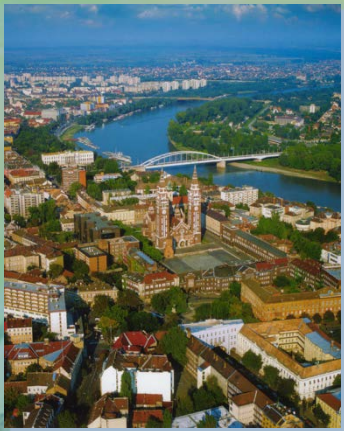




REDOX INTERACTION IN RC/PSiMc BIO- NANOCOMPOSITE



Kata Hajdu
University of Szeged
Hungary



2nd Plenary Workshop of Cost Action TD1102
9-11. April 2014

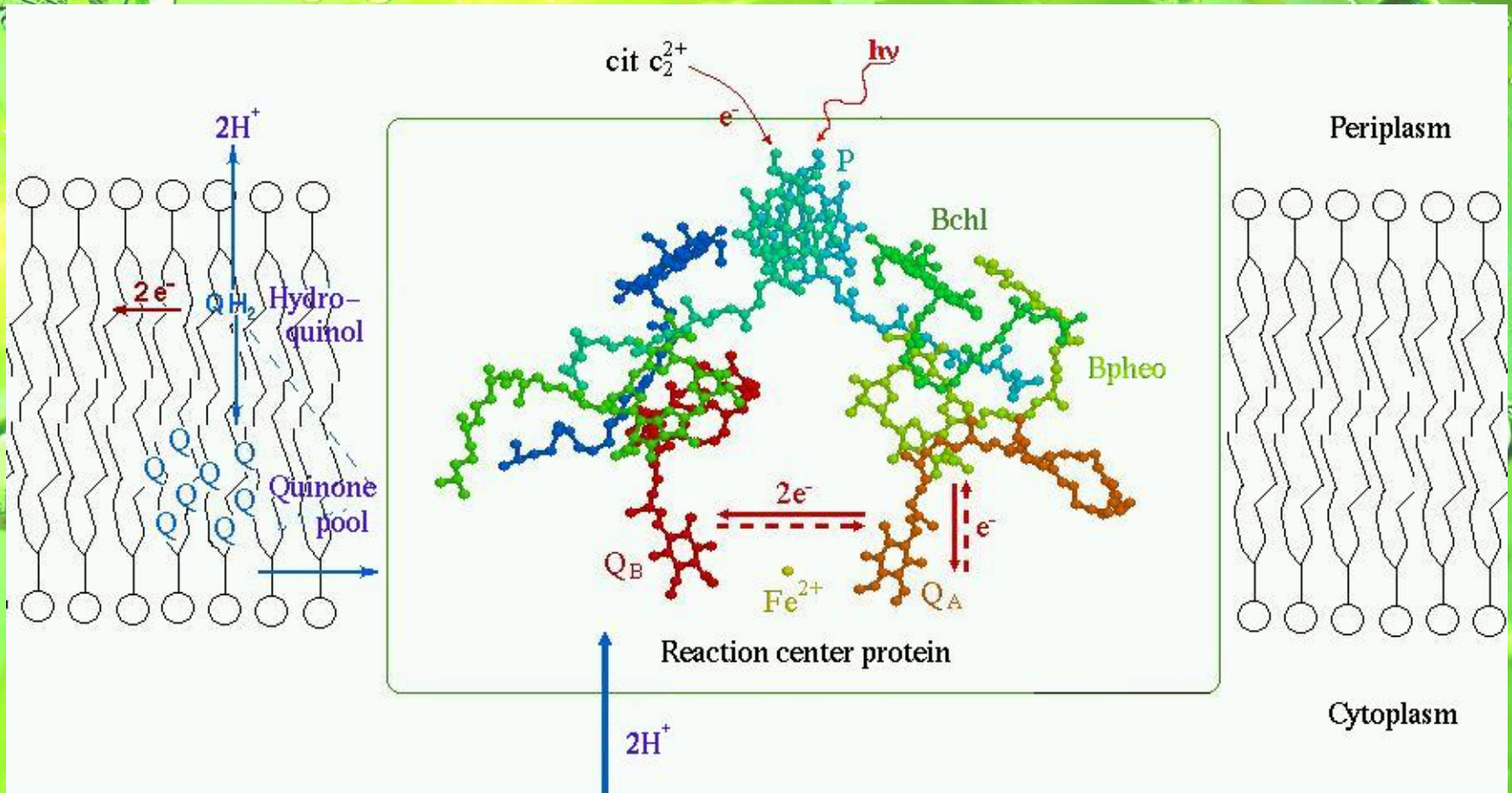


HUNGARY'S RENEWAL

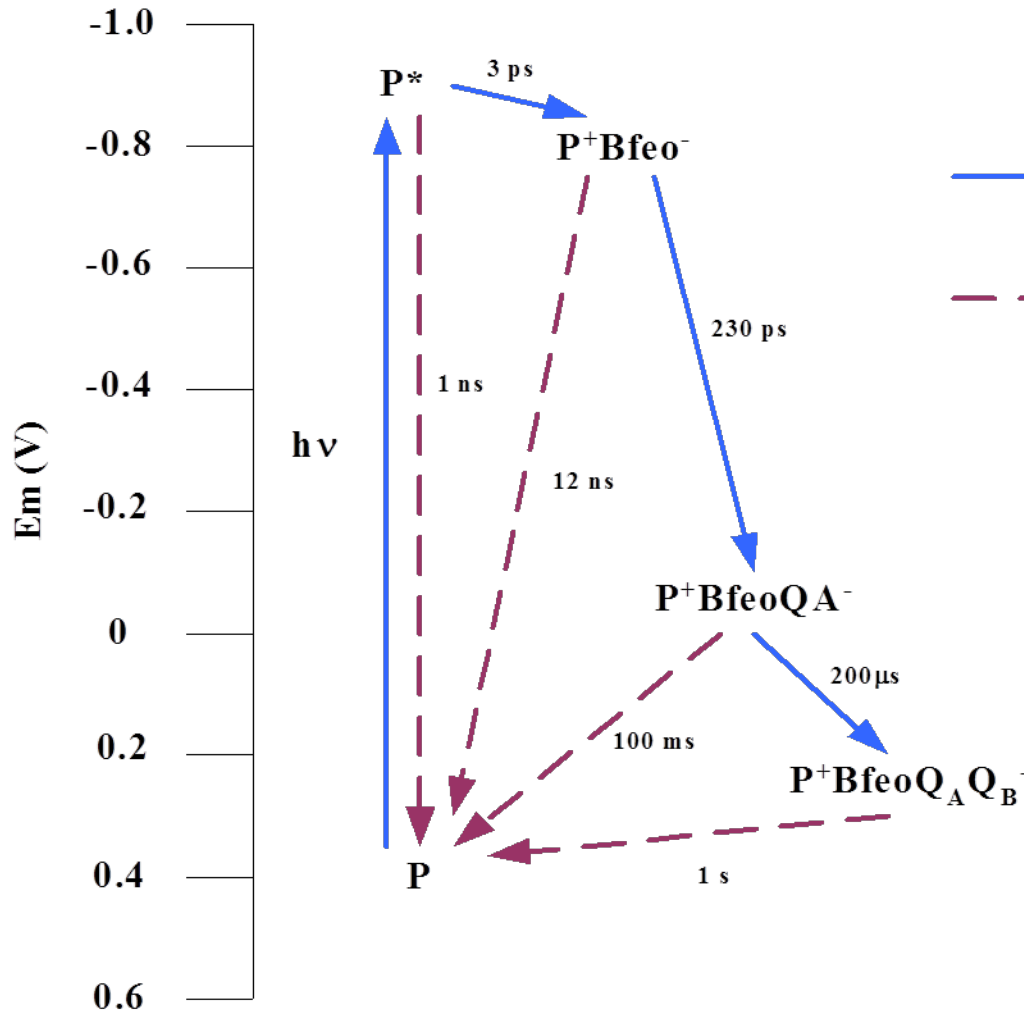
Structure of the talk

- Why photosynthetic reaction centre (RC)?
- RC immobilization into porous silicon
- RC's photoactivity
- Electrochemical measurements
- Conclusion

Photosynthetic Reaction Centre of *Rhodobacter sphaeroides*

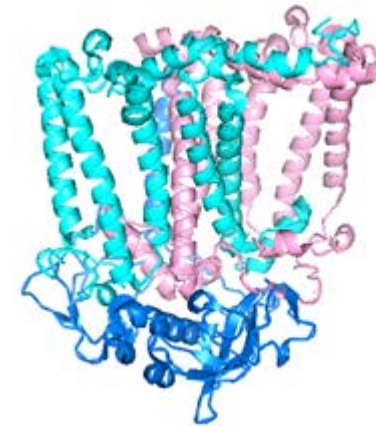


Photosynthetic reaction centre (RC)



Forward electron transport

Processes of the charge recombination



Porous silicon (PSi)

- **Semiconductor**
- **Remarkable optical properties**
- **Versatile structure presenting large sensing area**
- **Well controllable porosity and average pore size**



Binding methods

- **Peptide:** SPGLSLVSHMQT

High hydrophobicity, strong physical attachment

No orientation

- **APTES:** 3-Aminopropyl-triethoxysilane

Free NH_2 - groups on the OXIDIZED surface

+GTA (glutaraldehyde) amine-targeted homobifunctional crosslinker molecule

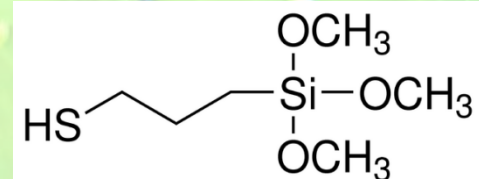
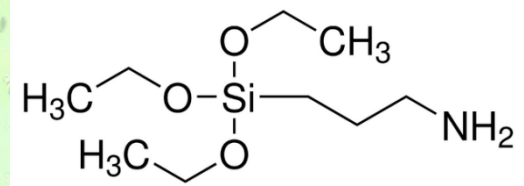
Chemical binding through amine groups

