PHRMA FOUNDATION









Pharmaceutical Research and Manufacturers of America Foundation

The PhRMA Goundation Awards in Excellence Gala



The "Awards in Excellence Gala" was a first-class affair, attended by more than 400 folks from our industry, awardees and advisory committee members. The Gala was held in Philadelphia, Pennsylvania during Interphex '98—an exhibition/conference which is attended by 10,000 folks mostly from PhRMA member companies. See pages 18-27 of this Annual Report for full details and photographs of this exciting premiere event.

Mayor Ed Rendell; Chris McCabe, Industry Vice President, Reed Exhibition Companies; Donna Moore, PhRMA Joundation President; and John Timoney, Police Commissioner of Philadelphia share a moment at the Awards in Excellence Gala.







Left: Alan Holmer, President of PhRMA, relates his personal story at the PhRMA Goundation Awards in Excellence Gala. Right: Patrick J. Jenner regales the Gala attendees with his remarks. Both men enthusiastically emphasized the importance of the Goundation and its mission.

Mission Statement



he quality of health care world-wide depends in large measure on advances in drug therapy, including the discovery and development of new medicines. This requires a framework which would foster the broad range of research, as well as the measurement of outcomes. Therefore, it is to this end that the mission of the PhRMA Foundation is dedicated to enhancing public health through biomedical technology and scientific research. The result will be new and improved medicines to enhance the quality of life world-wide while containing the overall cost of health care, thus improving and promoting the impact of the research-intensive pharmaceutical industry.

This mission shall be accomplished by:

- Developing the careers of young scientists and researchers dedicated to improving quality of life through discoveries in biomedical technology, scientific research, and outcomes measurement. As a result, the valuable base of well trained, quality scientists created by these newly developed careers would serve as a resource to meet the current workforce needs of the scientific and academic community, government, and the research-intensive pharmaceutical industry.
- Establishing an infrastructure of expertise in biomedical technology, scientific research and outcomes measurement to produce leaders in industry, academia and government for the purposes of training the educational and scientific leaders of tomorrow.
- Building alliances between industry and academia to augment the research activities of scientists within both arenas. The purpose of this alliance would be to forge and strengthen the continuum of basic and clinical research by identifying and developing important therapeutic outcomes and significant therapeutic technology leading to the "medicines of tomorrow." This in turn, would serve to enhance clinical practice and foster the improvement of patient care in America.

In Memory



GEORGE H. HITCHINGS, JR., PH.D.

(1905 - 1998)

Why father died after a prolonged illness when I was twelve years old. The deep impression made by this event turned my thoughts toward medicine,"— George H. Hitchings, Jr., Ph.D., 1988 Nobel Prize winner, giving his motivation for entering the field of science. Dr. Hitchings died on February 27, 1998, at his home in Chapel Hill, North Carolina.

Along with Gertrude Elion, Ph.D., Dr. Hitchings was awarded the 1988 Nobel Prize for Medicine, for their pioneering role in developing drugs in the fight against leukemia and malaria and such viral infections as herpes and AIDS.

For the past twenty years, Dr. Hitchings had pursued his growing interests in philanthropy. He set standards for philanthropy in the Triangle area of North Carolina that are still having a tremendous impact on people's lives. His contributions in the way of program development for the Foundation during its infancy is remembered by many. His focus served to lay a firm platform for the PhRMA Foundation for years to come.

Dr. Hitchings received his bachelor's degree (1927 - cum laude) and master's degree (1928) in Chemistry from the University of Washington and a doctorate in biochemistry from Harvard in 1933. 1933 also marked the year he married the love of his life, Beverly Reimer. His career began with the Wellcome Research Laboratories in 1942. In 1975, he retired as Vice President from Burroughs-Wellcome—now Glaxo Wellcome—but continued to report to the lab well into the '90s.

Robert A. Ingram, Chairman, Chief Executive Officer and President of Glaxo Wellcome, and Secretary-Treasurer of the PhRMA Foundation says: "George Hitchings knew how to combine his brilliance with a fierce dedication to his science. As a result, he revolutionized the world of drug exploration and design. It was his work that led to the first effective treatments for childhood leukemia and made the first kidney transplants possible."

Looking back on his career, Dr. Hitchings once said, "My greatest satisfaction has come from knowing that our efforts helped to save lives and relieve suffering."

We are very pleased to dedicate this *Annual Report* to George H. Hitchings, Jr., Ph.D., in tribute to his foresight in facilitating the establishment of the PhRMA Foundation.

In Memory



KEITH FENTON KILLAM, JR. (1927 - 1998)

PhRMA Foundation, Advisory Committee Member 1973 - 1998

To commemorate Dr. Killam's strong commitment and dedication to the teaching of students, the family has asked that donations be made to:

The Keith F. Killam, Jr. Memorial Fund for Graduate Student Travel American Society of Pharmacology and Experimental Therapeutics (ASPET) 9650 Rockville Pike, Bethesda, Maryland 20814-3995

or

The Keith F. Killiam, Jr. Research Fund for the Western Pharmacology Society Please contact Dr. Roberto P. Rosenkranz, P.O. Box 8, Menlo Park, California 94026 **O**_n January 2, 1998, Keith Fenton Killam, Jr., Ph.D., suffered a fatal heart attack and we lost a good friend. He was 70 years old. Keith is survived by his beloved wife of 43 years, Eva and his four children and four grandchildren.

Dr. Killam was born on March 2, 1927 in Hollywood, Florida. In World War II he served in the Army Medical Detachment, 1340th area service unit and was a military rifle marksman receiving a meritorious unit award.

He attended Tufts College where he received a B.S. in Engineering in 1948. He received his Masters Degree in Pharmacology in 1953 and his Ph.D. in Pharmacology in 1954, both from the University of Illinois, Graduate Professional College. Dr. Killam was a postdoctoral fellow in the departments of Pharmacology and Anatomy at UCLA Medical Center at the Brain Research Institute from 1955 until 1958 and while there he was a Research Fellow for the National Institutes of Health from 1957 to 1958. He also was a professor of Pharmacology at Stanford University School of Medicine from 1958 to 1968.

In 1968, Dr. Killam was asked to join the faculty at University of California, Davis to open a new medical school at that campus. He was the founding chair of the Department of Pharmacology at the UCD School of Medicine and was instrumental in the development of that medical school. He served as Chairman of the Pharmacology Department from 1968 until 1983. During that time, he was also affiliated with the National Center for Primate Biology in Davis, California and acted as Associate Director and Interim Acting Director in 1968. Dr. Killam was also Chairperson of the Faculty for the School of Medicine from 1972 to 1973 and Chairperson for Division of Sciences Basic to Medicine from 1977 to 1978. Dr. Killam was Director of Medical Learning Resources from 1978 to 1981 and Associate Dean for Sciences Basic to Medicine from 1979 to 1981. He officially retired from the School of Medicine at University of California, Davis in July 1994.

During Dr. Killam's career, he was active on many national and international committees and societies on Drug Abuse and other basic science research issues and was a founding member of the American College of Neuropsychopharmacology (ACNP), serving on its Council from 1973 until 1977.

One had only to talk with Keith Killam but a short time to detect his great enthusiasm for pharmacology, students and, most of all, his family. He served with dedication on the PhRMA Foundation's Basic Pharmacology Advisory Committee since 1973. The Board, advisory committee members and all who count him their friend will miss him greatly.



Purpose

Gertain guidelines have been developed to promote the wise and proper use of the limited resources available to the PhRMA Foundation. The areas of interest which govern the distribution of funds are in support of fundamental research on drugs and programs for training personnel in basic and clinical pharmacology, toxicology, morphology, pharmaceutics, pharmacoeconomics and bioinformatics.

Throughout the year, programs have been supported and developed which provide the means of achieving the goals of the Foundation. Many worthwhile proposals have been submitted. It has been necessary to limit support to those which hold the highest promise of advancing the purposes of the Foundation.

Those areas not supported within the existing guidelines are:

- Research on specific drugs, unless the drug is for an orphan disease. This exclusion is not meant to preclude support of projects which, of necessity use a number of drugs to establish a methodology or screening program of potential general applicability. It does exclude those efforts primarily aimed at learning more about specific drugs or classes of drugs.
- (2) Funds for construction. The Foundation is not unmindful of the needs and the tremendous pressures for private funds for construction projects. However, it is believed that the scientific community can be better served by channeling the Foundation's available resources into other areas.

(3) Funds for travel (except as otherwise indicated).

(4) Funds to cover entertainment costs.

6

While Foundation support of research continues, such support is currently primarily available in programs such as the Research Starter Grants as discussed on page 49 and under the "Education and Training Programs" Section on page 30.

While meetings have never received a large portion of the support dollar, only in very exceptional circumstances will meetings receive support in the future.

Table of Contents



Mission Statement	1	
Purpose	6	
Report of the Chairman	7	
Report of the President	11	
Tracking Thirty-Three:	14	
Activities of the PhRMA Foundation	14	
in its Thirty-Third Year		
Awards in Excellence	18	
Education and Training Programs	30	
Clinical Pharmacology	31	
Basic Pharmacology	35	1
Bioinformatics	40	
Pharmacology/Morphology	41	
Pharmaceutics	43	
Pharmacoeconomics	47	
Research Starter Grants	49	-
Report of the Treasurer	51	
Organization and Administration	53	-
Advisory Committees	56	
Applications	60	2
Benefactors	61	
Current Programs for 1999	inside back cover	

1



Chairman's Report



It is my pleasure to report to you that the past year has been marked by growth, excellence and a seamless transition in leadership for the PhRMA Foundation. For the first time since 1993, our year-on-year contributions increased, enabling us to further advance the vital work of the Foundation by investing additional resources in the medicines of tomorrow. For the first time ever, the Foundation presented *Awards in Excellence* to scientists whose careers exemplify the spirit of innovation and dedication that underpin everything we do. And for the first time in many years, the Foundation had a new President and CEO, as Donna Moore very capably assumed this position following the retirement of Morry Bectel last summer.

The following pages summarize the accomplishments of the Foundation during this period and describe the organization and its ongoing programs. Let me call your attention to just a few highlights from

the past year that I believe best represent the efforts of our staff, advisory committees and directors to strengthen the ties between the research-based pharmaceutical industry and the academic community, thereby, advancing public health, research and clinical practice.

FIRST-EVER AWARDS IN EXCELLENCE

The Foundation's inaugural *Awards in Excellence* were presented on March 17 during a gala event in Philadelphia that coincided with the Interphex '98 show, which was generously hosted by Reed/Elsevier. The recipients were: Ing K. Ho, Ph.D., University of Mississippi Medical Center; Perry V. Halushka, M.D., Ph.D., Medical University of South Carolina; Gary M. Mawe, Ph.D., College of Medicine, University of Vermont; and Vincent H. L. Lee, Ph.D., School of Pharmacy, University of Southern California. On behalf of the entire Board of Directors, let me once again congratulate these distinguished scientists. (Their work is described in the *Tracking Thirty-Three* section of this report.)

What's so special about these awards is that they represent a completely new area of recognition for the Foundation's scientific community: They honor both the career accomplishments of individual researchers as well as the universities in which they conduct their important work.

Robert C. Black Chairman PhRMA Foundation Even more importantly, the *Awards in Excellence*, which provide stipends totaling \$8,000 per recipient, are given to scientists who previously received Foundation funds—funds intended to help them become leaders in research and education.

In a sense, the Awards in Excellence offer testimony to the fact that these scientists have delivered on the promise they showed early in their careers. The outstanding contribution each of these individuals has made to public health over the course of their careers also reinforces the value of the Foundation's fellowships and research grants. If you think about it, every single award we make in any given year has the potential to be the "spark" that produces the next leader in academia, public health policy or the research-based pharmaceutical industry. For those of us on the Foundation Board and advisory committees who have long been looking for a way to measure the long-term impact of our awards programs, the 1998 Awards in Excellence recipients have given us a new level of confidence that we are making a real difference in shaping the future of health care.

FUELING OUR EFFORTS

Of course, the work done by the Foundation is only possible because of the generosity of so many PhRMA member companies. As Chairman of the Foundation's Board of Directors, I express our most sincere appreciation to the research-based pharmaceutical companies whose vision for the future of medicine is broad enough to encompass the discoveries and advances that originate from outside the industry, and whose commitment to the future has led them to support the Foundation for more than three decades. The increased financial support we received during the past year certainly reflects an understanding that *together* the industry and the academic community can be a formidable force in advancing health-care research. On behalf of the Board, I also extend very sincere thanks to those PhRMA associates, as well as the PhRMA research and international affiliates, who have supported our programs in so many ways during the past year.

As I've stated many times, the heart of the Foundation really beats within the advisory committees. These teams of world-class scientists painstakingly review the many grant applications we receive each year and do their very best to allocate our limited resources as wisely as possible. I thank them for their dedication and for their commitment to excellence, as reflected in the fellowship and research award recipients profiled in this report.

I also must congratulate Donna Moore and her staff, who bring the vision and mission of the PhRMA Foundation to life in countless ways every day of the year.

And finally, I must extend my sincere thanks to the industry leaders who have served with me on the PhRMA Foundation Board of Directors for the past year. These individuals have given generously of their time and talents, and each has contributed to the success we've recorded during this year: Jan Leschly, Chief Executive Officer, SmithKline Beecham plc, and PhRMA Founda-

9

tion Vice Chairman; Robert A. Ingram, Chairman, Chief Executive Officer, and President of Glaxo Wellcome Inc., and PhRMA Foundation Secretary/Treasurer; Richard J. Markham, Chief Executive Officer of Hoechst Marion Roussel; Robert N. Wilson, Vice Chairman, Board of Directors, Johnson & Johnson; Wayne P. Yetter, President and Chief Executive Officer of Novartis Pharmaceuticals Corporation; Patrick J. Zenner, President and Chief Executive Officer of Hoffmann-La Roche Inc; and Alan F. Holmer, President of PhRMA, who serves *ex officio*.

Of course the real "stars" of this report are the young scientists whose work is outlined in the pages that follow. I hope you will take the time to read about the fellowships and research awards they have been given, so that you too can share in the pride and the excitement that I feel for the future of the PhRMA Foundation—and more importantly, the future of medicine. Who knows which of these young researchers will some day be the recipient of the *Award in Excellence* for a distinguished career in research or education.

Robert C. Black Chairman of the Board of Directors PhRMA Foundation and

President

Zeneca Pharmaceuticals

PhRMA Goundation Board members Patrick J. Zenner and Alan Holmer greet Major Edward G. Rendell during the festivities of the Gala. Mr. Zenner is President and CEO, Hoffmann-La Roche, and Mr. Holmer is President of PhRMA.



