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ASBMB *Today*

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Proteomic Solutions in Cellular and Developmental Biology and Medicine

Stowers Institute For Medical Research
Kansas City, Missouri
May 2–4, 2003

Sponsored by the

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**Stowers Institute for
Medical Research**

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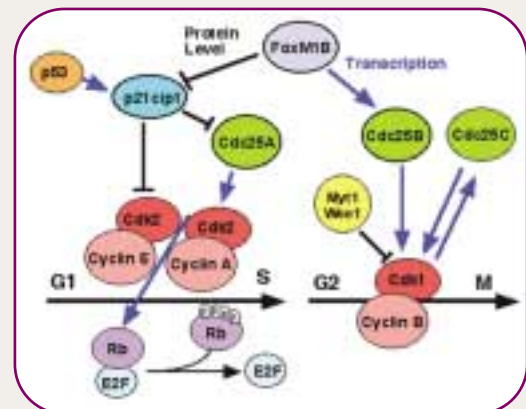
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A PLEA TO CONGRESS: Save Lives, Free

The following is an opinion piece by Dr. Michael DeBakey, Chancellor Emeritus at the Baylor College of Medicine, which appeared in the Houston Chronicle on December 29, 2002. The opinions expressed are those of the author and do not necessarily represent the views of ASBMB.

By Dr. Michael DeBakey

As I write this, researchers are engaged in extraordinary research. They are taking skin, muscle and blood cells from heart patients, engineering them in a laboratory and injecting them back into those patients. The hope is that the engineered cells will transform into heart cells to make failing hearts pump more strongly and extend the lives of patients who would otherwise have to undergo risky heart transplants.

This potential breakthrough—and what it could one day promise for heart patients across the country—should give Congress yet another compelling reason to continue to invest in medical research, our best hope for health.

But as you read this, debates continue on how Congress will support the National Institutes of Health, (NIH), the federal agency that funds medical research conducted by the brightest scientific minds in our country. The astonishing acceleration of their research over the past four years is a result of a bipartisan commitment made by Congress and the President to double the NIH budget over five years, beginning in 1999. Four payments toward that doubling have occurred so far.

The fifth and final appropriation, however, is stalled, hostage to a legislative holding pattern called a Continu-

ing Resolution. If a final 2003 budget is not approved by Congress this January, all 2003 federally sponsored medical research will be funded by substantially lower 2002 budgets. That means putting the brakes on medical advances

The cost of research is minuscule compared to the astronomical expense of caring for sick populations at today's—or tomorrow's—spiraling hospital rates.

that could sooner or later benefit every man, woman and child in this country, as well as future generations.

Some might argue that with our country running a deficit we must cut back on medical research funding. As one who has pioneered new research, thanks in part to federal funding, I suggest looking at what is at stake: The lack of funding could well force the best researchers into alternative careers, thus depleting the pool of medical scientists, and, in the process, imperiling America's current global leadership in medical research, so vital to our economy. Once the pool is depleted, it will require decades to replenish it.

Hostage Research Funds

The first four payments toward the NIH budget's doubling - about \$77 billion since 1999 - have virtually transformed American scientific research.

These funds have permitted scientists from different disciplines to collaborate in the same laboratories, enabling research to move at fast-forward speed toward new treatments and their clinical trials, and accelerating the creation of new diagnostic tests to detect illness earlier, when intervention can be most effective. The ultimate goal: Many Americans no longer need be told by their doctors, "There is nothing more we can do."

Thanks to the NIH budget-doubling, so far we are on track to do the following:

- ❖ Hasten research that takes cells from the inner lining of blood vessels to form a stent that the body will not reject. The stent aims to expand narrowed arteries permanently. This is crucial for children who have small arteries and now need repeated heart operations to keep them alive.
- ❖ Refine a new generation of cancer treatments that targets only cancer cells and spares other fast-growing cells. Many years of NIH-funded molecular research have helped lead to the development of new life-saving drugs like such as Gleevec imatinib mesylate, a cancer-killer that has fewer harsh side effects than current chemotherapy. This drug does not cause hair loss or nausea and does not preclude childbearing potential. New radiologic devices permit doctors to see if this new therapy is working without invasive surgery. Extremely effective against leukemia, the new drug is now being tested on other forms of cancer. New cancer therapy will continue to be an important American export worldwide.

- ❖ Help the paralyzed. Researchers are testing specially treated immune cells to help repair injuries and restore lost nerve impulses. This research provides hope where none existed before.

- ❖ Devise an early detection test for ovarian cancer, now one of the deadliest forms because it is so hard to diagnose in early stages. In later stages it is invariably fatal. Finding it early, when it is most easily treatable, will spare young women premature death and their children the agony of living without their mothers.

In my own field of interest, cardiovascular diseases, the advances in knowledge and in effective control of these disorders have been dramatic - all derived directly from medical research. In the past few decades, the treatment of both lethal and disabling cardiovascular diseases has been remarkably improved, leading not only to ever-increasing survival, but also to restoration of patients' normal activities. Coronary artery bypass, now common, has saved countless lives, previously doomed to certain death.

Similarly, aneurysmal surgery, replacement of defective heart valves, Dacron graft replacement surgery to restore arterial circulation, carotid endarterectomy for stroke, organ transplantation and cardiac assistors to support failing hearts—all products of the research laboratory—now successfully treat patients similarly doomed previously.

Postponing the crucial fifth installment of these life-saving NIH funds—\$27.3 billion due in January—would postpone these investigations and more promising medical research currently under way at academic medical schools, hospitals and independent laboratories in hundreds of communities across this country.

For example, in some laboratories that have benefited from the doubling of NIH funding, you will see robotic arms filling test tubes and yielding results 64 times faster than six years ago. You will see computers spilling out complex research results, checking patterns, discovering blind alleys and promising new pathways, and instantly printing out information that used to take years to obtain. If you have a very sick child or parent, you know that faster is better when it comes to learning more that can save lives.

The cost of research is minuscule compared to the astronomical expense of caring for sick populations at today's—or tomorrow's—spiraling hospital rates. NIH-funded research, in just the past few years, has helped lead to cost-saving new discoveries, such as a new drug group called statins, which sharply reduce the number of heart attacks and strokes that used to spell death. Heart attacks and heart disease currently cost this country almost \$200 billion a year in direct medical expenditures. More than 1.1 million people of

TELL US WHAT YOU THINK

We appreciate receiving letters that are suitable for publication from ASBMB members regarding issues of importance or commenting on articles appearing in *ASBMB News*. Letters should be sent to the editor, John Thompson, at the address found at left. Letters must be signed and must contain the writer's address and telephone number. The editor reserves the right to edit all letters.

all races and ethnicities will suffer a heart attack this year, and 65 percent of Americans will have some form of heart disease by retirement age. Statins prevent heart disease and strokes, decrease recurrence of heart attacks and reduce the need for bypass surgery.

More life-saving advances are waiting in the wings for adequate medical research funding, such as: Earlier diagnosis of Alzheimer's disease, when intervention can slow its onset. Alzheimer's disease now afflicts 4 million Americans and could well affect 14 million baby boomers as they age. New groundbreaking research has allowed us to look inside the living brain without surgery and permits diagnosis in persons who show no behavioral symptoms. Positron emissions tomography (PET) scans hold hope for early diagnosis of cancer, as well.

Meanwhile, other NIH medical research projects are investigating ways to prevent Alzheimer's disease, which costs the country \$5,000 per patient per month in nursing homes - a staggering \$100 billion this year. Slowing the disease by five years could save \$50 billion a year in health-care costs.

Mapping the Human Genome—A Milestone Accomplishment

The mapping of our body's genetic geography led to the discovery of more than 30,000 human genes, a feat that pinpoints the clear targets for tomorrow's medications.

Before the NIH budget doubling began in 1999, it took nine years to find the gene for cystic fibrosis. Recently, thanks to that doubling, scientists precisely described a gene for Parkinson's disease in just nine months.

We are on the brink of discoveries that will make the next decade a renaissance

of genetic treatments and cures. To do anything less than continue adequate funding of the NIH would mean a severe regression in medical progress. For these reasons and more, we must fund the final installment of the NIH budget on time, so that researchers in 2003 have the resources they need to realize our hopes.

The economy of this country depends in no small way on remaining the global leader in medical research. Jobs, profits, hope and health all depend on sustaining the momentum begun by four of the five installments of doubling the NIH budget. I speak not only for myself and my medical colleagues who wish to save more lives and who depend on medical research for the next generation of breakthroughs to do so, I speak also for the public.

Year after year, public opinion polls by Research!America, a nonprofit, non-partisan alliance for discoveries in

health, has surveyed Americans from many walks of life. The results are stunning: In terms of national priorities, almost all Americans want more money for medical and health research. A striking 88 percent of Americans want the United States to remain a world leader in medical research and feel more favorably toward candidates who support increased funding for research to find treatments and cures for disease.

I echo their voice. I call upon Congress to act on the 2003 LHSS Appropriations bill and thereby complete the doubling of the NIH the first week of January, when the congressional session resumes. Simply put, doubling the NIH budget and sustaining that budget in the future—financing the very structure for medical breakthrough—is clearly common sense and good economic sense. ■

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NAS Decries Visa Restrictions

By Peter Farnham, ASBMB Public Affairs Officer

In a major policy statement released December 13, the Presidents of the National Academies of Science (NAS) decried current visa restrictions on foreign students and scholars as having “serious unintended consequences for American science, engineering and medicine.” No less than continued U.S. leadership in world science and technology is at stake, according to the statement.

The statement was issued by National Academy of Sciences President Bruce Alberts, National Academy of Engineering President William A. Wulf, and Institute of Medicine President Harvey Fineberg. It notes that ongoing research collaborations have been hampered, outstanding young scientists, engineers and health researchers have been prevented from or delayed in entering this country, and that important international conferences have been canceled and future conferences will be moved out of the United States if the situation is not corrected. “Prompt action is needed,” the statement notes.

The statement urges the government to implement an effective and timely visa screening procedure for foreign scientists, engineers and medical researchers that is consistent with the twin goals of maintaining the health of our nation’s science and technology enterprise as well as protecting the national security. Possible mechanisms to streamline the visa screening process without compromising security include reinstating a procedure of pre-security clearance for scientists and engineers with the proper credentials; instituting a special visa category for established scientists, engineers, and health researchers; and involving the U.S. scientific and technical community in determining areas of particular security concern.

