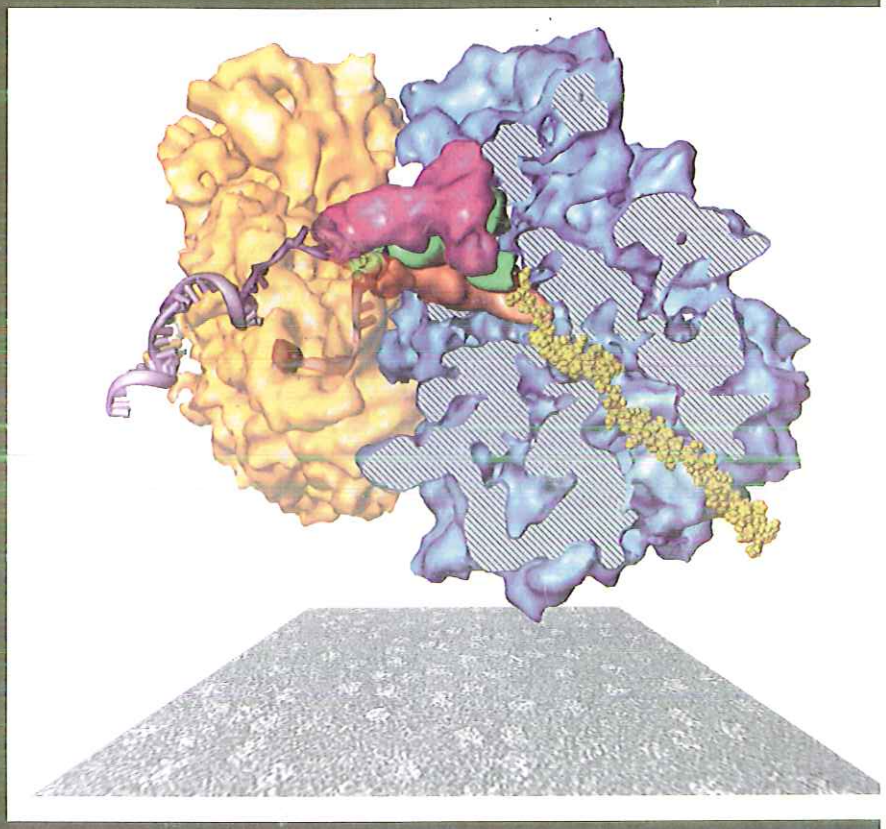
Abstracts

49th Annual Meeting • February 12–16, 2005 • Long Beach, California



Biophysical *Journal*

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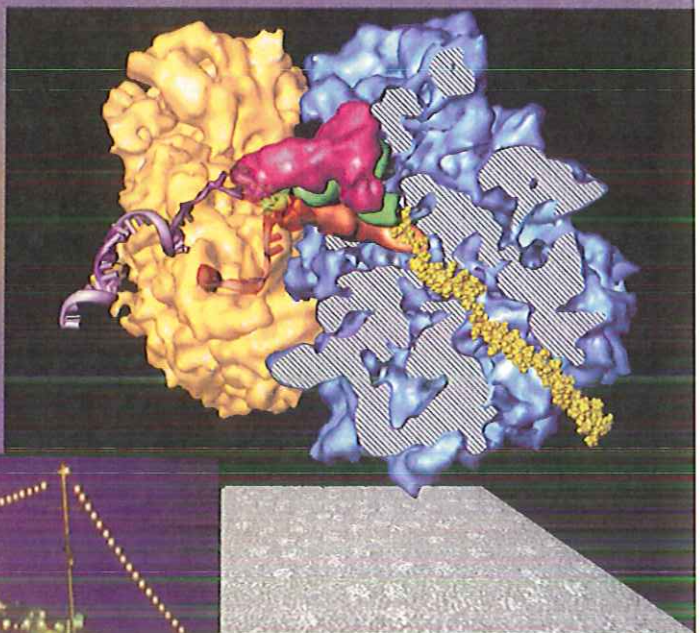
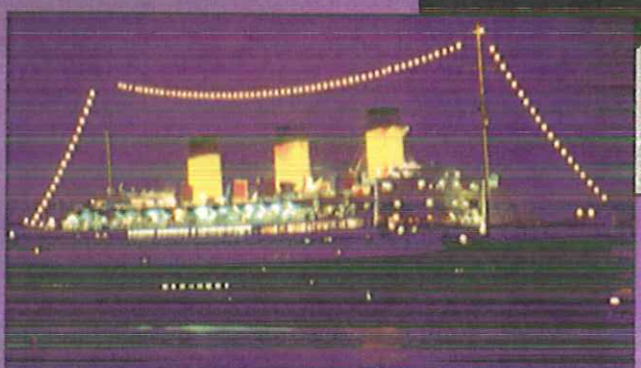
49th Annual Meeting

