

PREFACE

The third international conference on Unsolved Problems of Noise and fluctuations in physics, biology, and high technology (UPoN'2002) took place at the National Institutes of Health in Bethesda (Washington, DC metro area) on September 3 – September 6, 2002. In order to promote the penetration of concepts and quantitative methods of the physics of fluctuations into biological sciences and medicine, the conference brought together scientists from physics, biophysics, biomedical engineering, biology, and medicine. The conference was sponsored by four NIH institutes: National Institute of Child Health and Human Development, National Institute of Mental Health, National Institute of Neurological Disorders and Stroke, and National Institute on Deafness and Other Communication Disorders.

The third of the series, this conference adhered to well established UPoN traditions including double-blind refereeing of all conference contributions. The first conference, pioneered by Laszlo Kish, held in Szeged, Hungary in 1996, was mostly devoted to high technology devices. The second one, organized by Derek Abbott, was held in Adelaide, Australia in 1999 and focused largely on mathematical aspects and paradoxes in noise and fluctuation research.

The purview of this third conference was shifted toward biology and medicine. Among the topics covered were: the constructive role of noise in the central nervous system, neuronal networks, and sensory transduction (hearing in humans, photo- and electroreception in marine animals), encoding of information into nerve pulse trains, single molecules and noise (including single molecule detection and characterization by nanopores – molecular 'Coulter counting'), concepts of noise in neurophysiology (randomness and order in brain and heart electrical activities under normal conditions and in pathology), the role of noise in genetic regulation and gene expression, biosensors, etc.

Judging by the participants' response and the number of 'thank you' letters, I infer that the conference was memorable, useful, and successful. I would like to thank the scientific directors of the four NIH institutes, Dr. Owen Rennert, Dr. Robert Desimone, Dr. Story Landis, and Dr. Robert Wenthold, for their vision and support that made this conference possible. I am also grateful to the members of the scientific committee for their valuable advice and help in peer review of the submitted contributions.

The compilation of papers that you hold in your hands reflects the spirit of the conference. As the conference itself did, this volume represents the best research in the field of noise and fluctuations in biologically relevant fields of science. I hope that for this reason it will be interesting to a wide and diverse audience of researchers around the world.

Sergey Bezrukov,
UPoN'2002 chair

Scientific Committee

Derek Abbott (*Adelaide University, Australia*)
Robert Austin (*Cornell University, USA*)
Dean Astumian (*University of Maine, USA*)
Gijs Bosman (*University of Florida, USA*)
Adi Bulsara (*SPAWAR Systems Center, USA*)
Jim Collins (*Boston University, USA*)
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Louis DeFelice (*Vanderbilt University, USA*)
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Peter Hanggi (*University of Augsburg, Germany*)
Laszlo Kish (*Texas A&M University, USA*)
Mikhail Levinshtein (*AF Ioffe Physical Technical Institute, Russia*)
Andre Longtin (*University of Ottawa, Canada*)
Peter McClintock (*University of Lancaster, England*)
Frank Moss (*University of Missouri, USA*)
Ralph Nossal (*National Institutes of Health, USA*)
Lino Reggiani (*University of Lecce, Italy*)
Barry Richmond (*National Institutes of Health, USA*)
Lutz Schimansky-Geier (*Humboldt University, Germany*)
Michael Shlesinger (*Office of Naval Research, USA*)
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Charles Stevens (*Salk Institute for Biological Studies, USA*)
Nico Van Kampen (*Institute of Theor. Physics, The Netherlands*)
Lode Vandamme (*University of Eindhoven, The Netherlands*)
Michael Weissman (*University of Illinois, USA*)
Kurt Wiesenfeld (*Georgia Institute of Technology, USA*)

Sponsors

National Institute of Child Health and Human Development,
Dr. Owen Rennert, Scientific Director

National Institute of Mental Health,
Dr. Robert Desimone, Scientific Director

National Institute of Neurological Disorders and Stroke,
Dr. Story Landis, Scientific Director

National Institute on Deafness and Other Communication Disorders,
Dr. Robert Wenthold, Scientific Director

