

CURRICULUM VITAE

Lester Ingber



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Upon request, a full CV with personal references and recent compensation history can be provided as a URL to a file under <http://www.ingber.com/private/> .

Brief Summary

Professional Experience

- Over 100 publications
- Lester Ingber Research (LIR), Interdisciplinary Research/Consulting 1989-
- DUNN Capital Management, Stuart FL, Director R&D 2002-2003
- DRW Trading, Chicago IL, Director R&D 1997-2001
- George Washington University, Research Professor of Mathematics 1989-1990
- National Research Council, Senior Research Associate 1989
- US Army Concepts Analysis Agency, Guest Professor 1989
- Naval Postgraduate School, Professor of Physics 1986-1989
- National Research Council, Senior Research Associate 1985-1986
- Physical Studies Institute, President Nonprofit Corp. 1970-1986
- UC San Diego, Asst. Research Physicist 1970-1972
- State University New York at Stony Brook, Asst. Professor of Physics 1969-1970

Education

- National Science Foundation Postdoc, UC Berkeley and UC Los Angeles 1967-1969
- University of California San Diego, Ph.D. 1966, Theoretical Nuclear Physics
- California Institute of Technology, B.S. 1962, Physics
- Brooklyn Technical High School, Diploma 1958

Published Expertise

- Statistical Mechanics of Financial Markets — Options, Bond Futures, Trading Systems, Risk
- Statistical Mechanics of Neocortical Interactions — Short-Term Memory and EEG
- Statistical Mechanics of Combat — Baselined Simulations to Exercise Data
- Stochastic Algorithms — Simulated Annealing Optimization and Path Integration
- Theoretical Nuclear Physics — Nucleon-Nucleon Scattering, Nuclear Matter, Neutron Stars
- Teaching Methodologies — Private School Developed High-School and College Curricula
- Physics of Karate — Teaching Methodology Leading to 8th-Dan Black Belt

Positions

2003-	Lester Ingber Research	R&D
2002-2003	DUNN Capital Mgmt, Stuart FL	Director R&D
1997-2001	DRW, Chicago	Director R&D
1989-1997	Lester Ingber Research	R&D
1989-1990	George Washington University Dept of Mathematics, DC	Research Professor
1989	Naval Ocean Systems Center San Diego, CA	NRC ^{*1} Senior Research Assoc
1989	USA Concepts Analysis Agency Bethesda, MD	Guest Professor Extended Temporary Duty
1986-1989	NPS Physics Dept GS-15 Step 10 Equiv.	Professor of Physics
1986-1988	ANSER (Nonprofit Lab) Arlington, VA	Consultant
1985-1986	Naval Postgraduate School (NPS) Monterey, CA	NRC ^{*1} Senior Research Assoc
1980-1986	UC San Diego, IPAPS	Research Associate
1972-1978	Physical Studies Institute	Director Alternative School
1970-1978	Physical Studies Institute San Diego, CA	President
1972-1974	UC San Diego, Music Dept	Research Associate
1972-1973	UC San Diego Extension	Director, Learning to Learn
1970-1972	UC San Diego, Physics Dept Institute for Pure & Applied Physical Sciences (IPAPS)	Asst. Research Physicist
1969-1970	SU New York Stony Brook Physics Department	Asst. Professor
1968-1969	UC Los Angeles, Physics Dept	NSF ^{*2} Postdoctoral Fellow
1967-1968	UC Berkeley, Physics Dept	NSF ^{*2} Postdoctoral Fellow Lecturer
1965-1966	RAND Corp., Santa Monica	Consultant
1962-1966	UC San Diego, Physics Dept Niels Bohr Institute	Research Assistant
1960-1962	Caltech	Research Asst.: Metallurgy
1961-1962	Caltech	Grader: Mathematical Physics (graduate)
1960-1961	Caltech	Grader: Algebra (undergraduate)