February 12–16, 2005
Long Beach, CA





Abstracts Issue
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Biophysical Society

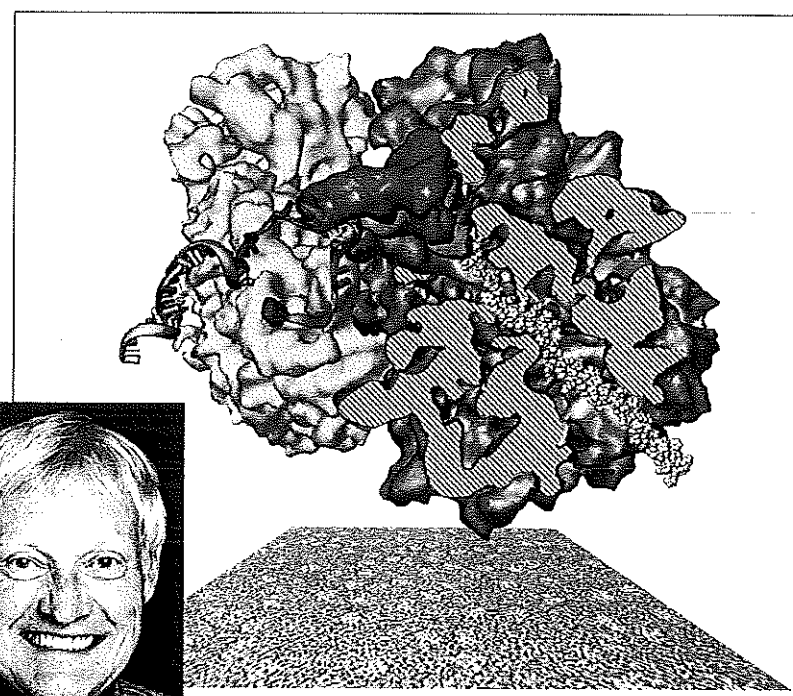
49TH ANNUAL MEETING

February 12–16, 2005
Long Beach Convention Center, Long Beach, California

ABSTRACTS ISSUE

National Lecturer

Joachim Frank
Howard Hughes Medical Institute,
Wadsworth Center
Cryo-Electron Microscopy of the Ribosome: Glimpses of a Molecular Machine in Motion



On the Cover: The ribosome visualized by cryo-electron microscopy and reconstructed from 130,000 particle images, at 7.8 A resolution (C.M.T. Spahn, R.A. Grassucci, V. Marquez, J. Linde, H. Gao, W. Baxter, P.A. Penczek, K.H. Nierhaus, J. Frank, in preparation). Models of messenger RNA and the polypeptide chain have been inserted. Transfer RNAs are visible at the A (pink), P (green), and E (brown) sites. The large subunit (blue) has been cut in the plane of the polypeptide tunnel. The image at the bottom shows a typical micrograph with ribosome images. (Modeling and artwork by Kakoli Mitra and Michael Watters).

