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Invited Speaker

Can Protein Electronic Conduction be a Quantum effect?

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Abstract:

Solid state Electron Transport (ETp), *electronic* conduction, across junctions with an ultra-thin protein film as active layer, can be surprisingly efficient. Length-normalized, ETp efficiency can be similar to, or even exceed that of conjugated molecules; moreover, it can be temperature-independent down to at least 4K. If intra-protein transport dominates, i.e., contacts are not limiting (not straightforward, as proteins are polyelectrolytes), then we cannot measure a significant transport barrier.

Such results have, nowadays, the banner "*quantum*" all over them, as they seem consistent with tunneling; one of the problems with such explanation, apart from the distances involved, is the implied coherence of transport. While coherent transport seems unlikely, the results are surprising, given that

- the system is disordered, and
- in biology electron transfer, ET, via proteins, occurs at *room temperature* in an aqueous electrolyte and/or membranes, and is ion transport-coupled.

Still, understanding ETp may have relevance for ET (replace coupling to the contacts by electron injection/extraction). I will discuss experimental data,[1,2] also from other groups, which help define the puzzle, which we try to solve.[3]

* work done with **Mordechai Sheves and Israel Pecht**, *the Weizmann Institute*
Ayelet Vilan, former students & former and present postdoctoral fellows, *the Weizmann Institute* ;
other collaborations are with Jochen Blumberger (London); Gabor Vattay (Budapest); Carlos Cuevas (Madrid) & Linda Zotti (Sevilla); Marc Tornow (Munich) ; David Lederman (Santa Cruz) +++.

References:

[1] C. Bostick et al. *Rep. Prog. Phys* (2018)

[2] N. Amdursky et al., *Adv. Mater.* (2014)

[3] D.Cahen, I. Pecht, M. Sheves, *J. Phys.Chem. Lett*. (2021)

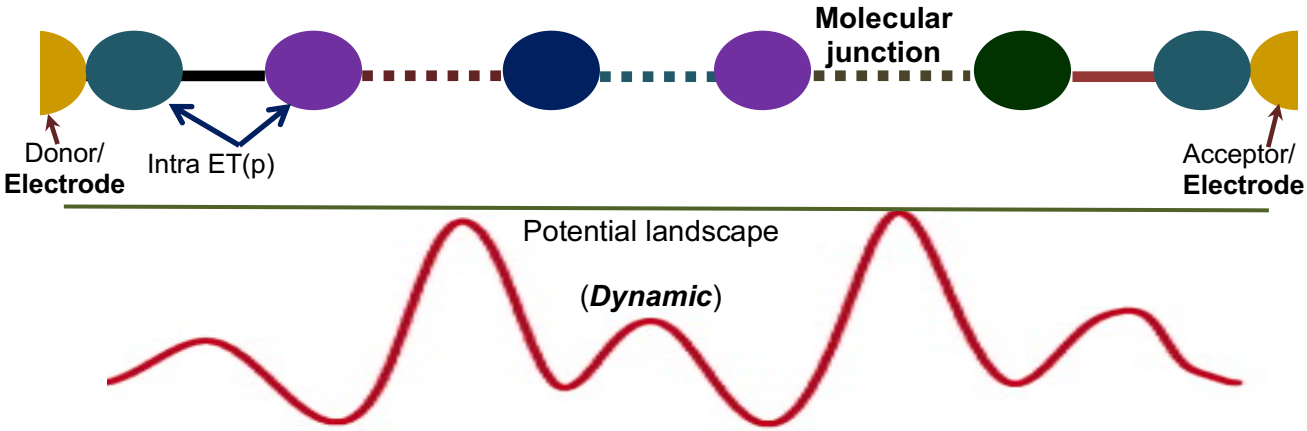

Figure: Schematic of protein junction, depicted as arrangement of amino-acids and cofactors, (TOP) and a snap-shot (< psec) of the electrostatic potential (BOTTOM); from ref. 1, to be referred to as the source.