Previous years' Magnus Lectures

Magnus Lectures Spring 2013 (March 13-15): Pascal Chossat, Director of Research, Department of Mathematics, University of Nice and French National Center for Scientific Research

Public Lecture: Bifurcation and symmetry, a mathematical view on pattern formation in nature
Abstract: Patterns in Nature are not of so many types. The coat of a zebra is stripped while the coat of a leopard is spotted (and a cougar has a uniformly colored fur). Honey bees build incredibly regular hexagonal cells. Many plants or sea organisms present a high degree of symmetry, like the icosahedral shell of certain radiolarians. These quite simple patterns are extremely common, not only with living creatures but also in inanimate matter, think of the regular patterns in crystals like the cubic symmetry of salt for example, or the spiral patterns which can form on the heart muscle and provoke a heart attack. The common denominator of these examples is the underlying mathematics, which model the formation of regular patterns. Although more complex patterns have recently been observed, like quasi-crystals, the mathematical theory of pattern formation, which was initiated by the celebrated mathematician Alan Turing, is an example of the "unreasonable effectiveness of mathematics in natural science" as Nobel Prize winner Eugene Wigner used to say.

Colloquium: Pattern formation on compact Riemann surfaces and applications
Abstract: Pattern formation on the sphere and torus has been widely studied in relation to the occurrence of periodic patterns in classical hydrodynamical systems and in biochemical models of reaction-diffusion equations. Recently a model for images texture perception by the visual cortex was introduced, which involves neural field equations posed on the hyperbolic plane. Looking for pattern formation in this non euclidean geometric context comes back to analyzing the bifurcation of patterns on compact Riemann surfaces of genus > 1. This leads to new and sometimes unexpected results, which open the door to a classification of patterns on Riemann surfaces.

Research Seminar: Pattern formation and the bifurcation of heteroclinic cycles
Abstract: Robust heteroclinic cycles (RHC) are flow-invariant bounded sets that naturally occurs in certain types of dynamical systems (typically in systems with symmetry). The presence of a RHC can explain intermittent switching between steady-states or periodic orbits, which are sometimes observed in physical experiments. Heteroclinic cycles in pattern formation systems can exist but are usually associated with codimension 2 (or higher) bifurcations. I shall show an example of a generic, codimension 1 bifurcation of robust heteroclinic cycles when the domain is the hyperbolic plane.

Magnus Lectures Spring 2012: Pascal Chossat (canceled)

Magnus Lectures Spring 2011 (April 5-7): Ridgway Scott, Louis Block Professor, University of Chicago, Computer Science and Mathematics

Public Lecture: Mathematics in drug design
Abstract: We show how mathematics can help in the complex process of drug discovery. We give an example of modification of a common cancer drug that reduces unwanted side effects. The mathematical model used to do this relates to the hydrophobic effect, something not yet fully understood. The hydrophobic effect modulates the dielectric behavior of water, and this has dramatic effects on how we process drugs. Future mathematical advances in this area hold the process of making drug discovery more rational, and thus more rapid and predictable, and less costly.

Colloquium: Two tales about Newton's method

Abstract: We talk about Newton's method for solving nonlinear (systems of) equations, a common topic in Calculus. We describe two new areas of research that are related to Newton's method. We show that the "endgame" for Newton's method (that is, the behavior of the iterates viewed as a dynamical system) in multiple dimensions can be extremely complex, leading to tensor eigenvalue problems. We also show how Newton's method for solving nonlinear ODE's can provide a productive approach to creating parallelism in what would seem to be essentially sequential computations.

Research Seminar: Optimal algorithms using optimal meshes
Abstract: We discuss two problems involving adaptive meshes. The first relates to non-nested multi-grid in two and three dimensions. We review what is known theoretically and describe some recent work related to optimal implementation. The second involves meshes in arbitrary dimensions. We show that there are meshes in which the number of nodes grows linearly in the dimension, and give some evidence via a quantum mechanics example that an h-P strategy can be effective to obtain good convergence behavior on these meshes. If time permits, we will describe some on-going work developing new formulations for nonlinear and nonlocal dielectric models for proteins.

Magnus Lectures Spring 2010 (April 14-15): Günter Uhlmann, Walker Family Endowment Professor of Mathematics, University of Washington, Department of Mathematics

Public Lecture: Cloaking, Invisibility and Inverse Problems
Abstract: We describe recent theoretical and experimental progress on making objects invisible to detection by electromagnetic waves, acoustic waves and quantum waves. For the case of electromagnetic waves, Maxwell's equations have transformation laws that allow for design of electromagnetic materials that steer light around a hidden region, returning it to its original path on the far side. Not only would observers be unaware of the contents of the hidden region, they would not even be aware that something was being hidden. The object, which would have no shadow, is said to be cloaked. We recount the recent history of the subject and discuss some of the mathematical issues involved.

