

IMPRS on Multiscale Biosystems

Project description

Title: Vibrational spectroscopy of light-activated membrane proteins

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Project description: Proteins change between conformations to perform their biological function. However, only some parts of the protein undergo molecular changes after activation. Vibrational spectroscopy resolves vibrational bands characteristic to the molecular groups which undergo a change during protein activity. Here, Raman spectroscopy exploits the resonance enhancement to selectively monitor vibrational bands of a cofactor and the difference technique is used in IR absorption spectroscopy to resolve structural changes of the entire protein. Time-resolved techniques cover the time range from nanoseconds to seconds and, thus, are able to resolve the functional mechanism of membrane proteins with high spatial sensitivity and appropriate temporal resolution.

In the present project, vibrational spectroscopy will be applied to membrane proteins. Of particular interest are retinal proteins that are activated by light. Sensory rhodopsins and channelrhodopsins are membrane proteins that are expressed in the hosts laboratory, purified, reconstituted in lipid bilayers and subjected to vibrational spectroscopy. Variants with specific amino acid exchanges will be generated to assign vibrational bands. The research topic will be specified based on the applicant's interest and background. Methodological development is inherent to the project and candidates with respective experimental skills will be preferred.

Required background: Master or equivalent degree in Physics, Chemistry or Biochemistry; Profound knowledge on protein structure and function or on biomembranes; Experience in vibrational spectroscopy.

Paper to read before the interview: Radu I, Schlegler M, Bolwien C, Heberle J. (2009)

'Time-resolved methods in biophysics. 10. Time-resolved FT-IR difference spectroscopy and the application to membrane proteins'

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