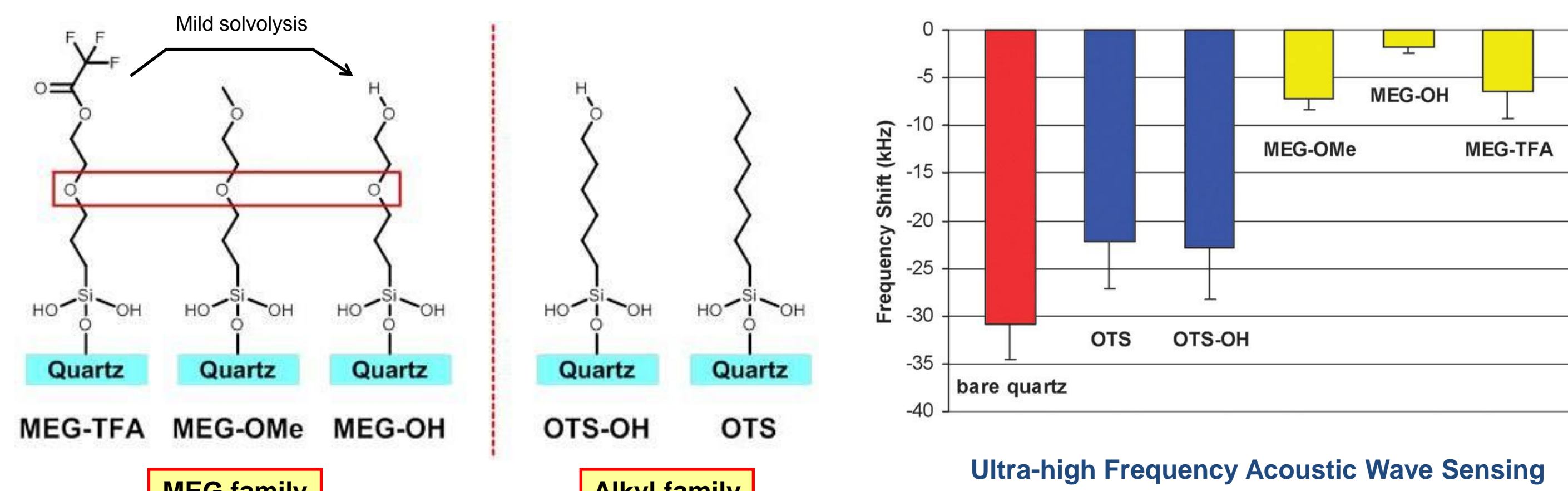
Biomedical concern for *in vivo* biomaterial applications: 'Foreign body reaction'



Bioanalytical concern in biosensor technology: 'Non-specific adsorption'



