Keynote Presentation

"Imaging the Addicted Human Brain: from Molecules to Behavior"

Nora Volkow, M.D.

Director, National Institute of Drug Abuse (NIDA)
National Institutes of Health

August 31, 2006, 8:00 – 8:45

Abstract

Addiction is a disorder that involves complex interactions between a wide array of biological and environmental variables. Studies employing neuroimaging technology paired with sophisticated behavioral measurement paradigms have led to extraordinary progress in elucidating many of the neurochemical and functional changes that occur in the brains of addicts. Although large and rapid increases in dopamine have been linked with the rewarding properties of drugs, the addicted state, in striking contrast, is marked by significant decreases in brain dopamine function. Such decreases are associated with dysfunction of prefrontal regions including orbitofrontal cortex and cingulate gyrus. In addiction, disturbances in salience attribution result in enhanced value given to drugs and drug-related stimuli at the expense of other reinforcers. Dysfunction in inhibitory control systems, by decreasing the addict's ability to refrain from seeking and consuming drugs, ultimately results in the compulsive drug intake that characterizes the disease. Discovery of such disruptions in the fine balance that normally exists between brain circuits underling reward, motivation, memory and cognitive control have important implications for designing multi-pronged therapies for treating addictive disorders.

Biographical Sketch

Nora D. Volkow, M.D. is the Director of the National Institute on Drug Abuse (NIDA). Before assuming this position on May 1, 2003, Dr. Volkow was Associate Director for Life Sciences at Brookhaven National Laboratory (BNL), Director of Nuclear Medicine at BNL and Director of the NIDA-Department of Energy Regional Neuroimaging Center at BNL. She was also Professor at the Department of Psychiatry, State University of New York (SUNY) at Stony Brook and Associate Dean for the Medical School at SUNY-Stony Brook.

Dr. Volkow received her M.D. in 1981 from the National University of Mexico, in Mexico City, Mexico, and performed her residency in psychiatry at New York University.

Her main area of interest is the investigation of the mechanisms underlying the reinforcing, addictive, and toxic properties of drugs of abuse in the human brain. Dr. Volkow was the first to use imaging to investigate the neurochemical changes in the human brain that occur during drug addiction. Her studies have documented a decrease in function of the dopamine system in addicted subjects that is associated with a disruption in function of frontal brain regions involved in motivation and drive. Her work has also focused on the investigation of the neurochemical mechanisms responsible for intersubject variability in response to drugs of abuse and its potential link to vulnerability to drug abuse and alcoholism.

Dr. Volkow has also used imaging to investigate the effects of stimulant drugs with respect to both their rewarding as well as therapeutic actions. By doing a systematic comparison of the pharmacological effects of cocaine (one of the most addictive drug of abuse) and of methylphenidate (a drug used to treat children with attention deficit hyperactivity disorder) in the human brain, her studies have highlighted the relevance that drug pharmacokinetics play in enabling the reinforcing effects of stimulant drugs to occur. These studies have also shown that stimulant drugs, when used therapeutically, amplify DA signals in the brain, enhancing the saliency of a stimulus and thus improving attention and performance.

She has also used imaging to investigate the changes in the dopamine system that occurs with aging and their functional significance. Her work has documented that the loss of dopamine brain function with age in healthy subjects with no evidence of neurological dysfunction is nonetheless associated with motor slowing and with changes in performance of cognitive tasks that involve executive functions. Her work now focuses on strategies to minimize the age-related losses in dopamine brain activity as a means to improve quality of life in the elderly.

Dr. Volkow has authored or coauthored more than 320 peer-reviewed publications, three edited books, and more than 55 book chapters and non-peer reviewed manuscripts. She is the recipient of multiple awards for her research, and has been elected to membership in the Institute of Medicine in the National Academy of Sciences. Dr. Volkow was named "Innovator of the Year" in 2000 by *US News and World Report.*

Plenary Presentation

"Molecular Imaging"

Michael Phelps, Ph.D.

Chair, Department of Molecular & Medical Pharmacology
Director, Crump Institute of Molecular Imaging
University of California at Los Angeles

August 31, 2006, 13:00 – 13:45

Abstract

Dr. Phelps's research interests are in the areas of biological imaging and neurosciences. His research focuses on the merger of biology and imaging to provide the means to examine molecular and cellular function in tissue cultures, as well as integrated organ function in animals and humans. These biological imaging assays are developed and integrated into biology and pharmacology based problems. Autoradiographic studies of cerebral metabolism, protein synthesis and gene expression are used in animals to study brain maturation, neuronal plasticity and compensatory reorganization to disease or injury. The anatomical expression of novel connections due to brain lesions promoting compensatory reorganization of the brain is determined by anterograde and retrograde tracing techniques, and their neurotrophic basis by in situ hybridization and gene knock-out techniques. Positron Emission Tomography (PET) is employed to map out gene expression, metabolic maturation, responses to select stimuli and learning, as well as compensatory reorganization of the brain in mice, monkeys and children. PET is also used to study the biological basis of human disorders such as epilepsy, Parkinson's and Alzheimer's, as well as alterations in neurochemical function by cocaine and methamphetamine.