^{*1} NRC: National Research Council of the National Academy of Sciences

^{*2} NSF: National Science Foundation

SCIENTIFIC PURSUITS. Lester Ingber has published approximately 100 papers and books in the categories of: theoretical nuclear physics, neuroscience, finance, general optimization, combat analysis, karate, and education. Through Lester Ingber Research (LIR) he develops and consults on projects documented in the <http://www.ingber.com/> archive. **NUCLEAR PHYSICS:** From 1965-1972 he published in atomic, nuclear, astro-, and elementary particle physics. His major work was to develop a nucleon-nucleon interaction described by exchanged mesons, and to apply this interaction to calculate properties of nucleon-nucleon scattering, the deuteron, nuclear matter, and neutron stars. In 1983-1986 he used modern methods of nonlinear functional analysis developed in the late 1970's to discover contributions induced by velocity-dependent potentials to nuclear matter binding energies. **NEUROSCIENCE:** Since 1978 he has developed a statistical mechanics of neocortical interactions applicable to a broad range of spatial and temporal scales, using modern methods of nonlinear nonequilibrium statistical mechanics to calculate brain 'observables' from neuronal dynamics, e.g., short-term memory and EEG analyses. His 1983 *Physical Review* paper was the first paper accepted on the brain in this premier physics journal. **FINANCE:** Since 1980 he has developed a statistical mechanics approach to financial markets, e.g., to multivariable term structure and stochastic markets. His 1990 *Physical Review* paper was the first paper accepted on finance in this premier physics journal. From 1997-2001, as Director R&D at DRW in Chicago, he led a team developing multi-factor nonlinear stochastic models of markets. From 2002-2003 he was Director R&D at DUNN Capital Management in Stuart FL, developing risk-management algorithms. **OPTIMIZATION/MODELING:** Since 1987 he has developed Adaptive Simulated Annealing (ASA), one of the most powerful optimization algorithms for nonlinear and stochastic systems, working with thousands of users. Other codes have been developed to model multivariate nonlinear stochastic systems. In 1994-1995, as principal investigator (PI) of an NSF Supercomputer grant, he ported his ASA and PATHINT codes onto parallel supercomputers. **COMBAT SIMULATION:** From 1986-1989, as PI of an Army contract, he applied these methods of mathematical physics, leading a team of scientists and officers to develop mathematical comparisons of Janus computer combat simulations with exercise data from the National Training Center (NTC), developing a testable theory of combat successfully baselined to empirical data.

EDUCATION AND POSITIONS. He received: his diploma from Brooklyn Technical High School in 1958; his B.S. in physics from Caltech in 1962; his Ph.D. in theoretical nuclear physics from UC San Diego in 1966, having studied at the Niels Bohr Institute in 1964, and having consulted at RAND in 1965-1966. He was a National Science Foundation Postdoctoral Fellow at UC Berkeley in 1967-1968 and at UC Los Angeles in 1968-1969, an Assistant Professor in physics at SUNY at Stony Brook from 1969-1970, and a research physicist in the Physics department and in the Institute for Pure and Applied Physical Sciences (IPAPS) at UC San Diego from 1970-1972. From 1970-1986 he was President of Physical Studies Institute (PSI), a nonprofit corporation he founded in 1970, which was an agency account in IPAPS from 1980-1986. From 1970-1972 he developed teaching methodologies for academics and fine arts, instructing in and administrating a six-course program through UC San Diego Extension. From 1972-1978, though PSI, he founded, funded, and instructed in an experimental alternative high school offering 30+ courses in academics, fine arts, and physical disciplines. He was a Research Associate at UC San Diego in the Music department from 1972-1974 and in IPAPS from 1980-1986. He was awarded a Senior Research Associateship for 1985-1986 by the National Research Council (NRC) of the National Academy of Sciences, taken at the Naval Postgraduate School (NPS) in Monterey, CA. From 1986-1989 he was Professor of Physics at NPS at a GS-15 Step 10 equivalent position. In March 1988 he was officially offered a Senior Executive Service (SES) appointment as Assistant Director of the Joint Tactical C³ Agency (JTC3A); he declined to complete his projects. From February through June 1989 he was on extended temporary duty at US Army Concepts Analysis Agency (CAA) in Bethesda, MD. In 1989 He won a second NRC Senior Research Associateship, taken at the Naval Ocean Systems Center (NOSC) in San Diego. From 1989-1990 he was Research Professor of Mathematics at The George Washington University (GWU), D.C. From 1989-1997, through Lester Ingber Research (LIR), he consulted on projects in his fields of expertise. From 1997-2001 he was Director of Research and Development at DRW, a trading firm in Chicago, IL. From 2002-2003 he was Director R&D at DUNN Capital Management in Stuart FL. Currently, through LIR, he conducts research in selected interdisciplinary projects.

OTHER PURSUITS. KARATE: From 1958-1988 he founded and instructed karate classes at: Caltech, UC Berkeley, UC Los Angeles, SU New York at Stony Brook, UC San Diego, PSI, and NPS. He has developed and published in several textbooks techniques promoting the learning of attentional skills in parallel with a physics approach to the learning of traditional physical skills. He received his black belt in karate in 1961 and became the first Westerner to receive the Instructor's degree from the Japan Karate Association in 1968. Now he is an 8th Dan black belt. From 1989-1991 he was Director of Scientific Studies of the American JKA Karate Associations (AJKA). **MARRIED:** Since 1976 he and his spouse Louise Ingber [<http://www.ingber.com/louise>] have been partners in several projects, including running a ballet company and karate studio (1976-1985).

