ICRP 2018 Scientific Program Outline

Monday, September 24th

Registration desk opens (15:00)

Reception (17:00-18:30)

Dinner (18:30-20:00)

Conference opening (20:00-20:10) – **Oliver Ernst/Leonid Brown/Rob Reedijk**

Three historical talks:

Janos Lanyi (20:10-20:50) - Half a century of bacteriorhodopsin: What have we learned?
Yoshinori Shichida (20:50-21:30) - Historical review in the field of visual pigments and related retinal proteins
Klaus-Peter Hofmann (21:30-22:10) - Rhodopsin, photoreceptor and GPCR

Tuesday, September 25th

Session I (8:30-10:10): Microbial rhodopsins – molecular mechanisms of ion transport and signaling

Chair: **Janos Lanyi** (8:30-8:40)
Klaus Gerwert (8:40-8:55) - What makes the difference between a pump and a channel?
Victor Lorenz-Fonfria (8:55-9:10) - Spectroscopic insights into the desensitization of channelrhodopsin-2
Clemens Glaubitz (9:10-9:25) - Photocycle-dependent Cross-Protomer Interactions in the PR Pentamer revealed by DNP-enhanced solid-state NMR
Eriko Nango (9:25-9:40) - A Molecular Movie of Structural Changes in the Light-Driven Proton Pump Bacteriorhodopsin
Franz Bartl (9:40-9:55) - Light energy transfer from the retinal to the protein and light adaptation in channelrhodopsins
Izuru Kawamura (9:55-10:10) - Structural changes in retinal-binding site of sodium ion pumping rhodopsin KR2 induced by His30 and Na^+-binding site at the extracellular side

Coffee break (10:10-10:40)

Session II (10:40-12:30): Animal rhodopsins – evolution and diversity

Chair: **Yoshitaka Fukada** (10:40-10:50)
Yohei Ogawa (10:50-11:05) - Molecular mechanism for gene expression of middle wavelength-sensitive visual opsins in zebrafish

Akihisa Terakita (11:05-11:30) - Contribution of opsin bistability to color opponency in the zebrafish pineal organs

Belinda Chang (11:30-11:45) - Molecular evolution of vision and visual pigments

Takahiro Yamashita (11:45-12:00) - Pinopsin acts as a scotopic visual pigment in lower vertebrates

Yasuhisa Mizutani (12:00-12:15) - Chromophore structure in an inactive state of a novel photosensor Opn5L1 of vertebrates

Elliot Gerrard (12:15-12:30) - Counterion displacement in a box jellyfish opsin

Lunch (12:30 – 14:00)

Posters set-up

Session III (14:00-15:45): Optogenetics - tools development and applications

Chair: **Mei Zhen** (14:00-14:10)

Ed Boyden (14:10-14:35) - Optical Control and Readout of Neural Activity Through Discovered and Engineered Retinal Proteins

Rob Lucas (14:35-15:00) - Supporting vision using photoreceptors in the mammalian inner retina

Jonas Wietek (15:00-15:15) - Anion conducting ChRs - fundamentals for spectral multiplexing and all-optical approaches

Mitsumasa Koyanagi (15:15-15:30) - Functionality of bistable animal opsins for optogenetic regulation of cellular signal transductions

Yasushi Imamoto (15:30-15:45) - Development of Red-Shifted Channelrhodopsin Variants Using Long-Conjugated Retinal Analogues

Coffee break (15:45-16:15)

Posters set-up

Tools talk and Poster talks I, followed by poster viewing (16:15-19:00, continued after dinner)

Chair: **Leonid Brown**

Sergey Shilov (Bruker) (16:15-16:30) - Measurement of multiple spectral ranges with a single instrument

Poster talks I (16:30-17:35) - 13 poster talks (5 minutes each), see the schedule below

Posters viewing (17:40-19:00, continued after dinner)

Dinner (19:00-21:00)

Posters viewing

Wednesday, September 26th

Session IV (8:30-10:15): Microbial rhodopsins – evolution, diversity, and ecology

Chair: **Sergei Balashov** (8:30-8:40)

Oded Béjà (8:40-9:05) - Type-3 Rhodopsins? A new group of microbial rhodopsins discovered via functional metagenomics

Hideki Kandori (9:05-9:30) - Light-driven sodium-pumping rhodopsin: A new concept of active transport