MEETING SUMMARY

For more complete information on each event, please see pages v–xxvii

	Saturday FEBRUARY 12	Sunday FEBRUARY 13	Monday FEBRUARY 14	Tuesday FEBRUARY 15	Wednesday FEBRUARY 16
7:30 AM		Postdoctoral Breakfast	BPS Business Meeting	Graduate Student Breakfast	
8:00 AM		Placement Service	Placement Service	Placement Service	Placement Service
8:15 AM		Symposium 1–TRP Channels: What a Sensation Symposium 2–Molecular Machines that Organize DNA Structure Platform Session A–E	Symposium 7–Membrane Biophysics: Synaptotagmins, SNAREs & Vesicle Biogenesis Symposium 8–Biophysical Approaches to DNA Replication & Repair Platform Sessions P–U	Symposium 13–Molecular Mechanisms of Translation Symposium 14–Theoretical Models of Dynamical Systems Platform Sessions AH–AM	Symposium 18–Mitochondrial Ion Channels: Gatekeepers of Life & Death Symposium 19–Molecular Motors: Biophysical Mechanisms in Cell Biology Platform Sessions AZ–BE
9:00 AM	Molecular Biophysics Subgroup Bioenergetics Subgroup				
10:00 AM		Undergraduate Student Symposium Exhibits Open	Exhibits Open	Exhibits Open	
10:15 AM		Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:30 AM			New Member Welcome Coffee		
10:45 AM		Symposium 3–Glycobiology: Synthesis, Multivalency & Glychaperones Symposium 4–Control & Regulation of Calcium Signaling in E-C Coupling Platform Sessions F–J	Symposium 9–Structural & Biophysical Dissection of Nucleocytoplasmic Transport Symposium 10–Protein Folding: Theory, Experiment & Design Platform Sessions V–AA	Symposium 15–Awards Symposium Platform Sessions AN–AS Grant Writing Workshop	Symposium 20–Exploring Molecular Motions of Channels & Transporters Platform Sessions BF–BL
11:00 AM	Permeation Transport Subgroup				
12:00 NOON	Placement Service (12:00–7:00)	International Travel Awards Luncheon			
1:00 PM	Membrane Biophysics Subgroup Biological Fluorescence Subgroup Membrane Structure & Assembly Subgroup Motility Subgroup Exocytosis/Endocytosis Subgroup	CPOW Career Luncheon Undergraduate Poster Session & Reception Minority Affairs Committee Forum: Resources for Attracting Minorities to Biophysics The Impact of Post-9/11 Visa Policies on Science & Technology	CPOW Panel Discussion–Starting in a New Position: Managing People Education Committee Panel–Innovations in the Teaching of Biophysics *Biophysical Journal* Workshop, Session I–How to Prepare Print-Quality Digital Art Photos	Early Career Development Panel Discussion Government Affairs Committee Meeting: Bridging the Sciences & Interacting with your Congressman *Biophysical Journal* Workshop, Session II–An Expert's Guide to Preparing Digital Art Photos	Poster Sessions (1:00–3:00) Late Poster Session (1:00–3:00) Popcorn Break
1:30 PM			Professors at Undergraduate Institutions (PUI) Luncheon		
1:45 PM		Poster Sessions (1:45–3:45) Popcorn Break	Poster Sessions (1:45–3:45) Popcorn Break	Poster Sessions (1:45–3:45) Popcorn Break	
3:00 PM					Meeting Ends
4:00 PM		Symposium 5–Cooperative Mechanisms in Molecular Motors Symposium 6–Moonlighting Proteins: Old Proteins Learning New Tricks Platform Sessions K–O	Symposium 11–Rho-GTPase Family Signaling: Intracellular & Structural Mechanisms Symposium 12–Nucleic Acid Packaging in Virus Particles Platform Sessions AB–AG	Symposium 16–New & Notable Symposium 17–Allosteric Pathways Uncovered Platform Sessions AT–AY	
5:00 PM	Opening Mixer Early Careers Committee Meet & Greet				
6:00 PM		SRAA Poster Competition			
6:30 PM	Student Travel Grant & MARC Awardee Reception				
7:30 PM		Workshop 1–RNA as a Therapeutic Drug Target: Progress and Challenges Workshop 2–Advances in High-Resolution Cellular Electron Tomography Workshop 3–Simulation Methodologies for Membrane Structure & Dynamics		Workshop 4–Advances in Single-Molecule & Single-Cell Detection & Manipulation Workshop 5–New Technologies for Electrophysiology	
8:00 PM			Awards Ceremony & National Lecture		
9:30 PM			Society Reception & Dance		