Professional Experience

As documented on <http://www.ingber.com>, from 1970-1986 through Physical Studies Institute (PSI), and since 1989 through Lester Ingber Research (LIR), I have done independent research on various projects intermittently between positions I have held in academia, government and business.

LIR Projects and Interdisciplinary Research 2003-

Through Lester Ingber Research (LIR), I continue to pursue research and consult in several disciplines in which I have gained expertise over several decades. The total number of publications in these fields is over one hundred.

I continue my research in statistical mechanics of multivariate nonlinear systems, which have included: Statistical Mechanics of Neocortical Interactions (SMNI), Statistical Mechanics of Combat (SMC), Statistical Mechanics of Financial Markets (SMFM), Trading in Risk Dimensions (TRD), and Statistical Mechanical Numerical Tools such as my optimization algorithm Adaptive Simulated Annealing (ASA), and path-integral algorithms PATHTREE and PATHINT.

A current project is Ideas by Statistical Mechanics (ISM) described in http://www.ingber.com/smni06_ism.pdf (published in 2007 & 2008 — see Publications). ISM is a generic program to model evolution and propagation of ideas/patterns throughout populations subjected to endogenous and exogenous interactions. The program is based my work in SMNI, using my ASA code for optimizations of training sets, as well as for importance-sampling to apply my TRD copula financial risk-management codes for assessments of risk and uncertainty. These tools process correlated multivariate systems with differing non-Gaussian distributions. Marginal distributions are evolved to determine their expected duration and stability using my PATHTREE and PATHINT codes. This product can be used for decision support for projects ranging from diplomatic, information, military, and economic (DIME) factors of propagation/evolution of ideas, to commercial sales, trading indicators across sectors of financial markets, advertising and political campaigns, etc.

These tools also are being applied to price complex projects as financial options with alternative schedules and strategies. PATHTREE processes real-world options, including nonlinear distributions and time-dependent starting and stopping of sub-projects, with parameters of shapes of distributions fit using ASA to optimize cost and duration of sub-projects. A project, Real Options for Project Schedules (ROPS), is described in http://www.ingber.com/markets07_rops.pdf (to be published in 2009 — see Publications).

Often I collaborate via the internet on such projects. Summaries are usually updated in http://www.ingber.com/ingber_projects.html. I continue to answer short technical queries on my publications and codes at no charge. I still maintain and update my ASA code, available at no charge from my archive <http://www.ingber.com> (mirrored at <http://alumni.caltech.edu/~ingber>). Another ASA mirror is at <http://asa-caltech.sourceforge.net>.

I regularly put aside time for anonymous or signed reviews, usually a few per month. Most of my reviews for journals or scientific agencies are of interdisciplinary subjects since my own interests have led me through a few interdisciplinary projects. Such reviews often have a different nature than reviews in relatively well-established disciplines where expert opinions can be considered definitive.

I continue to educate people on the art and science of karate. I am an 8th Dan black belt. My three karate text books and other files are available at no charge on my internet archive. I am a co-signer for Dan Certificates for the International Alliance for Shotokan Karate.

DUNN Capital Management Director Research & Development 2002-2003

From January 2002 to June 2003, I was Director R&D at DUNN Capital Management, then a \$billion hedge fund in Stuart FL. Their contract included a non-compete agreement expiring 1 December 2004. I developed state of the art copula risk-management algorithms and worked with others to enhance and perform due diligence on trading models.

DRW Director Research & Development 1997-2001

From July 1997 to December 2001, I was Director R&D at DRW, a Chicago-based proprietary trading firm. Although all projects, initiated by agreement with or requested by traders, were brought to proper focus and completion, most of our products were not implemented as the company quickly expanded five-fold. Projects included: (a) Developing my previously published PATHINT numerical algorithms, and a novel fast tree algorithm motivated by PATHINT, PATHTREE, to process new multivariate nonlinear generalizations of currently used options models. (b) Modeling indexes and options on indexes and baskets of their components, including risk scenarios and dynamic balancing of portfolios using my published Adaptive Simulated Annealing (ASA) code (an importance-sampling optimization algorithm). (c) Developing an optimized inter-minute computerized trading system, based on my published studies using Canonical Momenta Indicators (CMI). (d) Modeling US and German Cheapest-To-Deliver futures contracts on bonds. (e) Modeling Eurodollar and US Treasury options. (f) Optimizing portfolios of other traders, enhancing the effectiveness of their trading rules. (g) Directing mathematical modeling of codes being prepared for a commercial risk-management product, including preparation for exotic and energy options modules. (h) Working with other team members to obtain and integrate several data resources into a central database accessible to traders as well as to analysts. (i) Working with other team members to develop an electronic trading system interface to exchanges, prototyped using Canonical Momenta Indicators. (j) Leading, managing and administrating many projects associated with a growing company.