List of Participants

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Abdulrahman Alfuraih, *George Washington University*
David Allingham, *University of Warwick, Coventry, UK*
Andrew Allison, *Adelaide University, Australia*
Dean Astumian, *University of Maine*
Sonya Bahar, *Weill-Cornell Medical College*
Gábor Balázs, *Northwestern University*
Alexander Berezhkovskii, *CIT, NIH*
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James Collins, *Boston University*
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Edmund Di Marzio, *NIST*
Mingzhou Ding, *Florida Atlantic University*
Charles Doering, *University of Michigan*
Mark Dykman, *Michigan State University*
Robert Eisenberg, *Rush Medical Center*
Jianfeng Feng, *Sussex University, UK*
Jordi Garcia-Ojalvo, *Technical University of Catalonia, Spain*
Oleg Gerashchenko, *St. Petersburg Nuclear Physics Institute, Russia*
Dirk Gillespie, *University of Miami School of Medicine*
Zoltan Gingl, *University of Szeged, Hungary*
Brage Golding, *Michigan State University*
Gabriel Gomila, *University of Barcelona, Spain*
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Ewa Gudowska-Nowak, *Smoluchowski Institute of Physics, Poland*
Michael Hoffmann, *University of Ulm, Germany*
Gerhard Hummer, *NIDDK, NIH*
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Plamen Ivanov, *Boston University*
Kuni Iwasa, *NIDCD, NIH*
Fernan Jaramillo, *Carleton College*
Jorge Jose, *Northeastern University*
Peter Jung, *Ohio University*
Frank Jülicher, *Max Planck Institute, Germany*
Ad. Kalmijn, *Scripps Institution of Oceanography*
John Kasianowicz, *NIST*
Laszlo Kish, *Texas A&M University*

Samuel Kou, *Harvard University*
Vladimir Kuznetsov, *NICHD, NIH*
Hans Liljenström, *Agora for Biosystems, Sweden*
Katja Lindenberg, *University of California*
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Andre Longtin, *University of Ottawa, Canada*
David Lubensky, *Bell Labs*
Dmitri Luchinskii, *Lancaster University, UK*
Riccardo Mannella, *University of Pisa, Italy*
Abraham Mara, *R.W. Johnson PRD*
Ognian Marinov, *McMaster University, Canada*
Jose Mateos, *Institute of Physics, Mexico*
Peter McClintock, *Lancaster University, UK*
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Jason Middleton, *University of Ottawa, Canada*
John Milton, *University of Chicago*
Toshio Mori, *Kyushu University, Japan*
Rob Morse, *Keele University, UK*
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M. Muthukumar, *University of Massachusetts*
Alexander Neiman, *University of Missouri*
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Jose Sancho, *University of Barcelona, Spain*
Lutz Schimansky-Geier, *Humboldt University, Germany*
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Michael Shlesinger, *Office of Naval Research*
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Alexander Smirnov, *NHLBI, NIH*
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Mark Spano, *Carderock Laboratory*
Eugene Stanley, *Boston University*
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Lawrence Ward, *University of British Columbia, Canada*
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Kurt Wiesenfeld, *Georgia Institute of Technology*
Stephen Winters-Hilt, *University of California*
Sunney Xie, *Harvard University*
Yoshi Yamamoto, *University of Tokyo, Japan*
Renat Yulmetyev, *Kazan State Pedagogical University, Russia*
Robert Zwanzig, *NIDDK, NIH*

Unsolved Problems of Noise: at the Frontiers of Research

Laszlo B. Kish¹

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The research of noise is going through a revolution. More and more scientists realize that the noise is not only a kind of rubbish that has to be removed from the signal but it also carries a vast amount of information and, in many cases of biology and physics, is functionally involved in the system operation. The trend can be well seen in Table 1. The relative portion of papers where noise(s) or fluctuation(s) keywords produce a hit in the SCI database has grown by almost a factor of six during the last decade. It is important to note that acoustical noise papers make up only about 10% of these numbers.

Year	Total Number of Papers (SCI)	Noise/Fluctuation Papers	Ratio
1970	314347	1066	0.3%
1980	554615	1722	0.3%
1990	689629	2221	0.3%
2001	999620	16550	1.7%

TABLE 1. Evolution of the field of noise and fluctuations

The UPoN conference at the National Institutes of Health was certainly the crowning of the UPoN idea and this conference series. This would not have been possible without the hard and meticulous work of the organizers, especially of Sergey Bezrukov. The selection and the quality of the presented papers made this meeting a unique one in the history of noise research.

¹ Until 1999, his family name was Kiss

It is an appropriate moment to cite the names of some great scientists in the history of noise and fluctuation research, such as James Maxwell and Ludwig Boltzmann (gas molecule velocity thermal noise in kinetic gas theory), Max Planck (thermal noise of electromagnetic field, the black body radiation), Albert Einstein (thermal noise of the velocity of small particles in a fluid, the Brownian motion; spontaneous and induced emission), and Claude Shannon (noise and bandwidth, the ultimate limitations of information transfer rate). All these scientists have realized and solved important unsolved problems of noise and, by doing that, catalyzed the development of the field to its present magnificent state.