No orientation

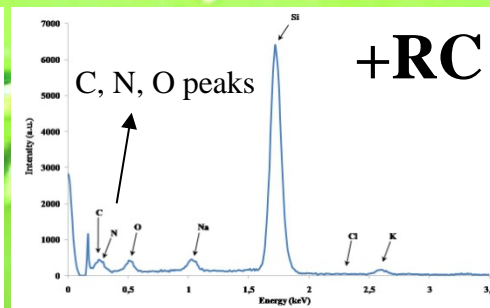
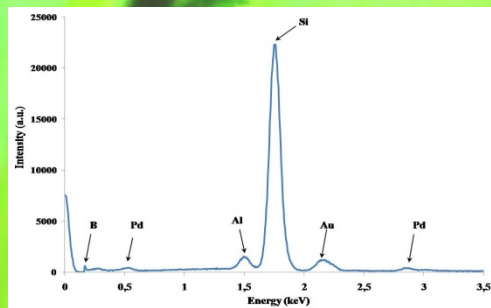
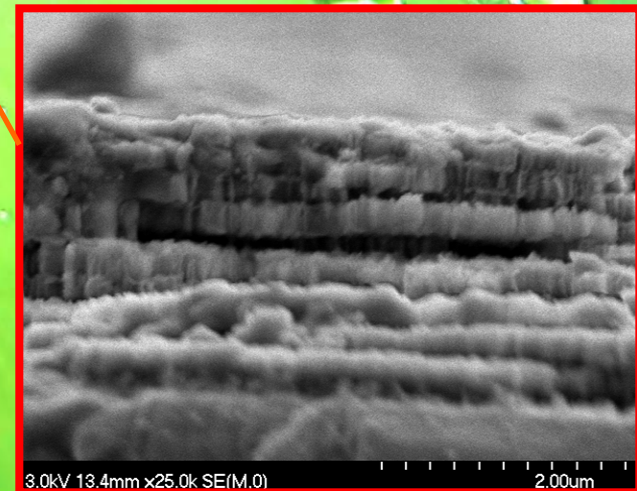
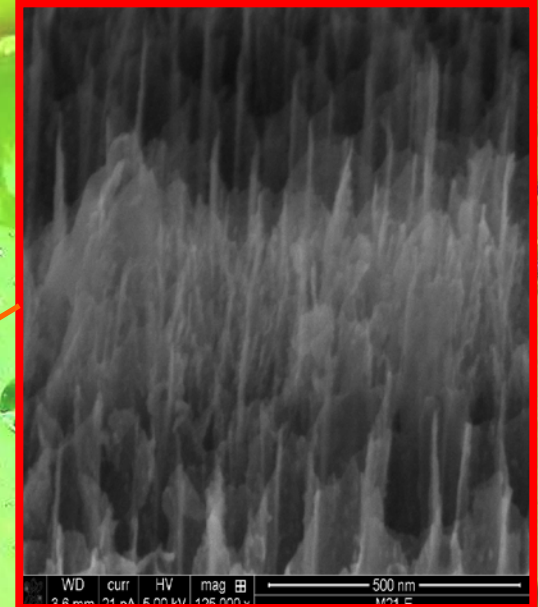
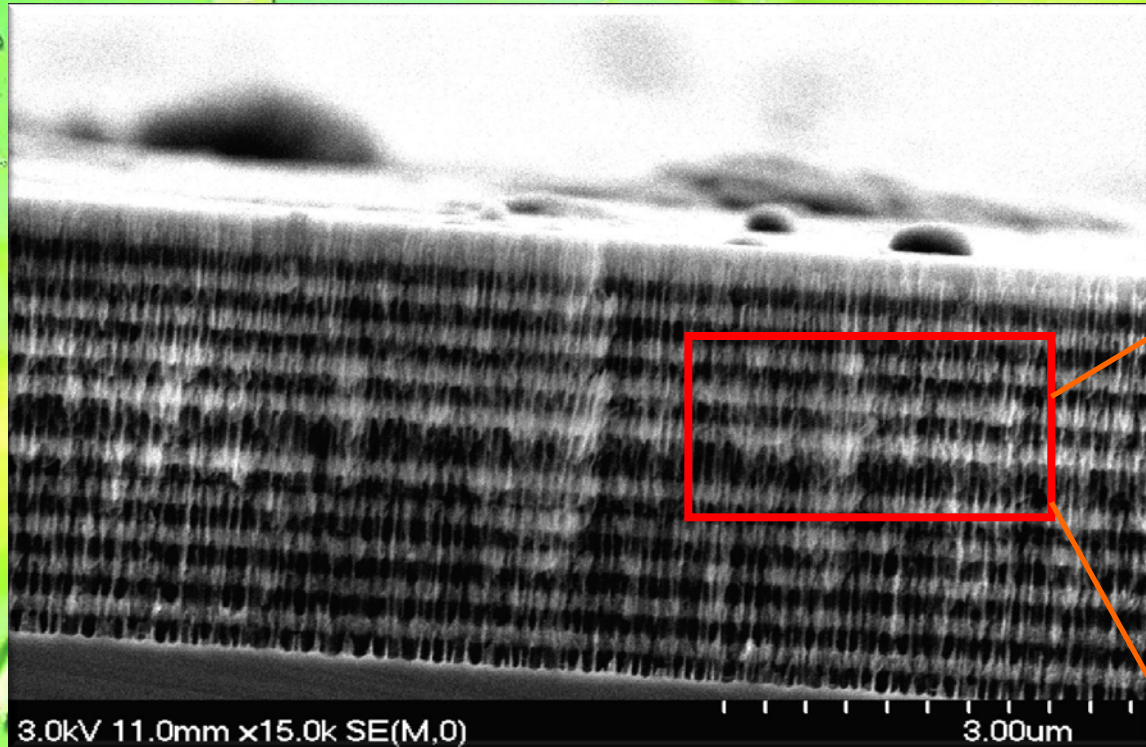
- **MPTS** 3-Mercaptopropyl-trimethoxysilane

