# VITA AND PUBLICATIONS

Benoit B. Mandelbrot

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Born 20 November 1924, Warsaw, Poland.

Ingénieur diplômé: *Ecole Polytechnique*, Paris; Admission class of 1944, graduated in 1947.

Master of Science, then Professional Engineer in Aeronautics:
*California Institute of Technology*, Pasadena CA, 1948 and 1949.

Docteur d'Etat ès Sciences Mathématiques: *Faculté des Sciences de Paris*, 1952.

1949-1957 Staff member (Attaché, then Chargé, then Maître de Recherches):
*Centre National de la Recherche Scientifique*, Paris, France.
1957-1958 Maître de Conférences de Mathématiques Appliquées: *Université*, Lille, France
Maître de Conférences d'Analyse Mathématique: *Ecole Polytechnique*, Paris.
1958-1993 Research Staff Member, 1958-74; IBM Fellow, 1974-93; IBM Fellow Emeritus since 1993:
*IBM Thomas J. Watson Research Center*, Yorktown Heights NY.
1987-1999 Abraham Robinson Adjunct Professor of Mathematical Sciences;
1999- Sterling Professor of Mathematical Sciences:
Mathematics Department: *Yale University*, New Haven, CT.
1988- Fellow, *Saybrook College*, New Haven, CT

**POSITIONS HELD ON LONG-TERM LEAVE**

1950-1953 Ingénieur, Groupe de Télévision en Couleur: *LEP, S.A.* (Groupe Philips), Paris, France.
1953-1954 Member of the School of Mathematics: *Institute for Advanced Study*, Princeton NJ.
1955-1957 Chargé de Cours de Mathématiques & Membre du Séminaire Jean Piaget: *Université*, Genève.
1962-1963 Visiting Professor of Economics & Research Fellow in Psychology:
*Harvard University*, Cambridge MA.
196319-64 Visiting Professor of Applied Mathematics & Staff Member of the Joint Committee
on Biomedical Computer Science: *Harvard University*, Cambridge MA.
1979-1980 Visiting Professor, later Professor of the Practice of Mathematics
Mathematics Department: *Harvard University*, Cambridge MA
1999 G.C. Steward Visiting Fellow: *Gonville & Caius College*,
and Member: *Newton Institute for Mathematical Sciences*, Cambridge, UK.

**SELECTED PART-TIME OR SHORT-TERM LEAVE ACTIVITIES**

1953-1971 Research Associate, later Lecturer in Electrical Engineering, most recently
Institute Lecturer: *Massachusetts Institute of Technology*, Cambridge MA.
1969-1977 Senior Staff Member: *National Bureau of Economic Research*, New York NY.
1970 Visiting Professor of Engineering & Applied Science: *Yale University*, New Haven CT.
1972 Visiting Professor of Physiology: *Albert Einstein College of Medicine*, Bronx NY.
1974 Visiting Professor of Physiology: *SUNY Downstate Medical Center*, Brooklyn NY.
1980 Visiteur: *Institut des Hautes Études Scientifiques (IHES)*, Bures-sur-Yvette, France.
1984, 2001 Visitor: *Mittag-Leffler Institute*, Djursholm, Sweden.
1984 Walker-Ames Distinguished Professor: *University of Washington*, Seattle WA.
1987, 2000 Regents' Lecturer: *University of California*, Santa Cruz CA; Riverside CA.
1987-1994 Charter Member: *Geometry Center*, Minneapolis MN.
1992 Charles M. and Martha Hitchcock Professor: *University of California,* Berkeley CA.
1995 Professeur de l'Académie des Sciences: *École Polytechnique,* Palaiseau, France.
1998 R. & B. Sackler Visiting Professor: *University,* Oslo, Norway.

**AWARDS, PRIZES, AND MEDALS (WITH SELECTED EXCERPTS FROM CITATIONS)**

1974 IBM Fellowship:
*IBM Corporation*, Armonk NY.
- "There are few contemporary scholars who have made such penetrating contributions to as many fields of physical and social science…In his work, both in depth and range, he is the world leader. His success, where others have faltered, has been due to a combination of command of mathematical tools, extraordinary breadth, and even rarer intellectual courage."

1983-84 Research Division Outstanding Innovation Award in 1983; Corporate Award in 1984:
*IBM Corporation*, Armonk NY.

1985 Barnard Medal for Meritorious Service to Science, "Magna est Veritas:"
*USA National Academy of Sciences and Columbia University*, Washington DC and New York NY.
- "In the great tradition of natural philosophers past you looked at the world around you on a broader canvas."

1986 Franklin Medal for Signal and Eminent Service in Science:
*The Franklin Institute*, Philadelphia PA.
- "For outstanding contributions to mathematics and the creation of the field of fractal geometry, and important and illuminating applications of this new concept to many fields of science."

1988 Charles Proteus Steinmetz Medal:
*IEEE Chapter, General Electric Company, and Union College*, Schenectady NY.
- "Fractals have given new insights into every field of science, mathematics, engineering, economics, psychology, art, and literature."

1988 Alumni Distinguished Service Award for Outstanding Achievement:
*California Institute of Technology*, Pasadena CA.
- "[gave] insight into such complex phenomena as turbulence of liquids..."

1988 Senior Award (Humboldt Preis):
*Alexander von Humboldt-Stiftung*, Bonn, Deutschland.

1988 "Science for Art" Prize:
*Fondation Moët-Hennessy-Louis Vuitton*, Paris, France.

1989 Harvey Prize for Science and Technology:
*Technion-Israel Institute of Technology*, Haifa, Israel.

1991 Nevada Prize:
*University of Nevada System and Desert Research Institute.*
- "Startled scientists, mathematicians and artists alike in 1975 [by] unveiling a dramatic new approach for describing what had previously seemed indescribable."

1993 Wolf Foundation Prize for Physics:
*Wolf Foundation to Promote Science and Art for the Benefit of Mankind*, Herzliyah, Israel.
- "By recognizing the widespread occurence of fractals and developing mathematical tools for describing them, he has changed our view of nature."

1994 Honda Prize:
*Soichiro Honda Foundation of Japan*, Tokyo, Japan.
- "Identified substantial bridges over the chasms that now separate mathematics, science and technology from one another and from the interests of the common man and the child..."

1996 Médaille de Vermeil de la Ville de Paris:
*Hôtel de Ville,* Paris, France.
- "On vous considère, à juste titre, comme le pionnier d'une nouvelle vision de notre monde... Votre démarche... constitue un effort pour rendre compte de phénomènes dont la théorie ne savait que faire."

1999 John Scott Award:
*John Scott Fund*, Philadelphia PA.
- for "Ingenious Men and Women Who Contribute in Some Outstanding Way to the Comfort, Welfare, or Happiness of Mankind."

1999 Lewis Fry Richardson Medal:
*European Geophysical Society.*
- for his "pioneering contributions to the development and applications of scale-invariance and fractal geometry to non-linear geophysics."

2002 Sven Berggren Priset:
*Kungliga Fysiografika Sällskapet,* Lund, Sverige.
*(Academy for the Natural Sciences, Medicine and Technology)*

2002 Medaglia della Prezidenza della Repubblica Italiana:
*Centro Pio Manzu,* Rimini, Italia.

2002 William Procter Prize for Scientific Achievement:
*Sigma Xi, The Scientific Research Society of America.*

2003 Japan Prize for Science and Technology:
*Science and Technology Foundation of Japan,* Tokyo, Japan.

**ACADEMIES**

1982 Fellow: *American Academy of Arts and Sciences*, Cambridge MA.

1987, 2001 Foreign Associate, then Member: *USA National Academy of Sciences*, Washington DC.
- "His creative thinking was essential for physicists working in diverse fields to capture the essence of previously intractable problems and to unveil order and simplicity in systems with a seemingly high degree of disorder, irregularity, and complexity."