I hope that we all join the effort so that the UPoN conference series will keep on evolving at the frontiers of scientific research.

Address on Behalf of the Committee

Derek Abbott

*Centre for Biomedical Engineering (CBME), EEE Dept.,
University of Adelaide, SA 5005, Australia*

I am delighted and honored to address so many distinguished researchers in the area of noise and fluctuations, here at the National Institutes of Health in Washington, DC.

In 1996, first UPoN conference, held in Szeged, Hungary, had a theme in the area of materials. In 1999, the second UPoN was held in Adelaide, Australia, and had a theme centered around fundamental issues in noise. Now in 2002, there is a strong theme on fluctuations in biological systems and thus is it highly appropriate that our host is the NIH.

The study of fluctuations is perhaps one of the most difficult areas of science to master, with many pitfalls for the unwary – it takes a rather special breed of scientist to boldly tackle the many subtleties and intricacies. But the rewards are great, because noise and fluctuations are so fundamental to all systems and crucial to understanding how the world operates at the microscopic level.

In this generation we are witnessing huge leaps in biophysics and biomedical engineering. We are moving into an age of bioinformatics. The study of noise and fluctuations in these systems is perhaps the most challenging and exciting – we are therefore honored that we have the splendid leadership of Sergey Bezrukov in chairing this meeting, as he is very much at the forefront and cutting edge of this field.

So, on behalf of the committee, I would like to extend our thanks to Sergey for his vision, his leadership and many late hours spent putting this conference together. He has truly put a superb program together – one that will surely make a lasting impact on the field for years to come.

The committee would also like to thank Laszlo Kish, the founder of the UPoN series, also for his tremendous vision and energy, who has made this conference series so popular and significant.

A special thanks is due to the hosting institution, the NIH, who have made available the splendid and stimulating setting for this conference.

Finally, last but not least, a many thanks must go to the speakers for coming here from distant parts of the world, bringing their enthusiasm and creativity for us all to learn.

Talks by Topics:

Constructive Role of Noise

1. **Open Questions for Suprathreshold Stochastic Resonance in Sensory Neural Models for Motion Detection Using Artificial Insect Vision**, M.D. McDonnell, D. Abbott.
2. **Intracellular Fluctuations**, J. Paulsson.
3. **Noise-induced Hypersensitivity and Stochastic Resonance: Can Living Systems Use Them At a Molecular Level?**, O.V. Gerashchenko, S.L. Ginzburg, M.A. Pustovoit.
4. **Stochastic Resonance, Brownian Ratchets and the Fokker-Planck Equation**, A. Allison, D. Abbott.
5. **Is Stochastic Resonance Just an Epiphenomenon?** L.M. Ward.
6. **Stochastic Synchronization: a Possible Phase-Transition?**, G. Balazsi, A. Ordemann, F. Moss.
7. **A Dynamical System Exhibits High Signal-to-Noise Ratio Gain by Stochastic Resonance**, Z. Gingl, P. Makra.
8. **Noise-Enhanced Signal Transmission: the Benefits of Communicating through Noisy Environments**, J. Garcia-Ojalvo.
9. **Subharmonic Stochastic Resonance: a Neural Mechanism for the Missing Fundamental Illusion and the Perception of Pitch**, D.R. Chialvo.
10. **The Constructive Role of Noise in Pattern Forming Chemical Systems**, J.M. Sancho, S. Alonso, F. Sagues.
11. **Stochastic Resonance with Delay and Traffic**, T. Ohira.

Sensory Systems

1. **Mathematical Modeling of Visual Transduction; Homogenization and Concentrated Capacity**, E. DiBenedetto.
2. **Noise in Hair Cells**, K.H. Iwasa, M. Ospeck.
3. **Enhanced Cochlear Implant Coding Using Noise**, R.P. Morse, N.G. Stocks, D. Allingham.
4. **Sensing Nature's Electric fields: Graded Positive Feedback in Ampullae of Lorenzini**, A.J. Kalmijn, S.M. Bezrukov.
5. **Sensing Nature's Electric Fields: Ion Channels as Active Elements of Signal Transduction**, S.M. Bezrukov, A.J. Kalmijn.
6. **Noise-Induced Transitions and Synchronization in Sensory Neurons**, A. Neiman, D.F. Russell.
7. **Do Noisy Oscillations in Sensory Receptors Have a Function?**, D.F. Russell, A. Neiman.
8. **Stochastic Synchronization and Signal Rectification in the Crayfish Caudal Photoreceptor**, S. Bahar, F. Moss.

