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# MONDAY, JUNE 24, 1996

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07.30 - 17.00

REGISTRATION

FOYER

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ORAL PRESENTATIONS

EREZ HALL

POSTER PRESENTATIONS

ALON HALL

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08.20 - 08.30

OPENING ADDRESS

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08.30 - 10.30

**SESSION 1: STRUCTURE OF RETINAL PROTEINS**

Chairperson: W. Stoeckenius

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08:30 - 09:00

REFINEMENT OF THE STRUCTURE OF BACTERIORHODOPSIN

N. Grigorieff<sup>1</sup>, T.A. Ceska<sup>1+</sup>, K.H. Downing<sup>2</sup>, J.M. Baldwin<sup>1</sup>,  
R. Henderson<sup>1</sup> (1 : UK, 2 : USA)

09:00 - 09:30

A THREE DIMENSIONAL MAP OF BACTERIORHODOPSIN AT  
3.0 °A RESOLUTION

K. Mitsuoka<sup>1</sup>, A. Miyazawa<sup>2</sup>, D. Vassilyev<sup>1</sup>, A. Kidera<sup>1</sup>,  
M. Matsushima<sup>1</sup>, K. Murata<sup>1</sup>, K. Hirai<sup>1</sup>, Y. Fujiyoshi<sup>1</sup>,  
Y. Kimura<sup>1</sup> (1 : Japan, 2 : UK)

09:30 - 10:00

THE ARRANGEMENT OF ALPHA HELICES IN RHODOPSIN  
OBTAINED BY ELECTRON CRYO-MICROSCOPY

G.F.X. Schertler (UK)

10:00 - 10:30

BACTERIAL RHODOPSINS IN EVOLUTION

Y. Mukohata (Japan)

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10:30 - 11:00

COFFEE

BREAK

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**11:00 - 17:00      SESSION 2: ULTRA-FAST PHENOMENA**

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**11:00 - 13:00      SESSION 2.1      Chairperson: T. Ebrey**

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**11:00 - 11:30      THE PHOTOPHYSICS OF BACTERIORHODOPSIN: A NEW TWIST**  
K.C. Hasson, F. Gai, P.A. Anfinrud (USA)

**11:30 - 12:00      REEXAMINING THE PRIMARY LIGHT-INDUCED EVENTS IN**  
**BACTERIORHODOPSIN USING A SYNTHETIC C<sub>13</sub>=C<sub>14</sub> LOCKED CHROMOPHORE**  
Q. Zhong<sup>1</sup>, S. Ruhman<sup>1</sup>, M. Ottolenghi<sup>1</sup>, M. Sheves<sup>1</sup>, N. Friedman<sup>1</sup>,  
G.H. Atkinson<sup>2</sup>, J.K. Delaney<sup>2</sup> (1 : Israel, 2 : USA)

**12:00 - 12:30      MECHANISM OF THE FEMTOSECOND ISOMERIZATION OF RHODOPSIN**  
G.G. Kochendoerfer, Q. Wang, D.S. Wexler, L.A. Peteanu,  
R.W. Schoenlein, C.V. Shank, P.J.E. Verdegem,  
J. Lugtenburg, R.A. Mathies (USA, The Netherlands)

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**12:30 - 14:00      LUNCH      BREAK**

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**14:00 - 16:00      POSTER SESSION**

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**16:00 - 17:00      SESSION 2.2      Chairperson: M. Stockburger**

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**16:00 - 16:30      ON THE RETINAL SUBPICOSECOND PHOTOISOMERIZATION DYNAMICS**  
**IN BACTERIORHODOPSIN**  
S. Luganov, Li Song, J. Lanyi, M.A. El-Sayed (USA)

**16:30 - 17:00      STRUCTURAL CHANGES IN THE ROOM-TEMPERATURE RHODOPSIN AND**  
**BACTERIORHODOPSIN PHOTO-REACTION: PICOSECOND COHERENT**  
**RAMAN SPECTROSCOPY**  
G.H. Atkinson, L. Ujj, A. Popp, F. Jager, J. Delaney, P. Schmidt (USA)

