Past Kilpatrick Lecture Speakers

1965 Ronald Percy Bell
1966 Lord Wynne-Jones
1967 Henry Eyring
1968 Martin Karplus
1969 John D. Roberts
1970 Manfred Eigen, George B. Kistiakowsky
1971 John R. Platt
1972 George C. Pimentel
1973 Roald Hoffmann
1974 Richard B. Bernstein
1975 Henry Taube
1976 William N. Lipscomb
1977 Melvin Calvin
1978 Symposium: Fast Time Spectroscopy and Chemistry
1981 Symposium: Carbenes, Carbenoids, Cyclopropanes in Organic Synthesis
1982 Symposium: Chemistry at Metal Surfaces
1984 Jack Halpern
1985 David L. Beveridge
1986 Symposium: Polymers (in memory of Paul Flory)
1989 Jaqueline K. Barton
1991 Mark S. Wrighton
1992 Symposium: Conducting Polymers
1993 Mary Anne Fox
1995 Symposium: Synchrotron Radiation in Chemistry
1996 Symposium: Host-Guest Interactions and Supramolecular Structures
1997 K. C. Nicolaou
1999 Wolfgang Gopel
2000 Symposium: Computational Chemistry with John Pople
2001 Symposium: Nanoscience and Nanotechnology
2003 Barry M. Trost
2004 Symposium: Enzyme Dynamics
2008 Fraser Stoddart
2009 Susan V. Olesik
2010 Symposium: Recent Advances in Polymer Science and Technology
2011 George Whitesides
2013 Daniel G. Nocera
2014 Roald Hoffmann

This event will be photographed and videotaped.
Illinois Institute of Technology may use photos and videos in promotional materials.

The Department of Chemistry at Illinois Tech
Presents

2017 Kilpatrick Lecture

SENSOR SCIENCE & TECHNOLOGY

Eric V. Anslyn
Welch Regents Chair
University Distinguished Teaching Professor
Department of Chemistry and Biochemistry
University of Texas at Austin
Mimicking the Senses of Taste & Smell

Frances S. Ligler
Lampe Distinguished Professor
Department of Biomedical Engineering
North Carolina State University
University of North Carolina–Chapel Hill
Keys to Biosensor Sensitivity: More than Affinity

Rashid Bashir
Abel Bliss Professor and Chair
Department of Bioengineering
University of Illinois at Urbana-Champaign
BioMEMS & Biomedical Nanotechnology: Opportunities & Prospects

Illinois Tech Mies Campus, Hermann Hall Ballroom,
33rd & State Street, Chicago
Monday, April 10, 2017

This event is co-sponsored by the International Center for Sensor Science & Engineering (cos.iit.edu/icsse)

CHEMISTRY ICSSE Rigor. Relevance. College of Science ILLINOIS INSTITUTE OF TECHNOLOGY

Welcome

Welcome to the 2017 Kilpatrick Lecture in chemistry. The theme of this year's Kilpatrick event is "Sensor Science and Technology." Sensor science is emerging as a highly interdisciplinary field with important applications across all areas of chemistry and chemical engineering. It promises beneficial effects for the environment, biomedicine, and for analytical and physical organic chemistry.

We are pleased to have three distinguished speakers for our 2017 Kilpatrick Lecture:

Eric V. Anslyn, from the University of Texas at Austin, will provide an analysis of how organic chemistry can be used to mimic the senses of taste and smell.

Rashid Bashir, a pioneer in the field of bionanotechnology from the University of Illinois at Urbana-Champaign, will speak on bioMEMS (microelectromechanical systems) and biomedical nanotechnology and will present his work on four different detections and developments.

Frances S. Ligler, jointly from the University of North Carolina–Chapel Hill and North Carolina State University, will speak on keys to biosensor sensitivity. Drawing from biosensors developed in her lab, she will provide examples of how manipulating elements increased (or decreased) sensitivity for target analytes.

On behalf of Illinois Tech's chemistry community, faculty, staff, students, and the 2017 Kilpatrick Lecture Committee, thank you for joining us for this special event. We hope you enjoy the program.