Program Number: 2062-Pos

MIMICKING BIOLOGICAL ENVIRONMENTS: AMYLOIDOGENIC PEPTIDE-BICELLE INTERACTION STUDIED BY NMR AND ELECTRON MICROSCOPY

Mercedes Cócera[1], Olga López[1], Josep Cladera[2], Jose Luis Parra[1], Alfonso de la Maza[1].
[1]I.I.Q.A.B.-C.S.I.C., Barcelona, Spain, [2]U.A.B., Barcelona, Spain.

Amyloidogenic peptides form citotoxic aggregates responsible for the development of spongiform transmissible encephalopaties and Alzheimer's disease. The last studies reveal on the one hand, the possible influence of the membranes on the aggregation phenomena, and on the other hand, the effects of these peptide aggregates on the structure and the properties of the membranes. For these reasons, the study of peptide-membrane interactions modelling a biological environment results the great importance.
Bicelles are planar and bilayered nanostructrures formed by phospholipids dispersed in aqueous solution. These bilayered micelles of phospholipid may be used as membrane mimetics for structural studies in both the anisotropic and the isotropic phase.
In this work, nuclear magnetic resonance (NMR) and transmission electron microscopy (TEM) techniques have been used for increasing our knowledge about the peptide-bicelle interactions. In this sense, bicelles were prepared with appropriate mixtures of dimyristoylphosphatidylcholine (DMPC) and dihexanoylphosphatidylcholine (DHPC) containing beta-amyloide. Physico-chemical characterization of these systems by dynamic light scattering (DLS) and TEM showed bicelles with disk-like shapes and diameters around 50 nm. The insertion of the peptide was evaluated by NMR. Our results indicate that this peptide has the ability to orientate in the membrane. TEM micrographs of the systems confirmed this insertion, which did not seem to cause significant disruption in lipid packing of the bicelles.
Taking everything into account, the bicellar structures could be very useful to evaluate some aspects of the beta-amyloide-membrane interactions.

Disclosures: M. Cócera, None; O. López, None; J. Cladera, None; J. Parra, None; A. de la Maza, None.

MIMICKING BIOLOGICAL ENVIRONMENTS: AMYLOIDOGENIC PEPTIDE-BICELLE INTERACTION STUDIED BY NMR AND ELECTRON MICROSCOPY

Topic: 3F Protein-Lipid Interactions ; 3D Membrane Structure

Mercedes Cócera[1], Olga López[1], Josep Cladera[2], Jose Luis Parra[1], Alfonso de la Maza[1].

[1]I.I.Q.A.B.-C.S.I.C., Barcelona, Spain, [2]U.A.B., Barcelona, Spain.

Presentation Number: 2062-Pos

Poster Board Number: B174

Amyloidogenic peptides form citotoxic aggregates responsible for the development of spongiform transmissible encephalopaties and Alzheimer's disease. The last studies reveal on the one hand, the possible influence of the membranes on the aggregation phenomena, and on the other hand, the effects of these peptide aggregates on the structure and the properties of the membranes. For these reasons, the study of peptide-membrane interactions modelling a biological environment results the great importance.