LIR Interdisciplinary Research 1989-1997

I have made available in a public archive, <http://www.ingber.com/> and <ftp.ingber.com>, Adaptive Simulated Annealing (ASA), the optimization algorithm of choice for many complex problems. From 1993-1996, ASA was located at <http://www.alumni.caltech.edu/~ingber/>. Pointers were placed in NETLIB and STATLIB to this location. As the archive grew, more room and maintenance was required, and in February 1996 the site was moved to the present [ingber.com](http://www.ingber.com) location. Pointers were placed in the Caltech site to the present locations. Since 1992 I have helped several thousand people with my code and papers via electronic mail, processing hundreds of queries per year on ASA.

Through Lester Ingber Research (LIR), I further developed mathematical and numerical algorithms for selected problems in finance, combat analysis, and general optimization, creating and testing multivariate nonlinear models. As published in over 30 papers during this period, projects developed decisions-aids for each of these systems that are intuitive and graphical, but faithful to the relatively complex multivariate nonlinear stochastic models that have established their worth by fitting data generated by these systems. These decision aids brought these multiple-year projects to reasonable foci, my intended goal. The abstract of one of my papers serves to summarize some of the main features of this work:

A modern calculus of multivariate nonlinear multiplicative Gaussian-Markovian systems provides models of many complex systems faithful to their nature, e.g., by not prematurely applying quasi-linear approximations for the sole purpose of easing analysis. To handle these complex algebraic constructs, sophisticated numerical tools have been developed, e.g., methods of adaptive simulated annealing (ASA) global optimization and of path integration (PATHINT). In-depth application to three quite different complex systems have yielded some insights into the benefits to be obtained by application of these algorithms and tools, in statistical mechanical descriptions of neocortex (short-term memory and electroencephalography), financial markets (interest-rate and trading models), and combat analysis (baselining simulations to exercise data).

During this time I consulted on several optimization projects, and worked with my spouse to develop an internet-based ballet-wear company.

GWU Research Professor of Mathematics 1989-1990

I held a position as Research Professor of Mathematics at The George Washington University (GWU) for one year before deciding to continue my projects on a full time basis on my own.

NRC-NPS Senior Research Associate 1989

I won a second one-year Senior Research Associateship from the National Research Council (NRC) of the National Academies of Sciences and Engineering, taken at Naval Ocean Systems Center (NOSC), San Diego, CA, beginning 3 July 1989. My successful research proposal was, "Statistical Mechanics of Mesoscopic Information Processing in C^3 and Neocortical Systems." I accepted this award for three months to extend my work in combat analyses.

From 1989-1991, I was a ranking member, 7th Dan (Master level) black belt in Shotokan karate, and Director of Scientific Studies, one of three executive directors, of the American JKA Karate Association (AJKA), an international federation of over 100 karate organizations.

NPS Professor of Physics 1986-1989

On 1 August 1986, I was appointed Full Professor of Physics at the Naval Postgraduate School, Monterey, CA, with a joint appointment to the C^3 (Command, Control & Communications) Academic Group.

My research focused on application of statistical mechanics to large-scale systems, specifically in neuroscience and modeling of combat-simulation systems. This research also directly involved directing thesis officer-students. I taught officer-students various physics subjects, including: mechanics, statistical physics, mathematical physics, and Combat Simulation Analysis (a physics course I created at NPS). Class sizes ranged from 15 to 30 students. I also regularly taught extra reading courses, composed of one or two students each, in advanced statistical physics and advanced stochastic physics. I served on the Physics curriculum committee and as Chairman of the Combat Analysis Sequence, a new sequence of eight courses.

During this period, I led an excellent team of military officers and civilians to accomplish my goals, helping most of my thesis students to win awards for their contributions.

On 25 March 1988, after several panels of technical and managerial review, I was officially notified that I was selected as Assistant Director Washington Operations, Joint Tactical C^3 Agency (JTC3A), a Senior Executive Service (SES) position, and that I would have to begin this new appointment immediately. However, I had worked for three years to carve out an approach to realistically baseline combat models to field data, had obtained funding for a civilian-military team from the Deputy Under Secretary of the Army for Operations Research, and (correctly) estimated that we needed a few more months to bring this project to some focus, as I did at CAA from February through June 1989 until the end of my contract with NPS.