Biographical Sketch

Dr. Phelps earned B.S. degrees in chemistry and mathematics at Western Washington State University in 1965, and a Ph.D. in chemistry, at Washington University, St. Louis, in 1970. Subsequently, he was on the medical school faculty of Washington University (1970-75), University of Pennsylvania (1976) and UCLA (1976-present). Dr. Phelps is the inventor of the Positron Emission Tomography (PET) scanner.

In addition to developing several generations of PET scanners with his colleague Dr. Edward Hoffman and CTI, Dr. Phelps and his other UCLA colleagues and students have used PET to study both the biological basis of normal organ functions, as well as numerous disorders of the brain and heart, as well as cancer.

In 1981, he established the use of imaging technologies for what today is called "Brain Mapping" for imaging how the brain performs various functions such as seeing, hearing, thinking, working and remembering with PET. Ten years later other imaging technologies such as fMRI were developed for brain mapping.

Drs. Phelps and Chugani performed seminal studies on the biological basis of how a child's brain develops its behavioral repertoire, specialized learning in the formative years and unique means by which the child's brain can reorganize to compensate for a lesion or surgical resection. Using PET, he and his colleagues in pediatric neurology and neurosurgery identified epileptic tissues, defined the surgical resection criteria and established a clinical service for the surgical treatment of childhood seizure disorders.

Along with his colleagues Gary Small, Dan Silverman, Pete Engel, Jeff Cummings and John Mazziotta, Dr. Phelps developed criteria for the use of PET in differentiating various types of dementia (e.g., Alzheimer's, frontotemporal, vascular, etc.) early in the degenerative process, as well as the biological alterations in early stages of Parkinson's, epilepsy and Huntington's diseases. In Huntington's and familial Alzheimer's, metabolic abnormalities were identified with PET, 7 and 5 years before symptoms, respectively. It was also shown that PET provided a diagnosis of Alzheimer's with a 93% accuracy 3 years before the clinical diagnosis of "probable" Alzheimer's.

He and his colleague, Dr. Heinrich Schelbert, developed techniques with PET for the early detection of coronary artery disease and cardiomyopathies. They established PET as a gold standard for determining if tissue in the heart tissue was metabolically viable to allow selection of patients who would benefit from revascularization by bypass or angioplasty and who would not or required heart transplant.

Dr. Phelps and his colleagues also developed a technique with PET for imaging the entire body for cancer; to detect tumors, differentiate benign from malignant lesions, determine extent of metastasis and therapeutic effectiveness. Analyzing publications involving over 24,000 patients, Drs. Gambhir, Phelps and Coleman at Duke, established that PET improved detection, staging, detecting recurrent disease and assessing therapeutic responses in 17 different cancers, with an accuracy 8 to 43% higher than conventional imaging and changed treatment selection in 15 to 60% of the patients, depending on the clinical question.

Dr. Phelps has also led the worldwide transition of PET from research to clinical service, establishing the first clinical PET service at UCLA, obtaining FDA approval and Medicare and private insurance reimbursement.

Recently, with his colleagues Drs Heath, Quake, Kolb and Tseng, Dr. Phelps developed a program for accelerating, diversifying and simplifying the synthesis of PET molecular imaging probes, biomarkers and drugs with integrated microfluidics and new classes of high affinity and specificity molecular imaging biomarkers using "Click Chemistry" and traditional chemistry on a chip.

With colleague Dr. Henry Huang, he developed a software based Kinetic Imaging System (KIS) for performing tracer- and pharmaco-kinetics and pharmacodynamics with PET. This system combines the educational aspects of learning systems with mathematical engines buried in KIS and presented to the user in a simple game like approach for analyzing experimental data from mice to patients to provide the results desired by biologists and pharmaceutical scientists.

Dr. Phelps built a new combined basic science and clinical Department of Molecular and Medical Pharmacology at UCLA that includes the clinical PET and nuclear medicine services to bring together molecular diagnostics and molecular therapeutics from cells and mice to the care of patients. He also founded the Institute for Molecular Medicine and the Crump Institute for Molecular Imaging at UCLA.