Report of the President



t is my distinct privilege to address you in this, my first, President's Report. As Bob Black has mentioned, this past year was a busy one for the Foundation and eventful for me! Not only did I step into the role as President and CEO of the PhRMA Foundation, but my husband and I adopted a little eight-year old boy from Estonia. He only has one kidney, but now he has a family with three brothers to nurture him. With the addition of Joseph to my family, I now have a higher stake in the innovations of our great pharmaceutical industry, and the work of the PhRMA Foundation as it relates to the medicines of tomorrow.

You see, the PhRMA Foundation, over the last 33 years has been supporting the young-in-career scientists and educators at U.S. schools of medicine, pharmacy and public health—nearly 2,400 now. Not only are these folks dedicated to research themselves, but they have touched literally thousands of other scien-

tists and researchers who now are the lifeblood of our industry. A recent survey shows that 86% of those receiving Foundation awards are still in academia—teaching the teachers and teaching the "do'ers." Our founding fathers knew what they were doing when they decided to invest in the careers of university scientists. It is the difference in giving a man a fish or teaching him to fish. Simply put, through the work of the Foundation—through the gift of training the teachers and the young-in-career scientists—the infrastructure for the future of U.S. R&D rests. So today —33 years later—we are still jumpstarting the careers of the next generation of scientists—awardee by awardee. I feel very honored to serve this superb Foundation during such a time as this.

Raymond V. Gilmartin, now Chairman of the PhRMA Board and Chairman, President and CEO of Merck, quoted a Columbia University study, in his Hatfield Lecture at Cornell University, "Success hinges on a country's willingness to adopt certain national policies essential to success. Primary among them are public funding of basic biomedical research... ." This is the business of the PhRMA Foundation—in the private sector. Over the years, the PhRMA Foundation's mission has been to support biomedical research in basic and clinical pharmacology, toxicology and morphology. Later years saw the introduction of funding for the discipline of pharmaceutics. And, more recently, with increasing challenges to exhibit the "value" of pharmaceuticals and



Donna Moore President PhRMA Foundation

11

patient outcomes research, the Foundation began a "Faculty Development Award in Pharmacoeconomics," and another in "Bioinformatics" thus positioning the Foundation to develop the careers of future scientists in these vital arenas.

This past year, 37% of our awards went to basic research in pharmacology, 31% for clinical pharmacology, 8% toward pharmacology/morphology, 11% in pharmaceutics, and 13% in bioinformatics and pharmacoeconomics. Our total contributions last year were up by 7%, thwarting a previous downward trend of five years mostly due to consolidations within our industry. This past year, as Bob Black indicated, we began the *Awards in Excellence* to highlight the careers of great scientists who had received PhRMA Foundation funding earlier in their careers. I feel personal gratification because it is with these awards that we truly see the value of Foundation awards—the value of supporting these young-in-careers scientists, by encouraging them to go on to greatness in their science to the benefit of mankind.

Too, this past year, we began an association with Reed/ Elsevier—the largest pharmaceutical publisher in the world. During their Interphex Exhibition/Conference, the PhRMA Foundation held a marvelous Gala —another first! In combination, the purpose of the Gala was to honor these stellar Award in Excellence scientists, to highlight their work and their universities, the work of the Foundation and to develop another avenue of revenue for the Foundation (see "Awards in Excellence Gala" under Tracking Thirty-Three). We believe this Gala provides additional opportunities for former awardees and others to give something back to the Foundation.

On a personal note, in 1997, we saw the retirement of Edward J. Cafruny, M.D., Ph.D., as Foundation Scientific Consultant —one of many positions he has held during his 33-year association with the Foundation. We will miss Ed's very wise counsel but I take comfort in knowing that Ed will always be part of the PhRMA Foundation. With Ed's retirement, I am very pleased to announce that William R. Darrow, M.D., Ph.D., currently Chairman of our Scientific Advisory Committee, has agreed to serve, in addition, as the Foundation's new Chief Science Advisor. Dr. Darrow is Senior Medical Advisor at the Schering-Plough Research Institute, and we welcome him to his new role with the Foundation.

Please take a moment now to peruse "Tracking Thirty-Three" for further activities of this past year, such as our Annual Awardee Meeting, held February 18-19, 1998 at the Willard Hotel in Washington D.C. Many thanks go to those scientists and researchers who took time from their busy schedules to attend the meeting and the scientific sessions. Special accolades go to Raymond L. Woosley, M.D., Chairman of Medicine at Georgetown University School of Medicine for being our banquet speaker. Ray, a former awardee, has been a long-time friend of the Foundation. Another long-time friend of the Foundation is Carl C. Peck, M.D., Director of Georgetown's Center for Drug Development Science and former head of CDER. We were very honored to have Dr. Peck as our *Thomas E. Hanrahan Memorial Lecturer*. An abstract of his presentation, "Is There Such a Thing as Drug Development Science?" is printed in this report.

I would also like to take this opportunity to express my sincerest gratitude to the Foundation Board and especially Bob Black. Through an extremely demanding schedule, he has willingly and graciously served as Chairman of the PhRMA Foundation Boardfor the past four years. He was Secretary-Treasurer of the Foundation two years before that. His mild-mannered and decisive leadership has been the rock which has sustained the direction of the Foundation. My sincerest thanks and gratitude to him for serving during this year of transition in the Office of the President! Two Board members in particular were instrumental in the success of the Awards in Excellence Gala-Pat Zenner and Alan Holmer. Both of these Board members delivered superb presentations at our Gala. The Foundation and I are particularly appreciative of their time and energies on behalf of the Foundation. My special thanks to all members of the Foundation Board who are dedicated to the future of the Foundation!

Allow me to also thank our world-class advisory committee members. As Bob mentioned, they are the heart of the Foundation's programs. The Foundation is very grateful to these dedicated scientists for the many hours spent in selecting the best and the brightest and for continuously reviewing the future direction of the Foundation. They have positioned us well.

I take great pride in the accomplishments of this past year and I have great optimism for the future of the PhRMA Foundation— PhRMA's centerpiece of philanthropy. And now, I am very proud to present to you in this Annual Report, our "hope for the future"—the PhRMA Foundation awardees.

Donna Moore President PhRMA Foundation



Sharing a moment at the Annual Awardee Meeting banquet are banquet speaker Raymond L. Woosley, M.D., Ph.D., C. Joseph Stetler, former PhRMA Goundation and Association President; and Dr. Carl C. Peck, Thomas E. Hanrahan Memorial Speaker



Tracking Thirty-Three

TWENTY-SEVENTH ANNUAL AWARDEE MEETING

The twenty-seventh PhRMA Foundation Annual Awardee Meeting was held on February 18-19, 1998, at the historic Willard Inter-Continental Hotel in Washington, D.C. Over the years, the PhRMA Foundation has brought together current and former awardees, staff and advisory committee members to provide a forum for interaction—observing current research and hearing scientific presentations in related areas. The meeting was well attended by more than 100 scientists who have the prestige of being called PhRMA Foundation Awardees.

The activities began with a banquet held on the evening of February 18 with Board members, as well as distinguished advisory committee members and staff. The Foundation was highly honored to have as its banquet speaker Raymond L. Woosley, M.D., Ph.D., Chairman, Department of Pharmacology, Georgetown University School of Medicine. Dr. Woosley is currently a Special Consultant for the FDA and a member of the

- Clinical Trials Review Committee for the National Heart Lung
- and Blood Institute. He received the Rawls-Palmer Award for his
- contributions to medicine by the American Society of Clinical

Discussing the upcoming events during the reception on Aebruary 18 are (I to r) former awardees Prashant Chikhale, Ph.D., Assistant Professor, University of Maryland; Walter Dixon, Ph.D., Professor at the University of Kansas; Aryeh Hurwitz, M.D., Professor at the University of Kansas Medical School, Irwin Weiner, M.D., (r) Emeritus Professor, State University of New York (HSC) Syracuse and presently Chairman of the PhRMA Goundation Basic Pharmacology Advisory Committee.





Enjoying a few moments at the Annual Awardee Meeting reception on Aebruary 18, 1998 are former awardees (I to r) Aleka K. Dash, Ph.D., Associate Professor, School of Pharmacy, Creighton University; Raymond D. Skwiercznski, Ph.D., and Kenneth Phares, Ph.D. Both Ray and Ken are now with 3M Pharmaceuticals.

15



Joe Stetler, as former

President of

PhRMA and

PHRMA

Joundation,

- mentors new
- President

Donna Moore.

Pharmacology and Therapeutics and was selected by practicing physicians to be listed in the *Best Doctors in America*. The Foundation is very pleased to have Dr. Woosley in its Alumni of Awardees. He received a Clinical Pharmacology Unit Development Award in 1988.

Thirty scientific posters were presented on the morning of February 19. Our Poster Session gives the awardees a chance to share the research they have undertaken which has been supported by their PhRMA Foundation grants. Enthusiastic, in-depth discussions are held among former and current awardees and advisory committee members. This session has become one of the most important events sponsored by the Foundation in recent years. The encouragement and affirmation these "new" scientists receive by the mentoring of more established scientists cannot be measured. We are very grateful that every year these dedicated former awardees and advisory committee members take time from their busy schedules to nurture the next generation of scientists. The Poster Session was followed by the Annual Awardee Meeting's General Session, at which time the Foundation was honored to have as the Thomas E. Hanrahan Memorial Lecturer, Carl C. Peck, M.D., Professor of Pharmacology and Medicine and founding Director for the Center for Drug Development Science at Georgetown University Medical Center. A brief synopsis of Dr. Pecks' presentation, entitled "Is There Such a Thing as Drug Development Science?" follows:

Is There Such a Thing as "Drug Development Science?"

Carl C. Peck, M.D. Center for Drug Development Science Georgetown University Medical Center Washington, D.C.

Is there such a thing as medical science? (just kidding...) That such a question is posed (is there such a thing as "drug development science?") may reflect (a) curiosity as to whether the process of drug development is essentially empirical or based upon mechanistic science, and, or (b) specialization of modern medical and biological scientists at the cellular, sub-cellular, or molecular levels, leading to lack of awareness of the multidisciplinary, integrative perspective necessary to achieve drug development as defined below.

In fact, there is a definable scientific framework and domain of disciplines that are routinely employed in the evolution of new drugs. To be more precise, drug development comprises the scientific, regulatory, and social processes and procedures involved in transforming a therapeutic concept into a commercially available therapeutic product for patients. The "science" of drug development encompasses scientific methods and approaches for derivation of new knowledge and technology to support of selection and evaluation of therapeutic candidates. General disciplines that contribute to drug development science include chemistry, biology, toxicology, basic and clinical pharmacology, medicine, and biostatistics. In addition, regulatory standard setting mirrors scientific development via utilization of "regulatory sciences" that include toxicology, basic pharmacology and microbiology, chemistry and manufacturing, biopharmaceutics, clinical pharmacology, biostatistics, and medicine.

Drug development is in the midst of a rapid transition from largely empirical to a scientifically sound, mechanistic approach. The science of clinical pharmacology is playing a key role in this transition, aided significantly by advances in biological, computational and biostatistical sciences. Computer simulation of clinical trials represents the cutting edge of such developments in mechanistic drug development.

The Georgetown Center for Drug Development Science (CDDS) exists to advance the science and science methodologies of scientific drug development (especially clinical phases) towards greatly enhanced efficiency, informativeness, and economy of time and resources.



Carl C. Peck, M.D.



Sandy Koppenol, Ph.D., Postdoctoral Gellow, University of Washington; Renate Reimschuessel, V.M.D., Ph.D., Director Aquatic Pathobiology Center, University of Maryland; Laurie Nadler, Ph.D., Postdoctoral Gellow, University of Washington; and Rochelle Schwartz-Bloom, Ph.D., Associate Professor, Duke University Medical Center relish a few moments at the Poster Session on Gebruary 19, 1998.



Donna Moore, PhRMA

Joundation President, welcomes

awardees, advisory committee

members and quests, to the 1998

Annual Awardee Meeting.

On the afternoon of February 19, subgroup sessions were held in order for second-year awardees to deliver progress reports on their research and for attendees to hear presentations in their particular disciplines from former awardees and Advisory Committee members.

Presenters at the Clinical Pharmacology Subgroup Session, moderated by **Paul Calabresi**, **M.D.**, Professor and Chair Emeritus, School of Medicine, Brown University:

Terrence F. Blaschke, M.D., Professor of Medicine and Molecular Pharmacology, Division of Clinical Pharmacology, Stanford University School of Medicine, Stanford, California: Title, "Medicine in an Underdeveloped Nation"; Richard D. Huhn, M.D., Hematology Staff Fellow, National Heart Lung and Blood Institute, National Institutes of Health, Bethesda, Maryland: Title, "The Clinical Pharmacology of Recombinant Interleukin-10"; and Arthur J. Atkinson, Jr., M.D., Senior Advisor in Clinical Pharmacology, National Institutes of Health, Bethesda, Maryland: Title, "NIGMS and Clinical Pharmacology Today." Presenters at the Basic Pharmacology Subgroup Session, moderated by **Irwin M. Weiner, M.D.,** Emeritus Professor and Former Dean of the College of Medicine at the State University of New York, HSC, Brooklyn:

E. Leong Way, Ph.D., Professor Emeritus, Department of Pharmacology, Schools of Medicine and Pharmacy, University of California, San Francisco, California: Title, "Chinese Traditional Medicine and Contemporary Pharmacology: Perspectives and Overview"; Claire M. Lathers, Ph.D., F.C.P., Chief Scientific Officer, Barr Laboratories, Inc., Pomona, New York: Title, "Cardiovascular Studies from NASA"; and Richard H. Kramer, Ph.D., Assistant Professor, Department of Molecular and Cell Pharmacology, University of Miami School of Medicine, Miami, Florida: Title, "Polymer-Linked Ligand Dimers: Rational Drug Design Based on Spanning Binding Sites on Tarfet Proteins."

Presenters at the Pharmacology/Morphology Subgroup Session, moderated by **George A. Condouris, Ph.D.,** Professor and Former Chairman, Department of Pharmacology/Toxicology, New Jersey Medical School, University of Medicine and Dentistry of New Jersey, Newark, New Jersey:

Holly Boettger-Tong, Ph.D., Instructor, Department of Obstetrics and Gynecology, Baylor University College of Medicine, Houston, Texas: Title, "The Molecular Genetics of Male Infertility"; and G. Allen Nickols, Ph.D., Science Fellow, Monsanto/Searle, Chicago, Illinois: Title, "Angiogenesis Inhibition by AlphaV Beta3 Integrin Antagonists Limits Tumor Growth."