Yuki Sudo (9:30-9:45) - Diversity of microbial rhodopsins and their applicability for optogenetics

Keiichi Inoue (9:45-10:00) - Biophysical study on heliorhodopsin

Kwang-Hwan Jung (10:00-10:15) - Photo-regulation of Cyanobacterial Sensory Rhodopsin through 2 Transducers

Coffee break (10:15-10:45)

Session V (10:45-12:25): **Eukaryotic microbial rhodopsins – channelrhodopsins and enzymerhodopsins**

Chair: **Peter Hegemann** (10:45-10:55)

Daniel Oprian (10:55-11:10) - Structure and Function of Rhodopsin-Guanylyl Cyclase and -Phosphodiesterase

Christian Bamann (11:10-11:25) - Ion Transport Mechanism of Channelrhodopsin-2

Oleg Sineshchekov (11:25-11:40) - Functional and Photochemical Characterization of Anion Channelrhodopsin 2 from *Guillardia theta*

Matthias Broser (11:40-11:55) - Rhodopsin Cyclases allow the light-induced production of cGMP and cAMP

Satoshi Tsunoda (11:55-12:10) - Enzyme rhodopsins, potential optogenetics tools for modulating intracellular cyclic-nucleotide levels

Ramona Schlesinger (12:10-12:25) - Proton Translocations in channelrhodopsin-1 from *Chlamydomonas augustae*

Lunch (12:30-14:00)

Session VI (14:00-15:50): **Novel experimental approaches to rhodopsins and GPCRs**

Chair: **Josef Wachtveitl** (14:00-14:10)

Dwayne Miller (14:10-14:35) - Coherent multidimensional studies of Rhodopsin and Bacteriorhodopsin – strong vibrational nonadiabatic coupling “sees” the light

Przemyslaw Nogly (14:35-14:50) - Retinal isomerization in bacteriorhodopsin captured by a femtosecond x-ray laser

Gabriela Kovacs (14:50-15:05) - Three-dimensional view of ultrafast dynamics in photoexcited bacteriorhodopsin

Hongjun Liang (15:05-15:20) - Rhodopsin Activities in Synthetic Polymer Membranes

John Kennis (15:20-15:35) - Strong pH-dependent near-infrared fluorescence in proteorhodopsin reconstituted with a retinal analogue pigment

Eglof Ritter (15:35-15:50) - A Synchrotron-based Mid-Infrared Spectrometer for Non-cyclic Systems at BESSY II

Coffee break (15:50-16:20)

Poster talks II, followed by poster viewing (16:20-19:00, continued after dinner)

Chair: **Oliver Ernst**

Poster talks II (16:20-17:30) - 14 poster talks (5 minutes each), see the schedule below

Posters viewing (17:30-19:00, continued after dinner)

Dinner (19:00-21:00)

Posters viewing

Thursday, September 27th

Session VII (8:30-10:30): Non-visual functions of animal rhodopsins

Chair: **Yoshinori Shichida** (8:30-8:40)

Craig Montell (8:40-9:05) - Opsins: a new class of polymodal sensory receptor

Russell Foster (9:05-9:30) - Light and sleep signalling to the molecular clockwork

Anant Menon (9:30-9:45) - Mechanism of phospholipid scrambling by a G protein-coupled receptor

Yuji Furutani (9:45-10:00) - Light-induced difference infrared spectroscopy on the photochromic reaction of a ciliary opsin by irradiation of ultraviolet and visible light

Keita Sato (10:00-10:15) - Functional conversion of molecular property of Opn5 by key amino acid substitution

Steven Hughes (10:15-10:30) - Functional characterisation of naturally occurring mutations in human melanopsin

Coffee break (10:30-11:00)

Free Afternoon (11:00-19:00)**: Conference trips - Niagara Falls, Golf, Winery. Boxed lunch will be provided**

Dinner (19:00-21:00)

Posters viewing

International Advisory Committee meeting (21:00-22:00)

Friday, September 28th

Session VIII (8:30-10:10): Computational approaches to rhodopsins and GPCRs

Chair: **Mudi Sheves** (8:30-8:40)

Ana-Nicoleta Bondar (8:40-8:55) - Protonation-coupled protein and water dynamics in retinal proteins

Igor Schapiro (8:55-9:10) - Computational study of the spectral tuning mechanism in Proteorhodopsin