Colloquium: 30 years of Calderón's inverse problem
Abstract: Calderón's problem consists in finding the electrical conductivity of a medium by making voltages and current measurements at the boundary. In mathematical terms one tries to determine the coefficient of a partial differential equation by measuring the corresponding Dirichlet-to-Neumann map. This problem arises in geophysical prospection and it has been proposed as a diagnostic tool in medical imaging, particular early breast cancer detection. We will also describe the progress that has been made on this problem since Calderón's seminal paper in 1980.

Research Seminar: Travel Time Tomography and Boundary Rigidity
Abstract: In this lecture we will describe a surprising connection between Calderón's inverse problem and travel time tomography. This latter problem consists in determining the index of refraction (sound speed) of a medium by measuring the travel times of sound waves going though the medium. In mathematical terms the question is to determine the Riemannian metric of a Riemannian manifold with boundary by measuring the distance function between points on the boundary. In differential geometry this is known as the boundary rigidity problem. This inverse problem arises in geophysics in determining the inner structure of the Earth by measuring the travel times of seismic waves as well as in ultrasound imaging.

Magnus Lectures Spring 2009 (April 22-24): Roland Glowinski, Cullen Professor of Mathematics and Mechanical Engineering, University of Houston

Public Lecture: Adventures in Computing
Abstract: The main goal of this lecture is to present real life situations where Applied & Computational Mathematics can significantly contribute, via numerical simulation in particular, to progress beneficial to

Society. This presentation will be illustrated by examples related to real life applications, in Cardio-Vascular Medicine in particular, an area where methods developed by the speaker have found applications.

General Seminar: Particle clustering in rotating cylinders
Abstract: In this lecture, we return, in some sense, to one of the *Magnus Lectures* given some years ago by *Tom Mullin*, and offer a computational science perspective to this former speaker exciting presentation. Indeed, in this lecture, we investigate computationally the clustering of rigid solid particles in rotating cylinders containing an incompressible viscous fluid, for particle populations ranging from 10 to more than 100. We study in particular the influence of the angular velocity on these clustering phenomena. The presentation will be illustrated by animations visualizing these truly three-dimensional phenomena, which to the best of our knowledge are not fully understood, as of today. The presentation will include a description of the numerical methodology retained for the solution of the differential system coupling the Navier-Stokes equations modeling the flow, with the Newton-Euler equations describing the particle motion.

Research Seminar: A Least-Squares/Fictitious Domain Method for Linear Elliptic Boundary Value Problems with Neumann or Robin Boundary Conditions: A Virtual Control Approach
Abstract: Motivated by the numerical simulation of particulate flow with slip-boundary conditions at the interface fluid-particles, we are going to address in this lecture the solution of the following elliptic problem

$$\alpha u - \mu \nabla^2 u = f \ in \ \Omega \setminus \varpi, \qquad (1)$$

$$u = g_0 \ on \ \partial\Omega, \quad \mu\left(\frac{\partial u}{\partial n} + \frac{u}{l}\right) = g_1 \ on \ \partial\omega, \qquad (2)$$

by a fictitious domain method (new to the best of our knowledge); in (1), (2), Ω denotes a bounded domain of $\mathbf{R}^d$ and ω a sub-domain of Ω. Our approach relies essentially on the transformation of (1), (2) in a (virtual) control problem (in the sense of J.L. Lions), involving an extension of (1) (completed by $u = g_0$ on $\partial\Omega$) on the whole Ω, the restriction of the extended solution to Ω / ϖ being the solution of (1), (2). From an algorithmic point of view, one solves the control problem by a least-squares/conjugate gradient algorithm whose finite element implementation is rather easy, even if the mesh associated with Ω does not match the geometry of ω. Numerical experiments, including the generalization to the solution of parabolic equations with moving ω, suggest optimal orders of convergence.