Welcoming qualified foreign scientists and students serves three general purposes. First, it harnesses international cooperation for counterterrorism. The statement cites a U.S.-Russian conference on nuclear non-proliferation that came within one day of cancellation before the necessary visas were obtained for foreign scholars to attend (which took intervention at “the highest levels of the State Department”).

Second, welcoming foreign scholars and students builds stronger allies through scientific and technological cooperation. “It is clearly in our national interest to help developing countries fight diseases such as AIDS, improve their agricultural production, establish new industries, and generally raise their standard of living,” the statement says. “There is no better way to provide that help than to train young people from such countries to become broadly competent in relevant fields of science and technology.”

Finally, welcoming foreign scholars and students helps maintain U.S. global leadership in science and technology. Our nation benefits enormously from the influx of foreign scientific talent that has come to our shores and made their lives here; those who have trained or studied here and then returned to their home countries “now are among the best ambassadors that our country has abroad.” Furthermore, about half of the currently-enrolled graduate students in the United States come from other nations, and these students’ contributions are essential to our country’s scientific enterprise.”

The statement notes that “U.S. scientific, engineering and health communities cannot hope to maintain their present position of international leadership if they become isolated from the rest of the world.”

The complete NAS statement is available on the public affairs page of the ASBMB website, www.asbmb.org.

ASBMB Welcomes New Ph.D.s

ASBMB extends its congratulations to these individuals who recently received their Ph.D. degrees. In recognition of their achievement, ASBMB is presenting them with a free one-year membership in the Society. The new Ph.D.s are listed below with the institution from which they received their degree.

Ryan Andrew Adams

University of California San Diego

Akinola O. Adisa

LaTrobe University Bundoora

Marena Galdzicka

University of Massachusetts
Medical School

Daren Heaton

University of Utah School of
Medicine

Pearl Kipnis

Hunter College—City University of
New York

JinLei Li

University of Buffalo,
State University of New York

Louis C. Martineau

University of Ottawa

Selvanayagam Nirthanan

National University of Singapore

Ken M. Riedl

Miami University

Tina Chi Wan

University of Louisville

2003 ASBMB Annual

Award Lectures

ASBMB-MERCK AWARD

S.J. Benkovic

ASBMB-AVANTI AWARD IN LIPIDS

R. Bittman

WILLIAM C. ROSE AWARD

J.E. Dixon

SCHERING-PLOUGH RESEARCH INSTITUTE AWARD

C. Drennan

FASEB EXCELLENCE IN SCIENCE AWARD

J.A. Steitz

HOWARD K. SCHACHMAN PUBLIC SERVICE AWARD

R. Kirschstein

MEETING I: MOLECULAR BASIS OF CELL AND DEVELOPMENTAL BIOLOGY

Organizers: N. Sonenberg
and N.G. Ahn

Plenary Lecture

J.V. Ruderman

Symposia

ORGANOGENESIS

Chair: S. Mango

MORPHAGENS AND DEVELOPMENT

Cochairs: B. Olwin and M.A. Rudnicki

CELL CYCLE

Chair: T. T. Su

POST-TRANSCRIPTIONAL MECHANISMS

Cochairs: P. Macdonald and P. Lasko

MEETING II: GLYCOBIOLOGY

Organizer: G.W. Hart

Plenary Lecture

R.D. Cummings

Symposia

NOVEL ASPECTS OF GLYCAN SYNTHESIS AND FUNCTION

Cochairs: G.W. Hart and P. Stanley

BIOLOGICAL FUNCTIONS OF GLYCOSPHINGOLIPIDS AND GLYCOSYLPHOSPHATIDYLINOSITOLS

Cochairs: R. Schnaar and A. Menon

ROLES OF GLYCANS IN CELL ADHESION AND TRAFFICKING

Cochairs: S. Rosen and A. Varki

BIOLOGICAL FUNCTIONS OF PROTEOGLYCANS AND GLYCOPROTEINS IN THE EXTRACELLULAR MATRIX

Cochairs: J. Esko and Y. Yamaguchi

MEETING III: LIPID SIGNALING, METABOLISM AND TRANSPORT

Organizer: D.R. Voelker

Plenary Lecture

S.D. Emr

Symposia

LIPID TRAFFIC

Chair: D.R. Voelker

LIPID ENZYMES—STRUCTURE AND FUNCTION

Chair: C.O. Rock

LIPID SIGNALING

Chair: J.D. York

LIPID METABOLISM—GENETIC DISEASES & STRESS

Chair: D.W. Russell

MEETING IV: BIOLOGICAL CATALYSIS

Organizer: T. Begley

Plenary Lecture

J.P. Klinman

Symposia

MACROMOLECULAR MACHINES AND PROTEIN ASSEMBLY LINES

Chair: C. Khosla

FUNDAMENTAL AND EMERGING ISSUES IN ENZYMATIC CATALYSIS

Chair: J.P. Klinman

COMPLEX BIOLOGICAL OXIDATIONS

Chair: T. Begley

ENZYMOLGY OF POST-TRANSLATIONAL MODIFICATION

Chair: V. Schramm

MEETING V: METABOLISM— PATHWAYS AND REGULATION

Organizer: L. Rossetti

Plenary Lecture

M.D. Lane

Symposia

NOVEL SIGNALING PATHWAYS INVOLVED IN LEPTIN ACTION AND REGULATION OF ENERGY BALANCE

Chair: B.B. Kahn

NOVEL MECHANISMS FOR INSULIN RESISTANCE

Chair: M. Birnbaum

TRANSCRIPTIONAL REGULATION BY INSULIN

Chair: D. Accili

NEW INSIGHT INTO BETA CELL BIOLOGY

Chair: P. Arvan

MEETING VI: SIGNALING PATHWAYS

Organizers: N.G. Ahn
and N. Sonenberg

Plenary Lecture

T. Hunter

Symposia

FRAP/MTOR

Chair: N. Sonenberg

SIGNALING TARGETS FOR DRUG THERAPIES

Chair: F. Mercurio

ADHESION AND MORPHOGENESIS

Chair: M. Schwartz

INTRACELLULAR TARGETING/SCAFFOLDS

Chair: J. Wang

Meeting Preview Highlights

<p>MEETING VII: GENOMICS, PROTEOMICS AND BIOINFORMATICS Organizer: P. Babbitt</p>	<p>MEETING IX: NUCLEIC ACID STRUCTURE, FUNCTION AND PROCESSING Organizer: M. Dahmus and M.F. Goodman</p>	<p>MEETING XI: THE FUTURE OF THE PROFESSION Organizer: A.S. Dahms</p>
<p>Plenary Lecture A. Sali</p> <p>Symposia</p> <p>GENOMICS OF CARDIOPULMONARY DISEASE AND DEVELOPMENT Cochairs: S.G. Young and B. Seed</p> <p>FUNCTIONAL GENOMICS Cochairs: V. Iyer and S. Kim</p> <p>PROTEIN-PROTEIN INTERACTIONS Cochairs: M. Vidal and J. Yates</p> <p>PROTEIN AND PATHWAY ENGINEERING Cochairs: J. Minshull and J. Keasling</p>	<p>Plenary Lecture T.A. Steitz</p> <p>Symposia</p> <p>MACROMOLECULAR COMPLEXES Cochairs: S.K. Burley and T. Ellenberger</p> <p>REPLICATION, RECOMBINATION, REPAIR Cochairs: M.F. Goodman and R.D. Wood</p> <p>REGULATION OF GENE EXPRESSION Cochairs: S. Buratowski and N. Hernandez</p> <p>EMERGING AREAS OF RNA PROCESSING Chair: D.L. Black</p>	<p>RECRUITING, EDUCATING AND MENTORING THE EXPERIMENTAL BIOLOGISTS OF THE FUTURE <i>Sponsored by the EB2003 participating societies</i> Chair: A.S. Dahms</p> <p>ON BEING A NEW FACULTY MEMBER: MYTHS AND REALITIES Chair: J.D. Smith</p> <p>THE GRE ADVANCED EXAMINATION IN BIOCHEMISTRY AND MOLECULAR AND CELL BIOLOGY: AN ANALYSIS OF THE FIRST 10 YEARS Chair: J.A. Boyle</p>
<p>MEETING VIII: PROTEIN SYNTHESIS, FOLDING AND TURNOVER Organizer: C.M. Pickart</p>	<p>MEETING X: MEMBRANE ASSEMBLY INTERACTION AND TRANSPORT Organizer: S.H. White</p>	<p>EDUCATION/TRAINING OF BIOMEDICAL SCIENTISTS (IN HONOR OF RUTH KIRSCHSTEIN INCLUDING THE HOWARD K. SCHACHMAN PUBLIC SERVICE AWARD) Chair: R.D. Wells</p> <p>TRANSITIONING FROM ACADEMIA TO INDUSTRY: A BEST PRACTICES APPROACH FOR FACULTY AND STUDENTS Chair: D. Jensen</p>
<p>Symposia</p> <p>CHEMICAL BIOLOGY APPROACHES TO CONTROLLING PROTEIN FUNCTION Chair: T.W. Muir</p> <p>PROTEIN FOLDING AND UNFOLDING Chair: U. Hartl</p> <p>MECHANISM AND FUNCTION OF PROTEIN CONJUGATION Chair: C.M. Pickart</p> <p>PROTEASES: TARGETING, INHIBITION, DRUG DESIGN Chair: B. Sloane</p>	<p>Symposia</p> <p>VESICLE TRAFFICKING Chair: S.L. Schmid</p> <p>MECHANISM OF FUSION Chair: L.K. Tamm</p> <p>PROTEIN UNFOLDING AND REFOLDING ON MEMBRANES Chair: W.A. Cramer</p> <p>MEMBRANE PROTEINS Chair: H.R. Kaback</p>	<p>MINORITY AFFAIRS SESSION - DIVERSIFYING THE PROFESSION: WHO? WHAT? WHEN? WHERE? AND HOW? Cochairs: P.A. Ortiz and J. Bell</p> <p>THE NEW ASBMB DIGITAL LIBRARY: WWW.BIOMOLECULESALIVE.ORG Chair: P. Craig</p> <p>WOMEN SCIENTISTS' MENTORING SESSION/RECEPTION Chair: M.B. Parsons</p>
<p>Special Sessions</p>		
<p>ABRF/ASBMB SYMPOSIUM: ANTIBODY AND PROTEIN MICROARRAYS FOR HIGHLY MULTIPLEXED PROTEIN ANALYSIS Cochairs: R.L. Niece and B.B. Haab</p>	<p>FUNDING OPPORTUNITIES—GRANT WRITING TIPS Chair: T.L. Woodin</p> <p>RESEARCH FUNDING BY THE AMERICAN CANCER SOCIETY Chair: C. Widnell</p>	<p>ASBMB GRADUATE/POSTDOCTORAL TRAVEL AWARD SYMPOSIUM Chair: J. Bell</p> <p>SEVENTH ANNUAL UNDERGRADUATE STUDENT RESEARCH ACHIEVEMENT AWARD POSTER COMPETITION Cochairs: P.A. Ortiz, C. Meyer, and M.B. Parsons</p>