1987 Member: *European Academy of Arts, Sciences and Humanities*, Paris, France.

1989-1993 Member: *IBM Academy of Technology*, Armonk N.Y.

1998 Foreign Member: *Norwegian Academy of Science and Letters*, Oslo, Norge.

2003 Member: *European Academy of Sciences*, Bruxelles, Belgique.

**DECORATIONS**

1989 Chevalier: *L'Ordre National de la Légion d'Honneur*, Paris, France.

**DIPLOMAS, *HONORIS CAUSA*, & THE LIKE**

1986 Doctor of Science & Engineering Commencement Speaker: *Syracuse University*, Syracuse NY.
- "Your interests transcend conventional disciplinary bounds and your work in its breadth and depth speeds the way toward unraveling secrets of the universe."

Commencement Speaker: *St. John's College*, Annapolis MD.
Doctor of Science: *Laurentian University/Université Laurentienne*, Sudbury ON, Canda.

1987 Doctor of Science: *Boston University*, Boston MA.
- "What you have named `fractal geometry'. describes ... as well the ... commodities market ... and a myriad of phenomena [that point] to a symmetry of pattern within each of the meldings, branchings, and shatterings of nature. [You are honored] for your prolonged and energetic refusal to confine yourself within accepted rigidities [and] for the scientific, mathematical, and aesthetic insights by which you have brought us closer to the character of the universe."

1988 Doctor of Science: *State University of New York*, Albany NY.
Doktor: *Universität Bremen*, Bremen, Deutschland.
- "For setting standards, as a wanderer-by-choice between the disciplines and between theory and applications."

Doctor of Humane Letters: *Pace University*, New York NY.
- "For bringing an unsuspected new form of beauty to mathematics, for giving new dimension to our lives"

1989 Doctor of Science & Commencement Speaker: *University of Guelph*, Guelph ON, Canada.
- "Has reshaped our vision of geometry. Is one of that small number of scientists whose ideas not only have a major impact upon science but also on the popular domain."

1992 Doctor of Science & Commencement Speaker: *University of Dallas*, Irving TX.

1993 Doctor of Science & Founders Day Speaker: *Union College*, Schenectady NY.
Engineering Commencement Speaker: *Université de Franche-Comté*, Besançon, France.
Doctor: *Universidad de Buenos Aires*, Buenos Aires, Argentina.

1995 Doctor Philosophiae: *Tel Aviv University*, Ramat Aviv, Israel.
- "For pioneering work... which broke new ground in the analysis of complex physical systems."

1998 Doctor of Science: *Open University* (U.K.), London Commencement.
- "[He investigated Julia sets] and thereby discovered a related set of extraordinary complexity and beauty which is named after him. The Mandelbrot set has now been studied in great depth, leading to profound mathematical insights. At the same time, the creation of pictures of these exquisite sets has become an art form in its own right... Our course M337 Complex Analysis has a unit entirely devoted to the Mandelbrot set, and many students report that this is the high point of their studies."

Doctor of Science: *Oikonomiko Panepistemio, University of Business and Commerce*, Athens, Greece.

1999 Doctor of Science: *University of St Andrews*, St Andrews, Scotland, U.K.
- "…created an entirely new geometry with as much system and generality as that of Euclid and a new physical science. Not overawed by tradition or authority…saw that the overwhelming smoothness paradigm with which mathematical physics had attempted to describe Nature was radically flawed and incomplete…Chancellor, as your predecessor…Lord Balfour in 1911 honoured Georg Cantor, I take the greatest pleasure in inviting you to honor a great mathematician of a great mathematical age."

1999 Master of Arts *privatim*: *Yale University*, New Haven, CT.

2002 Doctor of Science: Emory University, Atlanta, GA.
- "Your path-breaking study of fractals not only has established a prominent field worth of study in its own right but also influenced a broad range of other fields, from architecture to ecology, economics, linguisitics, neuroscience, and cinematic techniques."

**MEMBERSHIPS IN SCIENTIFIC SOCIETIES**

Member (honorary): *Société Physique de France.*

Fellow: •*American Physical Society.*
"For the development of fractal geometry, ... and ... its first applications in physics."
•*American Association for the Advancement of Science.*
•*American Geophysical Union* (inactive).
"For [improving] understanding of order and scale in geophysical processes."
•*Institute of Mathematical Statistics* (inactive).
•*American Statistical Association* (inactive).
"For many ingenious contributions to stochastic models in several fields."
•*Institute of Electrical and Electronics Engineers* (inactive).
"For contributions to information theory and its applications, and to understanding of 1/*f* random noise processes."
•*Econometric Society* (inactive).

Member (elected): *International Statistical Institute* (inactive).

Member: *Société Mathématique de France (inactive).*
*American Mathematical Society.*

**SELECTED MEMBERSHIPS IN BOARDS AND COMMITTEES**

1964-82 Editorial Board of the journal *Information and Control*.
1969-72 Committee on the Applications of Mathematics: *USA National Academy of Sciences*.
1974-78 Editorial Board of the *Journal of Financial Economics*.
1982-88 Editorial Board of the journal *Pure and Applied Geophysics*.
1984- Editorial Board of the journal *Advances in Applied Mathematics*.
1989-92 Editorial Board of the *Journal of Visual Communication and Image Representation*.
1990-91 Advisory Board of the journal *Experimental Mathematics.*
1990-92 Advisory Panel of the journal *Mathematics Review*.
1990-95 Advisory Board of the journal *Physica A*.
1992- Honorary Editor, *Fractals: An Interdisciplinary Journal on the Complex Geometry of Nature.*
1993-96 Commission on Mathematical Physics (C18), *International Union on Pure and Applied Physics.*
1993- President, *Mandelbrot Foundation for Fractals*.
1995- Member of the Scientific Council, Me Vis, Bremen, Germany.
2001- Member of the Advisory Board of the journal *Quantitative Finance.*

**GRANTS**

1953-54 *Scholar of the Rockefeller Foundation*.
1968 *Fellow of the John Simon Guggenheim Memorial Foundation* (resigned).
Grants from NSF and ONR.

**"FRACTALS" BOOKS**

**A** ***Les objets fractals: forme, hasard et dimension.***
Paris: Flammarion, 1975, 192 pp.

**A2** ***Les objets fractals: forme, hasard et dimension: 2e édition.***
Paris: Flammarion, 1984, 204 pp.

**A3** **WWW.** ***Les objets fractals: forme, hasard et dimension: 3e édition, suivie d'un Survol du langage fractal.***
Paris: Flammarion, 1989, 268 pp.

**A4** ***Les objets fractals: forme, hasard et dimension: 4e édition ("poche").***
Paris: Flammarion (Collection *Champs*), 1995, 209 pp.

***Objektu fraktalak: forma, zoria eta dimentsioa.***
Basque Translation of an update of A3, by Inaki Azkune Mendia. Usurbil: Elhuyar, 1992, 333 pp.

***Fraktalnite obekti: forma, sluchainost i razmernost.*** Bulgarian Translation of A3 by Petr Filipov Lazarov, Andrei Juliev Bakhner & Ilia Vasiliev Petrov. Sofia: St. Kliment Ohridski Press, 1996, 275 pp.