Free SH-groups on the OXIDIZED surface

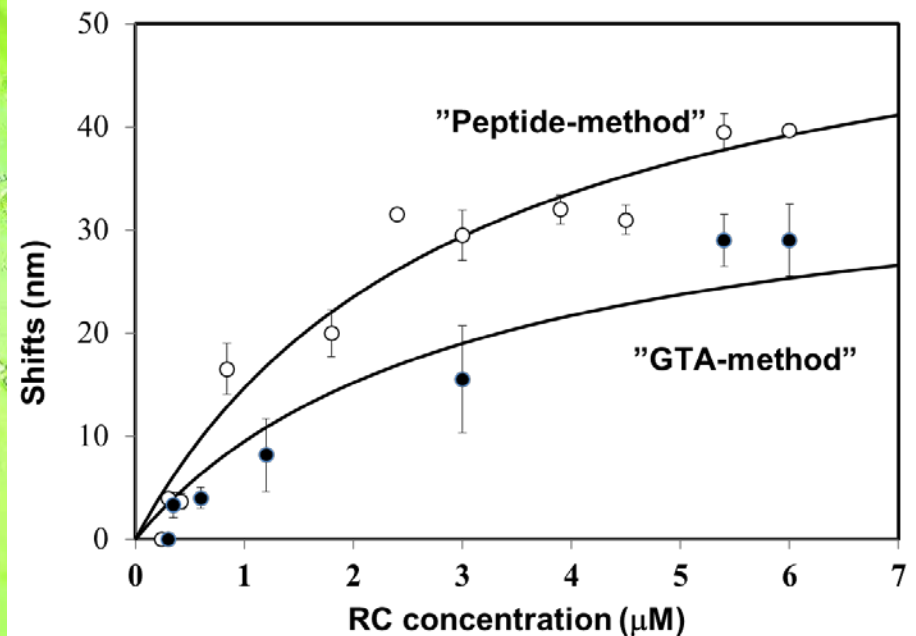
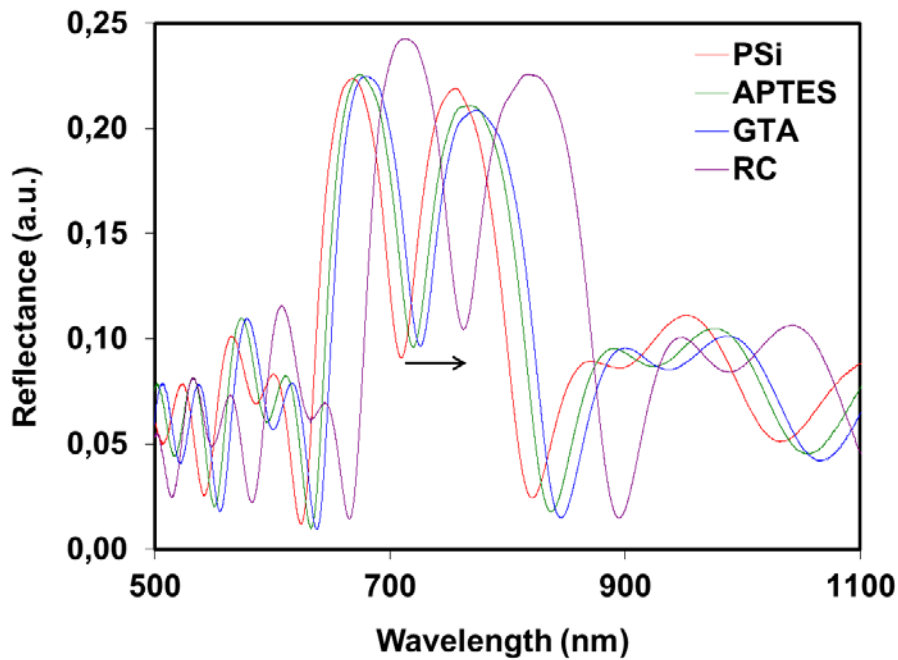
Direct chemical binding, ORIENTED