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2060-Pos Board #B172
Unraveling the structure of the photosynthetic membrane: High-resolution Scanning Probe Imaging.
J.G. Magis, A. Stamouli, P. Martinsson, T.H. Oosterkamp, T.J. Aartsma.
Leiden University, Leiden, The Netherlands.
Over the past few years the detailed molecular structure of key-components of the photosynthetic system have been reported. However, the organization of the individual components in the intact membrane is as important for the photosynthetic functionality as their individual molecular structure.
In order to elucidate this organization of the native membrane, we apply a Tunneling Atomic Force Microscope. This approach allows us not only to visualize the native membrane structure of plants and bacteria, but also to study their electronic properties by performing STS measurements in situ.
Various methods are presented for the immobilization and imaging of the pigment-protein complexes on solid substrates, such as adsorption from detergent and detergent-free solutions and two-dimensional crystallization, in which molecular resolution of light-harvesting complexes was obtained.
The results of tunneling spectroscopy on light-harvesting complexes showed a semiconductor-like response, while the reaction centers displayed a diode-like behavior.
Also, preliminary results on fragments of the thylakoid membrane found in the chloroplasts of green plants are presented, showing the high-resolution obtainable with AFM.

Protein/Lipid Interactions: Peptides I

2061-Pos Board #B173
Interactions between transmembrane beta-amyloid(1-40) and phosphatidylcholine bilayers
Maurits R. R. de Planque[1], Gabriel P. Mendes[1,2], Sonia A. Contera[2], Dirk T. S. Rijkers[3], John F. Ryan[2], Anthony Watts[1].
[1]Department of Biochemistry, University of Oxford, Oxford, United Kingdom, [2]Bionanotechnology IRC, Department of Physics, University of Oxford, Oxford, United Kingdom, [3]Department of Medicinal Chemistry, Utrecht University, Utrecht, The Netherlands.
The β-amyloid peptides Aβ(1-40) and Aβ(1-42) have been extensively investigated because of their abundance in the fibrillar senile plaques associated with Alzheimer's disease. Although the formation and structure of amyloid fibrils are well characterized *in vitro*, it is still unresolved whether these fibrils themselves are neurotoxic or rather represent a plaque-deposited byproduct of the neurodegenerative process. Interestingly, soluble Aβ peptides can associate with (neuronal) cell membranes, leading either to surface-catalyzed aggregation or to membrane incorporation of the Aβ peptides, depending on membrane composition. Transmembrane Aβ peptides form high-conductance multimeric ion channels which fatally disrupt cellular cation homeostasis, indicating that the Aβ channels could contribute to the pathophysiology of Alzheimer's disease. Little is known about the transmembrane configuration of the Aβ peptides nor about the interplay between the Aβ channels and the lipid components of the membrane. Here, we report a systematic study on the effect of transmembranously incorporated Aβ(1-40) in phosphatidylcholine model membranes. Atomic force microscopy and planar bilayer recordings are used to image the Aβ channel topography and to confirm channel activity, while vesicles of the same lipid composition are used to characterize the effects on lipid acyl chain order and on vesicle morphology by solid-state ^{2}H and ^{31}P NMR. The data are compared with peptide-lipid interactions of other membrane-active peptides, which are extensively documented for phosphatidylcholine model systems.

2062-Pos Board #B174
MIMICKING BIOLOGICAL ENVIRONMENTS: AMYLOIDOGENIC PEPTIDE-BICELLE INTERACTION STUDIED BY NMR AND ELECTRON MICROSCOPY
Mercedes Cócera[1], Olga López[1], Josep Cladera[2], Jose Luis Parra[1], Alfonso de la Maza[1].
[1]I.I.Q.A.B.-C.S.I.C., Barcelona, Spain, [2]U.A.B., Barcelona, Spain.
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Bicelles are planar and bilayered nanostructrures formed by phospholipids dispersed in aqueous solution. These bilayered micelles of phospholipid may be used as membrane mimetics for structural studies in both the anisotropic and the isotropic phase.
In this work, nuclear magnetic resonance (NMR) and transmission electron microscopy (TEM) techniques have been used for increasing our knowledge about the peptide-bicelle interactions. In this sense, bicelles were prepared with appropriate mixtures of dimyristoylphosphatidylcholine (DMPC) and dihexanoylphosphatidylcholine (DHPC) containing beta-amyloide. Physico-chemical characterization of these systems by dynamic light scattering (DLS) and TEM showed bicelles with disk-like shapes and diameters around 50 nm. The insertion of the peptide was evaluated by NMR. Our results indicate that this peptide has the ability to orientate in the membrane. TEM micrographs of the systems confirmed this insertion, which did not seem to cause significant disruption in lipid packing of the bicelles.
Taking everything into account, the bicellar structures could be very useful to evaluate some aspects of the beta-amyloide-membrane interactions.