***Chinese Translation of A4*** by Wen Zhiying. Beijing: World Publishing Corporation, 1999.

***Fraktály: tvar, náhoda a rozm•er.*** Czech Translation of A4 by Jiri Fiala, Prague: Mladá fronta, 2003.

***Gli oggetti frattali: forma, caso e dimensione.*** Italian Translation of A2 by Roberto Pignoni; preface by Luca Peliti & Angelo Vulpiani. Torino: Giulio Einaudi, 1987, xx+207 pp.

***Objectos fractais: forma, acaso e dimensão; seguido de panorama da linguagem fractal.***
Portuguese Translation of an update of A3 by Carlos Fiolhais & José Luis Malaquias Lima. Lisboa, Portugal: Gradiva, 1991, 300 pp. & Rio de Janeiro, Brazil: Contraponto, 2003.

***Obiecte fractale.*** Romanian Translation of A3 by Florin Monteanu. Bucaresti: Nemira, 1998.

***Los objetos fractales: forma, azar y dimensión.***
Spanish Translation of A2 by Josep Maria Llosa. Barcelona: Tusquets, 1987, 213 pp.

**B** ***Fractals: Form, Chance and Dimension.***
San Francisco, CA: W. H. Freeman and Company, 1977, xviii+265 pp.

**C** **WWW.** ***The Fractal Geometry of Nature.***
New York, NY: W. H. Freeman and Company, 1982, xii + 461 + xvi pp.

***Da Zi Ran De Feng Xing Gi He Xue.*** Chinese Translation of C
by Yongmian Huang & Shouji Chen. Shanghai: Far East Publishers.1998, xvi + 16 + 574 pp.

***Die fraktale Geometrie der Natur.*** German Translation of C
by Reinhilt & Ulrich Zähle. Basel: Birkhäuser & Berlin: Akademie-Verlag, 1987, 491 + xvi pp.

***Fraktal Kikagaku.*** Japanese Translation of C
directed by Heisuke Hironaka. Tokyo: Nikkei Science, 1984, 464 + xvi pp.

***Russian Translation of C***. Izhevsk: Scientific Publishing Center. 2002.

***La geometria fractal de la naturaleza***
Spanish Translation of C by Josep Maria Losa. Barcelona: Tusquets, 1997, 662pp.

**"SELECTA" BOOKS**

Note: In the lists that follow, the titles of the publications reproduced in a *Selecta* book are preceded by a bold-letter "marker." It consists in the book's distinguishing letter(s) (other than S here) and a chapter number when available. Examples are provided by items 1 and 23.

**SE** ***Fractals and Scaling in Finance: Discontinuity, Concentration, Risk.***
New York: Springer, 1997, x+551pp.

**SFE** ***Fractales, hasard et finance (1959 - 1997)***.
Paris: Flammarion (Collection *Champs*), 1997, 246pp.

**SN** ***Multifractals and 1/f Noise : Wild Self-affinity in Physics.***
New York: Springer. 1999, viii + 442 pp.

**SH** ***Gaussian Self-Affinity and Fractals: Globality, the Earth, 1/f, and R/S.***
New York: Springer. 2002, ix + 654 pp.

**SC** ***Fractals in Chaos: The Mandelbrot Set and Beyond.***
New York: Springer. Expected in 2003.

**SP** ***Fractal and Multifractal Finance: Crashes and Long Dependence.***
Open-ended web-book. 2003.

**SR** ***Random Multifractals.***
Open-ended web-book, 2003.

**SF** ***Essais et portraits: essais sur les fractales et portraits d'hommes de science.***
Open-ended web-book. 2003.

**PROCEEDINGS OR COURSE NOTES EDITED OR COEDITED**

**a** ***Proceedings of the Gaithersburg Symposium on Fractals in the Physical Sciences.***
*Journal of Statistical Physics* (Special Issue): **36**, Nos. 5/6.
Edited by Michael F. Shlesinger, BBM & Robert J. Rubin.
New York: Plenum, 1984, 400 pp.

**b** ***Fractal Aspects of Materials: Metal and Catalyst Surfaces, Powders and Aggregates.***
*Extended Abstracts of a MRS Symposium held in Boston*.
Edited by BBM & Dann E. Passoja. Pittsburgh PA: Materials Research Society, 1984, 47 pp.

**c** ***Fractal Aspects of Materials.***
*Extended Abstracts of a MRS Symposium held in Boston*.
Edited by Robert Laibowitz, BBM, & Dann E. Passoja.
Pittsburgh PA: Materials Research Society, 1985, 127 pp.

**d** ***Fractals: Basic Concepts, Computation and Rendering.*** Edited by BBM.
*Notes for a SIGGRAPH 85 Course*. San Francisco, CA; July 23, 1985.
Association for Computing Machinery; Special Interest Group on Computer Graphics.

**d2** ***Fractals: Basic Concepts, Computations and Rendering.*** Variant of **d**, with additions and deletions**.**
Notes for a Professional Development Seminar given in Boston, MA on March 3, 1986.
Boston Chapters of Siggraph and ACM.

**e** ***Fractal Aspects of Materials II.*** *Extended Abstracts of a MRS Symposium held in Boston*.
Edited by Dale W. Schaefer, Robert B. Laibowitz, BBM, & Samuel H. Liu.
Pittsburgh PA: Materials Research Society, 1986, 148 pp.

**f** ***Ensembles fractals.*** Ecole d'hiver CEA - EDF – INRIA.
Roquencourt (France) Jan. 1987, 340 pp.

**g** ***Fractal Aspects of Materials: Disordered Systems.*** *Extended Abstracts of a MRS Symposium held in Boston***.**
Edited by Alan J. Hurd, David A. Weitz, & BBM.
Pittsburgh PA: Materials Research Society, 1987, 208 pp.

**h** ***Fractal Aspects of Materials: Disordered Systems.*** *Extended Abstracts of a MRS Symposium held in Boston*.
Edited by David A. Weitz, Leonard M. Sander, & BBM.
Pittsburgh PA: Materials Research Society, 1988, 356 pp.

**i** ***Fractals in Geophysics***. Edited by Christopher H. Scholz & BBM.
*Pure and Applied Geophysics* (Special Issue): **131**, Nos. 1/2.
Boston MA & Basel, Switzerland: Birkhäuser, 1989.

**j** ***Fractals, Graphics, and Mathematics Education***. Edited by Michael L. Frame & BBM.
Washington DC: Mathematical Association of America
& Cambridge UK: The University Press, 2002, xiii + 206pp.

**FREE-STANDING BOOKS**

***Logique, langage et théorie de l'information.*** (avec Léo Apostel & Albert Morf).
Paris: Presses Universitaires de France, 1957 vi+207 pp.

***Macroscopic statistical linguistics.*** English Translation of Part I of Book A, by J. Cheek, Jr.
Cambridge, MA: Harvard Computation Laboratory, 1957.

***La geometria fractal de la naturaleza.***
Milano: Imago (Montedison Progetto Cultura), 1987, 91 pp. Roma: Edizioni Theoria, 1989.

***Nel mondo dei frattali***. Roma: Di Renzo Editore, 2001, 60 pp.

***Storms on Wall Street*** (with Richard L. Hudson).
New York: Basic Books, Expected in 2004.

**NOTATIONS USED IN THE LISTS THAT FOLLOW**

***The abbreviation M.*** Each publication is preceded by the author's or authors' names, "Mandelbrot" being replaced by the letter M.

***The identifying letters.*** Each publication not fully identified by its year is assigned a mnemonic letter. The author uses it in his books and in every other case that allows it.

***The marks of the form*** **FE4.** The publications that are reproduced in a book or web book of *Selecta* are marked by the letters denoting that volume followed by the chapter number. For books in progress, the contents is only tentative and there is no number.