Magnus Lectures Spring 2008 (January 22-24): *Dr. Desmond J. Higham, FRSE, Professor of Mathematics University of Strathclyde, Glasgow, Scotland, UK*
Elected Fellow of the Royal Society of Edinburgh

Public Lecture: Network Science: Joining the Dot
Abstract: Connections are important. In studying nature, technology, commerce and the social sciences it often makes sense to focus on the pattern of interactions between individual components. I will give examples of large, complex networks that arise:

• in the cell: connecting proteins
• in the brain: connecting neural regions
• in the World Wide Web: connecting web pages
• in the Internet Movie Database: connecting actors
• in supermarkets: connecting products

Improvements in computing power have allowed us to store and analyze these massive data sets, and a new discipline, network science, has emerged. I will focus on contributions that mathematicians and other scientists have made towards understanding how large networks evolve, discovering universal properties and developing tools to pick out interesting details. Along the way we will see how Google ranks your home page and why Kevin Bacon is the center of the universe.

Colloquium: Spectral Algorithms for Biological Networks
Abstract: Advances in experimental biology are creating challenging modelling and data analysis problems for researchers in bioinformatics. In particular, protein- protein interaction data sets can be viewed as large unweighted, undirected graphs that, when analyzed appropriately, may reveal important biological information. Researchers have considered high-level questions, such as "can we describe these networks in terms of a few parameters?" and low-level questions such as "can we identify interesting groups of proteins?" I will show how contributions at both levels can be made from a matrix computation viewpoint. Results for real biological data sets will be given.

Research Seminar: Stochastic Differential Equations with Switches
Abstract: To incorporate abrupt and unpredictable changes to the dynamics of a system, models are now being derived that incorprate a switch. Given a collection of stochastic differential equations (SDEs), the switch, taking the form of an independent continuous time Markov chain, determines which SDE is currently active. Important examples arise in mathematical finance and systems biology. I will look at two topics:

1. stability analysis of numerical methods, and
2. modelling/simulation issues for gene regulation.

Magnus Lectures Spring 2007 (March 26-28): Efmi Zelmanov, Fields Medalist, Professor of Mathematics at University of California, San Diego.

Public Lecture: Algebra in the 20th Century

Colloquium: Profinite Groups

Seminar: Some open problems concerning Infinite-Dimensional Algebras

Magnus Lectures Spring 2006 (April 14-16): Richard Ewing, Distinguished Professor of Mathematics, Applied Mathematics and Engineering, and Vice-President of Research, Texas A&M University

Public Lecture: Mathematical Modeling: How Powerful Is It
Abstract: Mathematical models have been widely used to understand, predict, or optimize many complex processes from a large variety of subject areas, from semiconductor or pharmaceutical design to global weather models to astrophysics and astronomy. In particular, use of mathematical models in aerospace engineering, effects of air and water pollution, production of hydrocarbons, protection of health, medical imaging, financial forecasting, and cryptography for security is extensive. Examples from several of these applications will be discussed.

There are five major stages to the modeling process. For example, for each process, a physical model must first be developed incorporating as much application-specific information as is deemed necessary to describe the essential phenomena. Second, a mathematical formulation of the physical model is obtained, often involving equations or coupled systems of non-linear equations. Third, the mathematical properties of the model must be sufficiently well understood. Fourth, a computer code capable of efficiently and accurately performing the necessary computations on a discrete version of the mathematical model must be developed. Finally, for complex solution sets, visualization techniques must be used to compare the discrete output with the original process to determine the effectiveness of the modeling process. The issues involved in each of the parts of this modeling process will be illustrated through a variety of applications.

Colloquium: Mathematical Modeling in Energy and Environmental Applications
Abstract: Mathematical models are used extensively to understand the transport and fate of groundwater contaminants and to design effective in situ groundwater remediation strategies. Four basic problem areas must be addressed in the modeling and simulation of the flow of groundwater contamination. One must first obtain an effective mathematical model to describe the complex fluid/fluid interactions that control the transport of contaminants in groundwater. This includes the problem of obtaining accurate reservoir descriptions at various length scales to describe the underground reservoir in a statistical manner. One obtains coupled systems of nonlinear time-dependant equations. Next, one must develop accurate discretization techniques to discretize these continuous equations that retain the important physical properties of the continuous models. Then, one must develop efficient numerical solution methods that can solve the enormous resulting systems of linear equations. Finally, one must be able to visualize the results of the numerical models in order to ascertain the validity of the modeling process by comparing with data obtained from the physical process. Aspects of each of these steps will be presented.

Seminar: Eulerian-Lagrangian Localized Adjoint Methods for Transport Problems
Abstract: Convection-diffusion problems, which arise in the numerical simulation of groundwater contamination and remediation, often present serious numerical difficulties. Conventional Galerkin methods and classical viscosity methods usually exhibit some combination of nonphysical oscillation and excessive numerical dispersion. Many numerical methods have been developed to circumvent these difficulties.