Presenters at the Pharmaceutics Subgroup Session, moderated by **James Swarbrick**, **D.Sc.**, **Ph.D.**, Vice President Research and Development, AAI, Inc., Wilmington, North Carolina:

Sandy Koppenol, Ph.D., Postdoctoral Fellow, Department of Bioengineering, University of Washington, Seattle, Washington: Title, "Effect of Streptavidin-Biotin Dissociation Kinetrics on the Two-Dimensional Crystallization of Streptavidin;" Anthony J. Hickey, Ph.D., Associate Professor, Division of Pharmaceutics, University of North Carolina School of Pharmacy, Chapel Hill, North Carolina: Title, "Dynamic Properties of Pharmaceutical Aerosol Powders"; and Samuel H. Yalkowsky, Ph.D., Professor of Pharmaceutical Sciences, University of Arizona College of Pharmacy, Tucson, Arizona: Title, "Ocular Delivery of Insulin."

Dr. Lawrence K. Ng, University of Colorado, discusses his research with Matthew Murawski, R.Ph., Ph.D., Assistant Professor, University of Mississippi. Dr. Murawski is a recipient of a 1997 Gaculty Award in Pharmacoeconomics.





Gormer and current Advisory Committee members discuss Goundation activities at the Annual Awardee Meeting. (I to r) George Leng, Ph.D., Jim Swarbrick, D.Sc., Ph.D., Gred Radziałowski, Ph.D., and E. Leong Way, Ph.D.

FOUNDATION BOARD SETS THE COURSE

On May 11, **Mr. Robert C. Black**, Chairman of the PhRMA Foundation Board, called to order the Spring meeting of the Board, held during the PhRMA Annual Meeting at The Greenbrier, White Sulphur Springs, West Virginia.

This year—1998—marks the 33rd year that gentlemen of the PhRMA Board have given of their time and talents to serve as Foundation Board members, guiding and setting the course for future years. The Foundation, and the awardees, give special thanks to these sagacious men, who in spite of tremendous demands on their time, are joining in the Foundation's vision and who have rededicated their efforts to fulfilling its mission. Officers elected for 1998-99 are: Mr. Robert C. Black, President, Zeneca Pharmaceuticals; Mr. Jan Leschly, Chief Executive Officer, SmithKline Beecham; and Mr. Robert A. Ingram, Chairman, President, and Chief Executive Officer, Glaxo Wellcome.

Bob Black, very graciously, has been our Chairman for four years and Secretary/Treasurer for two years before that. Jan Leschly came on the Board in 1992 and in this last year, very kindly stepped into the role as Vice-Chairman. Thanks to Bob Ingram, too, who became Secretary/Treasurer in 1997 after serving on the Board since 1994. Many thanks to the other Board members: Mr. Richard J. Markham, Chief Executive Officer, Hoechst Marion Roussel (since 1997); Mr. Robert N. Wilson, Vice Chairman, Board of Directors, Johnson & Johnson (since 1993); Mr. Wayne P. Yetter, President and Chief Executive Officer, Novartis Pharmaceuticals (since 1997); Mr. Patrick J. Zenner, President and Chief Executive Officer, Hoffmann-La Roche Inc. (since 1993); and PhRMA President Alan F. Holmer (*Ex-Officio*) (since 1996).

NEW FOUNDATION "AWARDS IN EXCELLENCE": FOUR SCIENTISTS HONORED AT INAUGURAL GALA IN PHILADELPHIA



In 1998, through the recommendation of the Scientific Advisory Committee and the backing of the Board, the Foundation enthusiastically developed a new program to recognize former Foundation awardees who, through their contributions to biomedical and pharmaceutical science, have exhibited excellence in their careers and fulfilled the goals of the PhRMA Foundation mission. That mission is "to enhance public health through biomedical technology and scientific research." The Awards in Excel-

The PhRMA Goundation Awards in Excellence Gala.

lence are thus provided to recognize both the career accomplishments of awardees and the stellar universities in which they conduct their important work.

NEW LEVEL OF FUNDING...

In the Fall of 1997, for the first time, letters were sent to Deans of Schools of Medicine, Pharmacy and Public Health asking for their recommendation for the *Award in Excellence*. When recommendations were received, four awards were selected—one in each area of clinical pharmacology, basic pharmacology, pharmaceutics and pharmacology/morphology. Then on March 17, 1998, in Philadel-

Left: Edward G. Rendell, Mayor of Philadelphia, delivers a friendly welcome to Gala attendees. Right: Chris McCabe welcomes attendees to the PhRMA Goundation Awards in Excellence Gala held in conjunction with Interphex, the world's largest exhibition and conference. Interphex is devoted exclusively to pharmaceutical discovery, process development, manufacturing and packaging.







Top: (I to r) The Weiner, M.D., Chairman of the PhRMA Joundation Basic Pharmacology Advisory Committee; Dona Plecinski, Administrative Coordinator, PhRMA Joundation; Gary M. Mawe, Ph. D., recipient of the Award in Excellence for Pharmacology/Morphology; Lt. Col. William "Max" Moore (Donna's husband), Donna Moore, and Dr. Walt Dixon discuss the excitement of the evening during the Inaugural Awards in Excellence Gala. Bottom: Thanks go to the many PhRMA members, associate members and research affiliates who participated by attending the Inaugural Gala.

phia, Pennsylvania, the four awardees were honored with the award before an audience of 400 and presented with the award.

Donna Moore states, "I personally feel a sense of closure in that the Foundation has had a hand in furthering the careers of these scientists years ago and now we are recognizing them for the great scientists and educators they have become. It is as if we have come full circle." She added, "Also of great satisfaction to me is that through this process, we have developed a method of 'measuring' the impact of Foundation awards, not just to evaluate the programs, but also to be able to say to our benefactors, 'Here is what we have done. The vital work of the Foundation has made a difference for these scientists, and thus for our industry, academe, and government by helping to build the infrastructure of tomorrow's medicines awardee by awardee. In the end, the real winners will be the patients waiting for the cures."

Thus, the Foundation, in part, serves as a catalyst for these scientists to the success of their mission in science and, through the generosity of the research-driven members of PhRMA, will continue to jumpstart the careers of future generations of scientists. These scientists will be the framework whereby tomorrow's medicines are developed.

(clockwise) Gary M. Mawe, Ph. D., Associate Professor, Department of Anatomy and Neurology, University of Vermont, expresses his thanks for receiving the 1998 PhRMA Joundation Award in Excellence_Donna Moore, President of the Joundation presents the PhRMA Joundation Award in Excellence in Pharmaceutics to Vincent H.L. Lee, Ph. D., Professor and Chairman, Department of Pharmaceutical Sciences, Professor of Ophthalmology, University of Southern California. Accepting the award on behalf of his brother is Dr. Vincent Li-Receiving his "Award in Excellence" is Perry U. Halushka, M.D., Ph.D. Dr. Halushka is Professor of Pharmacology and Medicine, Director, Division of Clinical Pharmacology, Medical University of South Carolina, __Ing K. Ho, Ph. D., Professor and Chairman, Department of Pharmacology and Toxicology, University of Mississippi Medical Center and recipient of the PhRMA Joundation Award in Excellence for Basic Pharmacology says a few words of thanks at the Awards in Excellence Gala.

VISIBILITY ...

It has long been the goal of the Scientific Advisory Committee and the Board to enhance the visibility of the work of the Foundation. Aligning with Reed/Elsevier in this manner has certainly helped us attain that goal with communications in 15 of their publications and more than 600,000 pieces of literature reaching various facets of our industry.

ADDITIONAL REVENUE...

Reed/Elsevier has very kindly agreed to donate \$20,000 to the work of the Foundation, and of course, contributions through those who participate in the Gala go to the Foundation.

THE INAUGURAL PHRMA FOUNDATION "AWARDS IN EXCELLENCE" GALA....

The "Awards in Excellence Gala" was a first-class affair, attended by more than 400 folks from our industry, awardees and advisory committee members. The Gala was held during Interphex '98—an exhibition/conference which is attended by 10,000 folks mostly from PhRMA member companies. In short, this is an excellent opportunity for the PhRMA Foundation.







Left: Christopher McCabe, Industry Vice President, Reed Exhibition Companies, shares a moment with William R. Darrow, M.D., Ph.D., Senior Medical Adviser, Schering-Plough Research Institute and Chairman of the PhRMA Goundation Scientific Advisory Committee. Right: Christine McCabe, wife of Christopher McCabe, Industry Vice President, Reed Exhibition Companies, sings the Irish National Anthem in Gaelic.

Thanks go to the many PhRMA members, associate members and research affiliates who participated by attending the Inaugural Gala.



Thanks go to all who attended to take part in the spirit of the mission of the PhRMA Foundation (see attendee list under "Bene-factors.") Tables of ten were sold for \$2,000 each (or \$200 per seat). By participating in the evening's events, for the first time, other former awardees were able to come along side the Foundation and, in part, give back to the Foundation what the Foundation had so long ago given to them.

Special thanks to two very special Board members who enriched the evening's events with their presentations—Pat Zenner and Alan Holmer. By taking time from their busy schedules, these two gentlemen greatly enhanced events of the evening. Thanks go to all who attended the Gala for taking time to participate in and share in the recognition of the inaugural "Awards in Excellence."

Our great appreciation goes to Reed/Elsevier for providing such an elegant forum and thanks to for providing the Foundation with \$20,000 to assist with the awards. It was a grand event! Special recognition and thanks to—Chris McCabe, Industry Vice President, and his lovely wife Christine who sang the Irish and American National Anthems; Mike Critzer, Director of Industry Development for Reed; and Anne Rodriguez—and the many others who pulled the Gala together.

Now, please join the Foundation in acknowledging the first recipients of the PhRMA Foundation *"Awards in Excellence"* and their universities:

Awards in Excellence

BASIC PHARMACOLOGY



Ing K. Ho, Ph.D. Professor and Chairman, Department of Pharmacology and Toxicology University of Mississippi Medical Center

Dr. Ing. K. Ho has been professor and Chairman of the Department of Pharmacology and Toxicology at the University of Mississippi Medical Center since 1982. He was recently appointed Interim Associate Vice Chancellor for Research and Graduate Studies at UMMC as well. His research has made enormous contributions to our knowledge of the neurochemical basis for tolerance to and physical dependence on barbiturates and opiods. He holds the Ph.D. degree from the University of California, San Francisco. Dr. Ho received the Faculty Development Award in Basic Pharmacology from the Pharmaceutical Manufacturers Association Foundation in 1974.

The University of Mississippi Medical Center in Jackson, Mississippi, is the University's Health Sciences campus. Established in 1955, it houses Schools of Medicine, Nursing, Health Related Professions, and Dentistry; Graduate Programs in the Medical and Clinical Health Sciences; and the University Hospitals and Clinics with 623 beds.

CLINICAL PHARMACOLOGY



Perry V. Halushka, M.D., Ph.D.

Professor of Pharmacology and Medicine, Director, Division of Clinical Pharmacology, Medical University of South Carolina

Perry V. Halushka, M.D., Ph.D., Professor of Pharmacology and Medicine, and Director, Division of Clinical Pharmacology, at the Medical University of South Carolina, was a recipient of the PhRMA Foundation Faculty Development Award in Clinical Pharmacology in 1975. His career has been marked by excellence in research, pre- and post-doctoral training, education and patient care. Dr. Halushka has published over 200 scientific articles in peer reviewed journals and written almost 50 invited reviews and book chapters. He is nationally and internationally known for his research on the role of thromboxane A₂ (TXA₂) and its receptors in physiologic and pathophysiologic processes, and for his studies of the characterization of human platelet and vascular TXA₂ receptors. Dr. Halushka's career exemplifies the quest of clinical pharmacology to span basic and clinical investigation.

Medical University of South Carolina: Since its beginning in 1824, the Medical University of South Carolina has grown from a small medical school, with the distinction of the first medical institution in the southern United States, to one of this country's major academic medical centers. Its mission is patient care, research and education. Located on the Charleston peninsula, the university educates students from across the state and beyond in its colleges of Medicine, Nursing, Dental Medicine, Graduate Studies, Pharmacology and Health Professions as well as its residency programs. It also serves as a referral center for specialized care.

PHARMACOLOGY/MORPHOLOGY



Gary M. Mawe, Ph.D.

Associate Professor, Department of Anatomy and Neurology, University of Vermont, College of Medicine

Dr. Mawe received a 1985 PhRMA Foundation Pharmacology/ Morphology Fellowship and a 1988 Research Starter Grant at Columbia University, College of Physicians and Surgeons. Dr. Mawe received his doctorate in 1984 at the Ohio State University, and was a postdoctoral fellow from 1984 to 1988 at the Columbia University College of Physicians and Surgeons. He joined the University of Vermont faculty in 1988. Dr. Mawe has developed an internationally recognized research program which focuses on the neural and hormonal control of the biliary tract. The work in progress entails multidisciplinary histochemical and electrophysiological approaches and has provided the first detailed cellular examination of the biliary neurons and smooth muscle cells. This research program focuses on mechanisms by which neurons in gallbladder and sphincter of Oddi ganglis integrate neuronal, hormonal and immune-mediated signals and how the output from these neurons regulate organ function.

Columbia University is a leading higher education and research institution. The College of Physicians and Surgeons is the oldest medical school in America. It is one of the country's outstanding research institutions. It ranks number one in New York State and number four nationally in federal research funding. Established in 1754, Columbia University has evolved into a major and renowned higher education and research center in the United States.

The University of Vermont College of Medicine, established in 1822, is the nation's seventh oldest medical school. The College of Medicine excels at generating new knowledge through basic science research and transferring new technologies to patient care. The College is nationally and internationally recognized for research activities, ranking in the top 20 percent of colleges of medicine in terms of federal research grants per faculty member.

PHARMACEUTICS



Vincent H.L. Lee, Ph.D.

Professor and Chairman, Department of Pharmaceutical Sciences, Professor of Ophthalmology, University of Southern California, School of Pharmacy

Vincent H.L. Lee is Professor and Chairman of the Department of Pharmaceutical Sciences and Professor of Ophthalmology at the University of Southern California. A leading scientist in drug absorption mechanisms at the cellular and molecular levels, his research has laid a sound foundation for the next generation of delivery systems for drugs of synthesis and biotechnology. In addition to his scientific research, Lee also contributes to advancing pharmaceutical sciences through his editorship of peerreviewed journals and through his presidency at the Controlled Release Society (1993) and the American Association of Pharmaceutical Scientists (1996).

University of Southern California: Founded in 1880, USC currently ranks among the top 10 private universitates receiving federal funds for research and development support and in the top 20 among all universities. More than one-third of the incoming 1996 freshman class were honor students with SAT scores of 1200 or better. In 1996-97, 79 freshmen were National Merit Scholars. Since 1988, three USC students have been selected to attend Oxford University as Rhodes Scholars, while another was awarded a Marshall Scholarship.