RC bound to porous silicon

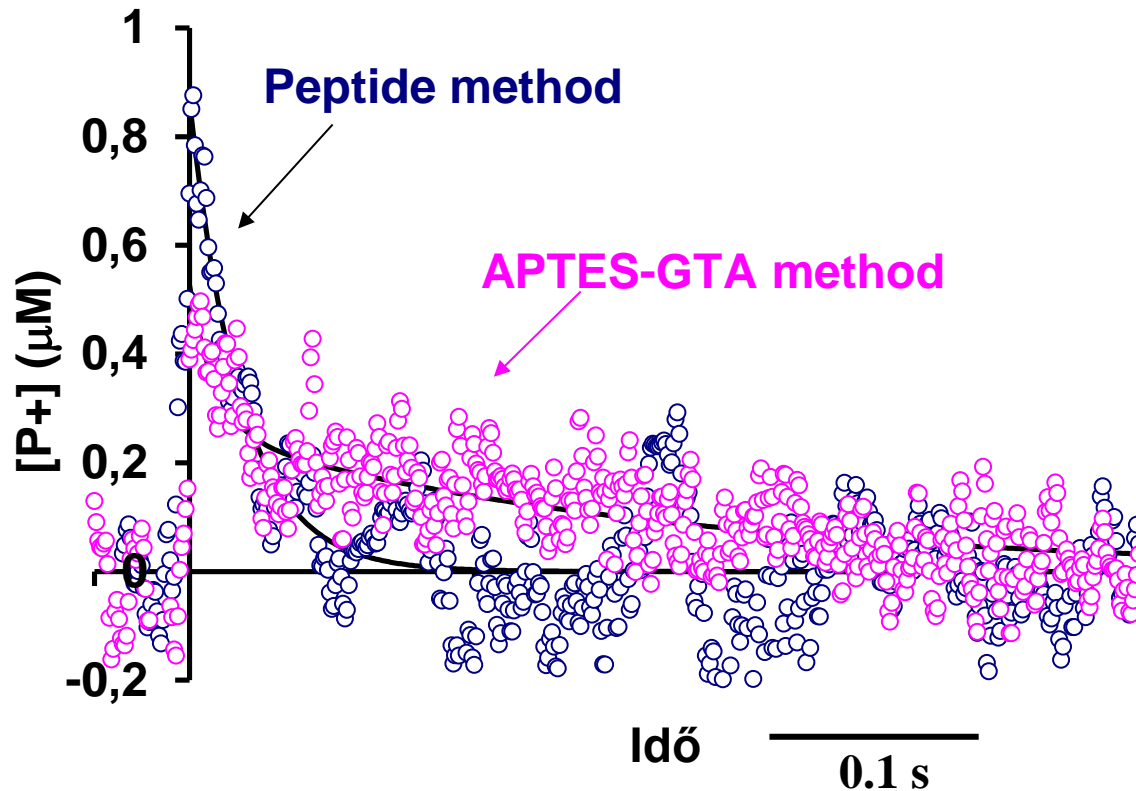


RC/PSi composites

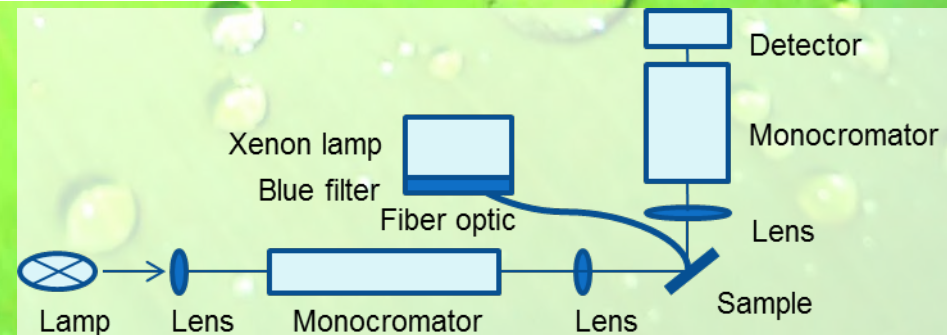


Hajdu et al., Porous silicon/photosynthetic reaction center hybrid nanostructure, Langmuir, 2012

