

COLLOQUIA IN MEMBRANE TRANSPORT

Venue: Technical University Vienna, „Freihaus“,
Wiedner Hauptstraße 8, Lecture Hall 7, 1040 Vienna
(Harald Sitte, Tel.: (01) 40160 31323, harald.sitte@meduniwien.ac.at,
Gerhard Schütz, Tel.: (01) 58801 134 80, schuetz@iap.tuwien.ac.at)

Friday 21.12.2012 14:00 c.t. **Harald Janovjak** (host: Gerhard Schütz, Harald Sitte)

Institute of Science and
Technology Austria (IST Austria)
Am Campus 1
A – 3400 Klosterneuburg

“OPTICAL CONTROL OF CELLULAR SIGNALS”

Harald Janovjak (harald.janovjak@ist.ac.at)

Abstract.

A major challenge in biology is to understand how cells sense and process signals from the environment. To understand cellular signaling we require technologies that generate well-controlled temporal and local stimulation of cellular signaling pathways. Our past work focused on ionotropic glutamate receptors (GluRs), which are the primary mediators of excitatory synaptic transmission in the mammalian central nervous system. In order to remote control neuronal signaling, we designed a novel GluR that is K⁺-selective and light-gated. This hyperpolarizing ion channel termed HyLighter is activated by millisecond light pulses and allows manipulating neuronal activity with unprecedented spatio-temporal resolution. In optogenetic experiments, HyLighter reversibly and stably inhibits action potential firing in neuronal cultures and behavior in zebrafish. Inspired by the surprising compatibility of a K⁺-selective pore with a GluR revealed in HyLighter, we discovered a new family of invertebrate glutamate receptors that combine a K⁺ selectivity filter with glutamate sensing and represent missing links in GluR evolution. The goal of our ongoing work is to remote control signaling cascades related to G-protein coupled receptors and receptor tyrosine kinases with light to understand how cells orchestrate these signals into physiological responses.