ON THE WEB "WWW.PHRMAF.ORG"

The Foundation has a new face on the Web. If you have not "clicked" on our site recently, you are in for a surprise. Through this technology, the Foundation has been able to "streamline" its distribution of program information by allowing individuals to download their choice of data directly from the site, expediting the award process and saving time and money.

Also, through the site, we are able to acknowledge and honor our benefactors—the research-driven members of PhRMA, Associates and Research and International Affiliates. Without the generosity of these companies, the vital programs offered to Schools of Medicine, Pharmacy and Public Health would not be possible. The companies have given over \$43 million since the inception of the Foundation.

Another major benefit of "the Web," by the mere nature of the animal, is *visibility*. It has been a long-time goal of the Board and the Scientific Advisory Committee to bring more visibility to the good work of the Foundation. We are always seeking ways to highlight the work of our Foundation and benefactors—this web site goes long in accomplishing this goal.

We are very proud of our Web site and have plans in this next year to broaden it by highlighting the philanthropy of PhRMA member companies. In this manner, our goal is to honor the generous benefactors of the Foundation.

Please take time to visit our site.

Gormer awardees Rochelle Schwartz-Bloom and Walt Dixon; and current awardee Stephanie Watts, Ph.D., Assistant Professor, Michigan State University; discuss the evening's events with Advisory Committee member Bernard Mirkin, M.D., Ph.D. Dr. Mirkin is Director of Research, Childrens Memorial Institute for Education and Research, and Professor at Northwestern University Medical School





Samuel Strada, Ph.D., Senior Associate Dean, University of South Alabama and a 1974 awardee of a Research Starter Grant and Gaculty Award in Basic Pharmacology/ Toxicology shares a few moments with George A. Condouris, Ph.D. and his wife Grances. Dr. Condouris is a Professor of Pharmacology at the University of Medicine and Dentistry of New Jersey and PhRMA Goundation Pharmacology/Morphology Advisory Committee member.

Advisory committee member and former awardee Terrence G. Blaschke, M.D., converses with Russel A. Bantham, PhRMA's Senior Vice President and General Counsel, at the Annual Awardee Meeting banquet. Dr. Blaschke is Professor of Medicine and Molecular Pharmacology at Standford University.



JOINT WEB PROJECT WITH THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND THE HOWARD HUGHES MEDICAL INSTITUTE.

On March 2, the American Association for the Advancement of Science (AAAS) and the Howard Hughes Medical Institute (HHMI) launched *GrantsNet*, a searchable online database (www.grantsnet.org) that provides up-to-date information on biomedical funding for scientists in the early stages of their careers. GrantsNet is a community resource involving funding organizations from all sectors of the biomedical community and is free to thousands of researchers who use it to search for funding opportunities each month. The PhRMA Foundation is enthusiastic about the project and information concerning the PhRMA Foundation fellowships has been entered into the GrantsNet collection system.

The Foundation is confident that being part of GrantsNet will help to fulfill our long-time goal of visibility. Also, the follow-up system in place through GrantsNet will produce valuable tracking information for committee members, Board members and awardees themselves regarding the Foundation grant programs.



Education and Training Programs

he PhRMA Foundation's primary mission is to promote the betterment of public health through scientific and medical research by providing funding to university-based scientists, researchers and educators. Foundation goals in education and research are accomplished through its twelve funding programs – three in clinical pharmacology, two in pharmacology/toxicology, one in the combined field of pharmacology-morphology, three in pharmaceutics, one in pharmacoeconomics, and one in bioinformatics. The Research Starter Grant provides starter funds in pharmacology, clinical pharmacology, drug toxicology and pharmaceutics. The Foundation also accepts applications in all program areas for research on drugs for rare diseases.

(l to r) Theresa Bectel, Kristine Thurston, Norine Stetler, Morry Bectel and Rob Bectel enjoy each other's company at the Annual Awardee Meeting reception.





- Donna Moore welcomes
- . Robert E. Taylor,
- Chairman, College of
- Medicine, Howard
- University and 1981
- Clinical Pharmacology
- Unit recipient.

CLINICAL PHARMACOLOGY

The clinical pharmacology program provides funding at three levels—students, postdocs, and faculty.

FACULTY AWARDS IN CLINICAL PHARMACOLOGY

The Foundation Faculty Development Awards in Clinical Pharmacology program makes three-year awards to medical schools for salary and fringe benefits in support of full-time junior faculty members. A ceiling of \$40,000 has been set on the amount of Foundation participation in total yearly salary and fringe benefits for any candidate. With the awards beginning July 1, 1998, 111 individuals have been supported under this program since 1967.

Recipients of the awards which began July 1998:

Nananda Francette Col, M.D., M.P.H., Assistant Professor of Medicine, Department of Medicine, Tufts University, School of Medicine (three years): "Hormone Replacement versus Alendronate Therapy for Postmenopausal Osteoporosis: Costs, Risks and Preferences." Osteoporosis results in significant morbidity, mortality, and costs. Alendronate (Fosamax), a nonhormonal alternative to hormone replacement therapy (HRT) for the prevention and treatment of postmenopausal osteoporosis, is more effective than HRT in increasing bone density but lacks HRT's carioprotective effects and cancer risks. Dr. Col has developed a decision model that estimates the impact of HRT on a woman's life expentancy and lifetime risks of hip fracture, breast cancer, heart disease, based upon her personal risk factors for disease. Dr. Col is now seeking to 1) develop a decision support aid that combines patient-specific risk factors, costs, and preferences to help inform women and their physicians of the risks and benefits of HRT and alendronate by predicting their effects on longevity and lifetime risks of hip fracture, breast cancer, heart disease; 2) begin the development of an instrument to measure women's individual preferences for health outcomes affected by HRT and alendronate, exploring their feelings about quality of life with osteoporotic fracture, coronary heart disease, breast cancer, and menopausal symptoms; and 3) determine the most effective ways to introduce this decision support tool into clinical practice to help clinicians counsel women on the risks and benefits of HRT vs. alendronate.

William G. Haynes, M.D., M.B.Ch.B., Assistant Professor, Department of Internal Medicine, University of Iowa, College of Medicine (three years): "Vascular Effects of Homocysteine: Effect of Genetic Moderate Hyperhomocysteinemia on Endothelial Function (Protocols A-E)." Dr. Haynes' research focuses on identifying and reversing the deleterious vascular effects of homocyst(e)ine. Homocysteine is an amino acid that is derived from metabolism of





methionine and whose catabolism is dependent on B-vitamin intake. Modest elevations in plasma homocyst(e)ine are associated with an increased risk of thrombotic and atherosclerotic disease, although a causative role for homocysteine in vascular disease has not been proven. Endothelial dysfunction is thought to contribute to atherosclerosis through promotion of platelet adhesion, blood coagulation, macrophage migration and mitogenesis. However, effects fo homocysteine on endothelial function have not been addressed in humans. This research will test whether moderate hyperhomocyst(e)inemia causes endothelial dysfunction in humans and whether this occurs through increased oxidant stress. Endothelial function will be tested using intra-arterial administration of vasoactive agents and ultrasound-Doppler techniques. Subjects with genetic and environmental hyperhomocyst(e)inemia will be studied before and after normalization of plasma homocysteine concentrations by B-vitamin supplementation. Also, methionine loading and folate restriction will be used to experimentally induce hyperhomocyst(e)inemia in healthy subjects. In addition, Dr. Hayes will examine whether anti-oxidants reverse the effects of homocysteine of endothelial function. This research should provide valuable information on the endothelial actions of homocyst(e) ine and thus help to develop novel therapeutic approaches to the prevention of atherosclerosis.



Richard Z. Lin, M.D., M.P.H., Assistant Professor, Department of Pharmacology, University of Texas, San Antonio, School of Medicine (three years): "Sphingosine-1-phosphate Inhibits Vascular Smooth Muscle Cell Migration via p38 Mitogen Activated Protein Kinase." Vascular smooth muscle cell migration from the medial to within the intimal layer of the arterial wall is a key element in the development of atherosclerosis. A cell membrane lipid derivative, sphingosine-1-phosphate (SIP) inhibits vascular smooth muscle cell migration by unknown mechanisms. Dr. Lin has observed that S1P activates p38 mitogen activated protein kinase (MAPK) via a G-protein coupled signal transduction pathway in vascular smooth muscle cells. Dr. Lin proposes to investigate the mechanisms by which SIP activates p38 MAPK signaling pathway. His hypothesis is that S1P activates p38 MAPK using a signaling pathway mediated by G protein beta gamma subunits, a Rho family GTPase Cdc42 and its associated kinase, PAK1. He will express interfering mutants of these signaling molecules to determine if they are required for S1P to activate p38 MAPK. Dr. Lin will also use pharmacologic inhibitors and interfering mutants to determine if S1P requires activation of these signaling molecules to inhibit vascular smooth muscle cell migration. Understanding how S1P inhibits vascular smooth muscle cell migration has obvious clinical implications. Novel treatment strategies to suppress atherosclerotic lesions could be developed based on the cellular mechanisms used by S1P to inhibit vascular smooth muscle cell migration.

Entering their second year in 1998 are:

Craig W. Hendrix, M.D., Department of Medicine, The Johns Hopkins University School of Medicine: "Antiretroviral Pharmacodynamics in the Semen."

Mark S. Wallace, M.D., Assistant Clinical Professor, Department of Anesthesiology, University of California, San Diego, School of Medicine: "Pharmacology of Human Experimental and Neuropathic Pain."

Those awardees who entered the third year of their award in 1998 are:

Nabil S. Andrawis, Ph.D., M.D., Assistant Professor, Division of Clinical Pharmacology, Department of Medicine and Pharmacology, Georgetown University School of Medicine: "Endothelin-1 Regulation of Vascular Growth."

Barbara D. Haehner, Ph.D., M.D., Clinical Lecturer, Department of Medicine, Indiana University, School of Medicine: "Investigation of the Bimodal Distribution of Cytochrome P450 3A5 (CYP3A5) Activity and Protein Content in Human Kidney."

Awardees who ended their award in 1998 are:

James Francis Cleary, M.B., B.S., F.R.A.C.P., Research Associate/ Clinical Instructor, Department of Human Oncology, University of Wisconsin - Madison, School of Medicine: "Therapeutics in the Treatment of Cancer Patients."

Lionel David Lewis, M.B. Chir., M.R.C.P., M.D., Assistant Professor, Division of Clinical Pharmacology, Dartmouth Medical School: "Project 1: The relationship between mitochondrial DNA replication and the pancreatic toxicity of anti-HIV nucleoside analogs."

Charles Michael Stein, M.B.Ch.B., M.R.C.P., Assistant Professor, Division of Clinical Pharmacology, Vanderbilt University School of Medicine: "Ethnicity and Vascular Reactivity."



Laurie Nadler, Ph.D., Postdoctoral Gellow, University of Washington and a recipient of a 1997 Gellowship in Pharmacology-Morphology, elaborates on her research with Richard Kramer, Ph.D., Assistant Professor, University of Miami and a 1996 Gaculty Awardee in Basic Pharmacology.

FELLOWSHIPS FOR CAREERS IN

CLINICAL PHARMACOLOGY

The second program in clinical pharmacology provides postdoctoral "Fellowships for Careers in Clinical Pharmacology." These fellowships offer clinicians an opportunity for intensive study in any of the basic sciences that fall within the general field of pharmacology. The program is open to physicians, dentists, and veterinarians who are well into their clinical training and wish to pursue careers in clinical pharmacology. With the year or two of support offered by this fellowship program, depending on the particulars of the undertaking, the individual can pursue full-time study in the basic pharmacologic sciences needed to complement his clinical skills.

The program allows an individual to apply for a fellowship three years in advance of the activation date of the award. For example, those applying for a fellowship in the fall of 1998 may request that the fellowship begin July 1999 or July 2000, or 2001.

First awards under this program were made in 1973. Since that time, 66 fellowships have been awarded.

Recipients who began their award in July 1998:



Jin Chen, M.D., Ph.D., Division of Clinical Pharmacology, Stanford University, School of Medicine (two years): "Role of Altered Transcription Factor CREB in Cellular Aging." Responsiveness to many drugs changes with human aging, which is likely due to change in expression of a variety of genes identified in senescent (aging) cells. Little is known about how gene expression is regulated in cellular senescence. Previous studies from Dr. Chen's laboratory have demonstrated that in aging fibroblasts cAMP production and cAMP-dependent protein kinase activity actually increased, but the capacity of cAMP to induce c-fos expression is markedly impaired. The blunted cAMP responses in aging cells are associated with decreased abundance and activity of an important transcription factor, CREB (cAMP resposne element binding protein). This protein binds to CRE (cAMP response element) in the promoters of many genes and is key in the stimulation of gene expression, suggesting that decreased expression of CREB may be rate-limiting for impaired downstream gene expression mediated by cAMP signal pathways during cell aging. To test this, Dr. Chen will use the normal human diploid fibroblast cell line (IMR-90) as a model system and overexpress CREB using an inducible expression system in the cells to manipulate cellular CREB levels to determine if overexpressed CREB restores normal and prevents impaired cAMPmediated gene expression in senescent cells. CRE activity and CREdependent c-fos mRNA expression will be measured using a CRE-CAT reporter system and Northern blot analysis in response to cAMP-producing and PKA-activating drugs. Furthermore, the mechanisms for decreased expression of CREB gene in aging cells will be explored. This study will provide better understanding of the molecular mechanism of cell aging and the pharmacodynamic changes of drug action in aging at the level of gene regulation.

Luiza Cecilia Iancu, M.D., Division of Respiratory & Critical Care, Physiology & Medicine, Harbor-University of California, LA., Research & Education Institute (two years): "mtDNA Mutations in Patients with Peripheral Arterial Disease." Peripheral arterial disease is a common debilitating disorder which results most commonly from atherosclerotic occlusion of the arteries to the lower limbs in patients over the age of 40. These occlusions result in ischemia to the local tissue with impaired oxygen delivery to the muscle of the lower limbs. The therapeutic options for these patients are limited. Options consist of pharmacologic intervention, exercise and bypass surgery. Altered muscle metabolism represents a novel therapeutic target in this population. The current proposal is designed to test the hypothesis that peripheral arterial disease is associated with mtDNA damage, defective mitochondrial gene expression and abnormal mitochondrial function which contribute to the patients' physiologic and functional status. By better understanding the moleular basis of this disease we hope to identify innovative strategies for therapeutic intervention and increase the options available for these patients.

Awardees who entered the second year of their award in 1998 are:

Gerald P. Linette, M.D., Ph.D., Harvard University, Massachusetts General Hospital: "Dendritic Cell Therapy of Human Malignant Melanoma."

Spencer Z. Rosero, M.D., University of Rochester School of Medicine: "Gene-Specific Pharmaco-therapy in the Hereditary Long QT Syndrome Caused by the SCN5A Gene Mutation."