Shigehiko Hayashi (9:10-9:25) - Functional molecular dynamics of rhodopsins revealed by hybrid molecular simulations

Nicolas Ferré (9:25-9:40) - How Anabaena Sensory Rhodopsin photochemical properties are tuned by pH

Carl-Mikael Suomivuori (9:40-9:55) - Exploring the dynamics of a light-driven sodium pump

Mikhail Ryazantsev (9:55-10:10) - Computational Models for Rhodopsins: from Primary Structures to Optical Properties

Coffee break (10:10-10:50)

Posters take-down

Session IX (10:50-12:25): Structural approaches to rhodopsins and GPCRs

Chair: **Tsutomu Kouyama** (10:50-11:00)

Scott Prosser (11:00-11:25) - NMR and DEER Inspired Studies of the Conformational Landscape of the Adenosine A2A Receptor – A Comparison with Visual Rhodopsin

Matthias Elgeti (11:25-11:40) - A Structure/Function Framework of GPCR Activation Based on the Rhodopsin Model

Vladimir Ladizhansky (11:40-11:55) - Thermal unfolding of Anabaena Sensory Rhodopsin followed by solid-state NMR

Valerie Panneels (11:55-12:10) - Towards rhodopsin dynamics using pump-probe serial femtosecond crystallography

Peter Judge (12:10-12:25) - High-resolution structures of the ground state (1.3 A resolution) and early photocycle intermediates (2.0 A resolution) of the Archaerhodopsin 3 photoreceptor from synchrotron and time-resolved XFEL diffraction data

Lunch (12:25-14:00)

Posters take-down

Session X (14:00-15:50): Visual animal rhodopsins – receptor structure, dynamics, and activation

Chair: **Ulrike Alexiev** (14:00-14:10)

Thomas Sakmar (14:10-14:35) - Genetic Code Expansion to Enable Biochemical and Biophysical Studies of Retinal Proteins

David Farrens (14:35-14:50) - Role of structural dynamics in retinal binding and release to rhodopsin

Paul Park (14:50-15:05) - Modulating the packing of rhodopsin in rod outer segment disc membranes

Andreyah Pope (15:05-15:20) - Coupling of retinal isomerization to activation Switch 2 in the visual receptor rhodopsin

Midori Murakami (15:20-15:35) - Towards the structural study of large conformational changes of squid metarhodopsin

Elena Lesca (15:35-15:50) - Jumping spider rhodopsin-1: a structural nexus between bovine rhodopsin and Class A GPCRs

Coffee break (15:50-16:20)

Session XI (16:20-18:10): Animal rhodopsins – signalling cascade and protein-protein interactions

Chair: **Klaus-Peter Hofmann** (16:20-16:30)

Gebhard Schertler (16:30-16:55) - The bovine rhodopsin-G-protein complex revealed by cryo-EM and Crystallography

Takefumi Morizumi (16:55-17:10) - Conformational studies of rhodopsin based on intra-/intermolecular distance measurements by EPR

Vladimir Kefalov (17:10-17:25) - Efficiency of rod transduction activation by a single opsin molecule

Ajith Karunarathne (17:25-17:40) - Adaptation of spectral and signaling properties of non-Rh opsins for GPCR-optogenetics

Takashi Nagata (17:40-17:55) - Peropsin as a potential light-inactivated G protein-coupled receptor

Jessica Rodgers (17:55-18:10) - Developing optogenetic tools for controlling Gαo signalling

Conference Dinner (18:30-21:30)

Saturday, September 29th

Session XII (8:30-10:15): Retinal proteins and GPCRs in disease

Chair: **Rosalie Crouch** (8:30-8:40)

Krzysztof Palczewski (8:40-9:05) - Systems pharmacology for retinal diseases

Jörg Standfuss (9:05-9:30) - From structures of rhodopsin mutants to pharmacological chaperones against retinitis pigmentosa

Pere Garriga (9:30-9:45) - Flavonoid allosteric modulation of mutated visual rhodopsin associated with retinitis pigmentosa

Beata Jastrzebska (9:45-10:00) - Binding of locked retinal chromophore analogue to rod opsin protects retina against bright light-induced retinopathy

Judith Klein-Seetharaman (10:00-10:15) - The local environment surrounding the conserved disulfide bond in the extracellular domain of GPCRs

Coffee break (10:15-10:45)

Session XIII (10:45-12:45): Late breaking news

Chair: **Joachim Heberle** (10:45-10:55)