***The mark*** **WWW .** The website http://www.math.yale.edu/mandelbrot includes already (or will shortly include) many items in this list. Those items are flagged by the mark **WWW.** It is often followed by a letter denoting a "web book," that is, a collection of related publications with its own Table of Contents.

## RESEARCH PUBLICATIONS OTHER THAN BOOKS

**1951**

1 **WWW AS & K FE4.** M 1951. Adaptation d'un message sur la ligne de transmission, I & II. *Comptes Rendus* (Paris): **232,** 1638-1740 & 2003-2005.

**1952**

2 M 1952. Sur la notion générale d'information et la durée intrinsèque d'une stratégie. *Comptes Rendus* (Paris): **234**, 1346- 1348.

3 M 1952. Les démons de Maxwell. *Comptes Rendus* (Paris): **234**, 1842-1844.

**1953**

4 M 1953t. Contribution à la théorie mathématique des jeux de communication (Ph.D. Thesis). Publications *de l'Institut de Statistique de l'Université de Paris*: **2**, 1-124.

5 **C.** M 1953i. An informational theory of the statistical structure of language. *Communication Theory, the Second London Symposium*. Edited by Willis Jackson. London: Butterworth; New York: Academic, 486-504.

**1954**

6 M 1954w. Structure formelle des textes et communication (deux études). *Word*: **10**, 1-27.
• Corrections: *Word*: **11**, 1955, 424.
• English translation by Anthony G. Oettinger: *The formal structure of texts and communication (two studies)*: Cambridge, MA, Harvard Computation Laboratory, 1955.
• Czech translation: Komunikace a formalni struktura textu. *Teorie informace a jazykoveda (=Information theory and linguistics)*, an anthology edited by Lubomir Dolozel. Prague: Press of the Czechoslovak Academy of Sciences, 1964, 130-150.
• Excerpt: *Le Langage*, anthologie dirigée par Robert Pagès. Paris: Hachette, 1959, 55-57.
• Summary: Information sans interprétation dans la description des langues réelles. *Synthèse*: **11**, 1959, 160-161.

7 M 1954. Simple games of strategy occurring in communication through natural languages. *Transactions of the IRE Professional Group on Information Theory*: **3**, 124-137.
• French translation: *Jeux de stratégie se présentant dans la communication au moyen des langues naturelles*. Centre National des Télécommunications, Traduction No. 1049, 1955.
• Abstract: Statistical macro-linguistics. *Supplemento di Nuovo Cimento*: **13**, 1959, 518-520.

**1955**

8 M 1955b. On recurrent noise limiting coding. *Information Networks, the Brooklyn Polytechnic Institute Symposium*. Edited by Ernst Weber. New York: Interscience, 205-221.
• Russian translation: O rekurrentnom kodirovanii, ogranichivayuschem vliyanie pomekh. *Teoriia informatsii (=Information Theory)*. Edited by W. Siforof. Moscow: 1957, 138-157.

9 M 1955. *Diagnostic en l'absence de bruit*. Institut de Statistique de Université de Paris. 1-73 (booklet).

10 M 1955t. Théorie de la précorrection des erreurs de transmission. *Annales des Télécommunications*: **10**, 122-134.

**1956**

11 **WWW.** M 1956c. La distribution de Willis-Yule, relative au nombre d'espèces dans les genres taxonomiques. *Comptes Rendus* (Paris): **242**, 2223-2225.

12 M 1956w. On the language of taxonomy: an outline of a thermo-statistical theory of systems of categories, with Willis (natural) structure. *Information Theory, the Third London Symposium*. Edited by Colin Cherry. London: Butterworth; New York: Academic, 135-145.

13 M 1956t. Exhaustivité de l'énergie d'un système, pour l'estimation de sa température. *Comptes Rendus* (Paris): **243**, 1835-1837.

14 M 1956m. A purely phenomenological theory of statistical thermodynamics: canonical ensembles. *IRE Transactions on Information Theory*: **112**, 190-203.

**1957**

15 M 1957b. Note on a law of J. Berry and on insistence stress. *Information and Control*: **1**, 76-81.
• Russian translation: Zakon Berri i predelenie "udareniya". *Teoriia informatsii (=Information Theory)*. Edited by W. Siforof. Moscow: 1957, 248-254.

16 M 1957p. Théorie *mathématique de la loi d'Estoup-Zipf*. Institut de Statistique de l'Université de Paris, 1-80 (booklet).

17 M 1957t. *Application of thermodynamical methods in communication theory and in econometrics*. Institut Mathématique de l'Université de Lille.

**1958**

18 M 1958p. Les lois statistiques macroscopiques du comportement (rôle de la loi de Gauss et des lois de Paul Lévy). *Psychologie Française*: **3**, 237-249.

**1959**

19 M 1959s. A note on a class of skew distribution functions:
Analysis and critique of a paper by H. A. Simon. *Information and Control:* **2**, 90-99.

20 **WWW AS FEP.** M 1959p. Variables et processus stochastiques de Pareto-Lévy et la répartition des revenus, I & II. *Comptes Rendus* (Paris): **249**, 613-615 & 2153-2155.

21 **WWW AS** M 1959g. Ensembles grand canoniques de Gibbs; justification de leur unicité basée sur la divisibilité infinie de leur énergie aléatoire. *Comptes Rendus* (Paris): **249**, 1464-1466.

**1960**

22 M 1960. Processus stochastiques à loi stable positive, permanents, markoviens et stationnaires (non additifs). *Comptes Rendus* (Paris): **250**, 451-453.

23 **E10.** M 1960i. The Pareto-Lévy law and the distribution of income.
*International Economic Review*: 1, 79-106.
• Preliminary report: *Au sujet de la distribution de Pareto, relative à la distribution des revenus*. Faculté des Sciences de l'Université de Genève, 1956.
• Abbreviated reprint: *Mathematics and Social Science I: Proceedings of UNESCO Seminars* (Menthon-Saint-Bernard, 1960 and Gösing, 1962), compiled by Saul Sternberg and others. The Hague: Mouton & Co., 1965, 217-239.
• Privately circulated supplement: *Additional note on the distribution of income*.

• Reprint: *Vilfredo Pareto*: *Critical Assessments*, Edited by John C. Wood & Michael McLure London: Routledge, 1999, **IV**, 155-182.
• Reprint: *Income Distribution*, Edited by Michael Sattinger. *The International Library of Critical Writings in Economics*; Series Editor: Mark Blaug, Edward Elgar, 2000 CheltenhaM UK.

**1961**

24 **C.** M 1961b. On the theory of word frequencies and on related markovian models of discourse. *Structure of Language and its Mathematical Aspects* (New York, 1960). Edited by Roman Jakobson (Symposia in Applied Mathematics **XII**). Providence, R.I.: American Mathematical Society, 190-219.
• Abbreviated reprint: *Mathematics and Social Science*, (Menthon-Saint Bernard, 1960 & Gösing, 1962) 1965, 241-256.
• Summary: Discussion of a paper by Prof. N. F. Ramsey. *Symposium on Critical Review of Thermodynamics* (Pittsburgh PA), Edited by Edward B. Stuart, Benjamin Gal-Or & Alan J. Brainard. Baltimore, MD, Mono Book Corp. 1970, 230-232.

25 M 1961s. Final note on a class of skew distribution functions (with a post-script). *Information and Control*: **4** 198-216 & 300-304.

26 **E11.** M 1961e. Stable Paretian random functions and the multiplicative variation of income. *Econometrica*: **29**, 517-543.
• Reprint: *Vilfredo Pareto*: *Critical Assessments*, Edited by John C. Wood & Michael McLure. London: Routledge, 1999, **IV**, 183-209.