Recipients who ended their award in 1998:

Karen C. Johnson, M.D., University of Virginia School of Medicine (One Year): "Clinical Trial Methodology in Stroke."

BASIC PHARMACOLOGY

FACULTY DEVELOPMENT AWARDS IN BASIC PHARMACOLOGY

Active for twenty-five years, the Faculty Development Award in Pharmacology has served to meet its goal to strengthen basic pharmacology by helping to maintain existing academic capability and, ultimately, expanding the field by enlarging the faculty base. To fulfill this goal, support has been provided, on a nationally competitive basis, to full-time junior faculty members who give promise of outstanding accomplishments.

The program provides stipend and fringe benefits of \$30,000 per year for two years. To date the total number of awards made is 71.



Recipients of the 1998 Faculty Development Awards in Pharmacology which began July 1998 are:



Vladlen Z. Slepak, Ph.D., Assistant Professor, Department of Molecular & Cellular Pharmacology, University of Miami, School of Medicine (two years): "Investigation Signaling Pathway Mediated by a Novel G Protein B Subunit, GB5." Hundreds of cellsurface receptors transduce external signals to the cell interior via heterotrimeric G proteins. G proteins are composed of multigene families of 20 α , 5 β and 11 γ subunits. This project investigates the signaling pathway mediated by the newest member of the $G\beta$ subunit family GB5. This protein is of particular interest because it deviates significantly from the four previously known GB subunits in its amino acid sequence, physico-chemical properties. localization in cytosol and expression pattern (only in CNS). Although these unusual characteristics suggested that GB5 could be involved in a unique signaling process, previous in vitro analysis did not show major functional differences from the other GB subunits. In contrast, isolation of G β 5 from its native source has revealed that in vivo it is coupled not to any of previously known G α or G γ subunits but rather to a pair of vet unidentified proteins with molecular weights of 65 and 10 kDa. This study will identify these proteins and investigate their possible functions, further unraveling this new signal transduction pathway. Identification of a specific set of receptors signaling through GB5 and its intracellular effectors will lead to finding new therapeutic targets in neuronal cells.



Stephanie Wengert Watts, Ph.D., Assistant Professor, Department of Pharmacology & Toxicology, Michigan State University (two years): "Vascular Tyrosine Kinase Activation in Hypertension; Interaction with Nitric Oxide." In hypertension, the vasculature undergoes smooth muscle cell growth and an increase in sensitivity to contractile hormones. Both processes are dependent on tvrosine kinase activation. One pathway in specific, the mitogen activated protein kinase or MAPK pathway, plays a central role in growth and mitogenesis and is stimulated by both classical growth factors and agonist of G protein coupled receptors. Mitogen activated protein kinase or MAPK/Erk kinase (MEK) is a tyrosine kinase central to the MAPK pathway. One explanation for an increase in tyrosine kinase activity in hypertension is the loss of substance which inhibits the MAPK pathway. Nitric oxide (NO) is a vasoactive substance which decreases vascular smooth muscle tone and growth and endothelial-derived NO is decreased in some forms of hypertension. This project investigates the hypotheses that 1) stimulation of tyrosine kinase(s), in particular MEK, by agonists of G protein coupled receptors and growth factors in vascular contraction is augmented in hypertension; and 2) NO can inhibit MEK. The actions of serotonin, angiotensin II, the growth factor EGF and NO will be investigated using an integrated approach (MEK assays, isolated tissue bath, whole animal surgery,

Western analyses). These studies should reveal novel mechanisms of agonist-induced contraction in the vasculature and elucidate a manner by which vasoactive hormones, including growth factors, can affect vascular reactivity and growth. Moreover, these studies may demonstrate an increased activity in a pathway known to be important to growth and provide one mechanism by which this pathway becomes enhanced in hypertension (loss of NO).

Those individuals who began their awards in July of 1997 are:

John R. Hepler, Ph.D., Assistant Professor, Department of Pharmacology, Emory University School of Medicine: "The Gq Family of G Proteins: Functional Roles for Amino Terminal Diversity and Interactions with RGS Proteins."

Brian K. Shoichet, Ph.D., Assistant Professor, Department of Molecular Pharmacology and Biological Chemistry, Northwestern University Medical School: "Structure-Based Inhibitor Discovery Against Beta-Lactamases."

Ending their awards in 1998 are:

Richard H. Kramer, Ph.D., Assistant Professor, Department of Molecular and Cell Pharmacology, University of Miami, School of Medicine: "Probing the Structure and Function of Cyclic Nucleotide-gated Channels with Competitive Antagonists.".

Jia Bei Wang, M.D., Ph.D., Assistant Professor, Department of Pharmaceutical Sciences, University of Maryland at Baltimore, School of Pharmacy: "Studying the Relationships Between Structure and Function of the Opiate Receptors."

FELLOWSHIPS FOR ADVANCED PREDOCTORAL TRAINING IN PHARMACOLOGY/TOXICOLOGY

One of the most popular awards is the PhRMA Foundation "Advanced Predoctoral Training in Pharmacology or Toxicology" fellowship program. The goal of this award is to increase the number of well-trained investigators in the field of pharmacological research. This program is designed to encourage and support promising students during their thesis research and is aimed at those candidates who are within two yeas of completing their research for pharmacology/toxicology doctoral dissertations.

This fellowship program provides a stipend of \$12,000 a year and \$500 a year for incidentals directly associated with preparation of the dissertation. The program, in its 21^{sr} year, has awarded a total of 247 fellowships. Those who have been awarded 1998 fellowships beginning between January and July are:

Alexander F. Hoffman, University of Colorado, School of Medicine (two years): "Functional Studies of Somatodendritic Regulation of Dopamine in the Rat Substania Nigra." The loss of dopamine regulation in the nigrostriatal pathway of the central nervous system has been linked to movement disorders, such as Parkinson's disease. This research is designed to investigate dopamine regulation within the nigrostriatal pathway, with special emphasis on release and reuptake mechanisms. In particular, these studies will explore the dynamics of dopamine release and reuptake from the cell bodies of the substantia nigra, and compare these processes with those observed in the striatum.

Matthew Hoffmann, Rutgers University, College of Pharmacy (two years): "The Role of the Proto-oncogenes; c-myb, c-myc, and c-fos in the Abnormal Myeloid Differentiation Induced by Hydroquinone." Chronic exposure to benzene, a ubiquitous environmental pollutant, increases the risk of acute myelogenous leukemia (AML) in humans. Hydroquinone (HQ) a metabolite of benzene, causes altered differentiation in cultured myeloblasts similar to that observed in AML. This study plans to determine if HQ causes aberrant proto-onocogene expression in these myeloblasts leading to an altered differentiation pathway.

Lloyd T. Lam, University of Wisconsin-Madison, School of Medicine (two years): "Identification and Characterization of HS2NF5, a Novel Regulator of the Human Beta-Globin Locus Control Region." The human beta-globin locus control region (LCR) is a powerful genetic element that regulates transcription of the beta-globin genes. Mr. Lam's focus has been on one of the regulatory proteins, HS2NF5, that functions through the LCR. The LCR is an important model for long-range transcriptional activation and also may be useful for developing gene therapy approaches to the treatment of globin synthesis disorders.

John C. Marquis, Harvard University, School of Public Health (one year): "Defense Responses to Nitric Oxide in Human Cells." Nitric Oxide (NO) is a biologically generated free radical that serves diverse roles in mammalian cell signaling and cytotoxicity. In view of the potential for cellular toxicity and mutagenesis upon exposure to NO, Mr. Marquis is studying genes and proteins which are induced in human cells exposed to NO, which may contribute to a defense response.

Robert L. McFeeters, Cornell University, School of Veterinary Medicine (two years): "Structural Effects of C-terminal GluR-6 Post-translational Modification." The goal of this project is to determine the solution structure of the intra-cellular domain of the glutamate receptor kainate sub-family subunit GluR-6 and how phosphorylation and palmitoilation at various sites affect the structural and dynamic properties of the protein. Michelle Nelson, Stanford University, School of Medicine (two years): "Functional Studies of Xnek1, a Potential Cell-Cycle Regulatory Kinase in Xenopus Laevis." Ms. Nelson is identifying key proteins that trigger cell division. Her project focuses on the Xnek1 protein, which is structurally related to a protein (NIMA) known to be important for cell division in a filamentous fungus. She will determine whether Xnek1 plays a similar role in regulating cell division in animal cells.

Timothy P. Reilly, Wayne State University, School of Pharmacy (one year): "Mechanism of Sulfonamide-Induced Adverse Drug Reactions in AIDS Patients." Although trimethoprimsulfamethoxazole is the most efficacious agent for the prophylaxis/treatment of *Pneumocystis carinii* pneumonia in AIDS patients, its use is significantly limited by an association with a high frequency of adverse effects. This poses a serious therapeutic dilemma in the treatment of AIDS patients since a large number of individuals are unable to continue therapy with the most effective anti*pneumocystis* agent. This research will test the hypothesis that the increased incidence of adverse effects in HIV-infected individuals is secondary to the formation of neoantigens which may lead to an immune response.

Michelle Steffen, University of Tennessee, Memphis, School of Medicine (two years): "Hormonal Regulation of Carnitine Palmitoyltransferase I Gene Expression." In thyroid disorders and insulin dependent diabetes (IDDM), accelerated oxidation of long chain fatty acids results in ketoacidosis. The mitochondrial enzyme carnitine palmitoyl-transferase I (CPT I) controls the rate of fatty acid oxidation and ketone body generation. This research will investigate the regulation of CPT I gene expression in diabetes and hyperthyroidism.

Michael Tanowitz, University of Virginia, School of Medicine (two years): "Role of SHP-2 in ARIA-induced Acetylocholine Receptor Gene Expression." The specialized area of skeletal muscle known as the neuromuscular junction is an integral component of nerveinduced muscle contraction. Tyrosine phosphorylation plays an important role in the formation of the neuromuscular junction. This research will investigate the involvement of protein tyrosine phosphatases (enzymes that remove phosphate from tyrosinephosphorylated proteins) in this event.

Phillip L. Thornton, Wake Forest University, Bowman Gray School of Medicine (one and one-half years): "Interaction of IGF-I and GABA_B Receptors on Memory of Aged Animals." The GABA_B receptor has been demonstrated to be an important component of long-term potentiation, a process necessary for learning and memory. This project will investigate: (1) whether changes in expression or activity of GABA_B receptors occur with age; (2) whether the anabolic hormone, IGF-1, modulates the GABA_B receptor; and, (3) whether the age-related decline in IGF-1 alters the GABA_b receptor and thereby contributes to learning and memory deficits associated with age.

39

Longtime friends Morry Bectel, former PhRMA Goundation President, and E. Leong Way discuss the events of the day and "old" times.



BIOINFORMATICS

FACULTY DEVELOPMENT AWARDS IN BIOINFORMATICS

Begun in 1997, the Faculty Development Award in Bioinformatics seeks to build the infrastructure of expertise in the new science of Bioinformatics. As defined, Bioinformatics seeks to couple computer technology with the enormous amount of information currently stored in biological databases. It is a process whereby genomic sequence data is turned into molecular biology information for the purpose of benefiting mankind through drug discovery. Because of the shortage of trained scientists and faculty, the PhRMA Foundation is very pleased to offer for the second year, this program.

Beginning their awards in July 1998:



Patricia C. Babbitt, Ph.D., Assistant Professor, Department of Biopharmaceutical Science, University of Califronia, San Francisco, School of Pharmacy : "Understanding the Protein Universe Using Superfamily Analysis." Dr. Babbitt is interested in the comparitive study of related proteins to investigate structure/ function relationships. The idea is that by understanding how nature has re-engineered proteins for new functions, we will be able to develop better strategies for re-engineering proteins in the laboratory, targeting proteins for drug development, and understanding the functions of specific proteins associated with genetic diseases. Using the huge volumes of data coming out of the genome projects, this approach provides a much more contextual picture of the structure-function paradigm than can be achieved by studying a single protein at a time. This work has been successfully applied to such problems as the prediction of function for unknown reading frames and elucidation of enzyme mechanisms. It has also provided new conceptual approaches for probing how differences in function can be generatred from similar structural scaffolds. Major projects focus on superfamilies of enzymes whose member proteins perform a broad range of biochemical functions

while sharing a common active site architecture. Recently, Dr. Babbitt's laboratory has embarked on a project to develop and apply new tools in bioinformatics to identify very distant superfamily relationships across the entire protein universe.

Iosif Vaisman, Ph.D., Research Assistant Professor, Division of Pharmaceutics, University of North Carolina, Chapel Hill, School of Pharmacy (two years): "Computational Analysis of Protein Structure." Revolutionary developments in computational biology, including both genomics and computational structural biology, lead to the rapidly increasing amount of data on biomolecular sequences and structures. The utilization of this data and the software for its processing will increase tremendously with the advent of the "postgenomic era" when biomedical and pharmaceutical research and clinical practice will incorporate sequence and structure analysis. Detailed knowledge of protein structure is essential for understanding the mechanisms of biological processes at molecular, cellular, and evolutionary levels. The primary goal of this proposal is to develop efficient techniques and algorithms for the analysis, classification and prediction of protein structures using computational geometry methods. and to develop a multidisciplinary bioinformatics program at the University of North Carolina.

Entering the second year of his award in 1998:

Mark Gerstein, Ph.D., Assistant Professor, Department of Molecular Biophysics and Biochemistry, Yale University, School of Medicine: "Analysis of Sequences and Structures on a Large Scale."

PHARMACOLOGY/MORPHOLOGY

FELLOWSHIP AWARDS IN PHARMACOLOGY-MORPHOLOGY

The goals of this postdoctoral program are to increase our knowledge about the actions of drugs by direct study of their effects on cells and tissues, to correlate the morphological changes and, concurrently, to uncover associations observed with functional parameters of cells and tissues.

In order to be eligible for an award, the candidate must possess formal training in a morphologic specialty or in pharmacology. However, subsequent training in the complementary discipline, during the period of the fellowship, may be informal. On completion of the program, the fellow should be able to use the tools and concepts of both disciplines.

The awards are two years each. The level of support varies and is aimed at keeping within the existing stipends for similarly trained individuals within the applicant university. First offered in 1968, 102 awards have been made to date.