ASBMB ANNUAL MEETING at EB 2003 in San Diego

CALL FOR LATE-BREAKING ABSTRACTS

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**“TRANSLATING
THE GENOME”**

DEADLINE FOR SUBMISSION:

Wednesday, February 26, 2003

Late-breaking abstracts will be accepted for special poster sessions scheduled on Tuesday, April 15, 2003. The purpose of the late-breaking abstracts is to give participants the opportunity to present and hear about new and significant material. Late breaking abstracts will be published in an addendum to the meeting program; they will not be published in *The FASEB Journal*.

Abstracts must be submitted electronically with payment of \$60 and received on or before Wednesday, February 26, 2003.

Abstract Submission Fee: \$60

Abstract submission site: www.faseb.org/meetings/eb2003

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- 203-ASBMB Genomics, Proteomics and Bioinformatics
- 204-ASBMB Glycobiology
- 205-ASBMB Lipid Signaling, Metabolism and Transport
- 206-ASBMB Membrane Assembly Interaction and Transport
- 207-ASBMB Metabolism—Pathways and Regulation
- 208-ASBMB Methods
- 209-ASBMB Molecular Basis of Cell and Developmental Biology
- 210-ASBMB Nucleic Acid Structure, Function and Processing
- 211-ASBMB Protein Synthesis, Folding and Turnover
- 212-ASBMB Science Education
- 213-ASBMB Signaling Pathways

Experimental Biology

- 801-EB Computers in Research and Teaching
- 802-EB Using Models and Demonstrations to Teach
- 803-EB Teaching and Learning in the Biological Sciences

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Wesley Sundquist to Receive

Wesley Sundquist, Professor of Biochemistry at the University of Utah, has been selected to receive the ASBMB-Amgen Award. The Award is made to a new investigator (defined as an individual with no more than 15 years experience since receipt of a doctorate) for significant achievements in the application of biochemistry and molecular biology to the understanding of disease. Nominations must be originated by Society members, but the nominees need not be ASBMB members. Recipients over the past five years include Joan and Ronald Conaway, Tyler Jacks, Masashi Yanagisawa, Patrick J. Casey, and Thomas Ried.

The Award consists of a silver and crystal commemorative sculpture, a stipend, a \$20,000 unrestricted research grant, and transportation and expenses to present a lecture at the ASBMB 2003 Annual Meeting in San Diego. Dr. Sundquist's lecture is scheduled for 5:00 – 6:00 p.m., Saturday, April 12.

On receiving news of the Award, Dr. Sundquist commented, "Receiving the Amgen Award is a terrific honor, and I am indebted to Amgen and the ASBMB, as well as to my close colleagues and collaborators who have helped to make our studies of HIV assembly both productive and enjoyable."

In nominating Dr. Sundquist for the Award, Dana Carroll, Professor and Chair of the Department of Biochemistry, University of Utah School of Medicine, noted, "Even before establishing his own laboratory, Wes Sundquist made an independent discovery of considerable significance. Working at the MRC Laboratory of Molecular Biology in Cambridge, England, he co-discovered the 4-stranded structure adopted

by the guanine-rich DNA sequences found at chromosomal telomeres.

"Upon initiating his own research program, he made the bold decision to elucidate the structures of the key organizers of the HIV-1 viral core—the Matrix (MA) and Capsid (CA) proteins. Dr. Sundquist's lab produced these proteins in sufficient quantity and quality for structural analysis, then participated in the structure determinations, both by collaboration and in his own laboratory."

At each stage of this research, Dr. Sundquist has extracted deep structural and biological insights and produced very satisfying models of virus assembly and stability. He has expanded the lessons derived from structures by generating and analyzing the effects of mutations in the viral core proteins. The detailed picture emerging from these studies forms the basis for designing and testing drug candidates that may inhibit replication by interfering with virus assembly. Most recently, Wes has identified the cellular pathway that is commandeered by HIV-1 to allow budding from an infected cell. The components of this pathway are again candidate targets for drug development. If small molecules with inhibitory properties can be found, this will have tremendous impact on the health of HIV-exposed people around the world.

Dr. Sundquist's first HIV target for structural analysis was the Matrix protein. Two structures were produced: one from NMR spectroscopy in collaboration with Dr. Michael Summers, and one from x-ray crystallography in collaboration with Dr. Chris Hill. Packing contacts in the crystals provided insight into how MA monomers assemble into trimers, that appear to

be the basic building block for further assembly, and make contact with the host cell membrane. Comparisons between the NMR and crystal structures gave evidence of conformational changes that occur as the MA network is assembled at the cell surface.

The Capsid protein, which forms the conical core of the mature virion, has occupied more of the Sundquist lab's attention. In this case the N- and C-terminal domains of the protein were attacked separately. An NMR structure of the N-terminus emerged first, followed by crystal structures of both domains. The N-terminal domain was crystallized in complex with the cellular protein Cyclophilin A, which is bound to about 10% of CA proteins in the mature virus.

In fact, entry or uncoating of the viral genome in a newly-infected cell depends on the presence of Cyclophilin in the HIV-1 particle, but this is not true for SIV. The Sundquist group demonstrated the basis for this difference with careful binding assays using hybrid CA proteins. Additionally, Cyclophilin had been identified as a cellular proline isomerase.

The CA-Cyclophilin complex provided a surprise, as the CA proline bound to the active site of Cyclophilin was in the trans configuration, as opposed to previous observations made with Cyclophilin-peptide complexes. Further work in Dr. Sundquist's lab has now shown that the CA proline residue is a substrate for Cyclophilin-catalyzed isomerization. Together with Hill, they have produced series of structures of enzyme-substrate complexes in which the proline changes conformation, and these structures suggest how cyclophilins actually catalyze proline isomerization.

Examination of the structure of the CA N-terminal domain showed the N-



ASBMB—Amgen Award



Dr. Wesley Sundquist

terminus itself folded back into the structure, making very favorable contacts with other residues. Since this N-terminus is created by proteolytic cleavage of the Gag precursor protein during virus maturation, the CA protein must change structure significantly upon cleavage. This has now been demonstrated elegantly by NMR spectroscopy, and the importance of this structural transition has also been demonstrated by directed mutagenesis, using the structures as a guide. Alteration of residues important for stabilizing the mature CA structure prevents the formation of infectious virus in transfection assays using cultured cells.

The crystal structure of the C-terminal domain of CA showed very clearly the interface that holds the CA dimer together. How this dimer assembles into conical viral cores was not obvious, however. The Sundquist group developed an *in vitro* CA assembly system that produces hollow cylinders and cones having dimensions similar to the mature capsid. Quantitative analysis of the apical cone angles

showed that they fell into a small number of classes, the same as those predicted for fullerenes. This indicated that the capsid structure was based on a hexagonal unit with discrete pentagonal defects. To confirm this prediction, Dr. Sundquist collaborated with Dr. John Finch to perform image reconstructions from cryo-electron microscope images of the CA cylinders. This work amply confirms the hexagonal matrix of CA dimers, and they were able to build the separate N- and C-terminal domains of CA into the EM-derived lattice.

Demonstrating the diversity of approaches Dr. Sundquist is willing to take to understand HIV assembly, his group has very recently identified host cell proteins that interact with the viral Gag protein and are required for virus budding from the cell. By yeast two-hybrid analysis, in collaboration with Myriad Genetics, the group discovered an interaction between a Gag fragment and cellular Tsg101, a component of the vacuolar protein sorting pathway. Using RNAi technology, they showed that Tsg101 is, in fact, required for HIV exit from infected cells. They have now determined the structure of the Gag-binding N-terminal domain of Tsg101 in complex with its Gag binding site and are designing further cellular experiments based on this structure.

About 10 years ago, Dr. Sundquist chose to devote his research effort to a very significant problem: the structural basis of HIV assembly. He has approached this topic with a full battery of experimental techniques, employing whatever methods seemed most likely to deliver the desired insights. He has incorporated a

remarkable number of techniques into his own lab, including NMR, cryo-EM and image reconstruction, viral phenotype analysis, molecular interaction measurements, genetics, and genomics technologies. The results of these efforts have been spectacular, and he has emerged as a leader in the fields of HIV research, virus assembly, and structural biology more generally.

Writing in support of the nomination, Stephen Goff, Howard Hughes Medical Institute and Higgins Professor of Biochemistry, Columbia University College of Physicians and Surgeons, said:

“I consider Dr. Sundquist to be one of the most effective, innovative, and rigorous young scientists of his generation. He is certainly at heart a structural biologist, both by training and inclination. But he is not a typical structural biologist, because he uses his structures to provide real understanding and to make real predictions about his molecules. His recent move is totally into molecular biology; he is now doing yeast two-hybrid work, making mutants and doing knock-down experiments with biochemical readouts to demonstrate the involvement of his host proteins in virus assembly. This is just the most recent example of his breadth and boldness in moving into new areas.