Ultrathin Antifouling Surface Chemistry

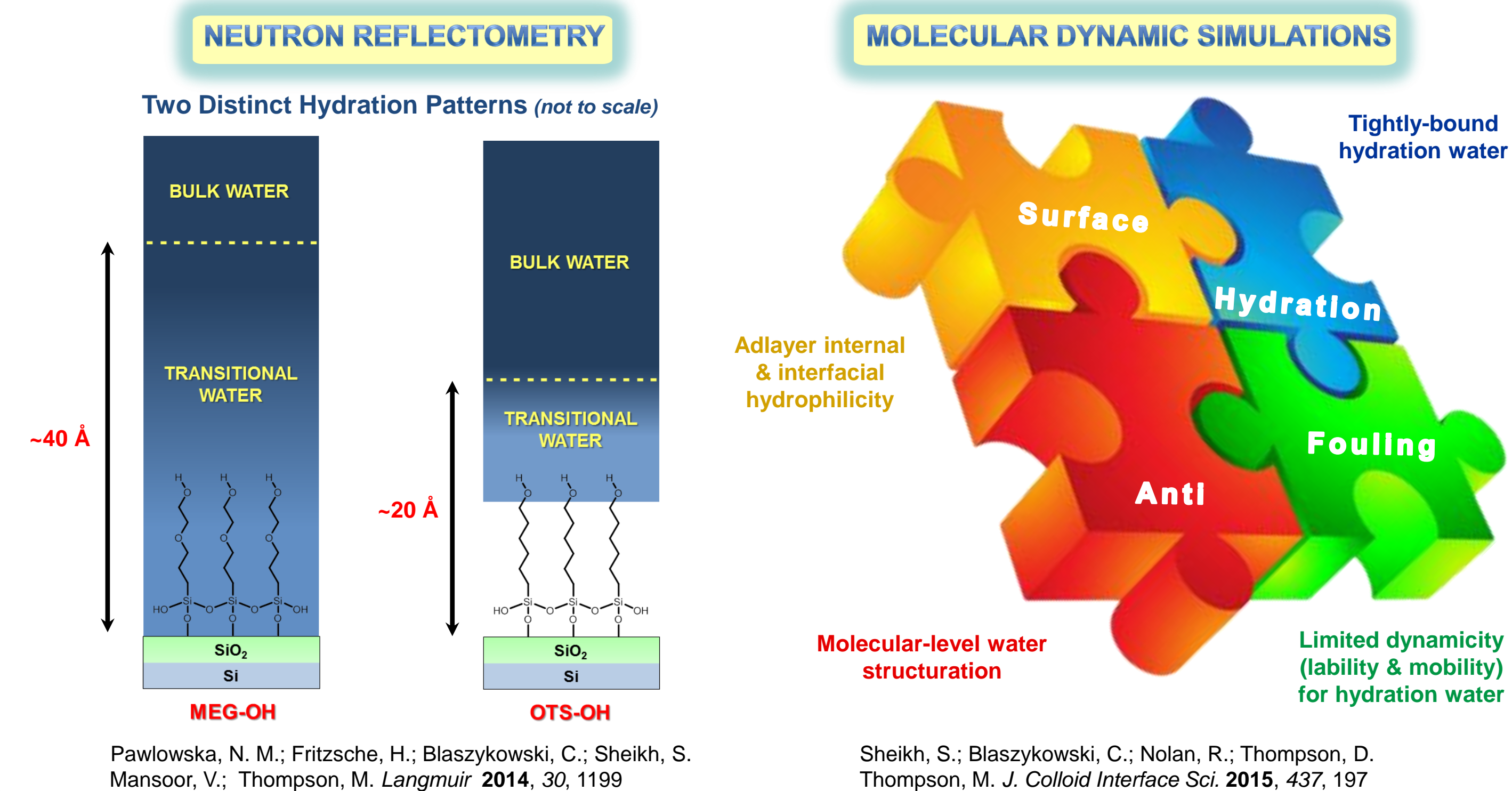


Antifouling behaviour against full serum

The frequency shift due to the adsorption of serum species was substantially reduced upon surface modification of quartz ($\Delta f \sim -31$ kHz) with antifouling MEG-OH coating ($\Delta f > -3$ kHz)

Sheikh, S.; Yang, D. Y.; Blaszykowski, C.; Thompson, M. *Chem. Commun.* **2012**, 48, 1305

