

# ***SFB 35 Colloquia in Membrane Transport***

Venue: Medical University Vienna, Center for Physiology and Pharmacology,  
Institute of Pharmacology, Waehringenstrasse 13a, 1090 Vienna,

**"Leseraum"**

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**Monday 28.05.2018 14:00 s.t.**

**Host: Gerhard Schütz**

**Amitabha Chattopadhyay**

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## ***Cholesterol-induced Conformational Plasticity and Oligomerization of GPCRs: Novel Insights in Health and Disease***

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G protein-coupled receptors (GPCRs) are the largest class of molecules involved in signal transduction across membranes, and represent major drug targets in all clinical areas. The serotonin<sub>1A</sub> receptor is an important neurotransmitter receptor of the GPCR superfamily and is implicated in the generation and modulation of various cognitive, behavioral and developmental functions. We demonstrated that membrane cholesterol is necessary for ligand binding, and G-protein coupling of serotonin<sub>1A</sub> receptors. Interestingly, recently reported crystal structures of GPCRs have shown structural evidence of cholesterol binding site(s). In this context, we reported the presence of cholesterol recognition/interaction amino acid consensus (CRAC) motifs in the serotonin<sub>1A</sub> receptor. We also showed that the receptor is more stable and compact in the presence of membrane cholesterol. Our recent results utilizing coarse-grain molecular dynamics simulations to analyze the molecular nature of receptor-cholesterol interaction offer interesting insight in cholesterol binding site(s) in the receptor and oligomerization of the receptor. We showed utilizing homo-FRET and photo bleaching image correlation spectroscopy (pbICS) that the oligomerization of the serotonin<sub>1A</sub> receptor is modulated by membrane cholesterol. Progress in deciphering molecular details of the nature of GPCR-cholesterol interaction in the membrane would lead to better insight into our overall understanding of GPCR function in health and disease.

## Biosketch

Prof. Amitabha Chattopadhyay received B.Sc. with Honors in Chemistry from St. Xavier's College (Calcutta) and M.Sc. from IIT Kanpur. He obtained his Ph.D. from the State University of New York (SUNY) at Stony Brook, and was a Postdoctoral Fellow at the University of California, Davis. He subsequently joined the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad and now is a **SERB Distinguished Fellow** there.



Prof. Chattopadhyay's work is focused on monitoring organization, dynamics and function of biological membranes in healthy and diseased conditions. His group has developed and applied novel, innovative and sensitive techniques (such as the wavelength-selective fluorescence approach) using fluorescence spectroscopy for monitoring solvent relaxation in membranes, membrane-mimetic media, and proteins. These pioneering studies have led to a better understanding of the dynamics of hydration of membranes and proteins. Another seminal contribution of Prof. Chattopadhyay's group focuses on the role of membrane cholesterol in regulating the organization, dynamics and function of G protein-coupled receptors such as the serotonin<sub>1A</sub> receptor. His work showed, for the first time, that membrane cholesterol is necessary for the function of G protein-coupled receptors (GPCRs) such as the serotonin<sub>1A</sub> receptor. His work has also provided novel insight in the role of membrane cholesterol in the entry of pathogens into host cells. Prof. Chattopadhyay has used fluorescence-based microscopic approaches such as Fluorescence Recovery After Photobleaching (FRAP), Fluorescence Correlation Spectroscopy (FCS), and Fluorescence Resonance Energy Transfer (FRET) to provide novel insight into organization, dynamics and function of membrane-bound receptors. Overall, his work has contributed significantly to the understanding of membrane organization and dynamics, and the interplay between membrane lipids and proteins, especially in neuronal membranes.

Prof. Chattopadhyay was awarded the prestigious **The World Academy of Sciences (TWAS) Prize, Shanti Swarup Bhatnagar Award**, Ranbaxy Research Award, Prof. G.N. Ramachandran 60th Birthday Medal from the Indian National Science Academy, SERB Distinguished Fellowship, and J.C. Bose Fellowship from the Dept. of Science and Technology, Govt. of India. He is an elected Fellow of Fellow of The World Academy of Sciences, Royal Society of Biology, Royal Society of Chemistry, and all the Indian Academies of Science, the Telangana Academy of Sciences, and West Bengal Academy of Science and Technology. Prof. Chattopadhyay has served on the editorial boards of a large number of journals that include Biophysical Journal, The Journal of Physical Chemistry, Journal of Neurochemistry, BBA-Biomembranes, Journal of Membrane Biology, FEBS Letters, IUBMB Life and ACS Chemical Neuroscience. He has mentored a number of students for Ph.D. Prof. Chattopadhyay has authored close to 250 research publications (mostly as first or senior/corresponding author; **total citations > 10,200, h-index 54, i-10 index 179**), two monographs, and national and international patents. He has delivered more than 550 invited lectures all over the world including keynote, plenary, and colloquium lectures. Prof. Chattopadhyay has organized a number of international conferences on the broad theme of biological membranes including a thematic meeting of the Biophysical Society. Prof. Chattopadhyay has been instrumental in designing and teaching courses related to biomembranes and fluorescence spectroscopy for Ph.D. students in India and abroad. Prof. Chattopadhyay is involved with science awareness and

popularization programs among high school and college students in India, and in giving lectures to students and junior faculty on manuscript and grant writing. Prof. Chattopadhyay is a **Distinguished Visiting Professor** at the Indian Institute of Technology Bombay (Mumbai), Adjunct Professor at the Tata Institute of Fundamental Research (Mumbai), Indian Institute of Technology (Kanpur), Jawaharlal Nehru University (New Delhi), Indian Institute of Science Education and Research (Mohali and Kolkata), Royal Melbourne Institute of Technology (Australia), Swinburne University of Technology (Australia), and Honorary Faculty at the Jawaharlal Nehru Centre for Advanced Scientific Research (Bangalore). He served as the first Dean of Biological Sciences of the Academy of Scientific and Innovative Research.