NRC-NPS Senior Research Associate 1985-1986

In August 1985 I received a one-year award as a Senior Research Associate from the National Research Council of the National Academies of Sciences and Engineering, tenured at NPS, to pursue my research into applications of my published methods of nonlinear nonequilibrium statistical mechanics to analyses of large-scale systems. My project was, "Applications of Nonlinear Nonequilibrium Statistical Mechanics to Options Planning."

PSI President 1970-1986

Physical Studies Institute (PSI) was a 501(c)(3) nonprofit scientific and educational California corporation I founded in 1970 and kept in operation through 1991. From 1978-1985, I developed methods of nonlinear nonequilibrium statistical mechanics derived by mathematical physicists in the late 1970s, and applied these methods to specific problems in neuroscience, nuclear physics and economics. From 1980-1986, PSI was an independent agency account of the Institute for Pure and Applied Physical Sciences (IPAPS) at UC San Diego.

In 1978, I received California Certification as an Emergency Medical Technician (EMT), and volunteered my time in this capacity.

From 1970-1978 I personally funded and administrated the Institute for Study of Attention (ISA) High School, a subsidiary of PSI, developing and publishing an educational methodology emphasizing restructuring of standard text material to enhance personal learning strengths. We offered over 30 courses in academics, fine arts and physical disciplines. From 1981-1986 I helped administrate another subsidiary, Conservatory of Ballet Arts Company, consisting of over 100 students, and an active dancing group of about 30.

From 1970-1978 I worked with other ISA teachers to prepare teaching aids in the form of problem-texts in Algebra, Chemistry, Probability, and Tennis. I also taught Mathematics and Physical Science at the ISA school.

I trained in and taught karate since 1958, at Caltech, UCSD, UCB, UCLA, SUNY SB, PSI, and NPS. I developed and published a methodology promoting the learning of attentional skills in parallel with a physics approach to the learning of traditional physical skills. From 1970-1988 I regularly taught karate through PSI, and published three textbooks in this discipline.

This period was extremely creative and fulfilling, albeit also quite challenging and difficult. I fully understood the necessity of my commitment to ideas and people to carry out these programs. I was able to use my trained mind and body effectively and artistically to help thousands of people, many on an individual basis for several years on a daily or weekly basis, reaching across many walks of life. Many of these people trained or worked with me simply to better themselves; many others required guidance and discipline to overcome adversity and personal problems; some contributed their own expertise to this organization to help others.

UCSD Research Associate, Physics 1980-1986

I held an honorary position at UC San Diego as a Research Associate in the Institute for Pure and Applied Physical Sciences (IPAPS), a research branch of the Physics Department.

UCSD Research Associate, Music 1972-1974

I held an honorary position as a Research Associate in the UCSD Music Department, doing research with Pauline Oliveros creating music with autonomic feedback.

UCSD Asst. Research Physicist 1970-1972

In 1970 I left my position as Assistant Professor of Physics at the State University of New York at Stony Brook, and returned to the University of California at San Diego (UCSD) to work with Keith Brueckner in theoretical nuclear physics.

I ran my first marathon with Keith, along the beach, in 2 hrs 40 mins.

In 1966 I had received my Ph.D. in theoretical physics from Keith Brueckner, the first Dean of Science and Engineering at UCSD. My thesis was entitled "One-Meson-Exchange Potentials and Properties of Nucleon-Nucleon Scattering and of Nuclear Matter."

On 17 Jun 80, Keith Brueckner wrote to Bernd Matthias (letter given to me by Bernd Matthias):

As you know, Lester was my graduate student. He certainly was the best graduate student I have had in 30 years of teaching. His abilities, enthusiasm and perseverance in research projects were absolutely outstanding.

Three papers from 1983-1986 calculated a contribution to the binding energy of nuclear matter induced by nonlinearities of realistic momentum-dependent nucleon-nucleon interactions, using methods developed by the author in the early '60's. These effects are large enough to possibly finally bring theory and experiment into agreement, but a much more detailed project would be required to fully test this conjecture.

SUNYSB Asst. Professor 1969-1970

I was an Assistant Professor in the Physics Department at the State University of New York (SUNY) at Stony Brook, developing my thesis work in theoretical nuclear physics. During this time I also performed research with the Psychology Department, working with Les Fehmi on behavioral correlates of control of EEG.

UCB & UCLA NSF Postdoctoral Fellow 1967-1968

I won a two-year National Science Foundation (NSF) Postdoctoral Fellowship to develop my thesis work in theoretical nuclear physics. I spent the first year with the Physics Department at UC Berkeley, and the second year with the Physics Department at UC Los Angeles.