**1962**

27 **E12.** M 1962q. Paretian distributions and income maximization. *Quarterly Journal of Economics;* **76**, 57-85.
• Reprint: *Vilfredo Pareto*: *Critical Assessments*, Edited by John C. Wood & Michael McLure. London: Routledge, 1999, **IV**, 210-240.

28 **WWW AS FE9.** M 1962c. Sur certains prix spéculatifs: faits empiriques et modèle basé sur les processus stables additifs de Paul Lévy. *Comptes Rendus* (Paris): **254**, 3968-3970.

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*Futurs* (Igor & Grichka Bogdanoff), TFI, Paris, 26 Octobre 1989.

*Soixante secondes* (Philippe Plaisance), Antenne 2, Paris, 31 Octobre 1989.

*Lateline* (Kerry O'Brien), ABC TV Channel 2, February 1990.

Chaos Theory and the Arts. *The Late Show* (Martin Davidson),

BBC TV Channel 2 (UK), May 23, 1990, 11:15 pm.

Nikkei Show, Channel 12, Tokyo, June 16, 1990.

Deutsche TV, *Aspekte* (Henning Lohner), November 1990.

BBC *Antenna* (David Malone), November 1990.

Nevada TV stations: NBC in Las Vegas, CBS and ABC in Reno, March 1991.

*The Nature of Things*, Discovery channel, October 13, 1991.

Korean TV, Seoul, April 1992.

On board program of Lufthansa Airlines, April 1992.

Dallas Channel 8 WFAA-TV(ABC), May 16, 1992.

French TV: FR-3 (Jean-François Vallée), 26 Octobre 1992.

IBM Corporate Network, April 29, 1993.

*Caputher Gespräch*, Ostdeutscher Rundfunk Brandenburg, August 1993.

Evening News Finnish Television, August 23, 1993.

*Les Fractales*, Inventer Demain, Cinquième chaîne (France), 12,13,14,15 et 16 février, 1996.

*Archimède*, Arte (France), 26 mars 1996.

Écu, éco et quoi? M6 (Paris), 5 décembre 1997.

*Archimède*, Arte (France), 27 janvier 1998.

European Business News (London), 1998.

*The Colours of Infinity.* New York WNET Channel 13, and many other TV stations, 1998.

*Clouds are not Spheres*. Many TV stations, 2001.

**SELECTED INVITED LECTURES**

1952 *Communication Theory (2nd Int'l Conference)*, London, UK.

1953 *Statistical Methods in Communication Engineering*, Berkeley CA.

1954 *Information Networks*, New York NY.

1955 *Information Theory (3rd Int'l Conference)*, London, UK.

1956 *Symp. on Information Theory* (Inst. Radio Engineers), Cambridge MA.

1958 *Corso sulla Teoria della Informazione*, Varenna sul Lago di Como, Italia.

1960 *Structure of Language and its Mathematical Aspects* (Am. Math. Soc.), New York NY.
*Summer School on Mathematics in the Social Sciences* (UNESCO), Menthon, France.

1962 *Econometric Society*, Pittsburgh PA.
*Summer School on Mathematics in the Social Sciences* (UNESCO), Mariazell, Österreich.

1963 *Institute of Mathematical Statistics*, Cambridge MA.

1964 *Int'l Congress of Logic, Methodology & the Philosophy of Science*, Jerusalem, Israel.
*Special Course on Thermodynamics*, M.I.T., Cambridge MA.
*Summer School on Mathematics in the Social Sciences* (UNESCO), Oslo, Norge.
*Econometric Society*, Chicago IL.

1965 *Fifth Symp. on Mathematical Statistics and Probability*, Berkeley CA.
*First World Econometric Congress*, Roma, Italia.
*Summer Study Program in Geophysical Fluid Mechanics*, Woods Hole MA.

1966 *Boundary Layers and Turbulence* (IUTAM), Kyoto, Japan.
Professeur invité de Mathématiques: *Faculté des Sciences*, Paris, France.

1967 *Conference on Stochastic Processes*, Santa Barbara CA.

1968 *Turbulence in Fluids and Plasmas*, New York NY.
*Symp. on the Use of Computers in Hydrology*, Tucson AZ.
Arts and Sciences Lecturer: *University of California*, Berkeley CA.

1969 *Fifth Int'l Conference on Operational Research*, Venezia, Italia.

1970 *Second World Econometric Congress*, Cambridge, UK.
Charles Gallaudèt Trumbull Lecturer: *Yale University*, New Haven CT.

1971 *Statistical Models and Turbulence*, La Jolla CA.

1972-73 Professeur invité de Mathématiques: *Université de Paris-Sud*, Orsay, France

1973 Conférencier: *Collège de France*, Paris, France.

1974 Abraham Wald Memorial Lecturer: *Columbia University*, New York NY.
Samuel Wilks Memorial Lecturer: *Princeton University*, Princeton NJ.

1975 *Turbulence and Navier-Stokes Equations*, Orsay, France.
Invited Lecturer: *Académie des Sciences*, Paris, France.

1977 *Buffon Centenary Conference on Geometrical Probability and Biological Structures*, Paris.
*Statphys 13 (13th Conference on Statistical Physics)* (IUPAP), Haifa, Israel.

1978 *Statistical Mechanics* (Rutgers U.), New Brunswick NJ.
Goodspeed-Richards Lecturer: *University of Pennsylvania*, Philadelphia PA.

1979 *Nonlinear Dynamics* (New York Academy of Sciences), New York NY.

1980-82 National Lecturer: *Sigma Xi, The Scientific Research Society of America.*

1980 *Canadian Mathematical Congress*, Montréal PQ.
*Kleinian Groups* (Am. Math. Soc.), Brunswick ME.
Distinguished Lecturer: *University of Texas at Dallas*, Richardson TX.

1981 *Society of Industrial and Applied Mathematics*, Los Angeles CA.
*Australasian Congress of Mathematics*, Sydney NSW, Australia.
Frontiers of Science Lecturer: *University of Florida*, Gainesville FL.
Mathew Vassar Lecturer: *Vassar College*, Poughkeepsie NY.

1982 *Statistical Mechanics* (Rutgers U.), New Brunswick NJ.
*Order in Chaos*, Los Alamos NM.
*Design Conference*, Aspen CO.
*Ergodic Theory and Applications* (Am. Math. Soc.), Durham NH.
*Random Walks and Applications* (N.B.S.), Gaithersburg MD.
*Summer School on Fractals*, Courchevel, France.
*Union Session on Fractals in Geophysics* (AGU), San Francisco CA.
Lewis Fry Richardson Centenary Lecturer: Paisley, Scotland, UK.
Célébration du Centenaire: *Ecole de Physique et Chimie Industrielles*, Paris, France.

1983 *Kleinian Groups* (Am. Math. Soc.), Boulder CO (declined).
*International Congress of Mathematicians* (IMU), Warsaw, Polska.
*Turbulence and Chaotic Phenomena in Fluids* (IUTAM), Kyoto, Japan.
*Microstructure of Metals* (Cyril Stanley Smith's 80th Birthday), Philadelphia PA.
*Statistical Mechanics* (Rutgers U.), New Brunswick NJ.
*Session on Fractal Geometry in Nature, Science and Art* (AAAS), Detroit MI.
*Symposium on Fractals* (IMA), Imperial College, London, UK.
*Random Processes* (Bernoulli Society), Ithaca NY.
*Statphys15. Fifteenth Conference on Statistical Physics* (IUPAP), Edinburgh, UK.
*Chaos and Statistical Methods*, Kyoto, Japan.
*Conference on Fractals in the Physical Sciences* (NBS), Gaithersburg MD.
Distinguished Short-Term Visiting Professor: *University of Guelph*, Guelph ON, Canada.
James Hudnall Distinguished Visiting Lecturer: *University of Chicago*, Chicago IL.