Sincerely,

Carlo Segre
Interim Chair
Department of Chemistry
Duchossois Leadership Professor of Physics

2017 Kilpatrick Lecture Committee: Anoklase Jean-Luc Ayitou, *Assistant Professor in Chemistry;* Richard Guan, *Associate Professor of Chemistry;* M. Ishaque Khan, *Professor of Chemistry;* Rong Wang (Chair), *Professor of Chemistry*

Event Schedule

2 p.m.	Welcome from Rong Wang Chair of the Kilpatrick Lecture Committee Professor of Chemistry, Director of International Center for Sensor Science & Engineering (ICSSE)
2:05 p.m.	Remarks from Russell Betts Dean of the College of Science Distinguished Professor of Physics
2:10 p.m.	Remarks from Carlo Segre Interim Chair, Department of Chemistry Duchossois Leadership Professor of Physics
2:15 p.m.	**Mimicking the Senses of Taste and Smell** Eric Anslyn Welch Regents Chair University Distinguished Teaching Professor Department of Chemistry and Biochemistry University of Texas at Austin
3:05 p.m.	**BioMEMS and Biomedical Nanotechnology: Opportunities and Prospects** Rashid Bashir Abel Bliss Professor and Chair Department of Bioengineering University of Illinois at Urbana-Champaign
3:55 p.m.	Break
4:10 p.m.	**Keys to Biosensor Sensitivity: More than Affinity** Frances Ligler Lampe Distinguished Professor Department of Biomedical Engineering North Carolina State University and University of North Carolina—Chapel Hill
5:00 p.m.	Reception and Student Poster Session
6:15 p.m.	Student Poster Session Awards
6:30 p.m.	Reception ends

Kilpatrick Lecturers

Frances S. Ligler is the Lampe Distinguished Professor of Biomedical Engineering in the Joint Department of Biomedical Engineering at North Carolina State University and the University of North Carolina-Chapel Hill and an elected member and councillor of the National Academy of Engineering. Before 2013, she was the Senior Scientist for Biosensors and Biomaterials at the U.S. Naval Research Laboratory. She earned a B.S. from Furman University and both a D.Phil. and a D.Sc. from Oxford University.

Currently working in the fields of biosensors, tissue-on-chip, and microfluidics, she has more than 400 full-length publications and patents, which have led to eleven commercial biosensor products and have been cited over 14,000 times with H=70 (GS).

She is a Fellow of SPIE, AIMBE, AAAS and the National Academy of Inventors. She also serves on the National Academies of Sciences, Engineering, and Medicine Board on Chemical Science and Technology. She has been awarded the Homeland Security Award by the Christopher Columbus Foundation, the Presidential Rank of Distinguished Senior Professional by President Bush, and the Presidential Rank of Meritorious Senior Professional by President Obama. In 2014, she was awarded an honorary doctorate from the Agricultural University of Athens, Greece. She is a 2017 inductee of the National Inventors Hall of Fame.

Keys to Biosensor Sensitivity: More than Affinity • How many times have you heard a frustrated scientist or engineer complain, "I could not get the required sensitivity because there were no antibodies (or aptamers, peptides, etc.) with sufficiently high affinity." While the affinity of a recognition molecule may well be the limiting factor for sensitivity and specificity in an optimized detection system, let's consider several possible alternatives to being stymied by the apparent fact that some target analytes simply do not elicit high affinity binding molecules. Often, the solution to increasing sensitivity or improving specificity lies in another element of a biosensor system, and the impact of some elements are far more obvious than others. The current focus for biosensor development is on handheld or fully autonomous systems, and we need to understand the tradeoffs involved in the system design to provide sufficient sensitivity for an actionable result.

Drawing from biosensors developed in her lab over the last 30 years, Ligler will provide examples of how manipulating a set of critical elements can increase sensitivity for target analytes detected in complex sample matrices.

About the Kilpatrick Lecture

Illinois Tech's annual Kilpatrick Lecture honors Martin and Mary Kilpatrick, who were outstanding researchers and educators. Martin served as chair of IIT's Department of Chemistry from 1947–1960, leading the department to national prominence in both undergraduate and graduate instruction and research. As a scientist, Martin made his mark in fundamental chemical research in areas of physical and inorganic chemistry, and materials science. Mary was a chemistry faculty member from 1947–1964.

The Kilpatricks devoted their lives to the critical and creative study of chemistry, particularly chemical kinetics, acid-based reactions, and electrolyte chemistry. Before coming to IIT in 1947, Martin was a professor at the University of Pennsylvania and assisted Harold Urey in the Manhattan Project at Columbia University. Both Kilpatricks were Fulbright research scholars who studied in Denmark under the legendary J. N. Brønsted.

As chair at IIT, Martin guided the department during a period of vigorous growth and development in both teaching

and research. Initially, the department occupied all of Wishnick Hall—one of the then three new buildings by Ludwig Mies van der Rohe that marked the beginning of today's modern Mies Campus.