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**17:00 - 17:30      COFFEE      BREAK**

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**MONDAY, JUNE 24, 1996** - continued

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**17:30 - 21:30**      **SESSION 3: PHOTOINTERMEDIATES AND ELECTROSTATIC**

**INTERACTIONS**

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**17:30 - 18:30**      **SESSION 3.1**      Chairperson: T. Yoshizawa

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**17:30 - 18:00**      **SOLID STATE NMR STUDIES OF BACTERIORHODOPSIN PHOTOINTERMEDIATES**

J.G. Hu<sup>1</sup>, A.T. Petkova<sup>1</sup>, B.Q. Sun<sup>1</sup>, M. Bizounok<sup>1</sup>, J. Raap<sup>2</sup>

J. Lugtenburg<sup>2</sup>, R.G. Griffin<sup>1</sup>, J. Herzfeld<sup>1</sup>

(1: USA, 2: The Netherlands)

**18:00 - 18:30**      **STRUCTURE, DYNAMICS AND FUNCTION OF BACTERIORHODOPSIN**

**M.P. Heyn** (Germany)

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**18:30 - 20:00**      **D I N N E R      B R E A K**

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**20:00 - 21:30**      **SESSION 3.2**      Chairperson: K. Schulten

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**20:00 - 20:30**      **INTERACTION OF AMINO ACID RESIDUES IN BACTERIORHODOPSIN  
AS DETERMINED FROM THE TITRATION OF ASP-85 AND pH DEPENDENCE  
OF DARK ADAPTATION**

S. Balashov<sup>1,2</sup>, E. Imasheva<sup>1,2</sup>, R. Govindjee<sup>1</sup>, T.G. Ebrey<sup>1</sup>,

R.K. Crouch<sup>1</sup>, D.R. Menick<sup>1</sup> (1: USA, 2: Russia)

**20:30 - 21:00**      **ELECTROSTATIC CONTROL OF PROTON TRANSFER IN MEMBRANE PROTEINS**

**B. Honig** (USA)

**21:00 - 21:30**      **CONFORMATION AND ELECTROSTATIC ASPECTS OF THE PROTON  
TRANSLOCATION IN BACTERIORHODOPSIN**

**C. Scharnagl** (Germany)

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# TUESDAY, JUNE 25, 1996

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TUESDAY, JUNE 25, 08:30 - WEDNESDAY, JUNE 26, 10:30

**SESSION 4: MOLECULAR MECHANISMS FOR BACTERIORHODOPSIN  
FUNCTION**

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08:30 - 10:30      **SESSION 4.1**      Chairperson: V. Skulachev

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08:30 - 09:00      ARG-82 REGULATES THE pKa OF THE GROUP RESPONSIBLE FOR  
THE LIGHT-DRIVEN PROTON RELEASE IN BACTERIORHODOPSIN

R. Govindjee, S. Misra, S.P. Balashov, T.G. Ebrey, R.K. Crouch,  
D.R. Menick (USA)

09:00 - 09:30      GENERAL CONCEPT OF ION TRANSLOCATION BY HALOBACTERIAL  
RETINAL PROTEINS: THE IST-MODEL

D. Oesterhelt (Germany)

09:30 - 10:00      MECHANISM OF THE PROTON TRANSFER SWITCH IN BACTERIORHODOPSIN

J.K. Lanyi (USA)

10:00 - 10:30      QUANTUM CHEMISTRY AND MOLECULAR DYNAMICS STUDIES OF THE  
PROTON PUMP CYCLE OF BACTERIORHODOPSIN

K. Schulten (USA)

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10:30 - 11:00      C O F F E E      B R E A K

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11:00 - 13:00      **SESSION 4.2**      Chairperson: J. Lanyi