“Three other comments about Wes are warranted. The first concerns his terrific seminar style. He simply gives polished, clear, and exciting seminars. The second is the quality of his data; the results are compelling and tight, a result of his demand for high quality among his students and fellows. The third is his generosity and willingness to share; having developed a working

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Ruth Kirschstein to Receive Schachman Public Service Award

Dr. Ruth Kirschstein will be the 2003 recipient of the ASBMB's Howard K. Schachman Public Service Award. Dr. Kirschstein, a career official at the NIH and currently Senior Advisor to NIH Director Elias Zerhouni, is being honored for her lifetime of public service to biomedical research and education.

ASBMB President Bettie Sue Masters told *ASBMB Today*, "We're delighted to recognize Ruth Kirschstein's many years of service at the National Institutes of Health. In particular, I think it's appropriate to realize how much influence she's had on mechanisms of training for students and postdoctoral fellows and promoting diversity in the biomedical sciences. She's been a friend to all of us in biomedicine and has represented our needs very actively through the years."

Said Dr. Kirschstein on being informed of the award, "I am honored to be receiving the Howard K. Schachman Public Service Award of the American Society for Biochemistry and Molecular Biology (ASBMB). It is a particularly meaningful award for me because Howard Schachman has been an important figure in my life for more than 25 years. Protagonist and outspoken advocate for support of basic biomedical research, hero of the struggle for appropriate oversight of research integrity, laboratory mentor to many, many distinguished scientists, mentor to two Directors of the National Institutes of General Medical Sciences, Marvin Cassman and me, advisor and mentor to two NIH Directors, Harold Varmus and me, Howard, more than anyone else, embodies the term 'citizen-scientist.'

"As chairman of the ASBMB's Public Affairs Advisory Committee for more than 10 years, Dr. Schachman served as a powerful and unique spokesperson. To be given an award for Public Service by the ASBMB is an honor. To be given the Howard K. Schachman Public Service Award by ASBMB is an even greater honor."

Dr. Kirschstein's public service includes almost 20 years as Director of the NIH's National Institute of General Medical Sciences (1974 - 1993), service as NIH's Deputy Director and two stints as NIH's Acting Director. Dr. Kirschstein also demonstrated strong support for training during her years of service at NIH, in particular her work to improve diversity in the life sciences.

During her years at NIGMS, Dr. Kirschstein oversaw expansion of the National Research Service Awards program, and the Minority Access to Research Careers program, which is designed to strengthen the science curricula and research at institutions with substantial minority enrollment.

In addition, she expanded the Medical Scientists Training Program, which seeks to reduce the shortage of physician/researchers by enabling highly qualified students



Dr. Ruth Kirschstein

to obtain a combined medical and Ph.D. degree.

From 1957 to 1972, Dr. Kirschstein performed research in experimental pathology at the Division of Biologics Standards (now the FDA's Center for Biologics Evaluation and Research). There, she helped develop and refine tests to assure the safety of viral vaccines for such diseases as polio, measles, and rubella. Her work on polio led to selection of the Sabin vaccine for public use. For her role, she received the Department of Health, Education, and Welfare's Superior Service Award in 1971.


In 1972 she became Assistant Director of the Division of Biologics Stan-

The ASBMB's Education and Professional Development Committee is sponsoring a "Special Symposium in Honor of Dr. Ruth L. Kirschstein" at the San Diego meeting this April. The symposium is chaired by ASBMB Past-President Robert D. Wells, and will feature presentations by Dr. Ken Berns, Mt. Sinai College of Medicine; Dr. Susan A. Gerbi, Brown Medical School; and Dr. Howard K. Schachman, University of California, Berkeley. The symposium will be held on Sunday, April 13, 2003.



dards. That same year, when the division was transferred to the FDA as a bureau, she was appointed Deputy Director. She subsequently served as Deputy Associate Commissioner for science at FDA before being named NIGMS Director in September 1974. From September 1990 to September 1991, she was also acting Associate Director of the NIH for research on women's health.

Dr. Kirschstein is memorialized on the FASEB campus; the garden in front of Beaumont House has been named the Kirschstein Garden in her honor.

The Howard K. Schachman Public Service Award, instituted in 2001 is given annually, and candidates are considered by the Society's Public Affairs Advisory Committee. The award consists of a permanent keepsake, an honorarium, an opportunity to deliver a talk or lecture at the Society's annual meeting, and travel expenses to the meeting. 

Joan Steitz to Deliver Excellence in Science Lecture at EB2003

Former ASBMB Council member Joan Steitz will deliver the FASEB Excellence in Science Lecture at EB 2003 in San Diego. Her lecture is scheduled for Saturday, April 12, 8:30-9:30 a.m.

Dr. Steitz, who received the FASEB Excellence in Science Award in recognition of her internationally-renowned

contributions to the field of gene expression, has been a member of the Yale University faculty since 1970 and in 1999 was named Sterling Professor of Molecular Biophysics and Biochemistry, Yale's highest academic honor. A Howard Hughes Medical Institute investigator, Dr. Steitz leads the molecular genetics program in the Boyer Center for Molecular Medi-



Dr. Joan Steitz

cine. Her achievements have earned her many honors, including the National Medal of Science and the Christopher Columbus Discovery Award in Biomedical Research.

The FASEB Excellence in Science Award, sponsored by the Eli Lilly Company,

recognizes women for outstanding achievement in scientific research. All women who are members of one or more of the members societies of FASEB are eligible for nomination. Nominations may be made only by members of FASEB societies. The award was instituted in 1989. Among earlier recipients is current ASBMB President Bettie Sue Masters (1992).

ASBMB-Amgen Award ...

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RNAi system, for example, he set up a web page with the protocols and recipes to disseminate the technology widely and freely."

Recalling Dr. Sundquist as a graduate student, Stephen J. Lippard, Chair and Arthur Amos Noyes Professor, Department of Chemistry, Massachusetts Institute of Technology, stated:

"While in my laboratory, Wes became interested in nucleic acid structure and the functions deriving therefrom. He executed an outstanding Ph. D. thesis that received justifiable international acclaim. In his

postdoctoral work with Aaron Klug, he was a co-discoverer with Jamie Williamson in Tom Cech's laboratory of the G-quartet structures in telomere-type sequences. His independent career at the University of Utah has been stellar. Wes has chosen an extremely difficult problem. With characteristic intelligence and organizational skill, he has assembled a team including Chris Hill at Utah, UMBC's Mike Summers, and John Finch at the MRC-LMB in Cambridge to characterize the HIV -1 matrix and capsid proteins with the important objective of

understanding dynamic transformations of the HIV-1 virion. Included are experiments designed to understand the viral maturation steps and, more recently, a deep understanding of the workings of the HIV -1 CA protein.

"This work is characterized by beauty and elegance, has made an important contribution to our understanding of the structures and life cycle of the retroviruses, and is highly acclaimed internationally. Wes's papers are thoughtful and full of wonderful science. He has not published anything of less than great interest." 

Search for Cholesterol Absorption Genes

Findings with lab mice may lead to novel cholesterol-lowering drugs against heart disease.

Two people eat the same egg, cheese and ham muffin for breakfast, yet one absorbs significantly more cholesterol into his or her blood than the other. Why?

The answer, and all of its implications for combatting heart disease, remains stubbornly hidden within our DNA. In recent genetic studies with lab mice, however, researchers at The Rockefeller University have begun to close in on the culprit genes.

“By determining the genetic basis behind the observation that some people absorb 25 percent of cholesterol from their diet, while others absorb up to 75 percent, we hope to develop new treatments to protect this latter group,” says senior co-author Jan. L. Breslow, M.D., an ASBMB member and Head of Rockefeller University’s Laboratory of Biochemical Genetics and Metabolism and former National President of the American Heart Association.

The researchers hope that the identification of genes that regulate cholesterol absorption in mice will lead them to the location of similar genes in humans—and ultimately to the development of drugs that specifically reduce cholesterol absorption and protect against coronary heart disease, the number one cause of death in the United States.

In the Dec. 10 issue of the *Proceedings of the National Academy of Sciences* (published online Nov. 22), the Rockefeller scientists report the use of mouse “genetic linkage mapping” technology to narrow the location of genes



By crossbreeding two different strains of laboratory mice (above) using a technique called "genetic linkage mapping," Rockefeller scientists were able to map the location of cholesterol absorption genes to two distinct chromosome regions.

responsible for regulating the absorption of plant fatty molecules called “plant sterols”—markers of cholesterol absorption—to two distinct regions on chromosome 2 and 14.

While the exact location of the genes has not been deduced, the results indicate that the researchers have indeed uncovered their general vicinity: one of the putative sites has an incredibly high probability—a billion to one—of carrying the suspected genes.

“We are excited because our data analysis shows that cholesterol absorption genes are very likely hiding in chromosome 14,” says Ephraim Sehayek, M.D., first author and principal investigator of the study and a clinical scholar at Rockefeller.

“Now that we know where to look, we can use a variety of techniques to uncover their identities.”

Cholesterol: Good and Bad

Cholesterol is an essentially fatty molecule found in blood and in all body cells. But, when too much of it floats throughout the blood, this waxy substance can clog arteries that feed the heart and brain, ultimately leading to heart disease and stroke. Factors that bring about a rise in the level of blood cholesterol include saturated fatty acids and trans-fatty acids, common to red meats, dairy products and margarine - as well as dietary cholesterol itself, found in meat, eggs, cheese and other animal products.

But, while scientists know much about the role of cholesterol in heart disease, they poorly understand how the body absorbs cholesterol from foods.

That’s why Dr. Sehayek and colleagues set out to discover the genes that regulate cholesterol absorption in mice. But to do this, they needed to directly measure the amount of dietary cholesterol absorbed into the blood of mice—a task confounded by the presence of non-dietary cholesterol in the blood. Cholesterol comes in two forms: dietary, which comes from foods; and non-dietary, which is made by the body. Their solution was to turn to plants.

Plants possess cholesterol-like molecules called plant sterols, which people also absorb from food. But unlike cholesterol, plant sterols are not produced by the body and thus their plasma levels directly reflect dietary absorption. In addition, previous studies have identified a rare genetic condition, beta-sitosterolemia, in which people absorb too much cholesterol and plant sterols from food and consequently develop heart disease at a young age. For these and other rea-

Narrows to Two Chromosome Regions

sons, Dr. Sehayek chose to use plasma plant sterol levels as a marker of cholesterol absorption.