2063-Pos Board #B175
Insertion Study of Antimicrobial Peptide Mimicking Polymer, meta-Phenylene Ethynylenes, with Model Cell Membranes
Yuji Ishitsuka[1], Lachelle Arnt[2], Maria Ratajczak[1], Jaroslaw Majewski, PhD[3], Gregory Tew, PhD[2], Kristian Kjaer, PhD[4], Ka Yee C. Lee, PhD[1].
[1]Department of Chemistry, Institute for Biophysical Dynamics & James Franck Institute, The University of Chicago, Chicago, IL, USA, [2]University of Massachusetts, Amherst, Amherst, MA, USA, [3]Los Alamos National Laboratory, Los Alamos, NM, USA, [4]Risø National Laboratory, Roskilde, Denmark.
Antimicrobial peptides (AP) are a class of peptides that are innate to various organisms and function as a defense agent against harmful microorganisms. Characteristic chemical and structural properties of AP's allow selective interaction against invader cell membranes. Polymers based on meta-phenylene ethynylenes (PPE) were designed and synthesized to mimic amphiphilic, cationic and rigid structure of β-sheet AP's. The initial interactions between two different PPEs, PPE-590 (MW=590) and PPE-4770 (MW=4770), and model biomembranes were characterized using Langmuir surface balance constant pressure insertion technique. The zwitterionic lipid, dipalmitoylphosphatidylcholine (DPPC), and anionic lipid, dipalmitoylphosphatidylglycerol (DPPG), were used to model mammalian erythrocyte and bacterial membrane respectively. Our results quantified in relative area changes show both PPEs possess favorable interaction with DPPG monolayer, but differs in degree of selectivity. While PPE-590 still inserts into DPPC monolayer, we find a minimal disturbance of the monolayer by PPE-4770. Epifluorescence microscopy and grazing incidence x-ray diffraction shows that PPE molecules disorder lipid tail packing as they insert. Furthermore, X-ray reflectivity demonstrates that PPE molecules which strongly interact with the monolayer do indeed penetrate into the tail group region.

2064-Pos Board #B176
THE INTERACTION OF AMYLOID PEPTIDE AB40 WITH MODEL MEMBRANES OF VARYING DIHYDROCHOLESTEROL CONCENTRATION
Stephen M. Danauskas[1,2], Ka Yee C. Lee[1,2].
[1]Department of Chemistry, The University of Chicago, Chicago, IL, USA, [2]Institute for Biophysical Dynamics, James Franck Institute, Chicago, IL, USA.
AB40 is a 40 residue peptide that has been implicated in the pathogenesis of Alzheimer's disease (AD). Although a definitive etiology for AD has not been identified, the AB family of peptides has been implicated as a major causative factor in both age-related and familial cases of Alzheimer's disease as they are the major component of fibrillar deposits found *in vivo* in AD. In recent years, a growing body of research has indicated that an intermediate oligomeric form of AB may be a major cause of neural toxicity in AD. In this study we examine the interaction of monomeric and low molecular weight oligomeric AB40 with model membranes composed of a range of phospholipids mixed with varying amounts of dihydrocholesterol. In addition to mimicking the high level of cholesterol found in the cell membrane, high transition temperature lipids mixed with dihydrocholesterol exhibit a phase diagram indicative of a dihydrocholesterol/lipid complex. We explore the interaction of AB40 with this complex using Langmuir monolayers in conjunction with Brewster Angle