Antifouling Mechanism: Pivotal Role of Water



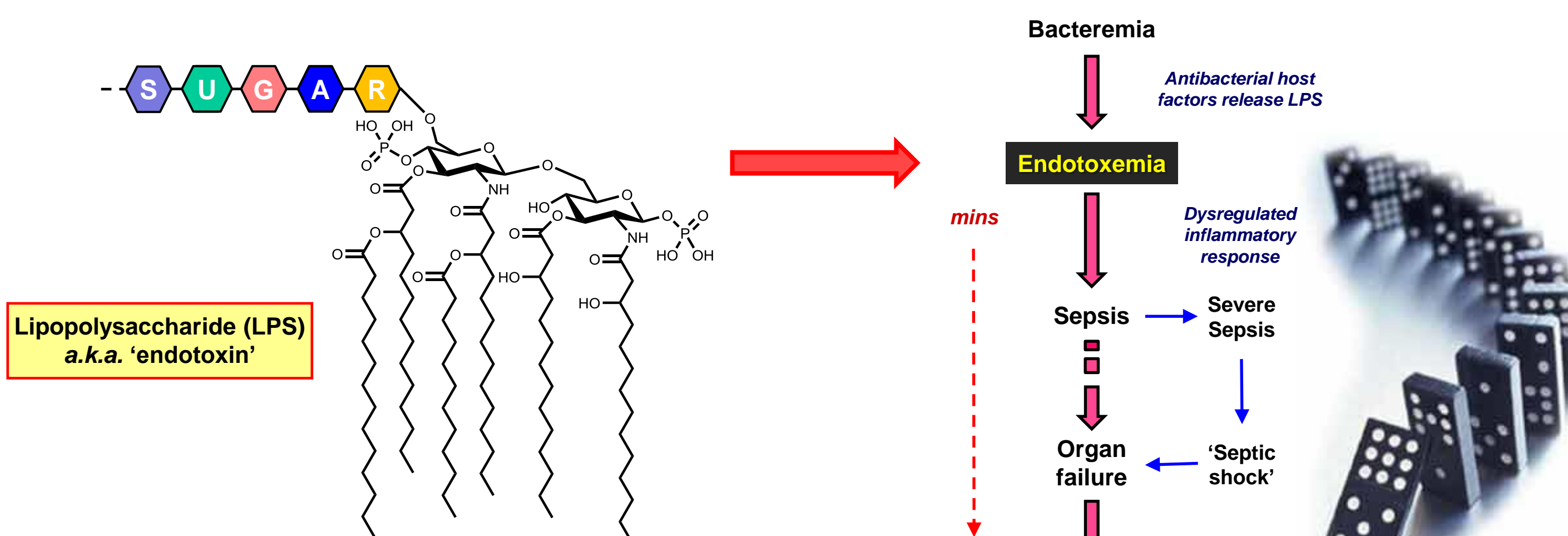
Pawlowska, N. M.; Fritzsche, H.; Blaszykowski, C.; Sheikh, S. Mansoor, V.; Thompson, M. *Langmuir* **2014**, 30, 1199

Sheikh, S.; Blaszykowski, C.; Nolan, R.; Thompson, D. Thompson, M. J. *Colloid Interface Sci.* **2015**, 437, 197