Breeding Mice in Search of Genes

Next came the tricky part: genetic linkage analysis. In this gene-hunting technique, researchers crossbred hundreds of mice in an attempt to link an observed trait to the genes that cause it. One experiment can take years and only sometimes results in the discovery of new genes.

The first step is to mate two strains of laboratory mice possessing opposite varieties of a trait of interest. Sehayek and colleagues began by mating a strain of mice they discovered to have low plasma plant sterol levels with another strain possessing high plasma plant sterol levels. Next, they crossbred the progeny of this mating while keeping track of each newborn animal's plasma plant sterol levels as well as

their DNA make-up; for every 10 million base pair units or so of DNA, they asked if the DNA originated from the parent with high or low plant sterol levels.


By tracking the origin of the DNA in this way hundreds of times across the entire genome, the researchers were able to link plasma levels of plant sterols in mice to two distinct patches of DNA that must control these levels. In other words, they mapped the location of plant sterol genes to regions, or loci, on chromosomes 2 and 14. "Our data analysis shows a very strong signal at chromosome 14," says Dr. Sehayek. "This means that sterol absorption genes are most definitely somewhere in this region."

With their genes on the DNA map, the researchers now plan to apply both genetic and molecular tools to hunt down their precise location.

In the meantime, their findings already have applications for human studies. Several researchers in the Breslow laboratory, along with Rockefeller researchers Jeffrey M. Friedman, M.D., Ph.D., and Markus Stoffel, M.D., Ph.D., are involved in ongoing studies of the island population of Kosrae, located 5,400 miles off Los Angeles in Micronesia.

The Kosraeans possess to a high degree the collection of health problems known as "Syndrome X," including obesity, diabetes, high blood pressure and high blood cholesterol. Also, most Kosraeans can trace their heritage to a relatively small "founder" population. Thus, by studying the genetic inheritance patterns of this group of islanders in a similar fashion to genetic linkage studies in mice, the researchers hope to identify the genes behind Syndrome X disorders.

The newly identified plant sterol absorption regions in the mouse now will guide the search for candidate DNA loci in the Kosrae population.

"By applying our findings in mice to human studies, we may actually gain clues to our hunt for mice genes," says Sehayek. "It's a back and forth process between humans and mice that hopefully will result in the discovery of novel human cholesterol absorption genes." 



Dr. Jan L. Breslow

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Healing Power in a Gene

With age, the body deteriorates. Muscles atrophy. Bones grow thin. The skin loses its elasticity. Wounds are slow to heal. Our tissues don't regenerate the way they did in youth.

University of Illinois at Chicago researcher and ASBMB member Dr. Robert Costa believes he knows why: our FoxM1B gene retires. In a paper published in the December 24 issue of *The Proceedings of the National Academy of Sciences* Dr. Costa's research group has shown that the FoxM1B gene, found on human chromosome number 12, is critical for tissues to heal and replenish themselves. Other UIC researchers involved in the study were Xinhe Wang, Hiroaki Kiyokawa

and Margaret B. Dennewitz.

If the gene is defective or just tired out (as in old age and rare genetic disorders causing premature aging), DNA can't duplicate itself, and cells can't divide and multiply the way they normally do. The result: a flood of activity in genes associated with aging.

Dr. Costa has been working on the FoxM1B gene since he discovered the whole family of Fox genes in 1993. Research has since shown that Fox family genes, found in animals from insects on up through mammals, are involved in the entire life cycle of a cell — its proliferation, maturation and death.

Fox is short for Forkhead Box, a name referring to a mutation in the gene in

the fruit fly that causes a duplication in the head structure.

One key finding came last year: Dr. Costa's research group was studying the FoxM1B gene in mice; in particular how it

affects growth of the liver after a portion of the organ is removed. One of the few adult organs capable in mammals of completely regenerating itself, the liver is also the only organ that regenerates from fully mature cells. Others, like blood, form new tissue from immature cells.

The experiment showed that the liver grew back at a rate typical of young mice — a discovery that led Dr. Costa to dub FoxM1B the "fountain-of-youth gene."

In the new study, his team set out to understand how FoxM1B directs the busy molecular traffic inside a cell to make it proliferate. In a feat of genetic engineering, the team created mice with liver cells lacking the FoxM1B gene. Rates of regeneration were measured in these mice and in mice whose FoxM1B gene was intact. Without FoxM1B, regeneration was slow.

Cell division requires two basic steps: first a doubling of DNA, the genetic instructions inside a cell, and then a process called mitosis, in which the duplicated DNA is separated into two new daughter cells.

Like a traffic cop, FoxM1B controls both steps, Dr. Costa says. "If the cells had no FoxM1B gene, their DNA often failed to make a copy of itself, and they had trouble dividing."

The DNA failed to duplicate due to a pileup of a protein called p21Cip1.



Dr. Robert Costa

Photo: Troy Heinze/UIC Photographic Services

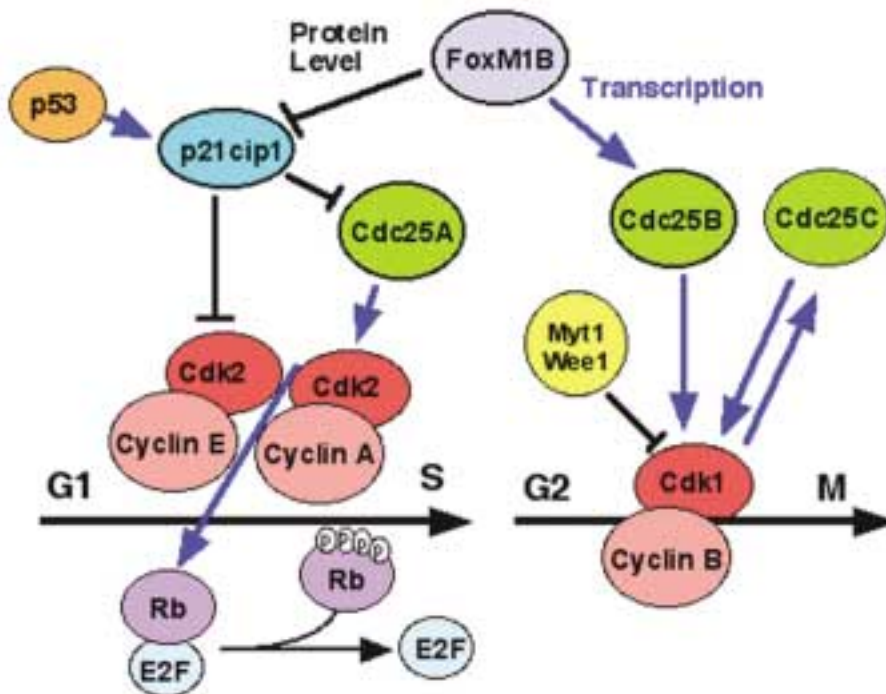


Diagram depicting FoxM1B regulation of cell cycle genes. Regenerating FoxM1B^{-/-} hepatocytes display increased nuclear protein levels of the Cdk inhibitor p21 Cip1 (p21), suggesting that FoxM1B controls the expression of a gene that regulates p21 protein stability. Blue arrows represent positive regulation and black lines represent negative regulation. Because regenerating p21^{-/-} liver displayed increased Cdc25A expression and earlier nuclear localization of Cdc25A (2), we propose that increased p21 levels may influence Cdc 25A phosphatase levels. Furthermore, the significant reduction in hepatocyte mitosis was associated with diminished mRNA levels and nuclear expression of Cdc25B phosphatase, which required for Cdk1 activation and entry into mitosis.

Continued on next page

New Regulations Control Use of Select Biological Agents

The U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) established new safeguards for the possession, use, and transfer of select biological agents and toxins (select agents) that could pose a threat to public, animal and plant health and safety.

In complementary regulations published December 13, HHS and USDA established new, tighter controls on these potentially dangerous agents. The regulations outline the safety and security requirements for possessing select biological agents and toxins and specify who should be restricted from working with select agents.

The HHS interim rule updates the previous select agent rule (issued in August 2002) by requiring facilities to register with the Centers for Disease Control and Prevention (CDC) if they possess a select agent or agents that pose a potential threat to human health. The previous rule only required facilities to register with CDC if they intended to transfer a select agent.

“Protecting the health of Americans is paramount, and this new rule strengthens our ability to ensure that essential research on these agents continues while making certain they don’t fall into the wrong hands,” said HHS Secretary Tommy G. Thompson.

The USDA interim select agent rule requires facilities to register with USDA’s Animal and Plant Health Inspection Service (APHIS) if they possess a select agent or agents that pose a potential threat to animal or plant health.

“This new rule will continue to strengthen programs aimed at protecting the American people from acts of terrorism,” said Agriculture Secretary Ann M. Veneman. “These safeguards will help protect the food supply without sacrificing valuable research being done on these agents.”

Some of the select agents subject to these regulations appear on both the HHS and the USDA select agent lists. To reduce the burden on facilities required to register select agents in their possession that overlap both lists, HHS and USDA have worked together to establish a single unified reporting system that will be used by both agencies, thus eliminating duplication of effort.

The HHS interim final rules will take effect on February 7 and the USDA rules on February 11. Each department will accept public comments on the new rules until February 11, and those comments could result in regulatory changes in the future.

The new rules are in accordance with the USA Patriot Act and the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. The USA Patriot Act sets requirements for the appropriate use of select biological agents. It also specifies those persons who should be restricted from working with select agents, and imposes criminal and civil penalties for the inappropriate use of select agents. The Public Health Security Bioterrorism Preparedness and Response Act of 2002 updated the existing Select Agent Rule by requiring facilities to register if they possess select agents. Previously, only facilities that wished to transfer select agents needed to register with CDC.

The HHS interim rule can be viewed at <http://www.cdc.gov> and the USDA interim rule can be viewed at <http://www.aphis.usda.gov/ppd/rad/w ebreport.html>.

The new rules affect almost 190,000 research facilities, including academic institutions and biomedical centers; commercial manufacturing facilities such as those in the pharmaceutical industry; federal, state and local laboratories, including clinical and diagnostic labs; and research facilities.