Dr. Phelps has:

- Published over 670 peer-reviewed scientific articles, books and book chapters.
- Over 410,000 citations to publications.
- Been principle or co-principle investigator of over $225 million in grants.
- Received over $21 million in private donations to support his research.
- Received international honors and awards such as the George von Hevesy Prize, 1978, 1982), von Hevesy Foundation in Zurich (von Hevesy won the Nobel Prize in chemistry); the S. Weir Mitchell Award, 1981, Academy of Neurology; chaired the 1983 Nobel Symposium; the Paul Aebersold Award, 1983, Society of Nuclear Medicine; The Ernest O. Lawrence Award, 1884 from DOE; Rosenthal Foundation Award, 1987, American College of Physicians; the Enrico Fermi Presidential Award awarded by President Clinton, 1998; Kettering Prize, 2001, General Motors Cancer Research Foundation; Benedict Cassen Memorial Prize, Society of Nuclear Medicine, 2002.
- Been elected to the Institute of Medicine of the National Research Council in 1985 and in 1999 to the National Academy of Sciences.
- Become Chairman of the Board, Norton Simon Foundation; Chairman of the Board, Norton Simon Research Foundation; Member of the Board of the Norton Simon Art Foundation. These foundations have over $2.5 billion in assets.

Plenary Presentation

"Functional Tissue Engineering"

Van Mow, Ph.D.

**Stanley Dicker Professor of Biomedical Engineering and Orthopaedic Bioengineering,
Director, Liu Ping Laboratory for Functional Tissue Engineering Research,
Chair, Department of Biomedical Engineering**

August 31, 2006, 15:45 – 16:30

Abstract

Articular cartilage is the load-bearing tissue within all freely moving joints of mammals, *i.e.,* the diarthrodial joints such as hips, knees, shoulders, etc. All diarthrodial joints must support loads of high magnitude, and function with a remarkably low coefficient friction even with the generally slow reciprocating motions. For example, in the knee or hip, the magnitude of loading may reach higher than 15x body weight, with a normal stress up to 20 MPa acting on its articulating surfaces. Even the shoulder, generally considered as a non-weight bearing joint, but it is actually not a non-load bearing joint. Due to the lever law effect, there is a 20 to 1 disadvantage; thus a 10N load carried by an outstretched arm may be magnified to 200N acting across the glenohumeral joint of the shoulder. Similarly, in the patello-femoral joint (PFJ) of the knee, again with an approximate 20 to 1 disadvantage, the force and stress levels acting across the PFJ may reach similar magnitudes. In addition, these loads are applied, in a normal young vigorous individual, about one million times a year, with a cyclic frequency usually less than 1Hz. For athletes, these operational mechanical requirements are increased many times. It is no wonder that for some unlucky individuals, they develop arthritis in the hip and knee (most frequently); this is a form of failure in these natural bearings. For any artificial material (whether it is plastic or stainless steel) used in joint prostheses to replace these failed biological bearings, prostheses failure often occur. Tissue engineered constructs planned for replacing of damaged cartilage or resurfacing the joint surfaces have not met these demanding functional requirements; indeed, all tissue engineered cartilage have much inferior properties when compared to normal healthy cartilage, and indeed even inferior when compared with cartilage obtained from necropies of osteoarthritic joints. Thus, there appears to be something special of natural articular cartilage that renders it to function for many decades with no signs of impairment. What that something is has been the focus of worldwide attention for many years.

In brief, articular cartilage (and most biological tissues) is a hierarchical material with specific micro- and ultra-structural architectural feature variations that spans 8 decades of dimensional scale. Over the years, it has been established from much basic biochemistry studies that the nano-scale structures of glycosaminoglycan and tropo-collagen molecular form at the 10^{-9} to 10^{-8}m important interactions in determining the physical properties of these fundamental building blocks of the solid organic matrix of the tissue. At two orders of magnitude up, from 10^{-7} to 10^{-6}m, i.e., at the ultra-scale level, the physical interactions resulting from the complex organizations of the proteoglycans and collagen network are important in determining the cohesiveness and strength of the porous-permeable matrix. At the micro- and meso- scale, 10^{-5} to 10^{-3}m interactions between cells and their extracellular matrix are important in the mechano-transduction of mechanical and physical signals that modulates biosyntheses of all the constituents that comprise the tissue; these constituents form the tissues that must function within our bodies at the macro-scale, e.g., hips, knees, shoulders, etc. These elemental components form the structural anisotropies and compositional inhomogenieties that afford the tissue with a wide variety of complex mechano-electrochemical phenomena, which in turn endow this tissue not only with intriguing material properties, but also make possible their function in the strenuous mechanical environments normally found in all diarthrodial joints, as the superb bearing materials that we all know as articular cartilage. This lecture will provide a summary of our current knowledge of some of these burgeoning fields under the rubric of biomechanics, and looks to new and challenging problems of study in functional tissue engineering toward finding an answer(s) to the etiology of osteoarthritis and repair of damaged joint surfaces.