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11:00 - 11:30      REVERSIBLE AND IRREVERSIBLE STEPS IN THE PHOTOCYCLE OF  
BACTERIORHODOPSIN STUDIED BY TIME RESOLVED  
RESONANCE RAMAN SPECTROSCOPY

M. Stockburger, T. Althaus (Germany)

11:30 - 12:00      LIGHT-DRIVEN STRUCTURAL CHANGES IN BACTERIORHODOPSIN

S. Subramaniam (USA)

12:00 - 12:30      IMPORTANCE OF STERIC CHROMOPHORE-PROTEIN INTERACTIONS  
IN BACTERIORHODOPSIN

F. Siebert, O. Weidlich (Germany)

12:30 - 13:00      CONFORMATIONAL CHANGES IN BACTERIORHODOPSIN (BR) AND RHODOPSIN  
ANALYZED BY PHOTOTHERMAL METHODS

W. Gartner, S. Braslavsky (Germany)

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**TUESDAY, JUNE 25, 1996** - continued

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13:00 - 14:00                    LUNCH        BREAK

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14:00 - 16:00            **POSTER SESSION**

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16:00 - 17:00            **SESSION 4.3**    Chairperson: G. Atkinson

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16:00 - 16:30            **PROBING THE ROLE OF WATER IN RETINAL BINDING TO BACTERIO-OPSIN WITH ABSORPTION SPECTROSCOPY AND ATOMIC FORCE SENSING**

**I. Rouso, I. Brodsky, E. Khachatryan, A. Lewis**

**M. Ottolenghi, M. Sheves (Israel)**

16:30 - 17:00            **PROBING THE UNDERLYING MECHANISMS OF LIGHT-INDUCED PROTEIN CONFORMATIONAL ALTERATIONS IN BACTERIORHODOPSIN USING NON-LINEAR OPTICS & ATOMIC FORCE SENSING**

**I. Rouso, E. Khachatryan, I. Brodsky, Y. Gat, O. Bouevitch,**

**Z. Chen, M. Ottolenghi, M. Sheves, A. Lewis (Israel)**

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17:00 - 17:30                    C O F F E E        B R E A K

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17:30 - 18:30            **SESSION 4.4**    Chairperson: B. Honig

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17:30 - 18:00            **MULTIDIMENSIONAL SOLID STATE NMR IN RETINAL PROTEINS**

**J. Hu<sup>1</sup>, B. Sun<sup>1</sup>, D. Maus<sup>1</sup>, D. Hall<sup>1</sup>, P. Costa<sup>1</sup>, C. Rienstra<sup>1</sup>**

**J. Raap<sup>2</sup>, J. Lugtenburg<sup>2</sup>, J. Herzfeld<sup>1</sup>, R. Griffin<sup>1</sup>**

**(1: USA, 2: The Netherlands)**

18:00 - 18:30            **VECTORIALITY AND VOLTAGE DEPENDENCE OF ION PUMPING IN BACTERIORHODOPSIN AND HALORHODOPSIN**

**E. Bamberg, B. Moeckel, M. Engelhard, G. Buldt, G. Nagel (Germany)**

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18:30 - 20:00                    D I N N E R        B R E A K

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## TUESDAY, JUNE 25, 1996 - continued

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20:00 - 21:00      **SESSION 4.5**    Chairperson: L. Keszthelyi

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20:00 - 20:30      **PROTON-TRANSLOCATION ACROSS BACTERIORHODOPSIN AND ALONG  
THE PURPLE MEMBRANE SURFACE: STRUCTURE-FUNCTION RELATIONSHIP**  
N.A. Dencher, G. Buldt, J. Heberle, M.H.J. Koch, D. Oesterhelt  
G. Rapp, J. Riesle, H.-J. Sass (Germany)

20:30 - 21:00      **MAPPING OF THE SURFACE CARBOXYLATES OF BR BY TIME RESOLVED  
PROTON TRANSFER MEASUREMENTS**  
E. Nachliel, S. Yaniv-Checover, M. Gutman (Israel)

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21:00              **ZICHRON WINE      CELLAR**