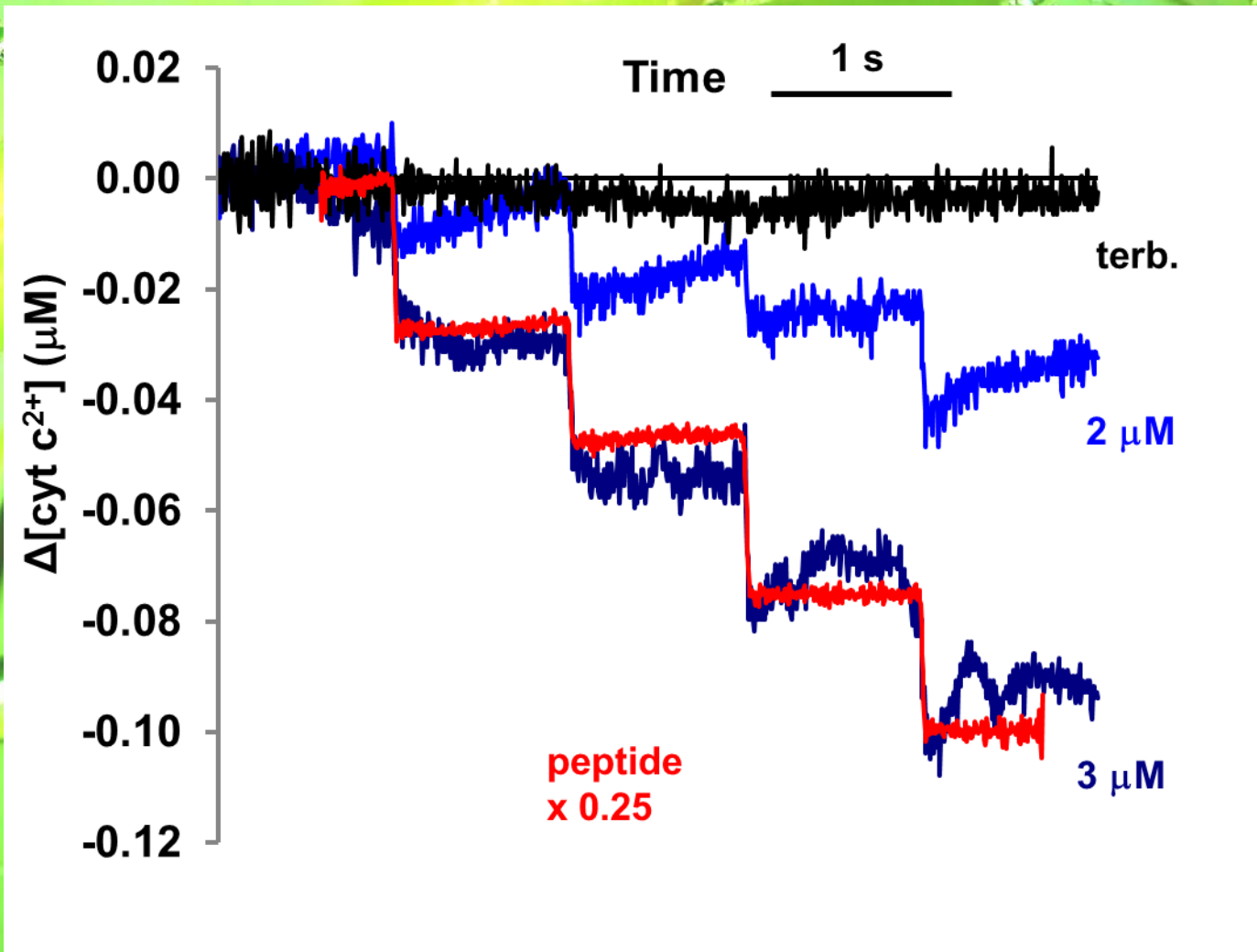
RC photoactivity

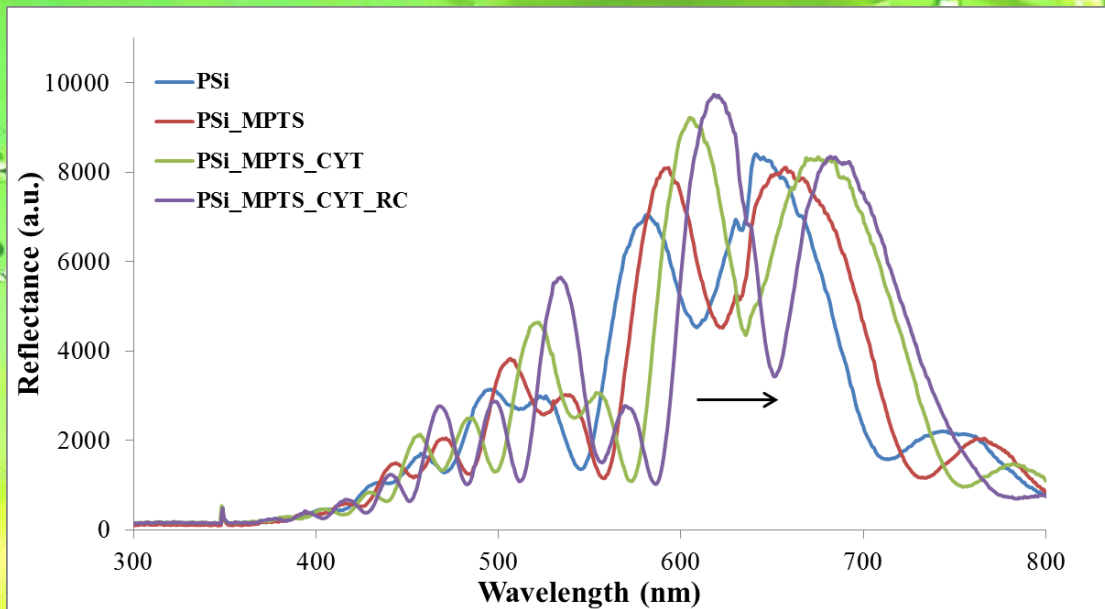


Light induced absorption change measurements (in reflexion mode)

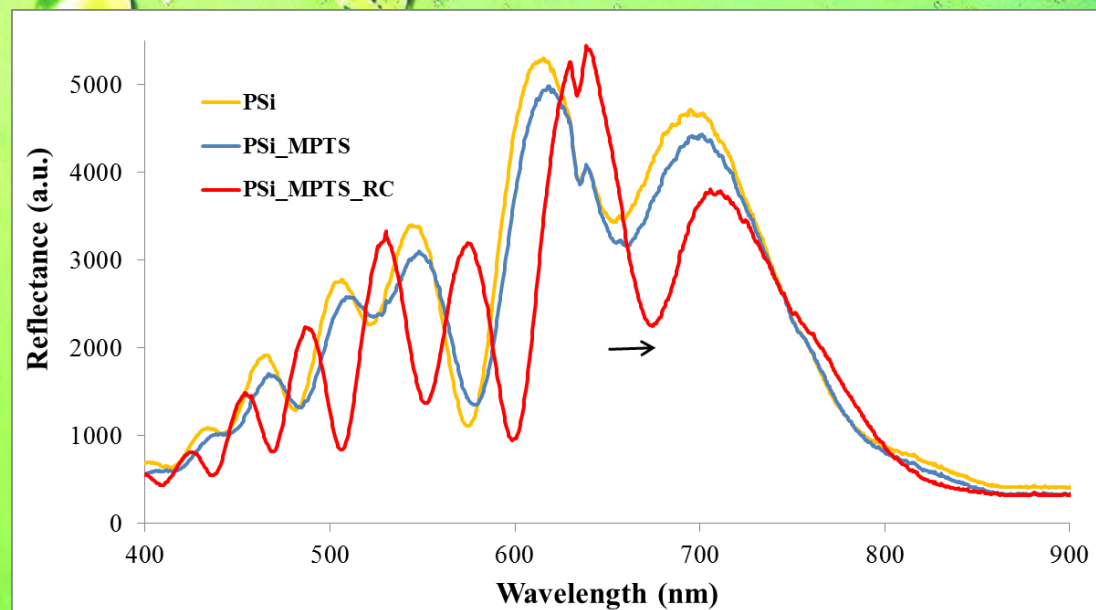


Cytochrome turnover measurements





**Binding
with
orientation!**



Binding methods

- **Peptide:** SPGLSLVSHMQT

High hydrophobicity, strong physical attachment

No orientation

- **APTES:** 3-Aminopropyl-triethoxysilane

Free NH₂- groups on the **OXIDIZED** surface

+GTA (glutaraldehyde) amine-targeted homobifunctional crosslinker molecule

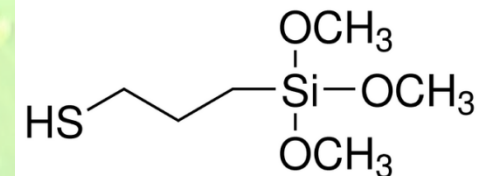
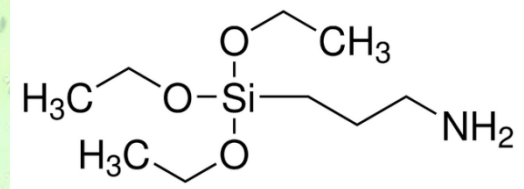
Chemical binding through amine groups