References

The reader may wish to consult the following texts for more information:

Brandt KD, Doherty M, Lomander LS (eds): *Osteoarthritis,* Oxford University Press, 2000; pp511

Buckwalter JA, Einhorn TA, Simon SR (eds): *Orthopaedic Basic Science: Biology and Biomechanics of the Musculoskeletal System,* American Academy of Orthopaedic Surgeons, Rosemont, IL 2000, pp872

Guilak F, Butler DL, Goldstein SA, Mooney DJ (eds): *Functional Tissue Engineering,* Springer-Verlag, Inc, New York, 2003, pp426

Mow VC, Huiskes R (eds): *Basic Orthopaedic Biomechanics and Mechano-biology,* 3rd Edition, Lippincott Williams & Wilkins, Philadelphia, 2005, pp720

Biographical Sketch

Dr. Van Mow received his BAE degree in Aeronautical Engineering in 1962 and his PhD in Applied Mechanics and Applied Mathematics in 1966 from Rensselaer Polytechnic Institute in 1966. From 1966-1968 he was a postdoctoral fellow in Applied Mathematics at the Courant Institute of Mathematical Sciences at New York University in New York City, and from 1968-69 he was a Member of Technical Staff at the Bell Telephone Laboratories in New Jersey. At both places he worked on mathematical theories related to ocean waves and ocean acoustics for the development of mathematical models of the sonar system used for detection of submarines along the East Coast of U.S. In 1969, Dr. Mow joined the faculty of RPI as an Associate Professor in the Mechanics Department.

At the age of thirty, when bioengineering activities in the nation was just beginning to blossom, Dr. Mow began his bioengineering career by studying the new field of the biomechanics of soft tissues, specifically of articular cartilage. What fascinated him was the challenge to understand how such biological materials function in the body for long periods of time and under high cyclic loads, and this became one of his career goals. For the next seventeen years of his career as a bioengineer, along with his graduate students, he took on the challenge in a methodical way, they developrd new theories and experiments to study such biological tissues.His publications, awards and professional society leadership led him to be recognized as the Clark and Crossan Professor of Engineering at Rensselaer and the first PhD President of the Orthopaedic Research Society.

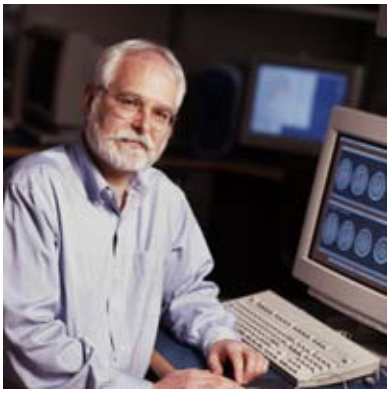
In 1986, Dr. Mow relocated to Columbia University as the Anne Y. Stein Professor of Mechanical Engineering and Orthopaedic Bioengineering, and Director of the New York Orthopaedic Hospital Research Laboratory at Columbia College of Physicians and Surgeons. Here he developed and directed a research and teaching program in orthopaedic research comprising more than forty engineering faculty members, orthopaedic surgeons, MD and PhD fellows, graduate and undergraduate students, and other support staff members. Today, from his research efforts, he has published over 700 papers, edited 7 books and delivered more than 475 keynote, plenary and meeting lectures world wide.

To honor Dr. Mow for his contributions to biomedical engineering, he has received numerous honors, including Fellow of ASME (1979), American Academy of Orthopedic Surgeons Kappa Delta Award (1981), ASME Melville Medal (1982), ASME HR Lissner Award (1987), Giovanni Borelli Award of the American Society of Biomechanics (1991), U.S. National Academy of Engineering (1991), Alza Distinguished Lecturer (1994), ASME RH Thurston Lectureship (1998), U.S. Institute of Medicine of the National Academy of Sciences (1998), Ray Kroc Award for Arthritis Research (twice), and Academia Sinica of Taiwan (2004).He is also the recipient of 6 honorary professorships in China and one in Hong Kong.