The new rules cover both human pathogens, and plant or livestock pathogens. Human pathogens and toxins are under the purview of HHS, and plant and livestock pathogens are under the purview of APHIS. A third category of pathogen called “overlap agents” must be reported to both CDC and APHIS. These are agents that could be used to harm either humans, or plants or livestock.

A list of specifically-named pathogens and toxins in all three categories (CDC, APHIS, and overlap) can be seen on the ASBMB website, www.asbmb.org. Other categories of pathogens and toxins, as well as exemptions, are described in the interim rules. ❧

Gene ...

Continued from previous page

According to Dr. Costa, FoxM1B probably unleashes the enzyme that normally digests this protein to prevent it from building up in the cell.

When the p21Cip1 protein accumulates, he says, it sets in motion a series of molecular events, like falling dominoes, that prevents DNA from doubling and gives a green light to genes linked with the diseases of old age.

“We know from earlier research by others that abnormal accumulation of p21Cip1 protein occurs during aging, turning on a host of genes associated with diseases found in the elderly, like Alzheimer’s and cancer,” said Dr. Costa.

His team also found that FoxM1B controls a key enzyme needed to help cells pull apart at the end of mitosis, the final step in cell division.

“These results clearly link FoxM1B with the failure of tissues to mend,” Dr. Costa said. “And in old age, when the FoxM1B gene is essentially out of action, we see the results.” ❧

Cloning Due Before Congress Again

by Peter Farnham, ASBMB Public Affairs Officer

The Bush administration and its allies in Congress are expected to make a new push this year for a comprehensive ban on all forms of human cloning. However, despite the new Republican majority in the Senate and a strengthened majority in the House, passage of such a ban will not be easy.

There is broad national consensus on the policy goal of a ban on so-called reproductive cloning—cloning for the purpose of producing a child. The Bush administration, virtually all of the Congress, and the vast majority of the scientific community support this goal. ASBMB, for example, supports S.2439, the Feinstein-Kennedy Bill, which was introduced in the last session of Congress and would prohibit reproductive cloning, but permit the asexual production of blastocysts for research purposes. However, the administration and its congressional allies would extend a ban on cloning to the production of stem cells, which could be used in treatments and therapies to cure or ameliorate human disease.

The administration supported a bill in the last Congress that would ban both forms of cloning. The House version of the bill passed in 2001 by more than 100 votes with little debate, but the Senate version died when Congress adjourned last fall. However, the administration and its supporters in Congress are prepared to try again to pass a comprehensive cloning ban. There are a number of new factors to consider in any assessment of the chances of such a ban passing Congress. First, and most

important, a group of cloning advocates has now claimed to have produced human clones.

Chemist Brigitte Boisselier, head of a company called Clonaid, announced in December that the company had cloned a healthy baby girl. Boisselier is associated with the Raelians, a cult that claims 55,000 followers worldwide and believes life on Earth was sparked by extraterrestrials who arrived 25,000 years ago and created humans through cloning.

Boisselier's claim, and others that followed, have been viewed skeptically by most scientists. However, Michael Manganiello, President of the Coalition for the Advancement of Medical Research (CAMR), called on Congress to pass a ban on reproductive cloning.



Clonaid's announcement "Should serve as a chilling reminder that individuals are still trying to clone human beings."

—Bill Frist (R-TN),
Senate Majority Leader

He stated, "It is more important now than ever that the American public understand the difference between reproductive cloning, which seeks to create babies, and somatic cell nuclear transfer, which seeks to create stem cells to treat people with life-threatening diseases and conditions."

President Bush reacted to the Clonaid announcement through a spokesman, saying that he found human cloning to be "deeply troubling," and that it underscores the need for "legislation to ban all human cloning."

Currently, there is no law against human cloning; however, the Food and Drug Administration has regulatory authority over experiments involving humans, and claims that its regulations forbid human cloning without agency permission. FDA officials reportedly are already investigating whether Clonaid performed any of the work on U.S. soil.

Senator Brownback (R-KS) will try to pass an anti-cloning bill again in the new Congress, but passage of the bill is in doubt because of strong bipartisan support for therapeutic cloning, led by Senators Dianne Feinstein (D-CA), Ted Kennedy (D-MA), Arlen Specter (R-PA) and Senator Orrin Hatch (R-UT). Since Senator Brownback is unlikely to garner the 60 votes needed to cut off an expected filibuster, he may try to call for a moratorium on cloning, rather than a complete ban.

This approach was endorsed by the President's Council on Bioethics, which called for a four-year moratorium on human embryo cloning in its report released last summer. However,


President Signs NSF Reauthorization Bill

By Peter Farnham, ASBMB Public Affairs Officer

most in the scientific community consider a moratorium to be nothing more than a cloning ban under another name. To quote CAMR's Manganiello, "A moratorium on therapeutic cloning is a thinly veiled attempt at banning important research outright. Supporters of a moratorium know how difficult it is to lift one—that is why they are proposing it. A moratorium would mean that important medical breakthroughs are put on hold. People suffering from life-threatening diseases and conditions are told they will just have to wait for their cures."

If a moratorium proposal does emerge, supporters of therapeutic cloning will want a "sunset clause" included in the bill—a date when the moratorium will expire. This would force moratorium supporters to pass an extension, a more difficult legislative feat than simply letting a current bill remain law.

Another factor to take into account is the new Senate Majority Leader, Bill Frist (R-TN), who supported the Brownback bill in the last Congress. Clonaid's announcement, said Frist, "Should serve as a chilling reminder that individuals are still trying to clone human beings."

Other factors include the efforts of other nations to press ahead with development of stem cell technologies, notably Britain, and the NIH's recent admission on its website that only 9 of the 70 stem cell lines President Bush allowed access to in August 2001 are actually available for researchers to use. 

The National Science Foundation Authorization Act of 2002, signed by President Bush in December, authorizes a budget increase of 105 percent for the NSF over the next five years, from \$4.8 billion in FY 2002 to \$9.8 billion in FY 2007. Although this act does not provide funds for NSF, it does provide the authority to obligate funds for specified activities. The last two years of the five-year authorization are contingent on NSF making satisfactory progress in meeting the goals of the President's Management Agenda. NSF is the only agency to have received green lights (in financial management and e-government) on the President's most recent Management Scorecard.

"The passing of this bill is the culmination of several years of effort by many people and organizations," Coalition for National Science Funding Chairman Sam Rankin said. "Now all we have to do is convince the appropriators to appropriate the levels of funding prescribed!"

ASBMB worked very hard to bring about passage of this bill, starting last spring when then-ASBMB President Bob Wells and current President Bettie Sue Masters flanked bill sponsors Sherwood Boehlert (R-NY) and Nick Smith (R-MI) at a press conference in the House Science Committee main hearing room heralding the bill's introduction. The NSF was last authorized by the 105th Congress in 1998. That authorization expired more than two years ago.

The Act includes portions of legislation previously enacted by the House


that authorize the Math and Science Partnership and the Science and Engineering and Technology Talent Expansion Act. Some highlights:

In addition to setting funding levels for the next five years, the bill authorizes funding in such NSF priority areas as information technology, nanotechnology, and science and mathematics education.

The bill requires the creation of a prioritized list of Major Research Equipment and Facilities Construction (MREFC) projects to be updated each time the National Science Board approves a new project to be funded by the MREFC account.

The bill authorizes the establishment of a new program to award grants to Hispanic-serving institutions, Alaska Native-serving institutions, Hawaiian Native-serving institutions and other institutions of higher education serving a substantial number of minority students to enhance the quality of science education, including funding for instrumentation.

The bill also includes a number of administrative amendments involving the National Science Board and its relationship with the Foundation. Among the more controversial amendments, the NSB Chair is now allowed to appoint up to five professional staff members to serve the Board. The NSF opposed this provision, as in the past the Foundation appointed the NSB staff.

The full text of the bill is available at: http://www.nsf.gov/od/lpa/congress/107/final_authorization_language.pdf 

by John D. Thompson, Editor

Computers + Biology = Bioinformatics

“The laboratory rat is giving way to the computer mouse as computing joins forces with biology to create a bioinformatics market that is expected to be worth nearly \$40 billion within three years.”

That, in a nutshell, was *The Economist's* assessment, in its December 12, 2002, edition, of the impact of the computer on the lab. Over the past five years, computers have changed the way research works. Wet lab processes that took weeks to complete are giving way to digital research. Notebooks with jotted comments, measurements and drawings have yielded to terabyte storehouses of genetic and chemical data, and empirical estimates are being replaced by mathematical exactness.

Bioinformatics—the acquisition, storage and analysis of biological data—has become a key factor in biotechnology's progress. It speeds

the search for new drugs, and biotech firms are looking to computer modeling, data mining, and high-throughput screening to discover drugs more efficiently. Biological institutions and biopharmaceutical firms are now among the largest users of computer power, such as petaflops (thousands of trillions of floating-point operations per second) of supercomputing power, and terabytes (trillions of bytes) of storage, not to mention such basics as workstations, servers, supercomputers, storage and data-management systems, knowledge management and collaboration tools, and the life-science equipment needed to handle biological samples. In 2001, sales of such systems amounted to more than \$12 billion worldwide, according to International Data Corporation, in Framingham, Massachusetts. By 2006, this

bioinformatics market is expected to be worth \$38 billion.

Researchers now find themselves swamped with data. Each time it does an experimental run, the average microarray spits out some 50 megabytes of data—all of which has to be stored, managed and made available to researchers.

It is in data mining, where bioinformatics has the prospect of its biggest pay-off. First applied in banking, data mining uses a variety of algorithms to sift through storehouses of data in search of “noisy” patterns and relationships among the different silos of information. To make the most of data mining, biologists are being forced to become mathematicians in order to describe the biological processes and models involved. That implies a demand for wholly new sets of skills and educational backgrounds.

Purdue Holding \$100,000 Competition

An entrepreneurial competition at Purdue University will award total prizes of \$100,000 for business plans that describe the path to market for products and technologies in the life sciences, biotechnology and biomedicine.

The inaugural Purdue University Life Sciences Business Plan Competition, sponsored by the Burton D. Morgan Center for Entrepreneurship and Roche Diagnostics, will take place April 22-24 on Purdue's West Lafayette campus. Teams should submit an entry form and executive summary by February 10 and full business plans by March 8.