Sepsis: Overview and Pathogenesis

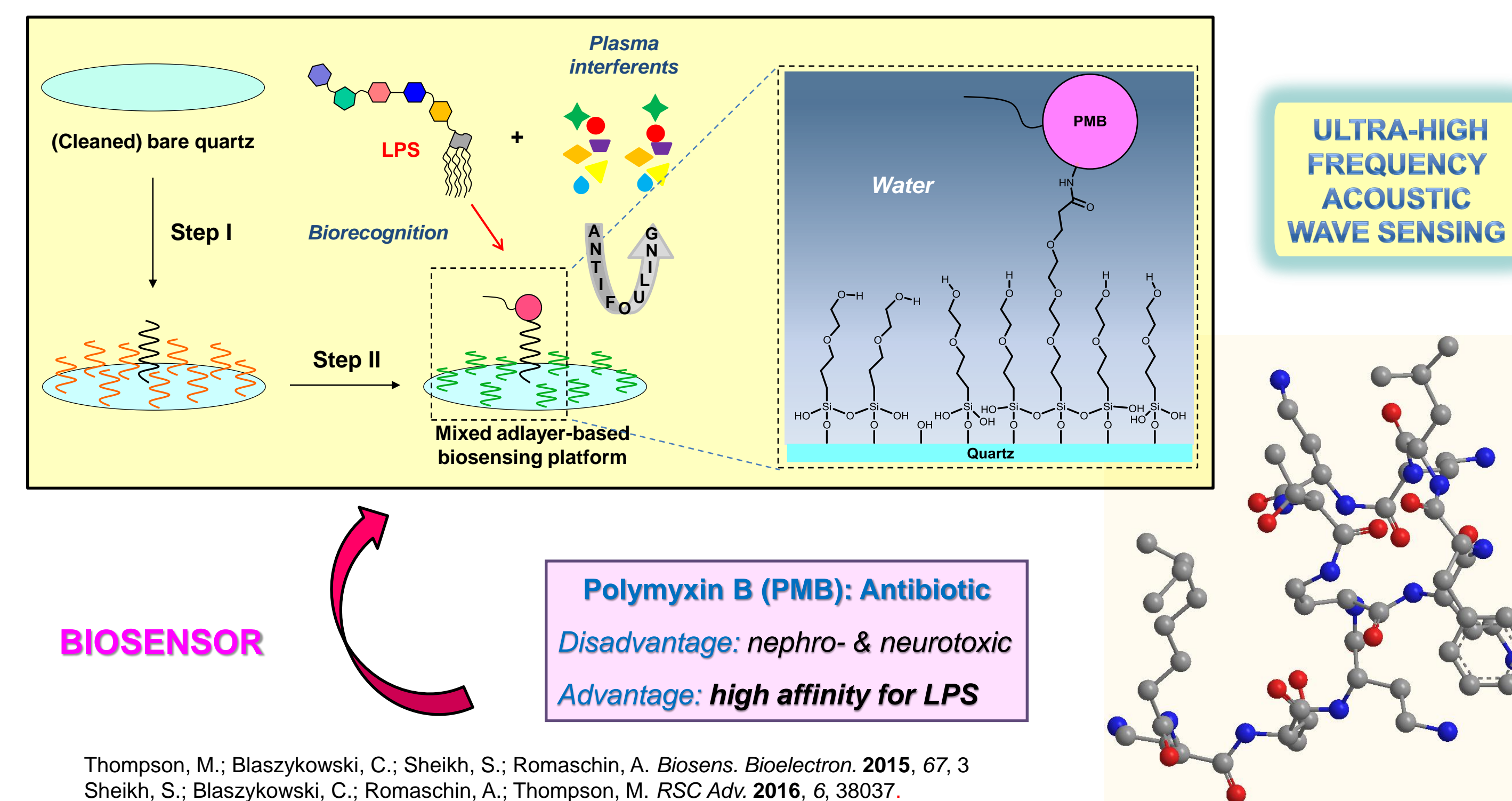
Sepsis: a medical condition characterized by pathogen-induced systemic inflammation

➤ One of the leading causes of death worldwide ➤ Key trigger: bacterial lipopolysaccharide (LPS)