1984 *Technology, Entertainment and Design*, Monterey CA.
*Congrès des Mathématiciens Belges*, Bruxelles, Belgique.
*Swedish Mathematical Soc. Annual Meeting*, Linköping, Sverige.
*The Computer and the Arts* (New York Philharmonic Orchestra), New York NY.
*The Physics of Chaos* (Nobel Foundation), Gräftavallen, Sverige.
*Geometric Measure Theory* (Am. Math. Soc.), Arcata CA (declined).
*Computer Graphics* (SIGGRAPH 1984), Minneapolis MN.
*Turbulence* (ICASE/NASA), Virginia Beach VA.
*Winter Workshop on Fractals*, Les Houches, France.
*Session on Fractals in Physics* (Am. Phys. Soc.), Detroit MI.
*Int'l Conference Kinetics of Aggregation and Gelation*, Athens GA.
*Theoretische Chemie*, Emmetten/NW, Schweiz.
*Symposium on Fractal Aspects of Materials* (MRS), Boston MA.
25th Anniversary Celebration Speaker: *Flemish Faculty of Sciences,* Bruxelles, Belgique.
*Vancouver Institute,* Vancouver BC, Canada.
Leon Lecturer: *University of Pennsylvania*, Philadelphia PA.

1985 *Influence of Computers on Mathematics*, Strasbourg, France.
*New England Section, American Physical Society*, Worcester MA.
*Computer Graphics Exhibit* (N.Y. SIGGRAPH Chapter), New York NY.
*Gordon Research Conference on Ceramics*, Plymouth NH.
*Summer Meeting, Am. Math. Soc. & Math. Assoc. Am.*, Laramie WY.
*Eastern Theoretical Physics Conference*, Philadelphia PA.
*Foundations of Statistical Inference*, Tel Aviv, Israel.
*Special Session on Fractal Geometry* (Am. Math. Soc.), Worcester MA.
*Fractals and the Geometry of Nature* (Math. Ass. Am.), Salisbury MD.
*Fractals in Physics* (ICTP), Trieste, Italia.
*Gordon Research Conference on Fractals*, Antrim NH.
*Course on How to Compute and Render Fractals* (Siggraph '85), San Francisco CA.
*Symposium on Fractal Aspects of Materials* (MRS), Boston MA.
Distinguished Speaker: *Graduate Center*, Hartford CT.
Distinguished Visiting Professor of Mathematics: *University*, Bremen, Deutschland.
Distinguished Lecturer: *Société Française de Physique*: Marseille, France.

1986 *Franco-Israeli Condensed Matter Physics Meeting*, Tel Aviv, Israel.
*Centennial of the Architectural Institute of Japan*, Tokyo.
*Annual Meeting of SIAM*, Boston MA.
*New Topics in Condensed Matter Physics*, Aspenäs, Sverige.
*Climatic Dynamics*, Los Angeles CA.
*Des fractales en mathématique et en physique* (CIRM), Marseille-Luminy, France.
*Fractals: a Professional Development Seminar*, Boston MA.
*Géométrie Fractale*, Montréal PQ, Canada.
*Summer Institute on Fractals*, Oberlech, Vorarlberg, Österreich.

*Gordon Research Conference on Fractals*, New London NH.
*Dynamics on Fractals and Hierarchies of Critical Exponents*, Orsay, France.
*Symposium on Fractal Aspects of Materials* (MRS), Boston MA.
*Union Session on Fractals in Geophysics* (AGU), San Francisco CA.
Conférence générale: *Ecole Polytechnique*, Palaiseau, France.
Frontiere della Scienza e della Tecnologia: *Progetto Cultura*, Milano, Italia.
Society of the Humanities Lecturer: *Cornell University*, Ithaca NY.
Falconbridge Lecturer: *Laurentian University*, Sudbury ON, Canada.
Annual Engineering, Arts and Sciences Lecturer: *Syracuse University*, Syracuse NY.
Frontiers of Science Lecturer: *University of Utah*, Salt Lake City UT.

1987 *Analyzing the Inchoate*, Ithaca NY.
*O. M. Corbino Memorial Meeting*, Roma, Italia.
*Boston Colloquium for the Philosophy of Science*, Boston MA.
*Chaos in Education*, Balatonfüred, Hungary.
*The Scientific Imagination*, Barcelona, Spain.
*Computer Graphics in the Arts & Sciences*, New York NY.
*Large-Scale Structure of the Universe* (Int. Astro. Union), Balatonfüred, Hungary.
*Centenaire de Paul Lévy*, Palaiseau, France.
*Dynamic Patterns in Complex Systems*, Fort Lauderdale FL.
*Inaugural Lectures of the Geometry Supercomputing Group*, Minneapolis MN.
*Fraktale und ihre Bedeutung in Mathematik und Naturwissenschaften*, Oberwolfach, Deutschland.
*Ensembles fractals*, Roquencourt, France.
*Fraktalot*, Budapest, Hungary.
*The Beauty of Fractals* (M.I.T.), Cambridge MA.
*Fractal Geometry Lecture Series* (CBMS MSRC), Cincinnati OH.
*The Fractal Cosmos: History, Dynamics and Modeling*, Santa Cruz CA & Santa Clara CA.
*Symposium on Fractal Aspects of Materials* (MRS), Boston MA.
Invited Lecturer: *Eötvös Lorand University*, Budapest, Hungary.
Werner Heisenberg Lecturer: *Bayerische Akademie der Wissenschaften*, Münich, Deutschland.
Boston Colloquium for the Philosophy of Science, Boston MA.
Invited Lecturer: *Accademia Nazionale dei Lincei*, Rome, Italia.
Gunnar Källen Memorial Lecturer: *University*, Lund, Sverige.
Invited Lecturer: *University*, Oslo, Norge.
Abraham Robinson Lecturer: *Yale University*, New Haven CT.

1988 *Design Conference*, Los Angeles CA.
*Non Linear Dynamics*, Santa Cruz CA.
*Large-Scale Structures and Motions of the Universe* (ICTP), Trieste, Italia.
*Mathematics in the Sciences*, National Academy of Sciences, Washington DC.
*Science and the Arts*, Herstmonceaux, UK.
*Landau Memorial Conference on Frontiers of Physics*, Tel Aviv, Israel.
*Non Linear Dynamics*, Düsseldorff, Deutschland.
*Mathematical Geophysics*, Blanes, Spain.
*Année des fractales*, Montréal PQ, Canada.
*Hausdorff Memorial Workshop on Fractals* (Max Planck Institut für Mathematik), Bonn, Deutschland.
*Fractals in Science and Art*, Delft, Nederland.
*Random Fluctuations and Pattern Growth*, Cargèse, Corse, France.
*Computer Graphics* (SIGGRAPH 88), Atlanta GA.
*Gordon Research Conference on Fractals*, Tilton NH.
*Fractals in the Natural Sciences* (Royal Society), London, UK.
*Summer School on Fractals*, Erice, Italia.
*F.A.U.S.T.*, Toulouse, France.
*Fractals in Geology* (Geol. Soc. Am.), Denver CO.
Invited Lecturer: *Institute of Physics*, Fiftieth Anniversary, Mexico City, Mexico.
Invited Lecturer: *Design Conference*, Los Angeles CA.
Bea Halley Ross Lecturer: *Ohio State University*, Columbus OH.
Max Planck Lecturer: *MPI*, Bonn, Deutschland.

