

Direct Electron Transfer of Cellobiose Dehydrogenase on Positively Charged Polyethyleneimine Gold Nanoparticles



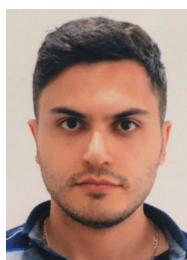
Mojtaba Tavahodi



Roberto Ortiz



Christopher Schulz



Ali Ekhtiari



Roland Ludwig



Behzad Haghighi



Lo Gorton

Invited for this month's cover is the group of Prof. Dr. Lo Gorton at Lund University, Sweden. The cover picture shows a bio-sensor for measuring lactose in dairy products. It consists of a gold electrode, onto which a layer of polyethyleneimine-capped gold nanoparticles is deposited. Read the full text of the article at 10.1002/cplu.201600453.

What prompted you to investigate this topic/problem?

Cellobiose dehydrogenase (CDH) is one of the few sugar oxidising enzymes that shows efficient direct electron transfer (DET) characteristics with electrodes and thus a very good candidate for making third-generation biosensors and bioanodes for biofuel cells. However, DET relies on good communication between the cytochrome domain (CYT) and the electrode. On a naked electrode CDH is expected to adsorb randomly meaning that all CYTs will not make efficient contact with the electrode. In this study, we combined two approaches to ensure advantageous orientation of as many CDH molecules as possible through: 1) making the electrode surface positively charged using polyethyleneimine and 2) nanostructuring the electrode surface with gold nanoparticles. This combination increased both the percentage of better orientated CDH molecules and current density leading to the sensitive detection of lactose.

Who contributed to the idea behind the cover?

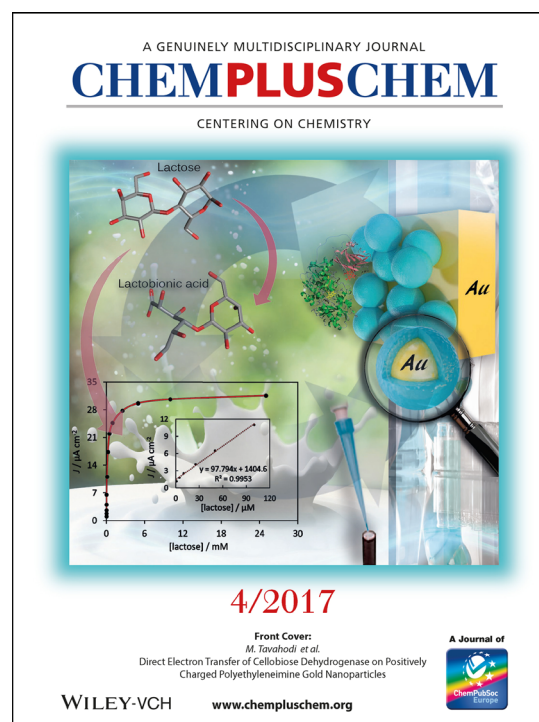
Mojtaba Tavahodi, Christopher Schulz and Roland Ludwig joined forces to come up with the ideas that were expressed graphically on the cover picture. M.T. prepared the final version of the cover.

What are the main challenges in the broad area of your research?

The main challenges are to design an electrode surface onto which a high surface concentration of biomolecule(s) can be immobilised and at the same time be orientated so that DET will be facilitated between the redox active sites of the biomolecule and the electrode. This guarantees long-term integrity of the biomolecule and also allows other molecules, such as substrates and products, to have access to the reaction centres of the biomolecule.

Who pays the bill for the research highlighted on the cover?

This study resulted from collaboration between three research groups at Lund University, Sweden (L.G., R.O., C.S.), BOKU University Vienna Austria (R.L.), Institute for Advanced Studies in Basic Sciences and Shiraz University, Iran (B.H., M.T.). It was supported by The Swedish Research Council (2010-5031, 2014-5908), The European Commission (FP7-PEOPLE-2010-ITN-264772, FP7-PEOPLE-2013-ITN-607793), the Integrated Infrastructure Initiative (262348), the European Soft Matter Infrastructure and the Institute for Advanced Studies in Basic Sciences (G2015IASBS119).



COVER PROFILE

*M. Tavahodi, R. Ortiz, C. Schulz,
A. Ekhtiari, R. Ludwig, B. Haghighi,
L. Gorton**

■■■ – ■■■

**Direct Electron Transfer of Cellobiose
Dehydrogenase on Positively Charged
Polyethyleneimine Gold Nanoparticles**



"In this study we combined two approaches to advantageously arrange the orientation of CDH molecules through: 1) making the electrode surface positively charged using polyethyleneimine and 2) nanostructuring the electrode surface with gold nanoparticles." Read more about the story behind the cover in the Cover Profile and about the research itself (DOI: 10.1002/cplu.201600453).