However, of the achievement that Van is most proud is the mentorship of his numerous Ph.D. students and postdoctoral fellows over the years. Today, many of his students are recognized for their research contributions, and they are in leadership positions in universities and industry across the nation and around the world. For these achievements, the American Society of Mechanical Engineers, and its Bioengineering Division have created the Van C. Mow Medal for Bioengineers, an annual award to be given to bioengineers at mid career for those who have displayed qualities of excellence in mentorship, excellence in research in biomechanics, and leadership in the profession, particularly in the Bioengineering Division of ASME.

Plenary Presentation

"Neural Engineering"



John Donoghue, Ph.D.

Henry Merritt Wriston Professor and Chairman
Department of Neuroscience, Brown University

September 1, 2006, 8:00 – 8:45

Abstract

Our lab investigates how the brain turns thought into voluntary behaviors. At the core of this problem is understanding higher level neural coding- how populations of neurons represent complex information. To study neural coding we are developing novel multielectrode recording arrays suitable for chronic implantation in the cerebral cortex. We are using these multielectrode arrays to examine the coding of goal directed reaching by ensembles of cerebral cortical neurons and to examine how ensembles change when a new motor skill is learned. Our laboratory works closely with several other Brown Brain Science faculty members to develop and test theories of higher order representation and to generate new mathematical tools to examine neural codes. We are also applying our knowledge of neural codes for movement to build brain computer interfaces. These devices can potentially be used a neural prosthetic to restore movement to paralyzed humans.

Biographical Sketch

John Donoghue is the Henry Merritt Wriston Professor and chair of the Department of Neuroscience at Brown University. Professor Donoghue also serves as director of the university's Brain Science Program.Under Professor Donoghue's leadership, the department of neuroscience has earned a national reputation for teaching and research excellence. In 1998, he was a driving force behind the creation of the Brain Science Program, an interdisciplinary research collaborative that brings together more than 80 faculty members from 11 departments ranging from neuroscience to mathematics, psychiatry to engineering.

Brain Science Program researchers aim to advance our understanding of brain function, human behavior, and nervous system disease. Research by Brain Science Program faculty has led to major discoveries in human vision, behavior, communication, and nervous system dysfunction as well as the fundamental codes of communication and computation used by the brain.

Professor Donoghue's research focuses on how the brain transforms thought into action. To understand this critical function, his laboratory work centers on understanding how networks of neurons represent and process complex information used in making skilled voluntary movement.

Professor Donoghue combined knowledge from his experiments with technical advances in brain recording developed in his lab to create a neurotechnology with a stunning promise – restoring movement to the paralyzed.

Most paralyzed people have normal brain function: their brains can command their muscles to move. But spinal cord, nerve or muscle damage makes such movement impossible. One seminal study in Professor Donoghue's lab, led by student Mijail Serruya, demonstrated that the activity from a small sample of neurons recorded from the motor area of a monkey's brain allows the animal to play a simple video game using only its mind. These findings, published in 2002 in *Nature*, received international attention.

In order to translate the findings into clinical applications for humans, Professor Donoghue went on to co-found Cyberkinetics Neurotechnology Systems Inc, a company headquartered in Foxborough, MA.

Cyberkinetics translated the proof-of-concept research and the new lab technology into a system called BrainGate. The system, which consists of an implantable sensor and external processors, is currently being tested in a clinical trial enrolling as many as five quadriplegic patients. Early results suggest that a quadriplegic can use signals from his motor cortex to read email, control a television set, turn room lights on and off and play video games.

Professor Donoghue serves as a director of Cyberkinetics and as the company's chief scientific officer.

Professor Donoghue's work earned him a 2005 Breakthrough Award from Popular Mechanics magazine and a 2004 Discover Award for Innovation. Reader's Digest selected BrainGate as a top medical breakthrough of 2005.

Professor Donoghue is the author of more than 100 research articles, book chapters and abstracts, which have appeared in publications such as *Nature*, *Science* and the *Proceedings of the National Academy of Sciences*. He has lectured at dozens of institutions, including Harvard Medical School, the Massachusetts Institute of Technology and the Smithsonian.

Professor Donoghue has served on review boards for the National Institutes of Health, the National Science Foundation and NASA. In 2002, he received a Javits Neuroscience Investigator Award from the National Institutes of Health. In 2004, he received the Discover Award for Innovation in neuroscience.

Professor Donoghue earned a bachelor of science degree in biology from Boston University, a master of science degree in anatomy from the University of Vermont, and a doctorate degree in neuroscience from Brown University. He joined the faculty in 1984 and became the founding chair of the department of neuroscience in 1992.

Plenary Presentation

"Nano-Technologies for Biomedical Applications"

Jennifer L. West, Ph.D.