Karate 1958-1970

My first instructor was Tsutomu Ohshima for a couple of years. My second instructor was Hidetaka Nishiyama for over 10 years, from whom I received my 3rd Dan Black Belt and my Sensei/Instructor's training and degree in 1969, becoming the first Westerner to receive the Sensei/Instructor's degree from the Japan Karate Association (JKA) and the All America Karate Federation (AAKF). Hidetaka Nishiyama stated to a fellow Instructor, circa 1990, over 20 years since I had left the JKA/AAKF in 1970, that I was his "most disciplined student."

Interdisciplinary Reviews of Applications of Mathematical Physics

I have described some personal issues in interdisciplinary review in http://www.ingber.com/ingber_projects.html in the section INTERDISCIPLINARY REVIEWS OF APPLICATIONS OF MATHEMATICAL PHYSICS.

Publications

- L. Ingber, "Statistical mechanics of neocortical interactions: Portfolio of physiological indicators," *The Open Cybernetics Systemics Journal*, (to be published) (2009).
- L. Ingber, "Statistical mechanics of neocortical interactions: Columnar EEG," Report 2009:CEEG, Lester Ingber Research, Ashland, OR, (2009). [URL http://www.ingber.com/smni09_columnar_eeg.pdf]
- L. Ingber, "Trading in Risk Dimensions (TRD)," in *Handbook of Strategic Trading*, edited by G. Gregoriou (Wiley, New York, 2009), p. (to be published).
- L. Ingber, "Statistical mechanics of neocortical interactions: Nonlinear columnar electroencephalography," Report 2009:NCE, Lester Ingber Research, Ashland, OR, (2009). [URL http://www.ingber.com/smni09_nonlin_column_eeg.pdf]
- L. Ingber, "AI and Ideas by Statistical Mechanics (ISM)," in *Encyclopedia of Artificial Intelligence*, edited by J.R. Rabuñal, J. Dorado, and A.P. Pazos (Information Science Reference, New York, 2008), p. 58-64. [ISBN 978-1-59904-849-9]
- L. Ingber, "Statistical mechanics of neocortical interactions (SMNI): Testing theories with multiple imaging data," *NeuroQuantology Journal* **6** (2), 97-104 (2008). [URL Invited paper <http://www.neuroquantology.com/journal/index.php/nq/article/view/186/237>]
- L. Ingber, "Real Options for Project Schedules (ROPS)," Report 2007:ROPS, Lester Ingber Research, Ashland, OR, (2007). [URL http://www.ingber.com/markets07_rops.pdf]
- L. Ingber, "Statistical mechanics of neocortical interactions: Time delays," Report 2007:TD, Lester Ingber Research, Ashland, OR, (2007). [URL http://www.ingber.com/smni07_timedelays.pdf]
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- L. Ingber, "Trading in Risk Dimensions (TRD)," Report 2005:TRD, Lester Ingber Research, Ashland, OR, (2005). [URL http://www.ingber.com/markets05_trd.pdf]
- L. Ingber and R.P. Mondescu, "Automated internet trading based on optimized physics models of markets," in *Intelligent Internet-Based Information Processing Systems*, edited by R.J. Howlett, N.S. Ichalkaranje, L.C. Jain, and G. Tonfoni (World Scientific, Singapore, 2003), p. 305-356. [Invited paper. URL http://www.ingber.com/markets03_automated.pdf]
- A.F. Atiya, A.G. Parlos, and L. Ingber, "A reinforcement learning method based on adaptive simulated annealing," in *Proceedings International Midwest Symposium on Circuits and Systems (MWCAS), December 2003* (IEEE CAS, Cairo, Egypt, 2003). [URL http://www.ingber.com/asa03_reinforce.pdf]
- L. Ingber, "Statistical mechanics of portfolios of options," Report 2002:SMPO, Lester Ingber Research, Chicago, IL, (2002). [URL http://www.ingber.com/markets02_portfolio.pdf]
- L. Ingber and R.P. Mondescu, "Optimization of trading physics models of markets," *IEEE Trans. Neural Networks* **12** (4), 776-790 (2001). [Invited paper for special issue on Neural Networks in Financial Engineering. URL http://www.ingber.com/markets01_optim_trading.pdf]
- L. Ingber, C. Chen, R.P. Mondescu, D. Muzzall, and M. Renedo, "Probability tree algorithm for general diffusion processes," *Physical Review E* **64** (5), 056702-056707 (2001). [URL http://www.ingber.com/path01_pathtree.pdf]
- L. Ingber, "Statistical Mechanics of Combat (SMC): Mathematical Comparison of Computer Models to Exercise Data," SMC Lecture Plates, Lester Ingber Research, Chicago, IL, (2001). [URL http://www.ingber.com/combat01_lecture.pdf and [combat01_lecture.html](http://www.ingber.com/combat01_lecture.html)]
- L. Ingber, "Statistical Mechanics of Neocortical Interactions (SMNI): Multiple Scales of Short-Term Memory and EEG Phenomena," SMNI Lecture Plates, Lester Ingber Research, Chicago, IL, (2001). [Invited talk U Calgary, Canada, April 2001. URL http://www.ingber.com/smni01_lecture.pdf and [smni01_lecture.html](http://www.ingber.com/smni01_lecture.html)]