Neurons and Neuronal Networks

1. **Driven by Inhibition**, J.V. Jose.
2. **Correlated Neuron Computation**, J. Feng.
3. **Can intrinsic fluctuations increase efficiency in neural information processing?**
H. Liljenstrom.

Central Nervous System

1. **The Human Brain Uses Noise**, T. Mori, S. Kai.
2. **Noise-Induced Sensitization of Human Brain**, Y. Yamamoto.
3. **Development of Demand-Controlled Deep Brain Stimulation Techniques Based on Stochastic Phase Resetting**, P.A. Tass.
4. **Delays, Scaling and the Acquisition of Motor Skill**, J.L. Cabrera, J. Milton.

Ion Channels and Motors

1. **Turning a Poor Ion Channel into a Good Pump**, R.D. Astumian.
2. **Carbon Nanotubes as Molecular Channels**, G. Hummer.
3. **Origins of $1/f^\alpha$ Noise in Membrane Channel Currents**, Z. Siwy, A. Fulinski.
4. **Receptor and Ion Channel Clustering**, P. Jung, J.W. Shuai.
5. **Motor Rumbles: Characterization of Adaptation Motors in Saccular Hair Cells by Noise Analysis**, V. Markin, F. Jaramillo.
6. **The Noisy Steps of a Motor Protein**, M. Bier.
7. **Collective Motions in Ion Channels and Lipid Bilayers: a Possible Link to Noise in Single-Channel Measurements?** P. Tieleman.
8. **Hysteresis in Channel Gating**, P. Bennekou, P. Christophersen, H. Flyvbjerg, E. Gudowska-Nowak.
9. **A PDE Formulation of Non-Equilibrium Statistical Mechanics for Ionic Permeation**, A. Singer, Z. Schuss.

Single Molecules

1. **Single Molecule Enzymatic and Conformational Dynamics**, S. Xie.
2. **Unzipping DNA: From Pores to Pulling and Back Again**, D. Lubensky.
3. **Polymer Translocation through a Narrow Pore**, Z. Konkoli, T. Ambjornsson, S.P. Apell, J.J. Kasianowicz, E. Di-Marzio.
4. **Highly Accurate Real-time Classification of Watson-Crick Base-Pairs on Termini of Single DNA Molecules**, S. Winters-Hilt.

Genetics and Gene Expression

1. **Stochastic Growth of Proteome Complexity due to Evolution**, V.A. Kuznetsov.

Noise and Noise Analysis in Medical Applications

1. **Statistical Physics Applied to Human Heartbeat Dynamics**, H. E. Stanley, L. A. N. Amaral, Y. Ashkenazy, P. Bernaola-Galv'an, A. Bunde, Z. Chen, A. L. Goldberger, K. Hu, P. Ch. Ivanov, J. W. Kantelhardt, E. Koscielny-Bunde, C.-K. Pengj, T. Penzel, M. G. Rosenblum, V. Schulte-Frohlinde, Z. Struzik.
2. **Cardiovascular Dynamics – Multiple Time Scales, Oscillations and Noise**, A. Stefanovska, A. Bandrivskyy, P.V.E. McClintock.
3. **Noise-Induced Surfactant Therapy**, B. Suki, S. Arold, A.M. Alencar, K.R. Lutchen, E.P. Ingenito.
4. **Noise and Fluctuations in Biological and Physical Discrete Stochastic Systems with Long-Range Correlations**, R. Yulmetyev, P. Hanggi, F. Gafarov.

Nonlinear Dynamics

1. **Drastic Reduction of the Activation Barrier by a Moderately Weak Periodic Driving**, S.M. Soskin, R. Mannella, A.N. Silchenko, M. Arrayas.
2. **Memory Effects in Stochastic Neurodynamical Systems**, A. Longtin, M. Chacron, B. Lindner, J. Middleton, R. Morse.
3. **Noise and Fluctuations in Excitable Units**, L. Schimansky-Geier.
4. **Fluctuational Escape from Chaotic Attractors**, I.A. Khovanov, D.G. Luchinsky, R. Mannella, P.V.E. McClintock, A.N. Silchenko.
5. **Singularities in Far-from-Equilibrium Distributions at Finite Noise Intensities**, A. Bandrivskyy, S. Beri, D.G. Luchinsky, P.V.E. McClintock.