Isabel C. Cameron Professor and Director,
Institute of Biosciences & Bioengineering, Rice University

September 1, 2006, 13:00 – 13:45

Abstract

My research in biomaterials and tissue engineering focuses on the synthesis development and application of novel biofunctional materials and on the use of biomaterials and engineering approaches to study biological problems. Several of the projects ongoing in my laboratory are described below.

Tissue Engineered Vascular Grafts: There is tremendous need for materials for small diameter vascular grafts. Synthetic materials have not proved suitable, and tissue transplantation is limited. Tissue engineering may provide an answer. My laboratory is approaching this problem from two directions; synthesis of novel scaffold materials that mimic extracellular matrix and genetic manipulation of the cells seeded into these scaffolds. The scaffold materials under development provide signals to promote cell adhesion, to control synthesis of matrix proteins, to regulate cell growth, and to allow degradation of the polymer as new tissue forms. The goals for genetic engineering of smooth muscle and endothelial cells are to reduce thrombosis and improve the mechanical properties of the engineered arteries.

Medical Applications of Metal Nanoshells: Nanoshells are a new type of nanoparticle with tunable optical properties. For medical applications, these particles can be designed to strongly absorb or scatter light in the near infrared where tissue and blood are relatively transparent. In a cancer therapy application, nanoshells are designed to absorb light and convert the energy to heat for tumor destruction. By conjugating antibodies or peptides to the nanoshell surfaces, binding of nanoshells can be targeted to cancerous cells, and subsequent exposure to near infrared light results in specific and localized destruction of the cancerous cells. A photothermally modulated drug delivery system, optically-controlled valves for microfluidics devices, and a rapid whole blood immunoassay are also under development using nanoshells.

Biographical Sketch

Jennifer West is the Cameron Professor of Bioengineering and the Director of the Institute of Biosciences and Bioengineering at Rice University. Professor West was one of the founding members of the Department of Bioengineering, building it to a top ten program over the past ten years.

Professor West's research focuses on the development of novel biofunctional materials. Part of her program has developed nanoparticle-based approaches to biophotonics therapeutics and diagnostics. An example of this work is the application of near-infrared absorbing nanoparticles for photothermal tumor ablation. In animal studies, this therapeutic strategy has demonstrated very high efficacy with minimal side effects or damage to surrounding normal tissues.

In 2000, Professor West founded Nanospectra Biosciences, Inc. to commercialize the nanoparticle-assisted photothermal ablation technology, now called AuroLase. Nanospectra Biosciences, Inc., located in Houston, TX, is the recipient of a NIST ATP Award. Professor West is a director of the company.

Professor West has received numerous accolades for her work. She was listed by MIT Technology Review as one of the 100 most innovative young scientists and engineers world wide. Other recognitions include the Christopher Columbus Foundation Frank Annunzio Award for scientific innovation, Nanotechnology Now's Best Discovery of 2003, Small Times Magazine's Researchers of the Year in 2004, and the Society for Biomaterials Outstanding Young Investigator Award.

Professor West has authored more than 80 research articles. She also holds 14 patents that have been licensed to seven different companies. She has lectured at numerous institutions, including Harvard, Harvard Medical School, MIT, FDA, and NCI.

Professor West is a member of the Bioengineering, Technology, and Surgical Sciences study section at NIH, and has served on numerous other review boards for NIH and NSF. She has also been a member of the Defense Sciences Study Group. Her laboratory receives funding from NIH, NSF, and DOD.

Plenary Presentation

"Computational Biology and Bioinformatics"

Joseph M. Jasinski, Ph.D.

Program Director, Life Sciences, IBM

September 2, 2006, 8:00 – 8:45

Abstract

I will discuss the current state of progress in high performance computing, biomolecular simulation and algorithms as we are applying them to understanding a range of problems in the use of information technology to understand biological systems. Examples will include the use of pattern discovery algorithms to understand gene expression, the use of massively parallel supercomputing capabilities made available by the Blue Gene architecture to probe the dynamics of protein folding and trans membrane proteins and how this work will impact the translation of basic science into clinical research and ultimately into clinical practice.

Biographical Sketch

Dr. Joseph M. Jasinski is currently the Program Director for Healthcare and Life Sciences Research at the IBM Thomas J. Watson Research Centerin Hawthorne NY. In this role he is responsible for developing strategies and coordinating research efforts across IBM's Research Division in areas ranging from the use of information technology in payer/provider healthcare to computational studies in molecular biology.