In recognition of the Kilpatricks' achievements at IIT, Martin's successor, Arthur E. Martell, and faculty colleagues instituted the now permanently endowed Kilpatrick Lecture.

Kilpatrick Lecturers

Eric V. Anslyn, Welch Regents Chair and University Distinguished Teaching Professor, University of Texas at Austin, earned his B.S. degree in chemistry from California State University Northridge. He performed doctoral research at California Institute of Technology under the direction of Robert Grubbs and received his Ph.D. in organic chemistry in 1987. He was a National Science Foundation postdoctoral associate at Columbia University from 1987-89, working with Ronald Breslow.

Anslyn's research involves the use of physical organic chemistry principles in the development of enzyme mimics and synthetic receptors. Most recently, these receptors have been used to create practical molecular sensors. Anslyn has been recognized with a variety of research and teaching awards, including the Izatt-Christensen Award in Macrocyclic and Supramolecular Chemistry; Molecular Sensors and Molecular Logic Gates Award; American Chemical Society Edward Leete Award for excellence in teaching and research; Arthur C. Cope Scholar Award for excellence in organic chemistry; Dreyfus Teacher Scholar Award; and Jean Holliday Award. He is also the co-author with Dennis Dougherty of the graduate textbook *Modern Physical Organic Chemistry*.

Mimicking the Senses of Taste and Smell • The senses of taste and smell operate via a series of cross-reactive protein-based receptors that are non-selective, but create patterns that discriminate solution and vapor composition, respectively. Anslyn will discuss the basic principles of how these mammalian senses operate, with simple examples, and then explain how organic chemistry can be used to mimic these senses. Analytes in beverages, chiral mixtures, and blood/saliva have been targeted. The receptors derive from a combination of rational chemical design and modeling, with combinatorial synthesis techniques. Anslyn will show that a union of designed receptors targeted to a class of analytes, with combinatorial methods, gives fingerprints that differentiate between the individual members of the class. The fingerprints of the solutions are created using artificial neural networks, principle component analysis, and/or linear discriminate analysis. The technique represents a marriage of supramolecular chemistry and pattern recognition protocols, resulting in a versatile artificial method that acts analogously to the mechanisms of taste and smell.

Kilpatrick Lecturers

Rashid Bashir, Abel Bliss Professor of Engineering at the University of Illinois at Urbana-Champaign, joined the Illinois faculty in 2007 as the director of the Micro and Nanotechnology Laboratory and co-director of the campus-wide Center for Nanoscale Science and Technology. He currently serves as the department head, as well as interim vice dean of the new, engineering-based Carle Illinois College of Medicine.

Bashir is a pioneer in the field of bionanotechnology. A short list of his research interests include BioMEMS and biosensors, interfacing of biology and engineering from molecular to tissue scale, and applications of semiconductor fabrication to biology. He has made key contributions to rapid electrical detection of pathogens and infectious disease, development of electrically based cell and molecular counters for cancer diagnostics, and more recently 3D bioprinting, applications in tissue engineering, and development of biological soft robotics.

Bashir has authored or co-authored more than 200 journal papers, has given more than 110 invited talks, and has been granted 38 patents. He has licensed technologies to three startups and other companies. Several professional organizations, including IEEE, AIMBE, AAAS, BMES, IAMBE, and APS, have elected him as a fellow to honor his outstanding contributions to science.

BioMEMS and Biomedical Nanotechnology: Opportunities and Prospects • Integration of biology, medicine, and fabrication methods at the micro and nano scale offers tremendous opportunities for solving important problems in biology and medicine and to enable a wide range of applications in diagnostics, therapeutics, and tissue engineering. Microfluidics and Lab-on-Chip can be very beneficial to realize practical applications in detection of disease markers, counting of specific cells from whole blood, and for identification of pathogens at point-of-care. The use of small sample size and electrical methods for sensitive analysis of target entities can result in easy to use, one-time-use assays that can be used at point-of-care. In this talk, Bashir will present his work on detection of T cells for diagnostics of HIV AIDs for global health, development of a CBC (Complete Blood Cell) analysis on a chip, electrical detection of multiplexed nucleic acid amplification reactions, and detection of epigenetic markers on DNA at the single molecule level. While the abovementioned devices are built with polydimethylsiloxane (PDMS) or silicon, bio-printing with stereolithography can be a very powerful technology to produce bio-hybrid devices made of polymers and cells such as biological machines and soft robotics. These devices could have potential applications in drug delivery, power generation, and other biomimetic systems.