Recipients of the fellowship beginning July 1998 are:



Bonnie Lynn Firestein, Ph.D., University of California. San Francisco, School of Medicine (two years): "cGMP-Dependent Protein Kinase Regulation of Cell Number in Developing Trigeminal Ganglia." Guanosine 3', 5'-cyclic monophosphate (cGMP) is a messenger molecule that has been implicated in the regulation of proliferation. However, very little is known about the effector that cGMP binds to which activates cellular events that mediate this regulation. cGMP-dependent protein kinase (cGK) is thought to be a major mediator of the effects of intracellular cGMP. cGK type I (cGKI) is expressed at high levels in the sensory ganglia. Dr. Firestein's experiments focus on the role of cGKI in the regulation of sensory cell number. The experiments make use of two systems - the chick embryo model, which affords easy administration of pharmacological agents, and an in vitro cell culture system. Using the in ovo system, the role of cGKI in developing sensory ganglia will be determined using pharmacological agents. Effects on proliferation, precursor cell number, and axon outgrowth will be determined in control and treated embryos. In addition, in vitro culturing of sensory neurons will be used to determine the mechanisms that underlie effects seen in ovo. These experiments will provide information on how cell growth and division in the nervous system may be regulated by cGKI and can give insight into potential ways to increase regeneration of central and peripheral neurons to alleviate sensory dysfunction.



Laura Beth Kozell, Ph.D., Oregon Health Science University, School of Medicine (two years): "The Effects of Cocaine on Glutamate Synapses." The goals of this fellowship are to examine ultrastructural immunocytochemical changes associated with identified glutamate nerve terminals as a correlate to the development of behavioral sensitization to cocaine and to determine whether interactions between dopamine (DA) and glutamate (Glu) transmission are involved in the sensitization process. To achieve these goals. Dr. Kogell will administer cocaine to rodents in a paradigm that should consistently result in behavioral sensitization and assess behavioral sensitization prior to determining whether there are any changes in nerve terminal immunolabeling. To determine whether interactions between Glu and DA transmission are involved in sensitization, she will block the development of sensitization, either with selective receptor antagonists or with lesions of mesolimbic dopaminergic neurons and assess whether the density of glutamate nerve terminal labeling changes. The novel aspect of this research is the ability to correlate neuronal adaptations with changes in the locomotor response to cocaine. Dr. Kozell is interested in teaching and conducting research on the neurochemical basis of drug-seeking behavior, specifically on the long-term neuronal adaptations following drug use.

Those individuals entering the second year of their award in 1998 are:

Laurie S. Nadler, Ph.D., Ph.D., University of Washington, School of Medicine: "Targeting of Muscarinic Receptor Subtypes in Polarized Cells."

Steven J. Ritter, Ph.D., The University of Texas Medical School at Houston: "Mechanism of Breast-Cancer Suppression by Retinoids."

Those individuals ending their awards in 1998 are:

Colleen M. Burns, Ph.D., Vanderbilt University, School of Medicine (one year): "Functional Characterization of Edited Serotonin 2C Receptor Isoforms in the Mammalian Central Nervous System."

Zhen-Ping Chen, M.D., Ph.D., University of Medicine and Dentistry of New Jersey, Robert Wood Johnson Medical School: "Anatomical Studies of Opioid Receptor Like-1 (ORL-1) Expression and Targeted Inactivation of the ORL-gene."

Kirk Hillsley, Ph.D., University of Vermont, College of Medicine: "Mechanism of CCK's Action in the Control of Sphincter of Oddi Junction."

Annika B. Malmberg, Ph.D., University of California, San Francisco, School of Medicine: "Spinal Mechanisms of Nociceptive and Neuropathic Pain."

PHARMACEUTICS

UNDERGRADUATE RESEARCH FELLOWSHIPS IN PHARMACEUTICS

The Undergraduate Research Fellowship program began in 1990 and is designed to encourage undergraduate students in pharmacy, chemistry, biology or a related discipline to pursue an advanced degree in pharmaceutics, thereby attempting to supplement the infrastructure of well-trained investigators in this important discipline. The Foundation's plan to accomplish this goal is by providing support for the undergraduate student to participate in a meaningful research project with a motivated, inspiring and research-active pharmaceutics faculty member.

The pharmaceutics faculty member must apply for the award and, once selected, is provided with a one-year, \$5,000 fellowship which the faculty member can provide to a qualified undergraduate of his or her choosing. Seven awards were made for 1997, bringing the total number of awards to 86. Faculty and their undergraduate students who received fellowships between January and August 1998 are:

Hayat Alkan-Onyuksel, Ph.D., Associate Professor, University of Illinois at Chicago, College of Pharmacy (one year).

Student: Bhavish Bodalia, "Interaction of Vasoactive Intestinal Peptide with Phospholipids." The goal of this research is to study the interaction of vasoactive intestinal peptide, VIP, with phospholipids. This interaction will be determined from the association of VIP with phospholipid monolayers and peptide conformation changes by circular dichroism studies. The results will help to explain the increased bioactivity of the peptide when administered in the presence of phospholipids, and may lead to the development of novel lipid based delivery systems for other peptide drugs similar in nature to VIP.

William F. Elmquist, Pharm.D., Ph.D., Assistant Professor, University of Nebraska, College of Pharmacy (one year).
Student: Christine M. Brandquist, "Biochemical Characterization of the Expression of the Multidrug Resistance-Associated Protein in the Blood-Brain Barrier." The overall goal of this research will be to characterize the expression and function of the multidrug resistance-associated protein (MRP) in the central nervous system (CNS). It is important to study the function of MRP in the bloodbrain barrier to avoid potentially harmful drug interactions when substrates and inhibitors of MRP are used in combination. Moreover, an understanding of the role MRP plays in limiting drug delivery to the brain will enable the design of therapeutic strategies to enhance the brain delivery of compounds to treat diseases in the CNS.

David J.W. Grant, D.Sc., Professor of Pharmaceutics, University of Minnesota, College of Pharmacy (one year).

Student: R. Todd Burkhardt, "Influence of the Water of Hydration on the Physico-Mechanical and Tableting Properties of a Model Pharmaceutical Hydrate." This research will probe the effects of structural water on tableting behavior by relating Hiestand's tableting indices of the well-characterized solid phases of the model compound L-Lysine Monohydrochloride, to the

interactions of water in the crystal structure.

James N. Herron, Ph.D., Associate Professor, University of Utah, College of Pharmacy (one year).

Student: Justin LeClaire, "Affinity and Avidity of Antibodies as Targeting Moieties in Immunoliposomes." An immunoliposome is a specialized drug-delivery system that consists of a sub-micron sized lipid vesicle (which contains a payload of cytotoxic drug) and pendant antibody molecules (which target the vesicle to pathological tissue such as tumors). This research investigates how to formulate immunoliposomes for optimal targeting of pathological cells.

Vincent H.L. Lee, Ph.D., Professor and Chairman, Department of Pharmaceutical Sciences, University of Southern California, School of Pharmacy (one year).

Student: Robert Chen, "Characterization of the Alveolar Organic Cation Transporter." This research seeks to characterize the organic cation transporter in the lung for improving pulmonary drug absorption.

Jagdish Singh, Ph.D., Assistant Professor, North Dakota State University, College of Pharmacy (one year).

Student: Angela K. Levang, "Mechanism of Transdermal Transport Enhancement of Beta Blockers by Terpenes." This research evaluates the effect of terpenes on the percutaneous absorption enhancement of beta blockers in order to develop non-invasive transdermal therapeutic systems to treat hypertension.

Philip C. Smith, Ph.D., Assistant Professor, University of North Carolina, School of Pharmacy (one year).

Student: Rachel C. Turner, "Drug Disposition in CF - Knockout Mice." Drug disposition in children with cystic fibrosis (CF) is often unpredictably altered. We propose to evaluate whether CF Knockout mice are reliable models for this altered drug elimination by investigating the disposition of acetaminophen and ICG in this mouse model.

FELLOWSHIP FOR ADVANCED

PREDOCTORAL TRAINING IN PHARMACEUTICS

Active for eleven years, this program assists awardees who have one or two years remaining in their pharmaceutics predoctoral training—the time during which they are engaged in dissertation research.

The fellowship program provides a stipend of \$12,000 a year for two year and \$500 a year for incidentals directly associated with the preparation of the dissertation. Five awards were made for 1997 bringing the total number of awards made to 66:

Those who received fellowships beginning between January and July 1998 are:

Jinnian Gao, University of Kansas, School of Pharmacy (two years): "Transport Characteristics of Peptidomimetics Containing Hydroxyethylamino Peptide Bond Bioisosteres." This research is designed to examine the effects of the hydroxyethylamino peptide bond bioisosteres on the permeability properties of peptidomimetics across the Caco-2 cell monolayers. An emphasis will be on the influence of the *P*-glycoprotein related efflux systems and the di/tripeptide transporters on the transport of these peptidomimetics. Annual Awardee Meeting General Session, Gebruary 19.



Susan Wells Hovorka, University of Kansas, School of Pharmacy (two years): "Effect of Protein Structure on the Metal-Catalyzed Oxidation of Growth Hormones." Metal-Catalyzed-Oxidation (MCO) compromises the efficacy and reliability of protein pharmaceuticals. Little is known about the mechanistic pathways of MCO degradation. The aim of this research is to elucidate such mechanisms by studying MCO of growth hormones as a function of solvent composition. Preliminary findings suggest that physical parameters of solvents may induce structural changes in the protein which protect the drug from MCO.

LaToya Shantel Jones, University of Colorado, School of Pharmacy (two years): "Mechanistic Determination of Stabilization of Pharmaceutical Proteins using Nonionic Surfactants." Pharmaceutical protein formulations are often stabilized by the addition of nonionic surfactants. The mechanisms of stabilization are not clear. Ms. Jones will investigate the stabilization of pharmaceutically important proteins by nonionic surfactants to elucidate these mechanisms.

Jeffrey J. Seyer, University of Iowa, College of Pharmacy (two years): "The Development of Near-Infrared Spectroscopy for Determining Crystallinity in Pharmaceutical Solids." Assessment of drug crystallinity is an important aspect in pharmaceutical product development. This research is aimed at the development of a non-invasive, non-destructive method for quantifying crystallinity in pharmaceutical solid products using near-infrared spectroscopy. A secondary objective of this work is to utilize near-infrared methods to examine process induced changes in solids in multi-component systems. The results obtained from near-infrared analysis will be compared to those from other solidstate characterization methods. **Timothy J. Spitzenberger**, University of Nebraska, College of Pharmacy (two years): "Delivery of Protease Inhibitors to the Brain Utilizing Inhibitory Drugs of the Efflux P np P-Glycoprotein." The treatment of human immuno-deficiency virus in the central nervous system is hampered by the limited delivery of protease inhibitors. This may be caused by the role the membrane efflux protein, p-glycoprotein, plays in the blood-brain barrier. The aim is to investigate the brain delivery of protease inhibitors through inhibition of p-glycoprotein.

POSTDOCTORAL RESEARCH FELLOWSHIPS IN PHARMACEUTICS

Complementing the other two pharmaceutics programs offered by the PhRMA Foundation, the Postdoctoral Research Fellowships in Pharmaceutics was initiated to encourage more qualified graduates to obtain the postdoctoral research training so vitally needed in the area of pharmaceutics. The PhRMA Foundation and its Pharmaceutics Advisory Committee recognize the critical need for such well-trained scientific investigators. The postdoctoral award gives \$25,000 per year for two years. Since its inception, ten awards have been given.

Entering the second year of his award in 1998:

William G. Mallet, Ph.D., Cornell University Medical College: "The Intracellular Transport and Localization of TGN38/41."

Ending her award in 1998:

Sandy Koppenol, Ph.D., University of Washington, School of Pharmacy. "Two Dimensional Protein Crystallization at Interfaces."

PHARMACOECONOMICS

FACULTY DEVELOPMENT AWARDS IN PHARMACOECONOMICS

There is widespread concern about rising health care expenditures as well as increasing interest in understanding the impact of new therapies on patient-focused outcomes such as mortality, functional status, and quality of life. Because of these new perspectives, choices about new drugs are now based not only on traditional safety and efficacy measures but also on patientassessed efficacy and economic values measures. A drug development program needs to include all of the outcome measures so that the information needs of the different decision makers can be met. Taking this into consideration, the PhRMA Foundation, recognizing the need for human resources to perform these outcome analyses, has implemented its Faculty Development Awards in Pharmacoeonomics program. Each award offers \$40,000 annually for two years. The program is now in its fourth year and has made one award for 1998:

Beginning his award in July 1998:

C. Daniel Mullins, Ph.D., Assistant Professor, University of Maryland, School of Pharmacy (two years): "Integration of Theory and Practice of Pharmacoeconomics by Disease State". Dr. Mullins' research focuses on the development of new methodologies for the economic evaluation of drug products, health care services and medical technologies. He feels the appropriate mechanism through which one can accomplish the goal of establishing more standardized pharmacoeconomic methodology is by focusing on individual disease states. The empirical research that he has performed in this area utilizes clinical trial and retrospective databases to perform pharmacoeconomic analyses aimed at evaluating "real world" cost-effectiveness. These studies can aid in the development of new assessment methods by tailoring general guidelines for pharmacoeconomic analysis to specific illnesses. Dr. Mullins has focused a considerable amount of time on the pharmacoeconomics of cardiovascular drugs and emergency medicine, but also work in the areas of infectious diseases, osteoarthritis, osteoporosis, and pneumonia. He is also interested in public policy issues that go beyond the micro level of assessment (drug vs. drug) into a systems-level analysis. Dr. Mullins is currently working with several managed care providers on research efforts that address disease state management issues. These research projects examine the relationship between optimal drug therapy, related services, health outcomes, and the total cost of care.

Entering the second year of their awards are:

John M. Brooks, Ph.D., Assistant Professor, College of Pharmacy, University of Iowa: "The Use of Instrumental Variable Techniques in Pharmacoeconomics Outcomes Research."

Matthew M. Murawski, R.Ph., Ph.D., Assistant Professor, School of Pharmacy, University of Mississippi: "Development of a Pharmacoeconomic Center at The University of Mississippi."

Those who ended their awards in 1998 are:

Karen Blumenschein, Pharm.D., Assistant Professor, College of Pharmacy, University of Kentucky: "Incorporating Quality of Life Assessments into Pharmacoeconomics Evaluations."

A. Mark Fendrick, M.D., Assistant Professor, School of Medicine, University of Michigan: "Development of a Pharmacoeconomics Research and Education Program at the University of Michigan."



RESEARCH GRANTS

One of the most important aspects of the PhRMA Foundation effort has been the support of fundamental research. In 1971 a change in emphasis within the Foundation shifted the bulk of the funds into educational support programs and, consequently, less into research. It is understood that these educational programs place high emphasis on the research programs of the applicants for each award. In this sense, educational support programs are in fact also supporting research. The Foundation continues to accept requests for research support and suggestions for pertinent research projects since it is important that the potential within the Foundation for helping that particularly promising effort be maintained.