Prior to his current position, Dr. Jasinski was world wide operations manager for IBM Life Sciences, responsible for day to day operations and strategy for one of IBM's fastest growing new businesses. He has also served as the Senior Manager of the Computational Biology Centerat IBM Research and managed and carried out research in nanotechnology, materials chemistry and chemical kinetics in his career with IBM.

Dr. Jasinski graduated from Dartmouth College in 1976 with an A.B. in mathematics and chemistry. He received a Ph.D. in chemistry from Stanford University in 1980. Following post-doctoral work at the University of California, Berkeley, he joined the IBM Thomas J. Watson Research Centeras a Research Staff Member in 1982.

He is a Fellow of the American Physical Society and the American Association for the Advancement of Science. He has authored or co-authored over 50 scientific papers and holds two patents.

Plenary Presentation

"Targeted Therapy with Monoclonal Antibodies: The New Generation of Pharmaceuticals"

David M. Goldenberg, Sc.D., M.D.

President, Garden State Cancer Center at the Center for Molecular Medicine and Immunology, Belleville, New Jersey; and Chairman and Founder, Immunomedics, Inc., Morris Plains, New Jersey

September 2, 2006, 13:00 – 13:45

Abstract

The last decade has witnessed a revolution in pharmaceutical sciences and commercial products with the introduction and intensification of biological products. Foremost has been the development and commercialization of antibodies, particularly for the therapy of cancer, with 8 such products already approved in the USA and hundreds of product candidates in various stages of clinical development. Although monoclonal antibodies have been pursued as new commercial candidates for about 30 years, advances in antibody engineering were required to de-immunize them for repeated human use, and when used as targeting agents, various constructs with isotopes, drug, and toxins have been developed and commercialized. As new targets become identified, the diverse antibody products are gaining in attention as prospective new therapeutics even beyond cancer, such as in the therapy of autoimmune, infectious, and neurodegenerative diseases. Not only are new antibody constructs of multifunctional nature being developed for enhanced potency, but new delivery systems involving methods of separating the targeting moiety from the effector molecules (radionuclided, drugs, toxins, cytokines), such as in so-called pretargeting methods, are under development. These advances have resulted in the concept of targeted disease therapy, attended by a better safety profile for this new class of pharmaceuticals, and are being used increasingly in combination with conventional cytotoxic drugs approved for the therapy of cancer and immune diseases. These disease-targeting antibodies, however, should soon decrease the dependence on traditional cytotoxic drugs by targeting such agents more selectively as immunoconjugates, especially with pretargeting technologies. Examples of advanced products or candidate technologies will be presented.

Biographical Sketch

Dr. David M. Goldenberg is President of the Garden State Cancer Center and the Center for Molecular Medicine and Immunology, a specialized cancer research center located in Belleville, New Jersey. He has also been Adjunct Professor of Microbiology and Immunology at New York Medical College, Valhalla, New York, and Adjunct Professor of Medicine and Surgery at New Jersey Medical School, UMDNJ, and is one of the recognized pioneers in the field of cancer imaging and therapy with monoclonal antibodies, which he coined as radioimmunodetection and radioimmunotherapy.

Born in Brooklyn, New York, Dr. Goldenberg received his S.B. degree from the University of Chicago, Division of Biological Sciences in December 1958. He received his M.D. degree, Magna Cum Laude, from the University of Heidelberg School of Medicine in Germany in 1966, and his Sc.D. degree, Cum Laude, from the University of Erlangen-Nuremberg Faculty of Natural Sciences, Germany in 1965.

In 1968, Dr. Goldenberg returned to the USA to the position of Associate Research Professor of Pathology, University of Pittsburgh School of Medicine, and Staff Pathologist at the VA Hospital, in Pittsburgh, Pennsylvania (1970-72).

In 1972, he moved to Kentucky where he was appointed Professor of Pathology and Director of Experimental Pathology at the University of Kentucky. In Kentucky, he was also the founder and first President of the Ephraim McDowell Cancer Research Center. In 1979, he took a sabbatical leave at the Immunology Branch Division of Cancer Biology and Diagnosis, National Cancer Institute, NIH in Bethesda, Maryland. Dr. Goldenberg moved to New Jersey in 1983 to become President of the Center for Molecular Medicine and Immunology/Garden State Cancer Center, his current post, and he now resides in Mendham, New Jersey. In 1982, he also founded the biotechnology firm, Immunomedics, Inc., and has been Chairman of the Board of this public company since 1983. He is also the founder and Chairman of IBC Pharmaceuticals, Inc., a subsidiary of Immunomedics, which is developing bispecific antibody-pretargeting technologies for cancer therapy.