Hideaki Kato (10:55-11:20) - Structural mechanisms of ion selectivity and high-speed gating in anion channelrhodopsins

Hai Li (11:20-11:35) - Crystal Structure of a Natural Light-Gated Anion Channelrhodopsin

Yuanyuan Chen (11:35-11:50) - A non-retinoid chaperone of rod opsin and its therapeutic potential

James Geiger (11:50-12:05) - Photoisomerizing Rhodopsin Mimics Visualized at Atomic Resolution

David Ehrenberg (12:05-12:20) - The two-photon reaction of JSR1, a bistable rhodopsin of the jumping spider eye

General discussion (12:20-12:40) - Future of rhodopsin research discussion (**Joachim Heberle/Oliver Ernst/Leonid Brown)**

Conference closing (12:40-12:45) - **Oliver Ernst/Leonid Brown/Rob Reedijk**

Boxed lunch will be provided

Shuttles to Pearson Airport

Poster talks I (September 25th) (16:30-17:35)

1) Takashi Tsukamoto - Anion concentration dependency on the photocycle of PsuACR1: Implications for the impairment of its fast channel closing
2) Akihiro Otomo - Effects of solubilized conditions on the oligomerization of KR2
3) Keiichi Kojima - Impact and mechanism of phosphate binding to a light-driven anion transporter SyHR
4) Sabine Panzer - Shedding Light on Corn Smut Rhodopsins: Localization and Functional Analysis of Retinal Proteins of the Basidiomycete *Ustilago maydis*
5) Peter Eberhardt - Target analysis of KR2 photocycles at different pumping modes
6) Meike Luck - Spectroscopic studies of the histidine kinase rhodopsin Ot-HKR from the picoalga *Ostreococcus tauri*
7) WITHDRAWN
8) Takashi Kikukawa - Functional importance of trimer formation of light-driven H+ pump Gloeobacter rhodopsin
9) Joel Kaufmann - How an aspartate in the binding pocket modulates the retinal back isomerisation in channelrhodopsin
10) Blake Mertz - Allosteric effects of the proton donor on the microbial proton pump, proteorhodopsin
11) Orawan Jakdetchai - Probing the photointermediates of KR2 by DNP-enhanced solid-state NMR
12) Marie Kurihara - An elevated pKa of the protonated retinal Schiff base counterion Asp as a key factor for efficient ion transport in Na+ pumping rhodopsins
13) Rei Yoshizumi - Role of aromatic residue in the oligomeric structure of a light-driven sodium pump KR2
14) Veniamin Borin - A combined computational and crystallographic study of the early

photochemical events in bacteriorhodopsin

Poster talks II (September 26th) (16:20-17:30)

1) Eshita Mutt - Molecular basis of vision: What do you and a box jellyfish have in common?
2) Rachel Munro - Biosynthetic production of an isotopically labelled retinal in *E. coli* for solid-state NMR
3) Seiji Wada - Color opponency with a bistable pigment parapinopsin in the zebrafish pineal organ
4) Johannes Vierock - Redder than Chrimson: structure guided engineering of a red-shifted optogenetic actuator
5) Srividya Ganapathy - Near-infrared active analog pigments of archaerhodopsin-3
6) Yoon Seok Kim - Structural insights into anion conduction of natural and designed anion channelrhodopsins
7) Juan Carlos Valdez-Lopez - Structural and Molecular Analysis of Signaling Activation and Desensitization in Melanopsin, an Opsin G-Protein Coupled Receptor
8) Javier Vinals - Novel and robust bioinspired detecting materials
9) Arita Silapetere - Isomerization versus fluorescence: case study of voltage sensors QuasArs
10) Shatanik Mukherjee - Spectroscopic studies to decipher activation mechanism of a rhodopsin guanylyl cyclase
11) Alexander Zhgun - Development of the production system for recombinant rhodopsin from *Octopus vulgaris* in HEK293-G7 cells
12) Kazumi Sakai - Drosophila melanogaster Rh7 is a UV-to-visible light sensor having extraordinarily broad absorption spectrum
13) Jessica Besaw - The Structure of the Chloride Pump, *Mastigocladopsis repens* halorhodopsin, and its Proton Pumping Mutant
14) Andrew Harris - Unusual new group of Antarctic microbial rhodopsins

For all other poster titles please see Abstracts for Posters section in the Program Book