Materials, Devices

1. **Designing Proteins**, M.F. Shlesinger, A.J. Mandell and K.A. Selz.
2. **Origins of Non-Gaussian Noise in Metallic Manganites**, M.B. Weissman, A. Palanisami, J.N. Eckstein.
3. **Thermal (Noise) Death of Moore's Law?**, L.B. Kish.
4. **Steady State of Random Resistor Networks under Biased Percolation: A Framework for Noise and Conduction in Disordered Materials?** C. Pennetta, E. Alfinito, L. Reggiani.
5. **Instability of the Noise Level in Polymer FETs with Non-Stationary Mobility**, O. Marinov, M.J. Deen, J. Yu, G. Vamvounis, S. Holdcroft, W. Woods.
6. **Monte Carlo Simulation of Noise in Electronic Devices: Limitations and Perspectives**, T. Gonzalez, J. Mateos, M.J. Martin-Martinez, S. Perez, R. Rengel, B.G. Vasallo, D. Pardo.
7. **Monte Carlo Simulations of Electronic Noise under Large-Signal Operation**, E. Starikov, P. Shiktorov, V. Gruzinskis, S. Perez, T. Gonzalez, L. Reggiani, L. Varani, J.C. Vaissiere.
8. **To Be or Not to Be a Source of Shot Noise: an Open Problem of Generation-Recombination Noise**, G. Gomila, L. Reggiani.
9. **Shot Noise as a Tool to Probe Microscopic Interactions**, G. Gomila.

Waves, Hydrodynamics, and Mechanics

1. **Noisy Wavefront Propagation in the Fisher-Kolmogorov-Petrovsky-Piscounov Equation**, C.R. Doering.
2. **Synthetizing Hydrodynamic Turbulence from Noise: Formalism and Applications to Plankton Dynamics**, F. Sagues, R. Reigada, J.M. Sancho.
3. **Surprising Aspects of Fluctuating “Pulled” Fronts**, D. Panja.

General Theory and Experiment

1. **Forces and Fluctuations: Rethinking the Meaning of Mean**, V.A. Parsegian.
2. **Stochasticity in Polymer Dynamics**, Muthu Muthukumar.
3. **First Passage Times for Systems Driven by Long Range Gaussian Noise**, K. Lindenberg, A. H. Romero, J.M. Sancho.
4. **Universality of Escape from a Modulated Potential Well**, M.I. Dykman, B. Golding.
5. **System Size Resonance in Coupled Noisy Systems and in the Ising Model**, A. Pikovsky, A. Zaikin, M.A. de la Casa.
6. **Walking Without a Pattern Generator**, J.L. Mateos, A. Neiman, F. Moss.
7. **On the Amplitude and Time-Structure Properties of $1/f^\alpha$ Noises**, Z. Gingl, R. Mingesz, P. Makra.
8. **Can Quantum Regression Theorem be Reconciled with Quantum Fluctuation Dissipation Theorem?**, P. Shiktorov, E. Starikov, V. Gruzinskis, L. Reggiani.
9. **Metal-Insulator Transition in One-Dimensional Disordered Binary Solids with Long-Range Correlations: Applications to DNA**, P. Carpena, P. Benaola-Galvan, P.Ch. Ivanov.
10. **Excess Noise in the Output of Linear Fluctuating Systems**, M.H.W. Hoffmann.

**Unsolved Problems of Noise and fluctuations in physics, biology, and
high technology (UPoN'02), September 3 – September 6, 2002
NIH campus, Natcher Building (Bldg. 45)**

September 3 (DAY 1, Single-session mode, Room E1+E2)

8:30 am Registration and Coffee
9:00 am Opening Addresses
9:30 am **Forces and Fluctuations: Nourished by Noise**, V.A. Parsegian

Constructive Role of Noise I (Sergey Bezrukov, chair)

10:00 am **Stochastic Resonance in Human and Animal Perception**, F. Moss
10:30 am Coffee Break
11:00 am **Can Noise Provide a Functional Benefit to Humans?** J.J. Collins
11:30 am **Intracellular Fluctuations**, J. Paulsson
12:00 pm **Subharmonic Stochastic Resonance: a Neural Mechanism for the Missing
Fundamental Illusion and the Perception of Pitch**, D.R. Chialvo
12:30 pm Lunch Break

Materials and Devices I (Derek Abbott, chair)

1:30 pm **Designing Proteins**, M.F. Shlesinger, A.J. Mandell, K.A. Selz
2:00 pm **Origins of Non-Gaussian Noise in Metallic Manganites**, M.B. Weissman, A.
Palanisami, J.N. Eckstein
2:30 pm **Thermal (Noise) Death of Moore's Law?**, L.B. Kish
3:00 pm Coffee Break