During his career, Dr. Goldenberg has written or co-authored approximately 1,500 journal articles, abstracts and book chapters on cancer immunology and other topics of cancer research. He has served on the editorial boards for numerous journals, including Journal of Cancer Research and Clinical Oncology, Cancer, Cancer Research, Tumor Targeting, Tumor Biology, and Journal of Nuclear Medicine. Dr Goldenberg is active in a number of scientific and medical societies, including the American Association for Cancer Research, Society of Nuclear Medicine, European Association of Nuclear Medicine, German Society for Nuclear Medicine, American Association of Immunologists, International Society for Oncodevelopmental Biology and Medicine, Society for Experimental Biology and Medicine, Society for Biological Therapy, American Society of Hematology, European Association of Hematology, and American Society of Clinical Oncology.

In recognition of his research contributions, Dr. Goldenberg was given the University of Kentucky Research Foundation Award in 1978, a Silver Medallion and Certificate from the German Fund for Cancer Research in Bonn in 1979, an "Outstanding Investigator Award" grant from the National Cancer Institute in 1985 and 1992, and the New Jersey Pride Award in Science and Technology in 1986. He was also cited by a Resolution of Commendation of the New Jersey General Assembly and the New Jersey Senate in 1985/86. Dr. Goldenberg was honored as the ninth Otto Herz Lecturer of Tel Aviv University Faculty of Life Sciences. In addition, he received the 1991 3M Mayneord Memorial Award and Lectureship of the British Institute of Radiology for his contributions to the development of radiolabeled antibodies used in the imaging and treatment of cancer. Dr. Goldenberg was the co-recipient of the 1994 Abbott Award, sponsored by the International Society of Oncodevelopmental Biology and Medicine, the recipient of the 1994 Sarabhai Memorial Oration Award, sponsored by the Society of Nuclear Medicine, India, and the 2002 Erin Berven Prize recipient and Lecturer of the Swedish Oncology Society, including a medal from the Swedish Medical Society. In 2003, he received the Garden State Cancer Center Award for Special Scientific Achievements, and in 2004 he received the Distinguished Scientist Award of the Clinical Ligand Assay Society. In 2005, Dr. Goldenberg received the Paul C. Aebersold Award, the highest recognition given by the Society of Nuclear Medicine for contributions to the basic sciences with applications to the practice of nuclear medicine. Also in 2005, he was named Inventor of the Year by The Research and Development Council of New Jersey for being the recipient of over 180 U.S. and foreign patents, particularly in the area of applying monoclonal antibodies to the detection and treatment of various diseases.

Plenary Presentation

"Bio-Defense Technologies"

Ernest T. Takafuji, M.D.

MPH, Director, Office of Biodefense Research, NIAID

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Abstract

The continuing threat of terrorism has resulted in an aggressive federal biodefense research effort leading to new approaches and interventions to address the threat of Weapons of Mass Destruction. Much of the focus has centered on strengthening defenses and response capabilities related to biological, radiological and chemical incidents. For the past four years, the NIH has been involved in a robust effort promoting the development of medical countermeasures against the leading public health terrorist threats. The threat of terrorism has been made more complex with the evolution on endemic infectious diseases with pandemic potential. This presentation will focus on some of the NIH efforts and the technological applications that have resulted in new approaches in mitigating these threats to national security and global health.

Biographical Sketch

Dr. Ernest T. Takafuji is the Director for Biodefense Research at the National Institute of Allergy and Infectious Diseases (NIAID), National Institutes of Health, Bethesda, MD. His responsibilities include coordinating biodefense research initiatives of NIAID, developing strategic approaches in medical biodefense research with other federal agencies, and representing the NIAID/NIH in various national and international forums. The NIH biodefense effort includes research directed at microbial and toxin threats, radiological and nuclear threats and chemical threats to the nation. He received his B.A. degree from the University of Hawaii, his M.P.H. degree from the Johns Hopkins School of Hygiene & Public Health, and his M.D. degree from the University of New Mexico. He is board-certified by the American College of Preventive Medicine and a fellow or member of many professional organizations. Before joining the NIH in 2002, he served for 30 years in the U.S. Army as Director/Commander of three military research institutions: the Walter Reed Army Institute of Research (WRAIR), the Army Medical Research Institute of Infectious Diseases (USAMRIID), and the Army Medical Research Institute of Chemical Defense (USAMRICD); Principal Consultant to the Army Surgeon General in Disease Control and Communicable Diseases, Medical Chemical Defense and Biological Defense; and Director of Medical Chemical and Biological Defense Programs in the Office of the Asst. Secretary of Defense for Health Affairs, Dept. of Defense.