Basically, there are two major classes of approximations. The first are the so-called optimal spatial methods, based upon the minimization of error in the approximation of spatial derivatives using optimal test functions that satisfy a localized adjoint condition. Optimal spatial methods yield time truncation errors that dominate the solution and potentially serious numerical dispersion. The second class, the so-called Eulerian Lagrangian Methods, accurately treat the advection along characteristics and show great potential. The methods described here combine the best aspects of both of these classes and have been applied succesfully to a wide variety of applications.

Extensions of these methods to spline-based test and trial functions are extremely effective for pure transport problems in one and two spatial dimensions. They also achieve accurate approximations under minimal regularity assumptions on the solution. Finally, an algorithm for the approximation of characteristics, a property required by all of these methods, is developed in higher spatial dimensions.

This is joint work with Hong Wang (University of South Carolina) and James Liu (Colorado State University.)

Magnus Lectures Spring 2005 (March 21-23): Bernd Sturmfels, Professor of Mathematics and Computer Science, University of California, Berkeley

Public Lecture - Algebraic Statistics for Computational Biology
Abstract: We discuss recent interactions between algebra and statistics and their emerging applications to computational biology. Statistical models of independence and alignments for DNA sequences will be illustrated by means of a fictional character, DiaNA, who rolls tetrahedral dice with face labels “A,” “C,” “G” and “T.” Reference.

Colloquium - Tropical Geometry

Abstract: Tropical geometry is the geometry of the tropical semiring (min-plus-algebra.) Its objects are polyhedral cell complexes which behave like complex algebraic varieties. We offer an introduction to this theory, with an emphasis on plane curves and linear spaces, and we discuss applications to phylogenetics. This talk will be suitable for undegraduates.

Seminar - Solving the Likelihood Equations
Abstract: Given a model in algebraic statistics and some data, the likelihood function is a rational function on a projective variety. We discuss algebraic methods for computing all critical points of this function, with the aim of identifying the local maxima in the probability simplex. This is joint work with Serkan Hosten and Amit Khetan (math.ST/0408270.)

Magnus Lectures Spring 2004 – (March 22-23): John G McWhirter FRS FREng, Senior Fellow, QinetiQ Ltd, Malvern Technology Centre

Graduate Student Lecture - The Mathematics of Independent Component Analysis
Abstract: Independent component analysis (ICA) is a powerful new technique for signal and data processing. It extends the scope and capability of principal component analysis (PCA) by exploiting higher order statistics in circumstances where the statistics of the data or signal samples are non-Gaussian. The development of effective techniques for ICA leads to some interesting and challenging mathematical problems. For example, the use of fourth order statistics to separate independent signals which have been mixed in an instantaneous manner involves approximate diagonalisation of a fourth order (i.e. four index) tensor. Whereas the problem of matrix diagonalisation is well understood, the diagonalisation of tensors of order greater than two poses some very challenging problems.

The use of independent component analysis to separate signals which have been mixed in a convolutive manner poses a particularly interesting challenge. The problem may be formulated in terms of polynomial matrices (i.e. matrices with polynomial elements) and involves identifying the elements of a paraunitary unmixing matrix.

In this seminar, I will introduce the basic concept of ICA, explain how some of these interesting mathematical problems arise and outline some of the progress which has already been made. I will then present some results obtained using ICA in practical applications such as HF communications and fetal heartbeat analysis.

Public Lecture - Mathematics, Who Needs It Anyway
Abstract: Mathematics is not just a very interesting and beautiful subject in its own right. It is also the language of science and engineering and at the heart of many developments which we take for granted in this modern technological age. And yet there is a tendency in many of the world's leading economic regions to assume that the teaching and learning of mathematics is less important than it used to be. Many people are entirely unaware of the role that mathematics plays in their day to day lives. It is assumed that the need for mathematics has been diminished by the widespread availability of high performance computers. In this talk I will attempt to illustrate some of the areas where mathematics has made a vital contribution to our lives and argue that the need for mathematical skills has been increased rather than diminished by recent developments in computer technology.