ETHICAL CONSIDERATIONS

The Scientific Advisory Committee as well as the program advisory committees of the PhRMA Foundation are sensitive to the appropriate use of experimental subjects, animals and humans, in research. In their deliberations, they consider all aspects of a proposal and may deny support for many reasons. Careful consideration is given to humane use and care of animal subjects. For human and animal research, the project review committee requires, in writing, a statement of adherence to prevailing standards of ethical research practices, including Institutional Review Board approval before initiation of any research project. In addition, for human research, assurance of informed consent will be required.

RESEARCH STARTER GRANTS

Research Starter Grants are intended to provide financial support for beginning investigators. The program, in 1998, supported eight Research Starter Grants at \$12,500 per year with the second year contingent upon need. The first awards were made in 1972, and a total of 508 grants have been made, including the eight awards beginning January 1, 1998.

Recipients of the Research Starter Grants which began January 1998:

Rama S. Dwivedi, Ph.D., Northerwestern University, School of Medicine (two years): "Regulation of Adenosylmethionine (Adomet) Synthetase Gene Expression in Neuroblastoma Tumor Cells. A Potential Role in Drug Resistance."

Linda A. Felton, Ph.D., University of New Mexico, College of Pharmacy (two years): "Influence of Additives in Aqueous Polymeric Dispersions on Film-Tablet Adhesion."

49

Charles Giardina, Ph.D., University of Connecticut, School of Medicine (two years): "Nonsteroidal Anti-inflammatory Drugs, Short Chain Fatty Acids and TNF-induced Apoptosis of Colon Cancer Cells: Synergistic Effects and the Role of Reactive Oxygen."

Richard Z. Lin, M.D., University of Texas, Medical School at San Antonio (two years): "Sphingosine-1-phosphate Inhibits Vascular Smooth Muscle Cell Migration via p38 Mitogen Activated Protein Kinase."

Jose E. Manautou, Ph.D., University of Connecticut, School of Pharmacy (two years): "Regulation of Hepatic ATP-Dependent Transport Proteins and their Potential Role in the Hepatobiliary Secretion of Model Hepatotoxic Agents."

Lawrence Ka-yun Ng, Ph.D., University of Colorado, School of Pharmacy (two years): "A Study of Ultrasonic Mediation of the Transport of Therapeutic Agents Across the Blood-Brain Barrier."

Felicia V. Nowak, M.D., Ph.D., St. Louis University, School of Medicine (two years): "Preoptic Regulatory Factors as Growth Factors in the CNS: Regulation by Steroid Hormones."

Peter W. Swaan, Ph.,D., Ohio State University, School of Pharmacy (two years): "Molecular Specificity of the Intestinal Bile Acid Carrier."

Based on need for funds, a review of the nine research starter grantees whose awards began January 1, 1997, for a second year of the award resulted in six of them having their awards continued. Those who did not receive the second year should be congratulated on receiving further funding.

Robert L. Judd, Ph.D., Northeast Louisiana University School of Pharmacy: "Effect of Metformin on Phosphoenolypruvate Carboxykinase Activity in Cultured Rat Hepatocytes and H4IIE Cells."

Patrick T. Murray, M.D., University of Chicago School of Medicine: "Mechanisms of Endotoxin Effect on Mesangial Calcium Mobilization."

Kathryn M. Partin, Ph.D., Colorado State University College of Veterinary Medicine: "Pharmacological Contributions of GluRB to Allosteric Modulation of AMPA Receptors."

Steven P. Schwendeman, Ph.D., Ohio State University College of Medicine: "Maintaining Protein Structure in Biodegradable Polymer Microspheres."

Zhao-Hui Song, Ph.D., Texas A&M University College of Medicine: "Characterization of Cannabinoid Receptors in the Eye."

Elizabeth Wattenberg, Ph.D., University of Minnesota Medical School: "cJun As a Target for TPA-type and Non-TPA-Type Tumor Promoters." Report of the Treasurer



The PhRMA Foundation has been building the infrastructure for the future of biomedical and pharmaceutical science for the past 33 years. The vital work of the Foundation has been accomplished through the generosity of the research-intensive pharmaceutical manufacturers who are the members of PhRMA—associates and research affiliates. As I recap the finances of this prestigious Foundation for 1997, I would like to give special thanks to our benefactors who are listed in the back of this annual report.

The total income of the Foundation in 1997 was \$2,289,157. Of this amount, \$1,505,250 came from contributions; \$469,476 came from interest and dividends; \$61,484 was from realized gains on sales of securities; \$221,896* was from unrealized gains on sale of securities; and \$31,051 came from unexpended grant monies.

In 1997, grant expenditures totaled \$1,511,152; Foundation Annual Awardee Meeting expenses amounted to \$73,360; Advisory Committee Meetings and Travel was \$61,725; Honoraria totaled \$27,480; Publications and web site cost \$47,951; Professional Services totaled \$43,950; and office expenses for 1997 rent, salaries, taxes and trust commission totaled \$393,300. The total net assets as of December 31, 1997 was \$4,820,369. This figure, however, does not reflect the tentatively authorized, undisbursed funds for some of the grants and programs described earlier. The Foundation reports these amounts as expenditures when the funds are disbursed. As of December 31, 1997, the contingency liability for 1998-00 was \$3,018,639.

The Foundation's financial position as of December 31, 1997, has been audited by the Rosslyn, Virginia accounting firm of Buchanan & Company.

Kobut G. Ingran

Robert A. Ingram Secretary-Treasurer PhRMA Foundation and

Chairman, Chief Executive Officer and President Glaxo Wellcome Inc.



Robert A. Ingram Secretary-Treasurer PhRMA Foundation

"FASB rules require that "unrealized gains on sales of securities" be reported as part of total income.

51

STATEMENT OF INCOME AND EXPENDITURES FOR THE YEAR ENDED DECEMBER 31, 1997

Income:

Contributions	\$1,505,250
Interest and Dividends	469,476
Realized Gains on Sale of Securities	61,484
Unrealized Gains on Sale of Securities	221,896
Miscellaneous Income	31,051
Total Income	\$2,289,157
Expenditures:	
Programs:	
Grants-Note A	
Clinical Pharmacology Unit Award	\$ -0-
Faculty Awards in Clinical Pharmacology	279,750
Faculty Awards in Basic Pharmacology	120,000
Fellowships for Careers in Clinical Pharmacology	77,700
Advanced Predoctoral Fellowships in Pharmacology/Toxicology	225,000
Pharmacology-Morphology Fellowships	143,952
Medical Student Research Fellowships	10,000
Research Starter Grants	262,500
Advanced Predoctoral Fellowships in Pharmaceutics	118,500
Undergraduate Fellowships in Pharmaceutics	35,000
Postdoctoral Fellowships in Pharmaceutics	43,750
Faculty Development Award in Pharmacoeconomics	180,000
Faculty Development Award in Bioinformatics	15,000
Subtotal—Grants	\$1,511,152
Annual Awardee Meeting	73,360
Program Total	\$1,584,512
Administrative	
Committee Meetings and Travel	61,725
Management and General:	
Honoraria	27,480
Publications	47,951
Office Expense	46,216
Professional Services	43,950
Rent	26,800
Salaries and Retirement Fund Contribution	312,544
Taxes, Insurance and Depreciation	40,582
Trust Commission Expense	6,304
Loss on Sale of Equipment	7,070
Administrative Total	\$620,622
Total Expenditures	\$2,205,134

Note A—In addition to the amounts shown, the Foundation is committed, subject to annual review, to make certain grants. At December 31, 1997 the amounts still to be disbursed with respect to these grants amounted to aggregated \$3,018,639 with \$1.805,303 of this to be disbursed during 1998; \$1,033,336 in 1999; \$180,000 in 2000.

Change in Net Assets	\$84,023
Net Assets, January 1, 1997	\$4,736,346
Net Assets, December 31, 1997	\$4,820,369



Organization and Administration

The PhRMA Foundation operates through its Officers, Board of Directors and six advisory committees. On May 11, 1998, Mr. Robert C. Black, President of Zeneca Pharmaceuticals, was reelected Chairman for the fourth year. Mr. Jan Leschly, Chief Executive of SmithKline Beecham plc, was re-elected Vice Chairman, and Robert A. Ingram was re-elected Secretary-Treasurer.

Donna Moore was elected President and CEO beginning September 1, 1997. Maurice Q. Bectel, D.Sc., who has served the Foundation as President for twelve years, retired effective August 31, 1997. Mr. Bectel continues to serve as consultant to the Foundation. Edward J. Cafruny, M.D., Ph.D., who has been Foundation Scientific Consultant, and was instrumental in the development and vision of the Foundation, retired August 31,1997.

Dr. Cafruny began his association with the Foundation by serving on the Scientific Advisory Committee beginning in 1968. He later became Chairman of the Basic Pharmacology Advisory Committee, then Consultant to the Foundation in 1989. Stepping into a newly created post of Scientific Advisory is William R. Darrow, M.D. Dr. Darrow has served as Chairman of the Scientific Advisory Committee and continues in that capacity.



- Donna Moore, Dr. Carl C. Peck, William R. Darrow, and Dr.
- Paul Calabresi enjoy a
- few moments at the
- Annual Awardee
- Meeting General Session
- on February 19.

1998-99 OFFICERS



Robert C. Black Chairman PhRMA Foundation President Zeneca Pharmaceuticals Wilmington, Delaware



Robert A. Ingram Secretary-Treasurer PhRMA Foundation Chairman, Chief Executive Officer and President Glaxo Wellcome Inc. Research Triangle Park, North Carolina



Jan Leschly Vice Chairman PhRMA Foundation Chief Executive SmithKline Beecham Philadelphia, Pennsylvania



Donna Moore President PhRMA Foundation Washington, D.C.

1998-99 BOARD OF DIRECTORS

54



Richard J. Markham Chairman of the Board of Management and Chief Executive Officer Hoechst Marion Roussel Bridgewater, New Jersey



Wayne P. Yetter President and Chief Executive Officer Novartis Pharmaceuticals Corporation East Hanover, New Jersey



Patrick J. Zenner President and Chief Executive Officer Hoffmann-La Roche Inc. Nutley, New Jersey



Robert N. Wilson Vice Chairman, Board of Directors Johnson & Johnson New Brunswick, New Jersey



Alan F. Holmer President Pharmaceutical Research and Manufacturers of America Washington, D. C. (*Ex-Officio*)



William R. Darrow, M.D., Ph.D. Chief Science Advisor *PhRMA Foundation* Senior Medical Advisor Schering-Plough Research Institute Schering-Plough Corporation Kenilworth, New Jersey



Maurice Q. Bectel, D.Sc. PhRMA Foundation Consultant

1998-99 BOARD OF DIRECTORS

STAFF CONSULTANTS

55



Advisory Committees

SCIENTIFIC ADVISORY COMMITTEE



William R. Darrow, M.D., Ph.D. (Chairman) Senior Medical Advisor Schering-Plough Research Institute Schering-Plough Corporation Kenilworth, New Jersey

Paul Calabresi, M.D. Professor and Chair Emeritus Department of Medicine Brown University Providence, Rhode Island

Jean Paul Gagnon, Ph.D. Director of Industry Affairs Hoechst Marion Roussel Kansas City, Missouri

Michael D. Gershon, M.D. Professor and Chairman Department of Anatomy & Cell Biology Columbia University

College of Physicians and Surgeons

New York, New York

Arthur Hull Hayes, Jr., M.D. President MediScience Associates

New Rochelle, New York

James Swarbrick, D.Sc., Ph.D. Vice President Research and Development AAI Inc. Wilmington, North Carolina

Hugh H. Tilson, M.D., Dr.P.H. Senior Medical Advisor for Health Affairs International Surveillance Epidemiology and Economics Glaxo Wellcome Inc. Research Triangle Park, North Carolina

Irwin M. Weiner, M.D. Emeritus Professor and Former Dean College of Medicine State University of New York, Brooklyn Health Science Center Brooklyn, New York

CLINICAL PHARMACOLOGY ADVISORY COMMITTEE



Paul Calabresi, M.D. (Chairman) Professor and Chair Emeritus Department of Medicine Brown University Providence, Rhode Island Darrell R. Abernethy, M.D., Ph.D.
Francis Cabell Brown Professor of Medicine and Pharmacology and
Director
Division of Clinical Pharmacology
School of Medicine
Georgetown University
Washington, D.C.

Thorir D. Bjornsson, M.D., Ph.D.

Vice President, Clinical Pharmacology Worldwide Clinical Research & Development Bristol-Myers Squibb Princeton, New Jersey

Terrence F. Blaschke, M.D. Professor of Medicine and Molecular Pharmacology Division of Clinical Pharmacology Stanford University School of Medicine Stanford, California

Alan S. Nies, M.D. Vice President Clinical Sciences Merck & Co., Inc. Rahway, New Jersey

BASIC PHARMACOLOGY ADVISORY COMMITTEE



Irwin M. Weiner, M.D. (Chairman) Emeritus Professor and Former Dean State University of New York Brooklyn, New York James W. Aiken, Ph.D. Director of Experimental Biology Pharmacia & Upjohn Stockholm, Sweden

Terry L. Bowlin, Ph.D. Vice President Research Bio Chem Therapeutics Laval, Quebec, Canada

Theodore M. Brody, Ph.D.

Professor and Former Chairman Department of Pharmacology and Toxicology Michigan State University East Lansing, Michigan

George C. Fuller, Ph.D.

Dean and Professor of Pharmacology College of Pharmacy and Allied Health Professions Wayne State University Detroit, Michigan

Paul S. Guth, Ph.D. Professor of Pharmacology School of Medicine Tulane University New Orleans, Louisiana

*Keith F. Killam, Jr., Ph.D. Professor and Former Chairman Department of Medical Pharmacology University of California, Davis School of Medicine Davis, California

George R. Lenz, Ph.D. President GRLEN and Associates Andover, Massachusetts

Bernard L. Mirkin, M.D., Ph.D.
William G. Swartchild, Jr. Distinguished Chair in Research
Head and Director of Research
Children's Memorial Institute for Education and Research
Professor of Pediatrics
Northwestern University Medical School
Chicago, Illinois

*Deceased

Sidney Pestka, M.D.

Professor and Chairman

Department of Molecular

Genetics and Microbiology

University of Medicine & Dentistry of New Jersey

Robert Wood Johnson Medical School

Piscataway, New Jersey

Frederick M. Radzialowski, Ph.D.

- President
- FMR Research Associates
- Glenview, Illinois

PHARMACOLOGY MORPHOLOGY ADVISORY COMMITTEE



Michael D. Gershon, M.D.

(Chairman)

...

...

4

Professor and Chairman

Department of Anatomy & Cell Biology

Columbia University

College of Physicians & Surgeons New York, New York

George A. Condouris, Ph.D.

Professor and Former Chairman

Department of Pharmacology

University of Medicine &

Dentistry of New Jersey Newark, New Jersey

Cheryl Dreyfus, Ph.D. Professor Department of Neuroscience & Cell Biology University of Medicine and Dentistry of New Jersey Robert Wood Johnson Medical School Piscataway, New Jersey

Felix A. de la Iglesia, M.D.