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## WEDNESDAY, JUNE 26, 1996

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08:30 - 10:30      **SESSION 4.6**    Chairperson: D. Oesterhelt

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08:30 - 09:00      **THEORETICAL ANALYSIS OF WATER INTERACTIONS AND THERMODYNAMICS  
IN BACTERIORHODOPSIN**  
J.C. Smith<sup>1</sup>, M. Nina<sup>2</sup>, R. Pomes<sup>2</sup>, B. Roux<sup>2</sup>  
(1: France, 2: Canada)

09:00 - 09:30      **THE PROTON PUMP MECHANISM OF BACTERIORHODOPSIN STUDIED  
BY TIMERESOLVED FTIR AND FTRaman SPECTROSCOPY**  
K. Gerwert (Germany)

09:30 - 10:00      **ELECTRIC SIGNALS AND BUFFER EFFECTS IN LIGHT EXCITED  
BACTERIORHODOPSIN**  
L. Keszthelyi (Hungary)

10:00 - 10:30      **BACTERIORHODOPSIN: A STEP IN EVOLUTION OF BIOLOGICAL  
PHOTOTRANSDUCERS**  
V. Skulachev (Russia)

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10:30 - 11:00      **COFFEE    BREAK**

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## WEDNESDAY, JUNE 26 - continued

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WEDNESDAY, JUNE 26, 11:00 - THURSDAY, JUNE 27, 10:30

### SESSION 5: SENSORY AND HALORHODOPSIN

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11:00 - 12:30      **SESSION 5.1**    Chairperson: Y. Mukohata

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11:00 - 11:30      **PROTONATABLE RESIDUES IN SRI AND IN ITS TRANSDUCER HTRI INVOLVED IN PHOTOTAXIS SIGNALING**

**J. Spudich, K.-H. Jung, B. Perazzona, E. Spudich (USA)**

11:30 - 12:00      **ANION BINDING TO HALORHODOPSIN FROM NATRONBACTERIUM PHARAONIS**

**M. Engelhard, R. Wittenberg, M. Geeves, I. Chizhov (Germany)**

12:00 - 12:30      **DIFFERENT MODES OF PROTON TRANSLOCATION BY SENSORY RHODOPSIN I**

**U. Haupts, E. Bamberg, D. Oesterhelt (Germany)**

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12:30 - 14:00      **LUNCH      BREAK**

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14:00              **CONFERENCE TOUR AND DINNER IN DALIAT EL CARMEL**

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## THURSDAY, JUNE 27, 1996

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09:00 - 10:30      **SESSION 5.2**    Chairperson: J. Herzfeld

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09:00 - 09:30      **IR SPECTROSCOPIC ANALYSIS OF SPECIFIC NON-COVALENT INTERACTIONS OF AMINO ACID SIDE CHAINS IN HR AND BR ACTIVE SITES**

**M.S. Braiman, A.K. Dioumaev, S.E. Plunkett (USA)**

09:30 - 10:00      **ANION TRANSPORT BY HALORHODOPSIN AND BACTERIORHODOPSIN**

**M. Rudiger, J. Tittor (Germany)**

10:00 - 10:30      **TRANSMEMBRANE SIGNALING IN BACTERIORHODOPSIN AND RHODOPSIN**

**A. Maeda (Japan)**

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10:30 - 11:00      **COFFEE      BREAK**

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**THURSDAY, JUNE 27, 1996** - continued

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**THURSDAY, JUNE 27, 11:00 - FRIDAY, JUNE 28, 12:30**

**SESSION 6: RHODOPSINS - STRUCTURE AND MECHANISMS**

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**11:00 - 13:00**      **SESSION 6.1**    Chairperson: J. Lugtenburg

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**11:00 - 11:30**      i. ABSOLUTE CONFIGURATION STUDIES OF THE RHODOPSIN CHROMOPHORE.