Distinguished Lecturer: *University of Connecticut*, Storrs CT.
J. Von Neumann Computer Center, Princeton NJ.
Six Hundredth Anniversary, *University of Cologne*, Deutschland.

1989 *Dynamics Days*, Houston TX.
*L.F. Richardson Memorial*, Bristol, UK.
*Arnolfini Art Gallery*, Bristol, UK.
*"SPACE" Conference*, Bergen, Norway.
*Geometry Supercomputing Group*, Minneapolis MN.
*Géométrie fractale et analyse*, Montréal, Canada.
*Chaos*, Woods Hole MA.
*Stat. Phys. 17. Conference on Statistical Physics (IUPAP)*, Rio de Janeiro, Brazil.
Kendall Lecturer, *International Statistical Institute*, Paris, France.
*International Congress of Stereology*, Freiburg/Breisgau, Deutschland.
*Probability Theory and Polymer Science*, Gaithersburg MD.
USSR Academy of Sciences, Moscow and Leningrad, USSR.
Studium Generale Lecturer: *University of Groningen*, Groningen, Nederland.
*Smithsonian Institution*, Washington DC.

1990 *Frontiers in Condensed Matter Physics*, Bar Ilan University, Israel.
*Chaos in Australia*, University of New South Wales, Sydney, Australia.
*Fractals and Music* (with C. Wuorinen), Guggenheim Museum, New York NY.
*Creativity and Discovery in the Arts and Sciences*, Glasgow, UK.
*Fractals in the Fundamental and Applied Sciences*, Lisbon, Portugal.
*Statistical Dependence and Fractals*, Minneapolis MN.
*Gordon Research Conference on Fractals*, Plymouth NH.
*Nobel Conference on Chaos*, Gustavus Adolphus College, St. Peter MN.
*Ben Gurion University*, Beer Sheva, Israel.
*Tel Aviv University*, Tel Aviv, Israel.
*Australian National University*, Canberra, Australia.
*University of New South Wales*, Sydney, Australia.
*Texas A&M University*, College Station TX.
Rouse Ball Lecturer in Mathematical Science, *University of Cambridge*, Cambridge, UK.
Cherwell-Simon Lecturer in Physics, *University of Oxford*, Oxford, UK.
*University of Warwick*, Coventry, UK.
*Université Européenne de Paris*, Paris, France.
*Method in Philosophy and the Sciences*, New York NY.

1991 *Meeting of the Am. Assoc. of Petroleum Geologists*, Dallas TX.
*Meeting of the Am. Chemical Soc.*, Atlanta GA.
*Regional meeting of the Am. Math. Soc.*, Tampa FL.
Nevada Medal Lecturer, Las Vegas NV and Reno NV.
Schrödinger Lecturer, *Imperial College*, London, UK.
Special Lecturer, *University of Bath*, Bath, UK.
Bernard Gregory Lecturer, *CERN*, Geneva, Suisse.
Bea Halley Ross Lecturer, *Ohio State University*, Columbus OH.
Special Lecturer, *Iona College*, New Rochelle NY.

1992 *Annual Meeting of the National Council of Teachers of Mathematics*, Nashville TN.
*Special Meeting of the Korean Mathematical Society*, Seoul, Korea.
*Fractals in Engineering*, Montréal, Canada.
*Gordon Research Conference on Fractals*, Plymouth NH.
*Fractals and Disordered Systems*, Hamburg, Deutschland.
*Europäisches Forum*, Alpbach, Österreich.
*International Congress of Mathematics Education*, Québec, Canada.
Hitchcock Professor, *University of California*,
Berkeley, Los Angeles, Santa Barbara, and San Diego CA.
*Science Forum on Fractals*, Tokyo, Japan.

Special Lecturer, *Ajou University*, Suwon, Korea.
Microcourse on fractals, *University*, Oslo, Norge.
Conférence Bernard Gregory, *Ecole Polytechnique*, Palaiseau, France.

1993 *Iso Institute*, Zermatt, Switzerland.
*European Economic Forum*, Davos, Switzerland.
*Fractals in Medicine and Biology*, Ascona, Svizzera.
*Chaos and Complexity*, Blois, France.
*Analyse Harmonique*, Conférence Jean-Pierre Kahane, Orsay, France.
*Science and Art*, Santiago de Compostela, España.
*Science and Art*, Aspen CO.
*125th Anniversary*, Finnish Mathematical Society, Helsinki, Finland.
*Summer School*, University of Jyväskylä, Finland.
*Fractals in Science*, Budapest, Hungary.
*36ème Congrès*, Association Mathématique du Québec, Montréal, Canada.
*Association des Professeurs de Mathématiques de l'Enseignement Public*, Poitiers, France.
Canadian Mathematical Society, Ottawa, Canada.
Bicentennial, *Williams College*, Williamstown MA.
Founders Day, *Union College*, Schenectady NY.
Harvard Computer Society, *Harvard University*, Cambridge MA.
Sakler Lecture, *Tel Aviv University*, Ramat Aviv, Israel.
Saul Kaplun Lecture, *Hebrew University of Jerusalem*, Israel.
Abe Gelbart Lecturer, *Bard College*, Annandale NY.

1994 *Western Meeting of the National Council of Teachers of Mathematics*, San Francisco CA.
*Bicentenaire de l'Ecole Polytechnique*, Paris, France.
*Gordon Research Conference on Fractals*, San Miniato, Italia.
*Fractal Geometry and Stochastics*, Finsterbergen, Deutschland.
*Lévy Flights*, Nice, France.
*Fractals* (BBM's Seventieth Birthday celebration), Chubu, Japan.
McGill Lecturer, *Columbia University*, New York NY.
Vito Volterra Lecturer, *Accademia Nazionale dei Lincei*, Roma, Italia.
Statistics of Fractals and Chaos, *Pennsylvania State University*, State College PA.
*Urania*, Berlin, Deutschland.
*Chinese Academy of Sciences*, Beijing, China.

1995 *Petroleum Conference*, Scarborough, UK.
*Fractal Analysis and Modeling of Materials*, Los Alamos NM.
*Large-Scale Structure of the Universe*, Sesto/Pusteria, Alto Adige, Italia.
*Bifurcations and Chaos in Economics*, Umeå, Sverige.
*Dolf Seilacher Festkolloquium*, Universität Tübingen, Deutschland
Universität Stuttgart, Deutschland.
*Physikalisch-Medizinische Gesellschaft*, Universität Würzburg, Deutschland.
*Urania*, Berlin, Deutschland.
Thirtieth Anniversary of the Physics Department, *Tel Aviv University*, Ramat Aviv, Israel.
*Académie des Sciences*, Paris, France.
*Ecole Polytechnique*, Paris, France.

1996 Jubilee, *Center for Mathematics and Information*, Amsterdam, Nederland.
*Fractales et Musique*, Genève, Suisse.
*Mathématiques et Musique*, Lyon, France.
*Complexity and Simplicity*, Beijing, China.
*Gordon Research Conference on Fractals*, Henniker NH.
World Congress; *Bernoulli Society*, Vienna, Österreich.
*New ideas in science and art*, Praha, Czech Republic.
Geometry and Physics, *C.E.C.*, Barcelona, España.
Financial derivatives, *Banca Monte di Paschi*, Siena, Italia.
Resnick Lecturer, *Rensselaer Polytechnic Institute*, Troy NY.

Special Lecturer, *Hong Kong Polytechnic University*, Hong Kong.
Lecturer: *Nonlinear Dynamics Society*, Shanghai, China.