Sensory Systems I (Kurt Wiesenfeld, chair)

3:30 pm **Enhanced Cochlear Implant Coding Using Noise**, R.P. Morse, N.G. Stocks,
D.Allingham
4:00 pm **The Possible Role of Suprathreshold Stochastic Resonance in Neural Coding
with Applications to Cochlear Implants**, N.G. Stocks, D. Allingham, R.P. Morse,
A.P. Nikitin
4:30 pm **Noise-Induced Transitions and Synchronization in Sensory Neurons**, A.
Neiman, D.F. Russell

Waves, Hydrodynamics, and Mechanics I (Katja Lindenberg, chair)

5:00 pm **Noisy Wavefront Propagation in the Fisher-Kolmogorov-Petrovsky-Piscounov
Equation**, C.R. Doering
5:30 pm Adjourn

September 4 (DAY 2, Parallel-session mode, Room E1)

- 8:30 am Coffee
- Sensory Systems II (Nigel Stocks, chair)
- 9:00 am **Do Noisy Oscillations in Sensory Receptors Have a Function?**, D.F. Russell, A. Neiman
- 9:30 am **Motor Rumbings: Characterization of Adaptation Motors in Saccular Hair Cells by Noise Analysis**, V. Markin, F. Jaramillo
- 10:00 am **Noise in Hair Cells**, K.H. Iwasa, M. Ospeck
- 10:30 am Coffee Break
- 11:00 am **Sensing Nature's Electric fields: Graded Positive Feedback in Ampullae of Lorenzini**, A.J. Kalmijn, S.M. Bezrukov
- 11:30 am **Sensing Nature's Electric Fields: Ion Channels as Active Elements of Signal Transduction**, S.M. Bezrukov, A.J. Kalmijn
- Constructive Role of Noise II (Michael Shlesinger, chair)
- 11:50 am **Noise-Enhanced Signal Transmission: the Benefits of Communicating through Noisy Environments**, J. Garcia-Ojalvo
- 12:10 pm **A Dynamical System Exhibits High Signal-to-Noise Ratio Gain by Stochastic Resonance**, Z. Gingl, P. Makra
- 12:30 pm Lunch Break
- 1:30 pm **The Constructive Role of Noise in Pattern Forming Chemical Systems**, J.M. Sancho, S. Alonso, F. Sagues
- 2:00 pm **Noise-induced Hypersensitivity and Stochastic Resonance: Can Living Systems Use Them at a Molecular Level?**, O.V. Gerashchenko, S.L. Ginzburg, M.A. Pustovoit
- 2:30 pm **Stochastic Synchronization: a Possible Phase-Transition?**, G. Balazsi, A. Ordemann, F. Moss
- 3:00 pm **Open Questions for Suprathreshold Stochastic Resonance in Sensory Neural Models for Motion Detection Using Artificial Insect Vision**, M.D. McDonnell, D. Abbott
- 3:30 pm Coffee Break
- 4:00 pm **Stochastic Resonance, Brownian Ratchets and the Fokker-Planck Equation**, A. Allison, D. Abbott
- Materials and Devices II (Lino Reggiani, chair)
- 4:30 pm **Steady State of Random Resistor Networks under Biased Percolation: A Framework for Noise and Conduction in Disordered Materials?** C. Pennetta, E. Alfinito, L. Reggiani
- 5:00 pm **Shot Noise as a Tool to Probe Microscopic Interactions**, G. Gomila
- 5:30 pm Adjourn

September 4 (DAY 2, Parallel-session mode, Room E2)