Eight finalists will be chosen from

the written business plan phase of the competition. Those teams will make 45-minute presentations to a panel of judges. First prize in the competition is \$50,000; second prize is \$20,000; third prize is \$15,000; fourth prize is \$7,500; fifth prize is \$5,000; sixth prize is \$2,500. Judging and awards presentations will take place on April 23.

Inquiries about the competition should be directed to Don Blewett, Associate Director of the Center for Entrepreneurship at 765-494-4485 or blewett@mgmt.purdue.edu. The competition website is at <http://www.purdue.edu/discovery-park/lifesciencescompetition>.

Amgen, ZymoGenetics Settle Patent Dispute Lawsuit

Biotechnology companies Amgen and ZymoGenetics Inc. have settled a patent infringement lawsuit over technology used in Amgen's popular rheumatoid arthritis drug, Enbrel. The settlement resolves a lawsuit filed by Seattle-based ZymoGenetics against a neighboring biotech firm, Immunex Corp., that is now part of Amgen, headquartered in Thousand Oaks, California. The agreement allows Amgen to continue selling Enbrel, but with nonexclusive worldwide licenses for the technology. ZymoGenetics will receive an undisclosed one-time cash payment.

Icelandic Firm Finds Gene Signal for Brittle Bones

Iceland's deCODE genetics Inc said on Thursday it had identified variations within a single gene that increase the risk of osteoporosis, paving the way for a diagnostic test for the brittle bone disorder. The discovery marks the first concrete advance under a multi-disease alliance with Switzerland's Roche Holding AG that could be worth up to \$300 million in funding, milestone payments and royalties to the Reykjavik-based biotechnology company.

DeCODE will earn an unspecified milestone fee for finding the seven single-base variations within a gene on chromosome 20. People with these genetic variations are several times

more likely to develop osteoporosis. Scientists at the firm who analyze disease-gene links in the Icelandic population, whose genetic make-up has changed little since the time of the Vikings, identified the gene by studying 1,000 patients and unaffected relatives in 139 families.

Osteoporosis can be a major health problem among people over 50, particularly women, and is characterised by the progressive thinning and weakening of the bones. Sufferers are at increased risk of bone fractures.

Kari Stefansson, deCODE's Chief Executive, said he believed a test could be brought to market rapidly, allowing

doctors to check for a pre-disposition to osteoporosis in much the same way that people already have their blood pressure tested. If found to be at risk, patients could then take corrective action by changing their diet, adapting exercise regimes or, if necessary, taking medication.

"Theoretically, it ought to be possible to get diagnostic tests to the market in a couple of years, against the 10 years or so it takes to develop a new therapeutic (drug)," he told Reuters. DeCODE said it would publish details of the gene and its links to decreased bone mass density in a major scientific journal at a later date.

Another British Invasion?

What Britain failed to do by force in the Revolution and the War of 1812, the Beatles did with music when they took the United States by storm in the 1960s. Now, physicists, chemists, biologists, engineers, and mathematicians seem on the verge of another successful British invasion.

Within the past year, for example, the British Embassy in Washington tripled to 12 the number of science and technology officers posted in the United States, and Boston which bid a British army goodbye in 1777 is now home to <http://www.belsgroup.com>, a website operated by British Expats in Life Sciences. In addition, when the Royal Society surveyed its members in 1999 it found that 12% were working in the U.S.

That may seem as if Britain is losing its scientists to a brain drain,

but while a UK government report on science and technology, released last summer, noted that while a wave of scientists had departed for the United States, Britain had a net gain of 5,000 scientists coming in from other countries.

Still, the exodus across the Atlantic may be helping Britain to establish a technology-transfer beachhead, although the results so far have been mixed. For example, a project to set up a joint institute between the University of Cambridge and the Massachusetts Institute of Technology was initially greeted with optimism, but recently was criticized in *Nature* (420, 256; 2002) for a lack of tangible results. Another program, announced last summer, to foster links between Rice University and Imperial College in London shows some promise.

Will India and the UK Join Hands in Research?

Do India and the UK have the potential for success as partners in scientific research? Experts in both nations think that British expertise in genomics and India's information technology could combine to benefit both countries.

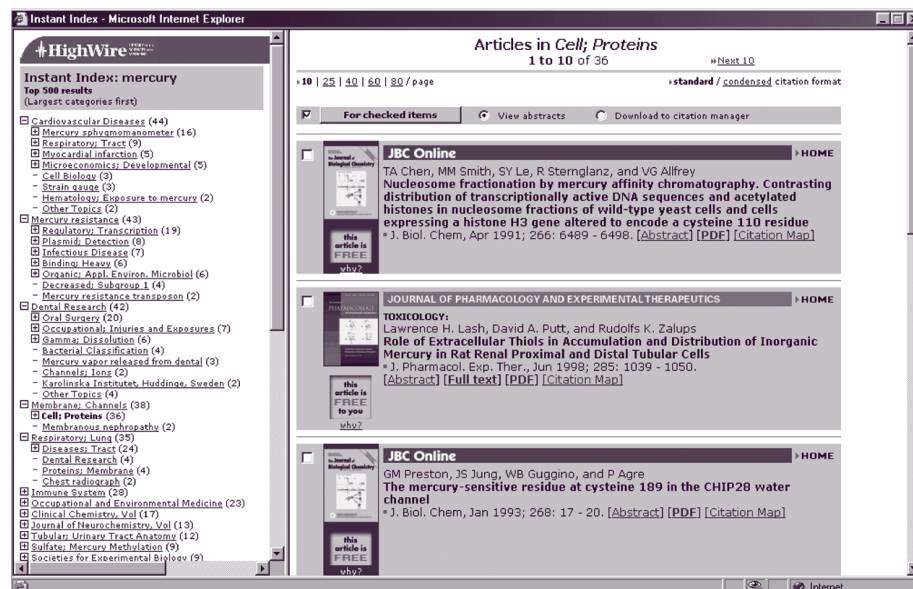
Both countries have a "mature science base" and have witnessed recent improvements in government research budgets, said the UK's chief scientific advisor, David King, in a recent India Day address to policy makers, researchers, and funding-body representatives from both India and the UK. Addressing the same group, Nigel Birch, head of international research at Britain's Engineering and Physical Sciences Research Council, said the council will shortly launch a new program to encourage UK/India collaboration in scientific research.

Making Keyword Searches Work

In early 2001, ASBMB introduced the new “portal” site from Stanford’s HighWire Press, which allows you to search all of Medline plus 340 journals’ full-text at once. We began a monthly series of short articles highlighting tools or features of this new site for researchers’ sore eyes. The new site is at <http://highwire.stanford.edu>

We could pretend that keyword searches of full text are an excellent tool for finding the specific articles you need—since keyword searches are just about the only tool most search systems give you!—but often a searcher is faced with thousands of search results in response to a keyword search because systems like PubMed index over 12 million article abstracts, and the HighWire Portal indexes all those abstracts plus the full text of over a million articles as well. But there is help for those who have to look for the needle in the haystack!

The HighWire Portal at <http://highwire.stanford.edu> has recently added some tools to help you spot the needles in the haystack of a large result. The new tools take advantage of the recognition ability we all have—“I know it when I see it!”—by augmenting the “recall” of the keywords to do a search, with the recognition of seeing just the right use of a term in the context of a sentence or phrase. These



tools are helpful when a scientific term used in a keyword search is ambiguous or multi-faceted, or when you are interested in only one aspect of many uses of that term; the tools are also useful when you are doing broad subject searches and can't provide very specific keywords.

The new tools are called “KWIC”—showing your search “keywords in context”—and “Instant Index”—which “clusters” items in your search results around major concepts. KWIC is shown in the first figure; here you see a search for the keywords “cytochrome oxidase” which returned over 13,000 citations. An Instant Index for a search on the term “mercury” is shown in the second figure.

KWIC

You can easily see from the example how KWIC can help you recognize articles that use your search terms in a relevant way in a sentence. Each citation in a search result will typically show you significant parts of the first two sentences in which your search terms are found in that

citation. Not only can KWIC help you spot relevant results, but it can suggest additional terms or phrase-search criteria that you can use to narrow your result.

Instant Index

The Instant Index is a more subtle—and potentially more helpful—new feature. Each search that retrieves more than 50 items will have a hyperlink that will take you to the Instant Index built from the top 500 items in your search result. You can see the Instant Index hyperlink in the middle of the first figure; it is the last link in the box under the Search Results heading; click on that link, and a new window like the one in the second figure will open up. The left side of the new window shows the index to your results; like the index in the back of the book, it contains concepts and sub-concepts. To the right of each concept is the number of citations that match. If you click on the concept name, the right side of the window will change to display the citations for that concept; in the example, we’ve clicked on “Cell;

Better, KWIC-ly

Proteins” and are looking at a list of 36 citations for that concept that contain the keyword “mercury” from our search. If you click on the “+” sign, it will show you the concepts indexed under another concept.

The technology that brings you the Instant Index is still being tuned, and we’d appreciate your feedback on whether and where you find it most helpful, and where you find otherwise. You may also find some interesting tests and uses for it. For example: try a search for your own papers, and see

whether the clusters of topics match what you think you’ve written about! Or, if you have to deliver a lecture (or a course!) on a topic, you might do a search for that topic as a keyword search—perhaps asking for “review articles only” — and then see whether the resulting Instant Index suggests possible topics for your lecture outline.

Previous issues of ASBMB Today covered topics about the new HighWire Portal. The articles are online at <http://highwire.stanford.edu/inthepress/asbmb/index.dtl>.

NIH Releases New Curriculum Supplements

The National Institutes of Health is releasing three new curriculum supplements to bring the latest findings on the brain, environmental health, and oral health to students across the nation. The state-of-the-art instructional materials are part of a project that promotes inquiry-based, interdisciplinary learning in kindergarten through grade 12, and NIH is distributing the modules to teachers free-of-charge to promote scientific literacy and student interest in the sciences.

The new curricula below are aligned with the National Science Education Standards released by the National Academy of Sciences. Each supplement comes with an interactive CD-ROM.