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- L. Ingber, "Statistical Mechanics of Financial Markets (SMFM): Applications to Trading Indicators and Options," SMFM Lecture Plates, Lester Ingber Research, Chicago, IL, (2001). [Invited talk U Calgary, Canada, April 2001. Invited talk U Florida, Gainesville, April 2002. Invited talk Tulane U, New Orleans, January 2003. URL http://www.ingber.com/markets01_lecture.pdf and [markets01_lecture.html](http://www.ingber.com/markets01_lecture.html)]
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- L. Ingber and J.K. Wilson, "Statistical mechanics of financial markets: Exponential modifications to Black-Scholes," *Mathematical Computer Modelling* **31** (8/9), 167-192 (2000). [URL http://www.ingber.com/markets00_exp.pdf]
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Teaching

Caltech, UCSD, UCB, Stanford, UCLA, SUNY SB, PSI, NPS 1960-1988

Founded and Instructed Karate Classes and Clubs

Caltech 1960-1962

Reader, Modern Algebra

Reader, Methods of Mathematical Physics, Graduate Course

UC Berkeley 1967

Advanced Quantum Mechanics, Graduate Course

SUNY Stony Brook 1969-1970

Freshman and Sophomore Physics

Methods of Mathematical Physics, Graduate Course

UC San Diego 1970-1972

Natural Science

UC San Diego Extension 1972-1973

Application of Karate to Physics and Attention

Developing Intuition for Physics

UC San Diego Summer Session 1973-1976

Concepts in Physics

ISA Alternative School 1972-1978

Physical Sciences, Mathematics, Karate, T'ai Chi

Naval Postgraduate School (NPS) 1986-1989

Advanced Statistical Physics, reading course

Advanced Stochastic Physics, reading course

Combat Simulation Analysis

Mechanics

Path Integrals, reading course

Special Assistance Lectures

Statistical Mechanical Computations, reading course

Statistical Physics

Theoretical Physics

Thesis Students, M.S. (7)

Reviewing

Reviewer for Technical Papers

Behavioral and Brain Sciences 1994-
 Clinical Neurophysiology 2002-
 Computational Intelligence and Security (CIS'07) 2007
 Computational Optimization and Applications 1994
 Computer 1991-
 Control and Cybernetics 1995-
 Encyclopedia of Artificial Intelligence 2007-
 European Journal of Finance 2006-
 Institute of Electrical and Electronics Engineers (IEEE) 1992-
 International Journal of Applied Intelligence 1994-
 International Journal of Artificial Intelligence, Editorial Board 1994-
 International Multi-Conference on Engineering and Technological Innovation: IMETI 2008-
 Journal of Computational Chemistry 1995-
 Journal of Nonlinear Science 2001-
 Journal of Statistical Computation and Simulation 2006-
 Mathematical and Computer Modelling 1989-
 Medical Science Monitor 2004-
 Neural Networks 1996-
 NeuroQuantology Journal 2008-
 Open Cybernetics and Systemics Journal, Editorial Board 2007-
 Physical Review and Physical Review Letters 1966-
 Psychophysiology 1994
 Scholarpedia.org 2006-
 Society for Industrial and Applied Mathematics (SIAM) 1995-
 Statistics and Computing 1992-1993
 Workshop on Physics of Computation 1993-1994
 World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI) 2007-2008
 World Scientific and Engineering Academy and Society (WSEAS) 2006-

Review Panels

American Society for Engineering Education 1989-1991
 Eighth International Conference on Mathematical and Computer Modelling 1-4 April 1991
 Chair, *Statistical Physics Modelling of Nonlinear Stochastic Systems*
 Frontier Science in EEG Symposium: Continuous Waveform Analysis
 October 9 1993, New Orleans LA
 Joint Directors of Laboratories (JDL) 1986-1989
 Naval Postgraduate School (NPS) 1986-1989
 Member, Command, Control and Communications (C³) Group
 Technical Panel on Command, Control and Communications (C³), Basic Research Group
 Naval Air Development Center 1985-1987
 Review Panel for SDI Architectures
 Workshop on Physics and Computation
 PhysComp '94, This Decade and Beyond
 November 17-20 1994, Dallas TX