- 8:30 am Coffee
- General Theory and Experiment I (Peter McClintock, chair)
- 9:00 am **First Passage Times for Systems Driven by Long Range Gaussian Noise**, K. Lindenberg, A. H. Romero, J.M. Sancho
- 9:30 am **Universality of Escape from a Modulated Potential Well**, M.I. Dykman, B. Golding
- 10:00 am **System Size Resonance in Coupled Noisy Systems and in the Ising Model**, A. Pikovsky, A. Zaikin, M.A. de la Casa
- 10:30 am Coffee Break
- 11:00 am **Can Quantum Regression Theorem be Reconciled with Quantum Fluctuation Dissipation Theorem?**, P. Shiktorov, E. Starikov, V. Gruzinskis, L. Reggiani
- 11:30 am **Metal-Insulator Transition in One-Dimensional Disordered Binary Solids with Long-Range Correlations: Applications to DNA**, P. Carpena, P. Benaola-Galvan, P.Ch. Ivanov
- 11:50 am **Direct Observation of Molecular Cooperativity near the Glass Transition**, E.V. Russell, N.E. Israeloff
- 12:10 pm **Monte Carlo Simulations of Electronic Noise under Large-Signal Operation**, E. Starikov, P. Shiktorov, V. Gruzinskis, S. Perez, T. Gonzalez, L. Reggiani, L. Varani, J.C. Vaissiere
- 12:30 pm Lunch Break
- Waves, Hydrodynamics, and Mechanics II (Lutz Schimansky-Geier, chair)
- 1:30 pm **Spontaneous Oscillations and Fluctuations at the Cellular Scale**, F. Julicher
- 2:00 pm **About *Daphnia* Circling in a Light Field and Their Bimodal Distribution of Turning Angle Between Successive Moves**, A. Ordemann, G. Balazsi, F. Moss
- 2:30 pm **Synthesizing Hydrodynamic Turbulence from Noise: Formalism and Applications to Plankton Dynamics**, F. Sagues, R. Reigada, J.M. Sancho
- 2:50 pm **Surprising Aspects of Fluctuating “Pulled” Fronts**, D. Panja
- Single Molecules I (David Lubensky, chair)
- 3:10 pm **Highly Accurate Real-Time Classification of Watson-Crick Base-Pairs on Termini of Single DNA Molecules**, S. Winters-Hilt
- 3:30 pm Coffee Break
- 4:00 pm **Deducing molecular information from DNA-induced single channel current blockades**, J.J. Kasianowicz, V. Stanford
- 4:30 pm **Polymer Translocation through a Narrow Pore**, Z. Konkoli, T. Ambjornsson, S.P. Apell, J.J. Kasianowicz, E. Di-Marzio
- Ion Channels and Motors I (Dean Astumian, chair)
- 5:00 pm **A PDE Formulation of Non-Equilibrium Statistical Mechanics for Ionic Permeation**, A. Singer, Z. Schuss
- 5:20 pm **Hysteresis in Channel Gating**, P. Bennekou, P.Christophersen, H. Flybjerg, E. Gudowska-Nowak
- 5:40 Adjourn

September 5 (DAY 3, Parallel-session mode, Room E1)

8:30 am Coffee

Central Nervous System (David Russell, chair)

9:00 am **Delays, Scaling and the Acquisition of Motor Skill**, J.L. Cabrera, J. Milton

9:30 am **Development of Demand-Controlled Deep Brain Stimulation Techniques Based on Stochastic Phase Resetting**, P.A. Tass

10:00 am **Noise-Induced Sensitization of Human Brain**, Y. Yamamoto

10:30 am Coffee Break

11:00 am **The Human Brain Uses Noise**, T. Mori, S. Kai

11:30 am **Can Intrinsic Fluctuations Increase Efficiency in Neural Information Processing?** H. Liljenstrom

Neurons and Neuronal Networks (Andre Longtin, chair)

12:00 pm **Stochastic Synchronization and Signal Rectification in the Crayfish Caudal Photoreceptor**, S. Bahar, F. Moss

12:30 pm Lunch Break

1:30 pm **Driven by Inhibition**, J.V. Jose

2:00 pm **Correlated Neuron Computation**, J. Feng

2:20 pm **A Novel Mechanism for Irregular Firing of a Neuron in Response to Periodic Stimulation**, J.R. Clay

Genetics and Gene Expression (Ralph Nossal, chair)

2:40 pm **Regulation of Noise in Gene Expression**, M. Thattai, A. van Oudenaarden

3:10 pm **Stochastic Growth of Proteome Complexity due to Evolution**, V.A. Kuznetsov

3:30 pm Coffee Break

Ion Channels and Motors II (Peter Jung, chair)

4:00 pm **Collective Motions in Ion Channels and Lipid Bilayers: a Possible Link to Noise in Single-Channel Measurements?** P. Tieleman

4:20 pm **Ion Channels as Natural Nanodevices**, R.S. Eisenberg

Constructive Role of Noise III (Derek Abbott, chair)

4:50 pm **Is Stochastic Resonance Just an Epiphenomenon?** L.M. Ward.