Mathematics Lecture - A Novel Technique for Boardband Signular Value Decomposition
Abstract: The singular value decomposition (SVD) is a very important tool for narrowband adaptive sensor array processing. The SVD decorrelates the signals received from an array of sensors by applying a unitary matrix of complex scalars which serve to modify the signals in phase and amplitude. In broadband applications, or a situation where narrowband signals have been convolutively mixed, the received signals cannot be represented in terms of phase and amplitude. Instantaneous decorrelation using a unitary matrix

is no longer sufficient to separate them. It is necessary to decorrelate the signals over a suitably chosen range of relative time delays. This process, referred to as strong decorrelation, requires a matrix of suitably chosen filters. Representing each filter (assumed to have finite impulse response) in terms of its z-transform, this takes the form of a polynomial matrix. The SVD may be generalized to broadband adaptive sensor arrays by requiring the polynomial matrix to be paraunitary so that it preserves the total energy at every frequency. In this talk, I will describe a novel technique for computing the required paraunitary matrix and show how the resulting broadband SVD algorithm can be used to identify the signal subspace for broadband adaptive beam forming.

Magnus Lectures Spring 2003 - (April 30- May 2): Tom Mullin, Manchester Center for Nonlinear Dynamics

Public Lecture - Patterns in the Sand: The Physics of Granular Flow
Abstract: Have you ever wondered why the sand dries around your foot when you walk along a wet beach? Or has it puzzled you that the fruit and nuts in your müsli are usually at the top of the packet? These fundamental physics questions will be discussed and videos of other spectacular effects in granular flows will be presented. Refreshments will be served before and after the presentation.

Mathematics Lecture - Can Granular Segregation be considered as a Phase Transition?
Abstract: Segregation of mixtures of granular materials is a topic of interest to a broad range of scientists from Physicists, to Geologists and Engineers. The process can be driven by either simple avalanching in binary mixtures when the angle of repose of the constituents are different or it can be promoted using an external drive or perturbation. We will discuss these issues and present the results of a new experimental study of particle segregation in a binary mixture that is subject to a periodic horizontal forcing. A surprising self-organization process is observed which shows critical behavior in its formation. Connections with concepts from equilibrium phase transitions will be discussed.

Mathematics Lecture - Balls in Syrup: A 'Simple' Dynamical System
Abstract: We present the results of an experimental investigation of a novel dynamical system in which one, two or three solid spheres are free to move in a horizontal rotating cylinder filled with highly viscous fluid. At low rotation rates steady motion is found where the balls adopt stable equilibrium positions rotating adjacent to the rising wall at a speed which is in surprisingly close agreement with available theory. At higher cylinder speeds, time-dependent motion sets in via Hopf bifurcations. When one or two balls are present the motion is strictly periodic. However, low dimensional chaos is found with three balls.

Magnus Lectures Spring 2002 (April 5 and April 8): Heinz-Otto Peitgen, University of Bremen and Florida Atlantic University

General Lecture - Harnessing Chaos
Abstract: We will discuss how chaos theory has changed our view of nature and has an impact on how we do science. The lecture will include a historical treatment of how our current scientific view of the world has evolved and changed with chaos theory, its impact on the arts and culture, and finish with state of the art applications in information technology and medicine.

Mathematics Lecture - Mathematical Methods in Medical Imaging: Analysis of Vascular Structures for Liver Surgery Planning
Abstract: Mathematics and medicine do not have a long history of close and fruitful cooperation. The application of mathematical models in medical applications is becoming viable due to the increasing performance of computers and because more and more image data are acquired digitally. With mathematical methods these data may be quantitatively analyzed and visualized such that medical

diagnosis and the assessment of therapeutic strategies become more and more reliable and reproducible. As an example we will demonstrate our work for the planning of oncological and transplantation liver surgery.

Magnus Lectures Spring 2001 (April 17-20): Robert Calderbank, AT&T Laboratories

General Lecture - 50 Years of Information and Coding
Abstract: Over 50 years have passed since the appearance of Shannon's landmark paper "A Mathematical Theory of Communication". This talk is a personal perspective on what has been achieved in certain areas over the past 50 years and what the future challenges might be. The focus will be on connecting coding theory with coding practice in areas like digital data storage, deep space communication and wireless networks.

Mathematics Colloquium - Combinatorics, Quantum Computing and Cellular Telephones
Abstract: This talk explores the connection between quantum error correction and wireless systems that employ multiple antennas at the base station and the mobile terminal. The two topics have a common mathematical foundation, involving orthogonal geometry - the combinatorics of binary quadratic forms. We explain these connections, and describe how the wireless industry is making use of a mathematical framework developed by Radon and Hurwitz about a hundred years ago.