ii. A<sub>2</sub>E. THE EYE PIGMENT IN MACULAR DEGENERATION

**K. Nakanishi, B. Borhan, E. Karnaukova, J. Lou, Q. Tan, N. Sakai,**

**R. Ren, N. Berova (USA)**

**11:30 - 12:00**      STRUCTURAL NATURE OF THE BARRIERS BETWEEN EARLY PHOTOLYSIS  
INTERMEDIATES OF RHODOPSIN

**D.S. Kliger, J.W. Lewis, S.G. Jager, T.L. Mah (USA)**

**12:00 - 12:30**      STUDIES ON THE PHOTOACTIVATION MECHANISM OF RHODOPSIN

**T.P. Sakmar (USA)**

**12:30 - 13:00**      PROBING OF THE PHOTOTRANSDUCTION PATHWAY WITH  
13-DESMETHYLRETINAL

**R. Crouch (USA)**

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**13:00 - 14:00**                      L U N C H      B R E A K

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**14:00 - 16:00**      **POSTER SESSION**

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**16:00 - 17:00**      **SESSION 6.2**    Chairperson: A. Maeda

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**16:00 - 16:30**      PINOPSIN, A NEW RETINAL PROTEIN IN CHICKEN PINEAL

**T. Yoshizawa (Japan)**

**16:30 - 17:00**      MOLECULAR PROPERTIES OF CONE VISUAL PIGMENTS

**Y. Shichida (Japan)**

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**17:00 - 17:30**                      C O F F E E      B R E A K

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## THURSDAY, JUNE 27, 1996 - continued

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17:30 - 18:30      **SESSION 6.3**    Chairperson: S. Smith

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17:30 - 18:00      **STRUCTURAL STUDIES OF OCTOPUS RHODOPSIN AND ITS SPECTRAL TUNING**

**M. Tsuda, M. Nakagawa, T. Owasa, S. Kikkawa (Japan)**

18:00 - 18:30      **STRUCTURAL CHANGES OF RHODOPSIN UPON PHOTOISOMERIZATION AND COMPLEX-FORMATION WITH TRANSDUCIN**

**H. Kandori, S. Nishimura, J. Sasaki, T. Matsuda, Y. Fukada, A. Maeda (Japan)**

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20:00              **FARE WELL GALA DINNER**

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## FRIDAY, JUNE 28, 1996

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08:30 - 10:30      **SESSION 6.4**    Chairperson: D. Kliger

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08:30 - 09:00      **SIGNALLING STATES AND LIFETIME OF ACTIVE RHODOPSIN**

**K.P. Hofmann, C. Berlin (Germany)**

09:00 - 09:30      **STRUCTURE OF THE CYTOPLASMIC SURFACE OF BOVINE RHODOPSIN**

**P.L. Yeagle, J.L. Alderfer, A.D. Albert (USA)**

09:30 - 10:00      **STRUCTURE-FUNCTION COMPLEMENTARITY OF HELICES III AND VI IN RHODOPSIN**

**M. Han, T.P. Sakmar, S.O. Smith (USA)**

10:00 - 10:30      **RHODOPSINS WITH ISOTOPICALLY LABELLED CHROMOPHORES**

**J. Lugtenburg (The Netherlands)**

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10:30 - 11:00      **COFFEE BREAK**

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11:00 - 12:30      **SESSION 6.5**    Chairperson: T. Sakmar

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11:00 - 11:30      **RHODOPSIN-MEDIATED SIGNALLING IN CHLAMYDOMONAS**

**P. Hegemann, W. Deininger, E. Holland (Germany)**

11:30 - 12:00      **ARRANGEMENT OF VISUAL CELLS AND THE EXPRESSED VISUAL PIGMENTS IN FISH RETINALS**

**F. Tokunaga, T. Satoh, O. Hisatomi (Japan)**

12:00 - 12:30      **9-DEMETHYL-9-HALO-CHROMOPHORE IN BR AND RETINOCHROME**

**T. Shinada, N. Sekiya, N. Bojkova, K. Yoshihara (Japan)**