1997 Annual Meeting, *American Finance Association*, New Orleans LA.
Annual Meeting, *American Mathematical Society*, San Diego CA.
Annual Meeting, *American Physical Society*, Kansas City KN.
*Fractals in Engineering*, Arcachon, France.
Paintings of Francisek Kupka, *Museum of Art*, Dallas TX.
Astrofundamental Physics, *Ettore Majorana Center*, Erice, Italia.
*Prematurity in Science,* University of California, Berkeley CA.
*Fractals in Teaching,* Yale University, New Haven CT.
Celsius Lecturer, *University of Uppsala*, Sverige.
Fields Institute Lecturer, *University of Toronto*, Toronto, Canada.
*University,* Amsterdam, Nederland.
*Essec,* Cergy-Pontoise, France.
*École Nationale Supérieure de l'Aéronautique et de l'Espace*, Toulouse, France.
Statistical Mechanics*, Rutgers University*, New Brunswick NJ.
European Molecular Biology Laboratory, Heidelberg, Deutschland.
Ta-You Wu Lecture in Physics, *University of Michigan*, Ann Arbor MI.
R. & B. Sackler Lecture, *University Oslo*, Norge.

1998 *Order, Chance and Risk*, Les Houches, France.
*Science at the Turn of the Century* (20 years of Wolf Prizes), Jerusalem, Israel.
*Gordon Research Conference on Fractals*, El Ciocco, Italia.
*Frontiers of Science: Recent Developments and New Challenges*, Coimbra, Portugal.
*Classical, Quantum and String Cosmology*, Observatoire de Paris, Paris, France.
*Statphys 20, Twentieth Conference on Statistical Physics* (IUPAP), Paris, France.
*Hercma Conference*, Athens, Greece.

1999 Risks in Investment*, Actuarial Foundation*, NewYork NY.
*RIMS* (Hewlett-Packard*),* Bristol, UK.
*Classical, Quantum and String Cosmology*, Observatoire de Paris, Paris, France.
*Forbes CEO Conference,* Atlanta GA.
Scott Lectures in Physics, *Cavendish Laboratory*, Cambridge, UK.
G.C. Stewart Lectures, *Gonville & Caius College*, Cambridge, UK.
Science for Survival, *Pontificia Academia Scientiarum*, Citta di Vaticano.
National Science Week, *University*, Cambridge, UK.
Felix Klein's 150$^{th}$ birthday, *Universität Göttingen.*
Probability Conference, *Columbia University*, New York, NY.
Workshop on New Market Models, *DIMAC, Rutgers University*, Piscataway NJ.
Heavy-Tailed Distributions in Economics, *American University*, Washington DC.
Finance conference, *London School of Economics,* London, UK.
Department of Cognition Neurology, *University College*, London, UK.
Colloque Monétaire International, *Banque de France*, Paris, France.
Scaling Phenomena in Communications Networks, *IMA*, Minneapolis, MN.
Finance, Banking and Insurance, *Universität*, Karlsruhe, Deutschland.
*ZKM Center for Art and Media*, Karlsruhe, Deutschland.

2000 *Fractals in Medicine and Biology*, Monte Verità, Ascona (Ticino), Svizzera.
*Fundamental Sciences 2000*: *Mathematics and Theoretical Physics.* National University, Singapore.
Annual Assembly: *European Geophysical Union*, Nice, France.
Beyond Efficiency and Equilibrium. *Santa Fe Institute*, Santa Fe NM
*Université de Tous les savoirs*, Paris, France.
Fractals in Education Workshop. Yale University, New Haven CT.
*Symmetry*, Wenner-Gren Foundation, Stockholm, Sverige.
*New Approaches in Financial Economics*, Santa Fe NM.
*Fractals.* Roma, Italia.

*The e/volution of Commerce*, Fontainebleau, France.
*École Normale Supérieure,* Paris France.

2001 Annual Meeting, *American Economic Association*, New Orleans LA.
Financial Mathematics-Risk Management and Numerical Methods*, UCLA,* Los Angeles CA.
*Arts and Sciences*, National Arts Club, New York NY.
Fractals from Art to Art. *Great Hall*, Cooper Union, New York NY.
*Creativity* (by video), Ottawa, Canada.
*Tercentennial Lecture*, Yale University, New Haven CT.
Image and Meaning, *M.I.T.* Cambridge, MA.
Computational Finance, *Yale University,* New Haven CT.
Financial Engineering (IAFE), *CERAM,* Sophia Antipolis, France.
Joint Meeting, *American & French Mathematical Societies,* Lyon, France.
Applied Probability Conference. *INFORS Applied Probability Society.* New York NY.
Applied Mathematics(*SIAM/EMS), KZC* (Teleconference), Berlin, Deutschland.
Sonja Kovalevsky-dagarna. *Royal Swedish Academy of Sciences and KTH*, Stockholm, Sverige.
Fractals: Roughness and Beauty. *KTH*, Stockholm, Sverige.
Probability and Conformal Mapping. *Mittag-Leffler Institute*, Djursholm, Sverige.
Artists and Scientists on the Creative Process, *Villa Serbelloni,* Bellagio, Italia.
Leaders in Innovation. MIT, Cambridge MA, and UK, University of Cambridge UK.
*Politecnico di Milano,* Milano, Italia.
Osher Fellowship, *Exploratorium,* San Francisco CA.
E. Lorenz Lecture. Annual Meeting, *American Geophysical Union*, San Francisco CA.

2002 Annual Meeting, *American Mathematical Society*, San Diego CA.
*Long-range Dependent Stochastic Processes* (by video), Bangalore, India.
*National Science Foundation*, Washington D.C.
*Emory University*, Atlanta GA.
Astrophysics, Observatoire de Paris, France
Fractales … *Université,* Orsay, France.
Fractals in Space, on Earth, and in Mathematics, *University*, Lund, Sverige.
Sven Berggren Lecture, *University*, Lund, Sverige.
Lund Art School, Malmö, Sverige.
Fractals in Education Workshops, *Yale University,* New Haven CT.
*Royal Physiographic Society*, Lund, Sverige.
Pio Manzu, Rimini, Italia.
A group of students from three high schools, Kyoto, Japan.
*Institute for Science, Engineering and Public Policy,* Portland OR.
Kliegel Lecture, *California Institute of Technology,* Pasadena CA.
Procter Prize Lecture. *Annual Meeting of Sigma Xi*, Galveston TX.
Annual Meeting, *Sigma Xi*, Galveston TX.

2003 Fractals in Art and Music, *Courtyard Gallery, W.F.C.*, New York NY
Multiple presentations, *Japan Prize Week*, Tokyo, Japan. Fractales et musique. Semaine Ligeti (Teleconfrernce), Lyon, France.
Fractals, *FUN University*, Hakodate, Hokkaido, Japan.

**LIMITED DISTRIBUTION ITEMS,**
**OTHER THAN PREPRINTS OR EARLY DRAFTS**

**1949** California Institute of Technology, Pasadena CA
*Some Problems of Potential Theory* (A.E. Thesis).

**1953** Institute for the Unity of Science, Boston MA
*The Brain as a Speaking Machine* (Handout).

**1957** Harvard Computation Laboratory, Cambridge MA
*Macroscopic statistical linguistics* (English translation of Part I of **Book A**, by J. Cheek, Jr.).

**1958**, etc IBM Research Center, Yorktown Heights NY, Reports and Notes.

RC-421 *Five Place Tables of Certain Stable Distributions* (with F. Zarnfaller). December 31, 1959.

NC-107 *A Critical Note on Information Theory and Statistical Mechanics*. April 16, 1962.

NC-265 *On the Description of Word Frequencies by the Log-Normal Function*. May 15, 1963.

RC-1344 *Self-Similar Turbulence and Non-Wienerian Conditioned Spectra*. December 1, 1964.