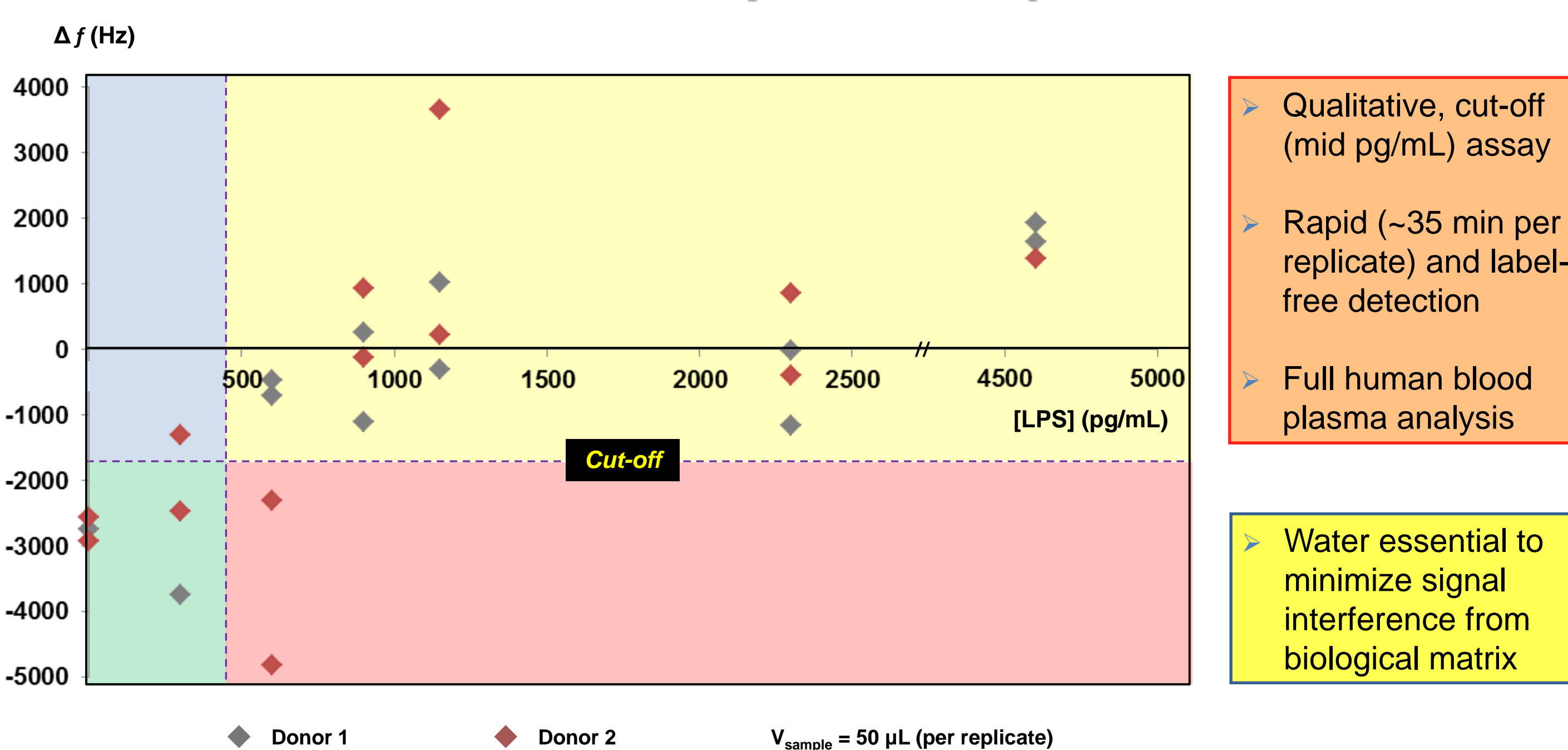
Thompson, M.; Blaszykowski, C.; Sheikh, S.; Romaschin, A. *Biosens. Bioelectron.* **2015**, 67, 3
Sheikh, S.; Blaszykowski, C.; Romaschin, A.; Thompson, M. *RSC Adv.* **2016**, 6, 38037.

Endotoxin Detection: Strategy and Working Principle



Thompson, M.; Blaszykowski, C.; Sheikh, S.; Romaschin, A. *Biosens. Bioelectron.* **2015**, 67, 3
Sheikh, S.; Blaszykowski, C.; Romaschin, A.; Thompson, M. *RSC Adv.* **2016**, 6, 38037.

LPS Biosensor Assay: Dose-Response Curve



Sheikh, S.; Blaszykowski, C.; Romaschin, A.; Thompson, M. *RSC Adv.* **2016**, 6, 38037.

Conclusion

- Successful preliminary research towards a new biosensor assay alternative for Sepsis capable of detecting bacterial endotoxin in full human blood plasma
- Assay able to qualitatively differentiate high from low endotoxin levels in a cost-effective, real-time, and label-free advanced manner – unlike current clinical tests
- Pivotal role played by water – through hydrogel antifouling surface chemistry – in minimizing signal interference from the biological matrix
- In principle, such technology offers the possibility for clinicians to rapidly determine the appropriate course of action to follow for patients suspected of being afflicted with LPS-induced Sepsis

Acknowledgments

- Department of Chemistry – University of Toronto
- Connaught Innovation Award Program
- Spectral Medical Inc.
- Organizing Committee of the 11th Annual Conference on the Physics, Chemistry & Biology of Water