Associations, Consulting and Contracts

Associations/Consulting

Academia (Academia.edu) 2009-
 American Institute of Physics (AIP.org) 1962-
 American Physical Society (APS.org) 1962-
 ANSER, Arlington VA, Consultant C³ SDI 1986-1988
 Brooklyn Tech Alumni Foundation (www.bthsalumni.org) 1958-
 Brooklyn Technical High School LinkedIn Group, Manager 2008-
 Buzz Analytics (BuzzAnalytics.com/board.htm), Advisory Board 2006-2007
 Caltech Alumni Association (alumnus.caltech.edu/~ingber) 1962-
 Circle of Experts (www.CircleofExperts.com) 2008-
 Community Emergency Response Team/CERT (ashlandcert.org) 2006-
 Computational Materials Science Network (www.phys.washington.edu/users/cmsn/) 2006-
 Fortnight Solutions (Fortnight-Solutions.com) 2006-
 Gerson Lehrman Group (glgcouncils.com) 2006-
 Global Association of Risk Professionals (GARP.com) 1999-
 GuidepointGlobal.com, Advisor 2007-
 Innocentive (www.innocentive.com), Solver 2007-
 Intellectual Ventures (intven.com), Consultant 2007
 International Alliance for Shotokan Karate 2009-
 MentorNet (MentorNet.net), Mentor 2006-2007
 LinkedIn (www.linkedin.com/in/ingber) 2005-
 NetWEB Elite Solutions, Board of Directors 2006
 Network Of Experts (www.networkofexperts.com) 2007-
 Professional Risk Managers' International Association (PRMIA.org) 2001-
 RAND, Santa Monica CA, Consultant 1965-1966
 Round Table Group (RoundTableGroup.com) 1996-
 Scholarpedia (Scholarpedia.org) 2006-
 Society of Industry Leaders (SocietyOfIndustryLeaders.com) 2006-
 TechCast (techcast.org/Expert.aspx), Expert 2006-
 UC San Diego Alumni (alumni.ucsd.edu) 1966-
 Your Encore (www.yourencore.com), Expert 2007-

Contracts

Principal Investigator, Army Contract RLF6L, 1988-1989
 “Mathematical Comparison of Computer Models to Exercise Data: Comparison of JANUS(T) to National Training Center Data”
 subcontracts:
 UC Lawrence Livermore National Laboratory (2)
 BDM (1)
 TRAC-MNTRY Army officers (3)
 Principal Investigator, NSF/PSC Grant DMS940009P, 1994-1995
 “Porting Adaptive Simulated Annealing and Path Integral Calculations to the Cray; Parallelizing ASA and PATHINT Project (PAPP)”
 selected (8) internet volunteers from many applicants

Honors and Awards

Brooklyn Technical High School

Chief Justice, Student Court 1955-1958

American Institute of Physics Special Award for paper, "Electroluminescence"

Honorable Mention, New York Science Exam

New York State Merit Scholar

Caltech

Kelman Scholar 1958-1962

Captain, Karate Club 1960-1962

Sigma Pi Sigma, Physics Honor Society 1961-

Sigma Xi, Scientific Research Society 1963-

UC San Diego

President, Organization of Organizations 1965

Chancellor's advisory committee of student organization officers

Research Associate, Honorary Researcher

Music Department 1972-1974

Institute Pure & Applied Physical Sciences 1980-1986

National Science Foundation (NSF), Postdoctoral Fellow

UC Berkeley 1967-1968

UC Berkeley 1968-1969

Japan Karate Association (JKA) & All America Karate Federation

First Westerner to receive Instructor's degree 1968

National Research Council (NRC), Senior Research Associate

Naval Postgraduate School (NPS) 1985-1986

Naval Ocean Systems Center (NOSC) 1989

U.S. Senior Executive Service (SES) 1988

Selected as JTC3A/DCA Asst. Director Washington Operations (declined)

Mensa 2008-

Clearances

SECRET

RAND/U.S. Air Force, 1965-1966

National Academy of Sciences, 1986-1987, 3 July 1989 - 6 October 1989

SAIC, 1 February 1990 - 7 June 1990

TOP SECRET/NATO/CNWDI

NPS, 4 May 1987 - 31 June 1989

SAIC, 23 August 1989 - 1 February 1990

TOP SECRET/Special Compartmented Information (TS/SCI)

NPS, 22 January 1988 - 6 July 1989