Algebraic Combinatorics Seminar - Tailbiting Representations of the Binary Golay Code
Abstract: This talk introduces tailbiting representations of a most extraordinary binary code - the [24,12,8] Golay code. The problem is to represent Golay codewords as paths in a graph - the graph has a particular form - it is the concatenation of 24 identical sections - section per coordinate symbol - and the paths have to start and end at the "same" node. The objective is to minimize the number of nodes, and the analysis will involve Conway's Miracle Octad Generator.

Magnus Lectures Spring 2000 (April 10-11): Gilbert Strang, MIT

General Lecture - Partly Random Graphs and Small World Networks
Abstract: It is almost true that any two people in the US are connected by less than six steps from one friend to another. What are models for large graphs with such small diameters? This is the "6 Degrees of Separation" that appeared in a movie title.

Watts and Strogatz observed (in Nature, June 1998) that a few random edges in a graph could quickly reduce its diameter (longest distance between two nodes). We report on an analysis by Newman and Watts (using mathematics of physicists) to estimate the average distance between nodes, starting with a circle of N friends and M random shortcuts, $1 << M << N$.

We also study a related model, which adds N edges around a second (but now random) cycle. The average distance between pairs becomes nearly $A \log n + B$. The eigenvalues of the adjacency matrix are surprisingly close to an arithmetic progression; for each cycle they would be cosines, the sum changes everything.

We will discuss some of the analysis (with Alan Edelman and Henrik Eriksson at MIT) and also some applications. We also report on the surprising eigenvalue distribution for trees (large and growing) found by Li He and Xiangwei Liu. And a nice work by Jon Kleinberg discusses when the short paths can actually be located efficiently.

Colloquium Lecture - Cosine Transforms and Wavelet Transforms and Signal Processing
Abstract: Each Discrete Cosine Transform uses N real basis vectors whose components are cosines. These

basis vectors are orthogonal and the transform is much used in image processing (we will point out drawbacks). The cosine series is quickly computed by the FFT. But a direct proof of orthogonality, by calculating inner products, does not reveal how natural these cosine vectors are in applications.

We prove orthogonality in a different way. Each DCT comes from the eigenvectors of a symmetric "second-difference matrix". By varying the boundary conditions we get the established transforms DCT-1 through DCT-4 (and also four more orthogonal bases of cosines). The boundary condition determines the centering (at a meshpoint or a midpoint) and decides on the entries cos [j or j+0.5] [k or k+0.5] pi/N .

Then we discuss bases from filter banks and wavelets. The key is to create a banded *block Toeplitz* matrix whose inverse is also banded. The algebra shows how the approximation properties of the wavelet basis are determined by the polynomials that can be reproduced exactly by wavelets. In signal processing, so much depends on the choice of a good basis.

Seminar Lecture - Teaching Applied Mathematics
Abstract: We will discuss the possibilities (and the problems) of teaching applied mathematics and engineering mathematics. I have found this a very positive experience -- the students are interested and more motivated, I have new ideas to learn about, the mathematics is interesting and not simply formulas. It is pleasing to see how a few key ideas appear in many different genuine applications.

Magnus Lectures Spring 1999: Cheryl Praeger, University of Western Australia
General Lecture - Symmetries of Designs
Colloquium Lecture - Algorithms for computing with groups of matrices over finite fields
Seminar Lecture - Quasiprimitive permutation groups and their actions on graphs and linear spaces

Magnus Lectures Spring 1998: Raghu Varadhan, Courant Institute of Mathematics
General Lecture - How Rare Is Rare?
Colloquium Lecture - Problems of Hydrodynamic Scaling
Seminar Lecture - Large Deviations for the Simple Exclusion Process

Magnus Lectures Spring 1997: Marty Golubitsky, University of Houston
General Lecture - Symmetry and Chaos: Patterns on Average
Colloquium Lecture - Oscillations in Coupled Systems and Animal Gaits
Seminar Lecture - Spiral Waves and Other Planar Patterns

Magnus Lectures Spring 1996: Fabrizio Catanese, University of Pisa
General Lecture - Moduli of surfaces and differentiable 4-manifolds
Colloquium Lecture - Enriques' rough classification of algebraic surfaces and the fine classification
Seminar Lecture - Homological algebra and algebraic surfaces

Magnus Lectures Spring 1994: Lawrence Sirovich, Brown University
General Lecture - Image Analysis
Colloquium Lecture - Dynamics of Wall-Bounded Turbulence
Seminar Lecture - EOF Analysis of TOMS Ozone Image Data

Magnus Lecture Spring 1993: Bill Jones, University of Colorado
Public Talk - Szego Polynomials Applied to Signal Processing