Vice President Pathology & Experimental Toxicology Parke-Davis Pharmaceutical Research Ann Arbor, Michigan

Robert B. Jennings, M.D.

James B. Duke Professor of Pathology School of Medicine Duke University Durham, North Carolina

Hugh B. Lewis, B.V.M.S., M.R.C.V.S. Senior Vice President Practice Development Medical Management International, Inc. Portland, Oregon

David L. Nelson, Ph.D.

Senior Research Scientist Lilly Research Laboratories A Division of Eli Lilly and Company Indianapolis, Indiana

Henry J. Ralston III, M.D.

Professor and Chairman Department of Anatomy School of Medicine University of California, San Francisco San Francisco, California

PHARMACEUTICAS ADVISORY COMMITTEE



James Swarbrick, D.Sc., Ph.D. (Chairman) Vice President Research & Development AAI Inc. Wilmington, North Carolina

William J. Curatolo, Ph.D. Assistant Director Pfizer Central Research Pfizer Inc. New York, New York

William I. Higuchi, Ph.D. Distinguished Professor and Chairman Department of Pharmaceutics College of Pharmacy University of Utah Salt Lake City, Utah

George Zografi, Ph.D. Professor of Pharmaceutics School of Pharmacy University of Wisconsin-Madison Madison, Wisconsin

PHARMACOECONOMICS ADVISORY COMMITTEE



Jean Paul Gagnon, Ph.D. (Chairman) Director of Industry Affairs Hoechst Marion Roussel Kansas City, Missouri

Lyle Bootman, Ph.D. Dean College of Pharmacy University of Arizona Tucson, Arizona

Jane T. Osterhaus, Ph.D. Director of the Arthritis Team Department of Global Health Outcomes Searle Skokie, Illinois

Frederick W. Telling, Ph.D. Vice President Corporate Strategic Planning and Policy Pfizer Inc. New York, New York



Haian Qu, Ph.D., Assistant Professor, Emory University, James A. Weyhenmeyer, Ph.D., Professor, University of Illinois, and Dennis Paul, Ph.D., Associate Professor Louisiana State University Medical Center enjoy the Annual Awardee Meeting reception. Dr. Ng received a 1993 Postdoctoral Gellowship in Pharmaceutics, a 1997 Undergraduate Research Gellowship in Pharmaceutics and a 1998 Research Starter Grant. Dr. Weyhenmeyer and Dr. Paul both received postdoctoral fellowships in Pharmacology-Morphology.



Applications

Descriptive brochures and application forms for all of the PhRMA Foundation grant programs are available on the World Wide Web: www.phrmaf.org. For more information, please write to:

Ms. Donna Moore President Pharmaceutical Research and Manufacturers of America Foundation 1100 Fifteenth Street, N.W. Washington, D.C. 20005 (202) 835-3470 (phone) (202) 467-4823 (fax)

Joshua Atiba, M.D., University of California, expounds on his poster display during the Poster Session on 4ebruary 19, 1998 with Spencer Rosero, M.D., University of Rochester.



(bottom) Dona Plecinski, new Administrative Coordinator of the PLRMA Joundation, meets Joundation awardees and advisory committee members before the Annual Awardee Meeting banquet: Stephanie Watts, Ph.D., Assistant Professor, Michigan State University; and Terrence Blaschke, M.D. and his wife Jeannette. Dr. Blaschke is a former awardee and a current member of the PhRMA Joundation's Clinical Pharmacology Advisory Committee.

Benefactors

PHRMA MEMBER COMPANIES AND COMPANY FOUNDATIONS

OVER \$3.5 MILLION

Bristol-Myers Squibb Foundation Bristol-Myers Squibb Company Hoffmann-La Roche Foundation Hoffmann-La Roche Inc.

OVER \$2.5 MILLION

The Merck Company Foundation Merck & Co., Inc. Merck Human Health Division Warner-Lambert Foundation Warner-Lambert Company Parke-Davis

OVER \$2 MILLION

Glaxo Wellcome Inc. SmithKline Beecham Foundation SmithKline Beecham p.l.c. SmithKline Beecham Pharmaceuticals SmithKline Beecham Consumer Health Care SmithKline Beecham Clinical Laboratories Pharmacia & Upjohn Foundation American Home Products Corporation Wyeth-Averst Laboratories Eli Lilly and Company Foundation Eli Lilly and Company Pfizer Inc.

Johnson & Johnson Advanced Care Products Advanced Sterilization Products Cordis Corporation Direct Access Diagnostics Ethicon, Inc. Ethicon Endo-Surgery Immunobiology Research Institute, Inc. Indigo Medical Janssen Pharmaceutica, Inc. Johnson & Johnson Clinical Diagnostic Johnson & Johnson Consumer Products Inc. Johnson & Johnson Development Corporation Johnson & Johnson Finance Corporation Johnson & Johnson Health Care Systems, Inc. Johnson & Johnson Medical. Inc. Johnson & Johnson - Merck **Consumer Pharmaceuticals** Inc. Johnson & Johnson Professional, Inc. LifeScan, Inc. McNeil Consumer Products Company McNeil Specialty Products Company Neutrogena Inc. Noramco, Inc. Ortho Biotech, Inc. Ortho Clinical Diagnostics, Inc. Ortho Dermatological Ortho McNeil Pharmaceutical Personal Products Company R. W. Johnson Pharmaceutical **Research** Institute Therakos, Inc. Vistakon Johnson & Johnson Vision Products. Inc.

61

OVER \$1 MILLION

Novartis Pharmaceuticals Corporation

Searle

Searle Pharmaceutical Group Hoechst Marion Roussel Inc. Schering-Plough Foundation, Inc. Schering-Plough Corporation Zeneca Pharmaceuticals

OVER \$500,000

Sanofi Pharmaceuticals, Inc. Bayer Corporation Boehringer Ingelheim Corporation Boehringer Ingelheim Pharmaceuticals, Inc.

OVER \$250,000

The Procter & Gamble Company Rhone-Poulenc Rorer Inc.

OVER \$100,000

Amgen Inc. 3M Pharmaceuticals

\$100,000 (AND UNDER)

Knoll Pharmaceutical Company Organon Inc. Astra USA, Inc. Pasteur Merieux Connaught Alza Corporation Genentech, Inc. Yamanouchi U.S.A. Inc. Solvay Pharmaceuticals Inc. B.F. Ascher & Company, Inc.

PHRMA ASSOCIATES AND RESEARCH AFFILIATES

AAI

American Medical Association Clark-O'Neill, Inc. Corbett Healthconnect IMS America Ltd. Kelly/Waldron and Company Klemtner Advertising, Inc. Lowe McAdams Healthcare Medical Economics Medicus Group International, Inc NDC Health Information Services Scott-Levin Associates Sudler & Hennessey

*Aggregrate contributions

1997 Benefactors

PHRMA MEMBER COMPANIES AND COMPANY FOUNDATIONS

\$160,000 AND OVER

Bristol-Myers Squibb Foundation Bristol-Myers Squibb Company

\$125,000 AND OVER

Johnson & Johnson Advanced Care Products Advanced Sterilization Products Cordis Corporation

62

Direct Access Diagnostics Ethicon, Inc. Ethicon Endo-Surgery Immunobiology Research Institute, Inc. Indigo Medical Janssen Pharmaceutica, Inc. Johnson & Johnson Clinical Diagnostics Johnson & Johnson Consumer Products Inc. Johnson & Johnson **Development** Corporation Johnson & Johnson Finance Corporation Johnson & Johnson Health Care Systems, Inc Johnson & Johnson Medical, Inc.

Johnson & Johnson - Merck **Consumer Pharmaceuticals** Inc. Johnson & Johnson Professional Inc. LifeScan, Inc. McNeil Consumer Products Company McNeil Speciality Products Company Neutrogena Inc. Noramco, Inc. Ortho Biotech, Inc. Ortho Clinical Diagnostics, Inc. Ortho Dermatological Ortho McNeil Pharmaceutical Personal Products Company R.W. Johnson Pharmaceutical **Research Institute** Therakos, Inc. Vistakon Johnson & Johnson Vision Products, Inc.

\$100,000 AND OVER

American Home Products Corporation Hoffmann-La Roche Foundation Hoffmann-La Roche Inc. Pfizer Inc. Zeneca Pharmaceuticals

\$75,000 AND OVER

Hoechst Marion Roussel Inc. Eli Lilly and Company Foundation Eli Lilly and Company SmithKline Beecham Foundation SmithKline Beecham p.l.c. SmithKline Beecham Pharmaceuticals SmithKline Beecham Consumer Health Care SmithhKline Beecham Clinical Laboratories Warner-Lambert Foundation Warner-Lambert Company Parke-Davis

\$50,000 AND OVER

Glaxo Wellcome, Inc. Merck & Co., Inc. Novartis Pharmaceuticals Corporation Pharmacia & Upjohn Foundation Schering-Plough Foundation, Inc. Schering-Plough Corporation

\$40,000 AND OVER

Amgen Inc. Boehringer Ingelheim Corporation Boehringer Ingelheim Pharmaceuticals, Inc.

\$30,000 AND OVER

Bayer Corporation The Procter & Gamble Company

\$10,000 AND OVER

Rhone-Poulenc Rorer, Inc. Sanofi Pharmaceuticals, Inc. Searle Yamanouchi U.S.A. Inc.

\$4,000 AND OVER

Alza Corporation Organon Inc.

\$3,000 (AND UNDER)

B.F. Asher & Company, Inc. Purdue Frederick Company

PHRMA ASSOCIATES AND RESEARCH AFFILIATES

AFFILIATES

American Medical Association Corbett Healthconnect Kelly/Waldron and Company Medical Economics NDC Health Information Services Scott-Levin Sudler & Hennessey

63

Special thanks go to all of the following companies and individuals who have come alongside the Goundation by participating in the Awards in Excellence Gala

ABB Industrial Systems Inc. American Home Products Corporation **Bayer** Corporation **BF** Goodrich Burns & Roe Process Group Centeon Custom Metalcraft Inc. Daiichi Pharmaceutical Corporation William R. Darrow, M.D., Ph.D Schering-Plough Research Institute Walter Dixon, Ph.D. University of Kansas **Domino** Amjet **DT** Industries Elsevier Science Inc. Excerpta Medica Inc. **FDC Reports Fisher-Rosemount** Gebo Corporation **Geneses** Reports Greater Philadelphia First **Gusmer Enterprises** Perry V. Halushka, M.D., Ph.D. Medical University of South Carolina Health Care Congress Board Ing K. Ho, Ph.D. University of Mississippi Medical Center Hoechst Marion Roussel Hoffmann-La Roche Inc. Index Manufacturing **IPX Speakers ISPE**—Society for Pharmaceutical and Medical Device Professionals Johnson & Johnson Kelly/Waldron and Company **Klockner-Pentaplast**

KPMG Peat Marwick Vincent Li, Ph.D. Whitehall Robins Healthcare Lockwood Greene Gary M. Mawe, Ph.D. University of Vermont Patrick McKercher, Ph.D. University of Maryland Daniel Mullins, Ph.D. University of Maryland Moss Printing Niro, Inc. Novartis Pharmaceuticals Corporation Osmonics, Inc. Philadelphia College of Pharmaceutical Science PECO Energy Horizon Pfizer Pharm Pro Magazine Public Service Electric & Gas Reed/Elsevier Ed Rendell, Mayor of Philadelphia **Reed Exhibition Companies** Sepha Products SIGMA-Tau Pharmaceuticals Inc. SmithKline Beecham p.l.c. The Stellar Group **STERIS** Corporation John Timoney, Police Commissioner of Philadelphia Irwin Weiner, M.D. SUNY Health Sciences Center at Syracuse Valicor Associates, Inc. Vision Quest The West Company Wilco AG Switzerland Wilco USA Wyeth-Averst Laboratories Zeneca Pharmaceuticals

PhRMA Foundation Current Programs for -1999

Nan Year	ne of Program/ r of First Awards	Number of Awards Budgeted Yearly/ Length of Award	P	rogram	Budget	Deadline Announcement Date Starting Time
Clin	nical Pharmacology Advisory Committee					
(1)	Faculty Awards in Clinical Pharmacology (1967)	3 budgeted/ 3 years	s s	360,000 40,000	total per award per year	October 1 December 15 July 1
(2)	Fellowships for Careers in Clinical Pharmacology (1973)	2 budgeted/ 2 years	ss	96,000 24,000	total per award per year	October 1 December 15 July 1
(3)	Medical Student Research Fellowships (1974-Amended 1982)	4 budgeted/ 3 months up to 24 months	s s m	48,000 1,000 aximum	total per month \$ 12,000	October 1 December 15 July 1
Bas	sic Pharmacology Advisory Committee					
(4)	Faculty Awards in Basic Pharmacology/Toxicology (1973)	2 budgeted/ 2 years	s s	120,000 30,000	total per award per year	September 15 December 15 July 1
(5)	Research Starter Grants (1972)	11 budgeted/ 2 years	s	275,000 12,500	total per award per year	September 1 December 15 January 1
(6)	Advanced Predoctoral Fellowships in Pharmacology/Toxicology (1978)	9 budgeted/ 1 or 2 years	s s	225,000 12,500	total per award per year	September 15 December 15 January-August
(7)	Faculty Development Award in BioInformatics (1997)	1 budgeted/ 2 years	s s	60,000 30,000	total per award per year	September 1 December 15 July 1
Pha	armacology-Morphology Advisory Committee					
(8)	Fellowships in Pharmacology-Morphology including Cell Biology (1968)	3 budgeted/ 2 years	55	129,000 21,500	total per award per year	January 15 March 15 July 1
Pha	armaceutics Advisory Committee					
(9)	Advanced Predoctoral Fellowships in Pharmaceutics (1987)	5 budgeted/ 1 or 2 years	s	125,000 12,500	total per award per year	October 1 December 15 January-August
(10)	Undergraduate Research Fellowships in Pharmaceutics (1990)	7 budgeted/ 1 year	s s	35,000 5,000	total per award	October 1 December 15 January-July
(11)	Postdoctoral Fellowships in Pharmaceutics (1992)	1 budgeted/ 1 or 2 years	s s	50,000 25,000	total per award per year	October 1 December 15 January-December
Pha	armacoeconomics Advisory Committee					
(12)	Faculty Awards in Pharmacoeconomics (1995)	2 budgeted/ 2 years	\$ \$	160,000 40,000	total per award per year	September 1 December 15 July 1

Pharmaceutical Research and Manufacturers of America Foundation

- - -

1100 Fifteenth Street, N.W. Washington, D.C. 20005

.