The Brain: Understanding Neurobiology Through the Study of Addiction. Allows students in grades 9 through 12 to explore how drugs alter brain function by changing the way neurons communicate.

Chemicals, the Environment, and You: Explorations in Science and Human Health. Enables students in grades 7 and 8 to explore the relation-

ship between chemicals in the environment and human health, utilizing basic concepts in the science of toxicology.

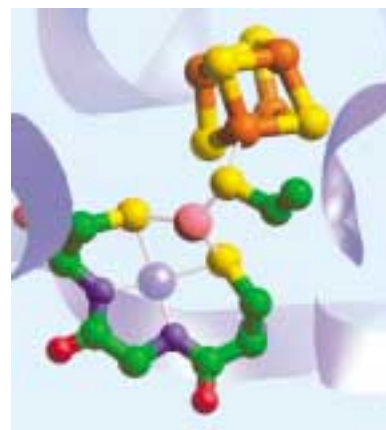
Open Wide and Trek Inside: Encourages students in grades 1 and 2 to explore the wonders of the mouth as a living environment and learn major scientific concepts relating to oral health.

The modules are the result of a cooperative effort among teachers, scientists, and curriculum developers. Three earlier curriculum supplements, designed for use in high school classrooms, are Cell Biology and Cancer, Emerging and Re-emerging Infectious Diseases, and Human Genetic Variation. Each is available on the NIH Office of Science Education Web site. Additional supplements are planned each year. For more online information, visit <http://science.education.nih.gov/supplements>.

For more information or review copies, contact: Dr. David Vannier, Professional Development Coordinator, OSE, NIH 6705 Rockledge Dr, RM 700, Bethesda, MD 20892-7984; Ph: 301-496-8741; Fx: 301-301-402-3034, Email: vannierd@od.nih.gov.

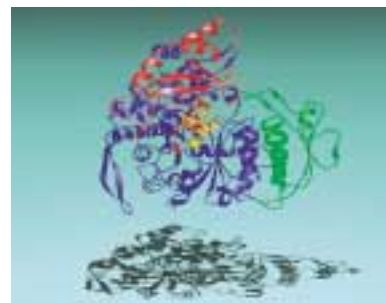
Correction

The captions for the photos below were unfortunately transposed in the print version of the December 2002 *ASBMB Today*. Although this was corrected in the online edition of the magazine, we are reprinting the photos here with the correct captions.



A new metallocofactor containing three different transition metals, iron (orange), copper (pink), and nickel (blue), has been discovered in the bifunctional enzyme carbon monoxide dehydrogenase/acetyl coenzyme A synthase. Amazingly, organisms containing this enzyme can grow on the greenhouse gas carbon dioxide as their sole carbon and energy source.

Photo by Dr. Catherine Drenman.



From RNA to DNA: crystal structure of a class II ribonucleotide reductase.

Photo by Michael Sintchak (Drenman Group)

Calendar of Scientific Meetings

MARCH 2003

The American Society for Microbiology (ASM) Meeting: Future Directions for Biodefense Research: Development of Countermeasures

March 9-12 • Baltimore Marriott Waterfront, Baltimore, MD
Abstract Deadline: January 30, 2003
Ph: 202-942-9248; Fx: 202-942-9340
Email: meetingsinfo@asmusa.org; www.asmbiodefense.org

Principles and Applications of Time-Resolved Fluorescence Spectroscopy

March 23-28 • University of Maryland Baltimore
Contact: Mary Rosenfeld, Tel: 410-706-8409
Email: cfs@cfs.umbi.umd.edu; Website: <http://cfs.umbi.umd.edu>

Keystone Symposium, Proteomics: Technologies and Applications

March 25-30 • Keystone Resort, Keystone, Colorado
Contact: Paul Lugauer; Tel.: 970-262-1230 ext. 111
Email: info@keystone.symposia.org
Website: <http://www.keystonesymposia.org>

APRIL 2003

Origin and Evolution of Mitochondria and Chloroplasts Advanced Lecture Course for the Federation of European Biochemical Societies (FEBS)

April 5-10 • Hvar, Croatia
Contact: Prof. Dr. Jürgen Soll
Ph: + 49 89 17861 225/273/276; Fx: + 49 89 17861 185
e-mail: hvar2003@botanik.biologie.uni-muenchen.de
Website: http://www.febs.unibe.ch/Activities/Advanced_Courses/Adoc03.htm

9th International Congress on Neuronal Ceroid Lipofuscinosis (Batten Disease)

April 9-13 • The Holiday Inn-City Centre, Chicago
Program Chair: Glyn Dawson, University of Chicago Pritzker
School of Medicine; Website: <http://www.ncl2003.org/>

American Society for Biochemistry and Molecular Biology Annual Meeting in Conjunction with EB2003

April 11-15 • San Diego, California
Contact: EB2003 Office; Ph: 301-634-7010
Fx: 301-634-7014; Email: eb@faseb.org
Website: <http://www.faseb.org/meetings/eb2003>

9th National Symposium on Basic Aspects of Vaccines

April 30-May 2 • Bethesda, Maryland
Contact: Conference Secretariat; Walter Reed Army Institute of
Research; Dept of Membrane Biochemistry
503 Robert Grant Ave, Room 2A24; Silver Spring, MD 20910
Ph: 301-319-9462 fx: 301-319-9035
e-mail: symposium@na.amedd.army.mil
Website: <http://wrair-www.army.mil/symposia/dmbsym.htm>

MAY 2003

Proteomic Solutions in Cellular and Developmental Biology and Medicine

May 2-4 • Stowers Institute, Kansas City, Missouri
Contact: Kelly Gull; Ph: 301-634-7145; Fx: 301-634-7126
Email: kgull@asbmb.faseb.org; Website: <http://www.asbmb.org>

10th Undergraduate Microbiology Education Conference

May 16-18 • University of Maryland, College Park, Maryland
Contact: Carlos Pelham; Ph: 202-942-9317
Email: EducationResources@asmusa.org
Website: <http://www.asmus.org/edusrc/edu4c.htm>

JUNE 2003

Transposition, Recombination and Applications to Plant Genomics A Plant Sciences Institute Symposium

June 5-8 • Iowa State University, Ames, Iowa
Abstracts due April 4, 2003; Registration deadline May 5
Students may apply for travel grants (applications due April 4)
Contact: Gulshan Singh
Ph: 515-294-7978; Fx: 515-294-2244; E-mail: pbmb@iastate.edu
Website: <http://molebio.iastate.edu/~gfst/phomepg.html>

ECM IV: Bone Tissue Engineering

June 30-July 2 • Davos, Switzerland
Contact: R. Geoff Richards, Dr. Sci. M.Sc. biol.
Programme Leader AO Research Institute,
Bioperformance of Materials & Devices
email: geoff.richards@ao-asif.ch; Ph: ++41 (0) 81 4142 397
<http://www.aofoundation.org/events/ao/ecm/ECMIV/index.shtml>

JULY 2003

FEBS 2003 Meeting on Signal Transduction

July 4-8 • Brussels
Contact: V. Wouters; Ph: 32 2 7795959; Fx: 32 2 7795960
Email: febs@iceo.be; Website: <http://www.febs-signal.be>

Education in the Molecular Life Sciences: The Central Role of Biochemistry and Molecular Biology

July 18-20 • University of Toronto, Canada
Contact: Kelly Gull; Ph: 301-634-7145; Fx: 301-634-7126
Email: kgull@asbmb.faseb.org
<http://www.richmond.edu/~jbell2/iubmb-satellite.html>

19th International Congress of Biochemistry and Molecular Biology

July 20-24 • Toronto, Canada
Contact: Congress Secretariat; Ph: 613-993-9431
Email: iubmb2003@nrc.ca
Website: <http://www.nrc.ca/confserv/iubmb2003/>

AUGUST 2003

First Gordon Research Conference on Cellular Osmoregulation: Sensors, Transducers and Regulators

August 15–20 • Roger Williams University, Bristol, RI
Contacts: Janet M. Wood (jwood@uoguelph.ca) and Karlheinz Altendorf (altendorf@biologie.Uni-Osnabrueck.de)
Website: <http://www.grc.uri.edu/programs/2003/cellosmo.htm>
Application: <http://www.grc.org/scripts/dbml.exe?Template=/Application/apply1.dbm>

Sixth International Symposium on Mass Spectrometry in the Health and Life Sciences: Molecular and Cellular Proteomics

August 24–28 • Fairmont Hotel, San Francisco
Contact: Marilyn Schwartz; Ph: 415-476-4893
Email: sfms@itsa.ucsf.edu
Website: <http://donatello.ucsf.edu/symposium>

Biology of Molecular Chaperones Mechanisms and Regulation of Chaperones

August 30–September 4 • Tomar, Portugal
Contacts: Dr. Josip Hendekovic or Caroline Walford
Ph: + 33 388 76 71 35; Fx: + 33 388 36 69 87
Website: http://www.esf.org/esf_euresco
Please quote 2003-15 in any correspondence

16th International Mass Spectrometry Society Conference

August 31–September 5 • Edinburgh, Scotland, United Kingdom
Contact: John Monaghan; Email: johnmonaghan@ed.ac.uk
Website: <http://www.imsc-edinburgh2003.com>

SEPTEMBER 2003

NMR in Molecular Biology EuroConference on Structural Genomics: From Gene to Structure as viewed by NMR

September 5–10 • Obernai (near Strasbourg), France
Contact: Dr. Josip Hendekovic or Anne-Sophie Gablin
Ph: + 33 388 76 71 35; Fx: + 33 388 36 69 87
Website: http://www.esf.org/esf_euresco
Please quote 2003-14 in any correspondence

Sixth Conference on Protein Expression in Animal Cells

September 7–11 • Mont-Tremblant, QC, Canada
Contact: Marc Aucoin, Technical Officer
Biotechnology Research Institute; Email: 6thPEACe@nrc.ca
Website: <http://www.bri.nrc.ca/6thPEACe>

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ASBMB members may also register for the Annual Meeting at discounted rates. In addition, you can order your 2003 edition of the *Annual Review of Biochemistry* through ASBMB.

If you have any questions, please email asbmb@asbmb.faseb.org.





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