

Synopsis of research – Lital Alfonta

One of the major research directions in the lab is the generation of effective microbial fuel cells. With that purpose in mind we tackle many problems related to low power outputs, low energy density and current stabilities. Hence, we focus our work on genetically engineering of the biocatalysts that are being used in such cells (microorganisms). We ask what makes electrogenic bacteria electrogenic? And we try to mimic and improve these traits in easier to manipulate microorganisms. Our tool box is extremely wide in range of disciplines and technologies. We use site specific modifications of bacteria, surface display of redox enzymes and digestive enzymes and synthetic chemistry tools to achieve our goals.

The second direction is to develop an accessible technology that will allow any research lab to be able to incorporate unnatural amino acids into proteins outside of the cellular context. We have recently immensely improved an in vitro assay for the expression of proteins with these unnatural modifications after revealing the most important determinants that will allow high efficiencies in such a system. This development may pave the way to the generation of proteins with new functions that they were not evolved for, site specific labeling of proteins for basic studies, preparations of therapeutic proteins with specific modifications, study of the effects of posttranslational modifications in signal transduction.

The third direction is the development of easy to fabricate novel class of biosensing devices based on immobilized enzymes within polymeric nanopores. The pores are generated in different polymers after ion beam irradiation, and upon chemical etching processes. We have recently published a series of 10 publications related to the development of these devices and the basic understanding of their functionality, both in biosensing and in the generation of uniform pore size and shape.