5:20 pm **Stochastic Resonance with Delay and Traffic**, T. Ohira

5:40 pm Adjourn

September 5 (DAY 3, Parallel-session mode, Room E2)

8:30 am Coffee

Nonlinear Dynamics (Alexander Neiman, chair)

9:00 am **Memory Effects in Stochastic Neurodynamical Systems**, A. Longtin, M. Chacron, B. Lindner, J. Middleton, R. Morse

9:30 am **Fluctuational Escape from Chaotic Attractors**, I.A. Khovanov, D.G. Luchinsky, R. Mannella, P.V.E. McClintock, A.N. Silchenko

10:00 am **Singularities in Far-from-Equilibrium Distributions at Finite Noise Intensities**, A. Bandrivskyy, S. Beri, D.G. Luchinsky, P.V.E. McClintock

10:30 am Coffee Break

11:00 am **Noise and Fluctuations in Excitable Units**, L. Schimansky-Geier

11:30 am **Stability Enhanced by Noise in Nonlinear Systems with Metastable States**, B. Spagnolo, A.A. Dubkov, N.V. Agudov

12:00 pm **Drastic Reduction of the Activation Barrier by a Moderately Weak Periodic Driving**, S.M. Soskin, R. Mannella, A.N. Silchenko, M. Arrayas

12:30 pm Lunch Break

Noise and Noise Analysis in Medical Applications (Frank Moss, chair)

1:30 pm **Statistical Physics Applied to Human Heartbeat Dynamics**, H. E. Stanley et al.

2:00 pm **Cardiovascular Dynamics – Multiple Time Scales, Oscillations and Noise**, A. Stefanovska, A. Bandrivskyy, P.V.E. McClintock

2:30 pm **Some Unsolved Problems in Neural Data Analysis**, M. Ding

3:00 pm **Noise-Induced Surfactant Therapy**, B. Suki, S. Arold, A.M. Alencar, K.R. Lutchén, E.P. Ingenito

3:30 pm Coffee Break

4:00 pm **Noise and Fluctuations in Biological and Physical Discrete Stochastic Systems with Long-Range Correlations**, R. Yulmetyev, P. Hanggi, F. Gafarov

Materials and Devices III (Laszlo Kish, chair)

4:20 pm **To Be or Not to Be a Source of Shot Noise: an Open Problem of Generation-Recombination Noise**, G. Gomila, L. Reggiani

4:50 pm **Instability of the Noise Level in Polymer FETs with Non-Stationary Mobility**, O. Marinov, M.J. Deen, J. Yu, G. Vamvounis, S. Holdcroft, W. Woods

5:10 pm **Monte Carlo Simulation of Noise in Electronic Devices: Limitations and Perspectives**, T. Gonzalez, J. Mateos, M.J. Martin-Martinez, S. Perez, R. Rengel, B.G. Vasallo, D. Pardo

5:40 pm **Excess Noise in the Output of Linear Fluctuating Systems**, M.H.W. Hoffmann

6:00 pm Adjourn

September 6 (DAY 4, Single-session mode, Room E1+E2)

8:30 am Coffee

Ion Channels and Motors III (Robert Eisenberg, chair)

9:00 am **Turning a Poor Ion Channel into a Good Pump**, R.D. Astumian

9:30 am **Carbon Nanotubes as Molecular Channels**, G. Hummer

10:00 am **Origins of $1/f^\alpha$ Noise in Membrane Channel Currents**, Z. Siwy, A. Fulinski

10:30 am Coffee Break

11:00 am **Receptor and Ion Channel Clustering**, P. Jung, J.W. Shuai

11:30 am **The Noisy Steps of a Motor Protein**, M. Bier

Sensory Systems III (Mark Spano, chair)

12:00 pm **Mathematical Modeling of Visual Transduction; Homogenization and Concentrated Capacity**, E. DiBenedetto

12:30 pm Lunch Break

Single Molecules II (Sergey Bezrukov, chair)

1:30 pm **Single Molecule Enzymatic and Conformational Dynamics**, S. Xie

2:00 pm **Entropic Barrier Theory and Modelling of DNA Translocation through Protein Channels**, M. Muthukumar, C.Y. Kong

2:30 pm **Statistical Analysis of Single Molecule Experiments**, Samuel Kou

3:00 pm Coffee Break

3:30 pm **Unzipping DNA: From Pores to Pulling and Back Again**, D. Lubensky

General Theory and Experiment II (Alexander Berezhkovskii, chair)

4:00 pm **Adiabatic Elimination and Rate Description**, P. Talkner

4:30 pm **Walking Without a Pattern Generator**, J.L. Mateos, A. Neiman, F. Moss

5:00 pm **On the Amplitude and Time-Structure Properties of $1/f^\alpha$ Noises**, Z. Gingl, R. Mingesz, P. Makra

5:30 pm Adjourn