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Bacterial Electrochemistry

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Bacterial electrochemistry has become one of the hottest topics in bioelectrochemistry. We have since 2004 pioneered "wiring" both Gram-positive and Gram-negative bacteria [1-4] (and thylakoid membranes [5-7]) to electrodes using osmium redox polymers (Os RPs) that strongly facilitate extracellular electron transfer (EET) reactions. Because of the cationic nature of the Os RPs they will electrostatically interact very strongly with bacterial cells and biological membranes to form hydrogels that will strongly attach onto electrode surfaces and will allow substrates and products to freely diffuse in and out of the hydrogel. We have investigated the influence of E°'-value and structure of the Os-complexes of the Os RPs on the rate of electron transfer. However, only recently we have obtained a much clearer picture on how the RPs and the cells interact and how the interaction changes with time. In these recent investigations we have "wired" wild type and some mutants of Enterococcus faecalis with both 4 different Os RPs as well as with a quinone RP [8-12]. Comparing the efficiency for EET for wild type and some E. faecalis mutants using an Os RP or ferricyanide we could prove that there are different ET pathways in this organism [12]. These recent results will be shown and discussed.

References

[1] K. Hasan, S. A. Patil, D. Leech, and L. Gorton, Biochem. Soc. Trans., 2012, 40, 1330-1335.

[2] S. A. Patil, C. Hägerhäll, and L. Gorton, Bioanal. Rev., 2012, 4, 159-192.

[3] G. Pankratova and L. Gorton, Curr. Opin. Electrochem., 2017, 5, 193-202.

[4] G. Pankratova, L. Hederstedt, and L. Gorton, Anal. Chim. Acta, 2019, 1076, 32-47.

[5] G. Pankratova, D. Pankratov, K Hasan, H.-E. Åkerlund, P.-Å. Albertsson, D. Leech, S. Shleev, and L. Gorton, Adv. Energy Mater., 2017, 1602285.

[6] G. Pankratova, D. Pankratov, and L. Gorton, Curr. Opin. Electrochem., 2020, 19, 49-54.

[7] D. Pankratov, G. Pankratova, and L. Gorton, "Current Trends in Development of Photosynthetic Bioelectrochemical Systems for Light Energy Conversion", in "Novel Catalyst Materials for Bioelectrochemical Systems: Fundamentals and Applications", Eds. L. Singh, D. M. Mahapatra, H. Liu, ACS Book Ser. 2020, 1342, 123-146.

[8] G. Pankratova, K. Hasan, D. Leech. L. Hederstedt, and L. Gorton, Electrochem. Commun., 2017, 75, 56–59.

[9] G. Pankratova, D. Leech, L. Gorton, and L. Hederstedt, Biochemistry, 2018, 57, 4597−4603.

[10] G. Pankratova, E. Szypulska, D. Pankratov, D. Leech, and L. Gorton, ChemElectroChem, 2019, 6, 110-113.

[11] G. Pankratova, D. Pankratov, R.D. Milton, S. D. Minteer, and L. Gorton, Adv. Energy Mater, 2019, 1900215.

[12] L. Hederstedt, L. Gorton, and G. Pankratova, J. Bacteriol., 2020, 202, e00725-19.