No orientation

- **MPTS** 3-Mercaptopropyl-trimethoxysilane

Free SH-groups on the **OXIDIZED** surface

Direct chemical binding, **ORIENTED**



Electrochemical measurements

Three electrode arrangement

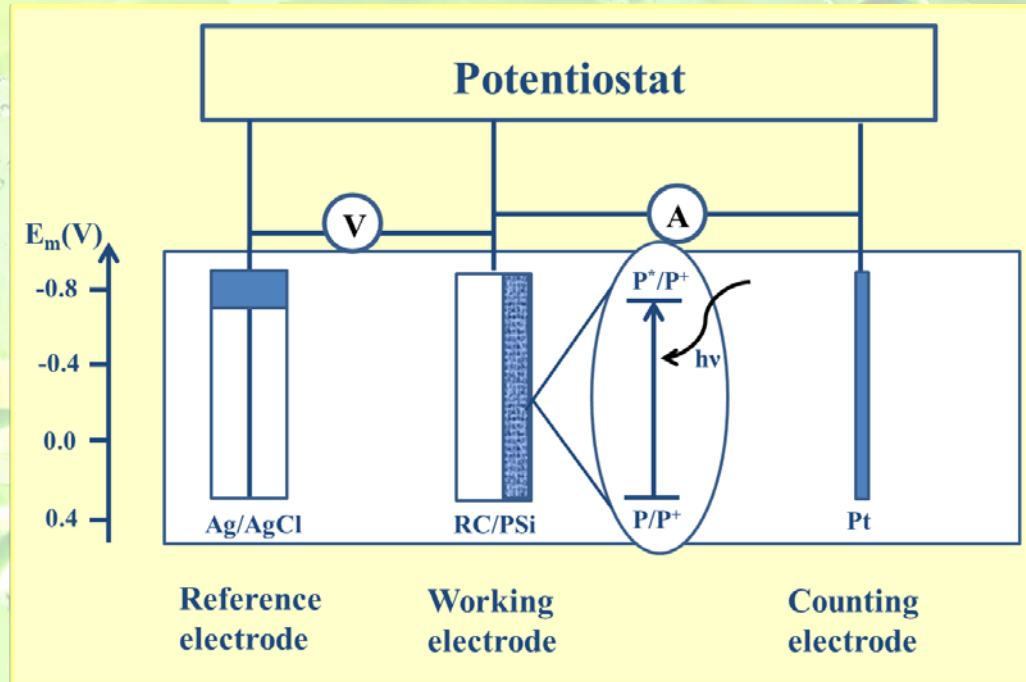
Working electrode: RC/PSi

Counter electrode: platinum

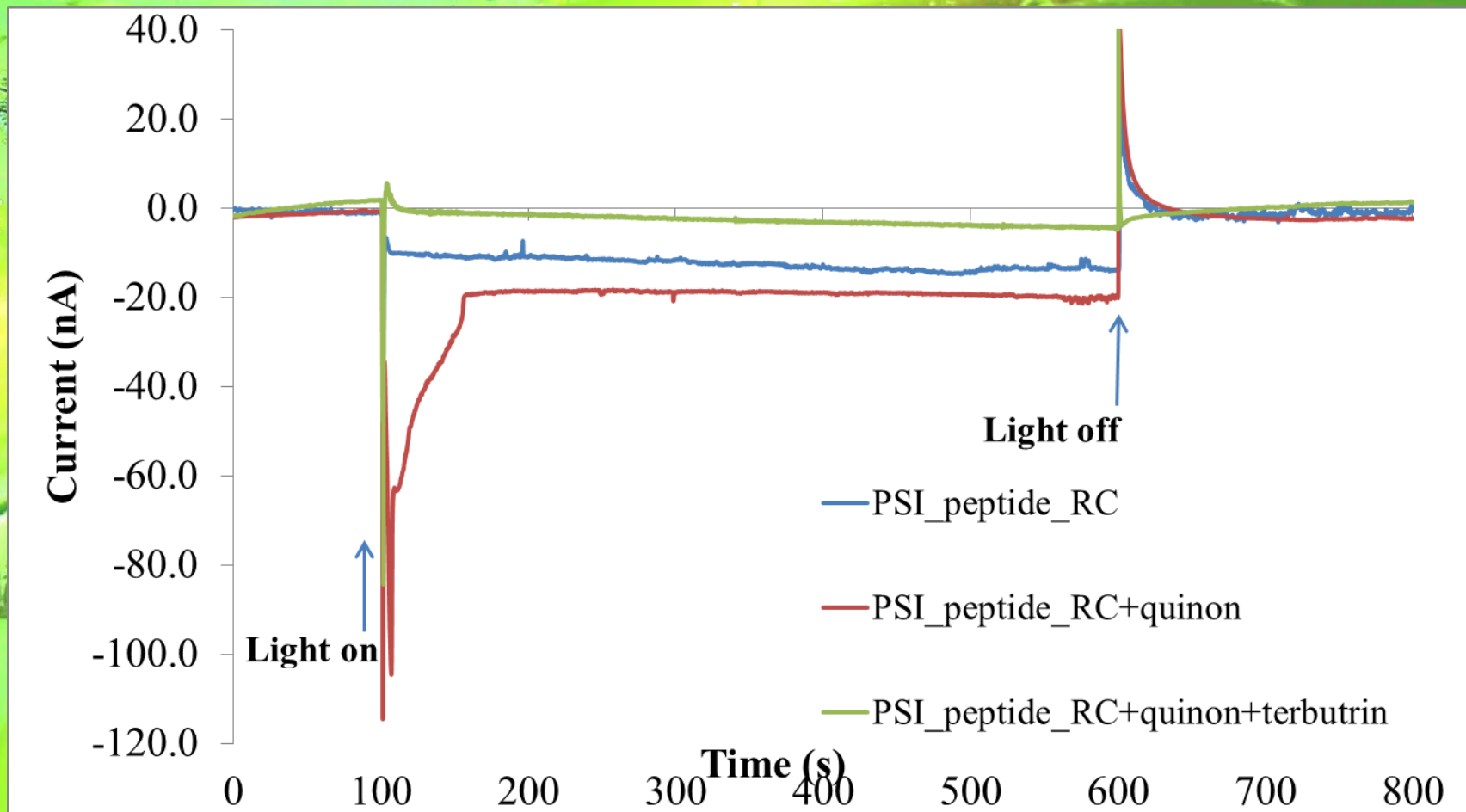
Reference electrode: Ag/AgCl

0.1M NaCl

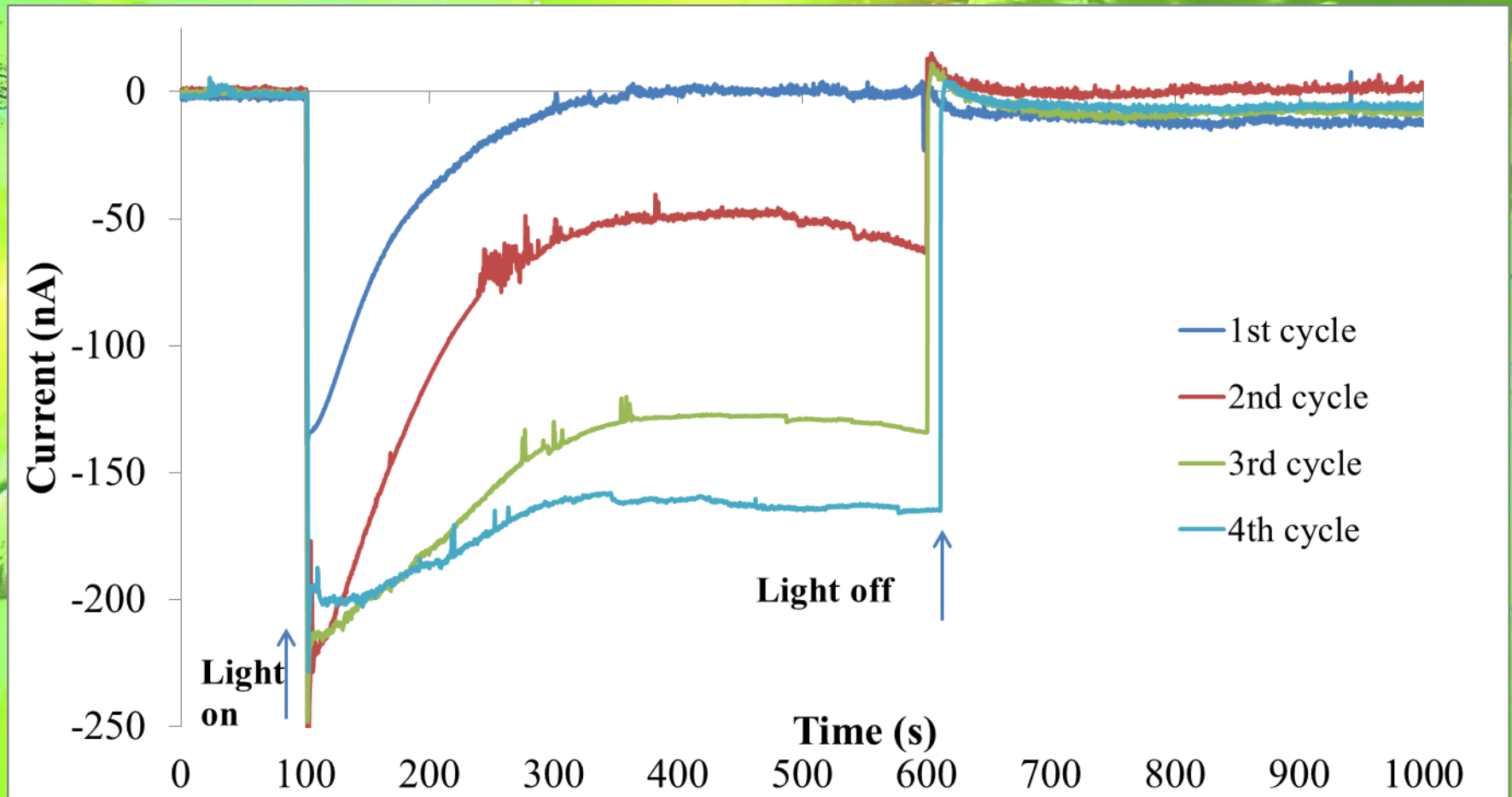
Mediator: Ubiquinon0 (UQ_0)







Electrochemical measurements



Electrochemical measurements



Summary

- RC binding to P_{Si} 
- RC photoactivity 
- RC accessibility 
- Redox interaction between RC and P_{Si} 

Contributors:

**Gabriela Palestino², Jessica Márquez León², Vivechana Agarwal³,
László Zimányi⁴, Csilla Gergely⁵, Marta Martin⁵, Zoltán Németh⁶,
Klára Hernádi⁶, Melinda Magyar¹, Tibor Szabó¹, László Nagy¹**

1. Department of Medical Physics and Informatics, Faculty of Science and Informatics, University of Szeged, Hungary
2. Facultad de Ciencias Químicas, Universidad Autónoma de San Luis Potosí, Mexico
3. CIICAP- Universidad Autonoma del Estado de Morelos, Col Chamilpa, Cuernavaca, Mexico
4. Institute of Biophysics, BRC, Szeged, Hungary
5. Laboratoire Charles Coulomb, UMR 5221 CNRS-Université Montpellier 2, France
6. Department of Applied and Environmental Chemistry, Faculty of Science and Informatics, University of Szeged, Hungary



Thank you for your attention!

