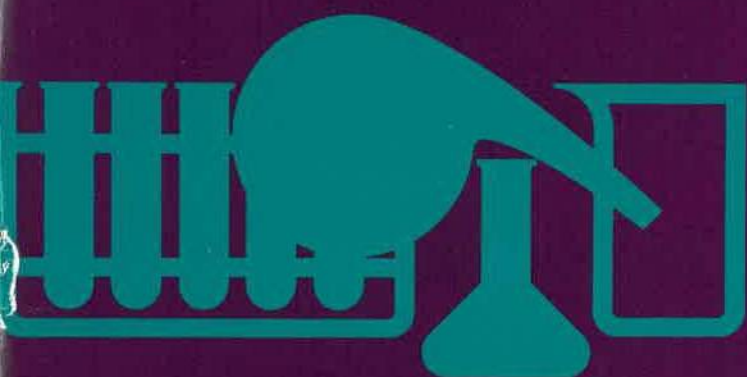


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ANNUAL REPORT



Pharmaceutical
Manufacturers
Association
Foundation, Inc.

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REPORT OF THE CHAIRMAN

For the Foundation, some years are more significant than others and 1986 was such a year. It marked the close of the Foundation's second decade of outstanding service and encouragement to the academic community and to able young scientists in particular.

During 1986, a very special review of the Foundation was launched. Phase I of this review is the twenty-year historical perspective or, "The Pharmaceutical Industry in Support of Medical Science." This document is dedicated to the pharmaceutical industry and to the more than 1,000 recipients of grants and awards who have enhanced the world of bioscience and extended its promises into the future. A great number of awardees have gone on to key professorships in schools of medicine, with a very large majority still directly engaged in research. Virtually all can be said to have immensely strengthened the world of medical academe. The overwhelming majority of Foundation awardees continue to combine teaching with research in positions seminal to the long-term development of their respective disciplines.

Phase II, a critical appraisal of the Foundation's status and future, has just been completed by an outside Review Committee chaired by Dr. Theodore Cooper, now Chairman and Chief Executive Officer of The Upjohn Company. The report and its recommendations are now before the Foundation Board of Directors for consideration. I am certain they will meet with vigorous support since they speak to the maintenance of a contemporary and dynamic role in support of science by the PMA Foundation.

Overall, we are extremely gratified at the progress achieved by the Foundation and believe the programs offered have indeed met the Foundation's goals and objectives qualitatively. At a time when society's need for assistance to science is at its greatest, when the promise of science is beckoning more seductively than ever, we have in place a major program of support to scientific education and research. While this program may have eventual impact on the products of our research-based pharmaceutical industry, it is primarily concerned with encouraging some of the best young scientists in this country to pursue promising paths that will be of significant long-term benefit to human and health. The success of the Foundation has been made possible by some \$20 million to date in voluntary contributions from the research-intensive PMA member companies. These companies have given generously to the PMA Foundation in addition to their own direct contributions and grants in support of scientific research. All of us involved with the Foundation are sincerely appreciative of their generous and positive support.



I also do not want to pass up the opportunity to acknowledge the commitment of the Foundation's staff and the industry and academic advisory committee members serving the Foundation. A large measure of the success enjoyed by the Foundation is directly related to the dedication and wise counsel of these individuals.

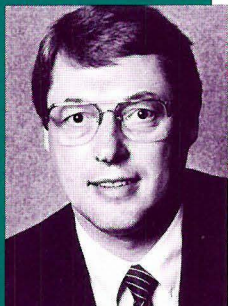
These committee members can take credit for bringing scientific relevance to the Foundation's ten programs.

Also, I would like to thank Dr. I. C. Winter, Foundation Consultant since 1975. Dr. Winter appeared on the Foundation scene in 1966, serving on several committees and later chairing the Scientific Advisory Committee. He was well qualified to take on the position of PMA Foundation Consultant. He was also at the helm of the Foundation for six months after Tom Hanrahan died until Maurice Bectel came on board.

I wish I could tell you that the Foundation has an overflowing pot of gold to devote to funding useful research, but I cannot. We do, however, hope to achieve increased latitude and flexibility for the PMA Foundation Board of Directors and the advisory committees to launch new programs and to strengthen existing programs as we enter the third decade of the Foundation's activities.

Irwin Lerner
Chairman

REPORT OF THE PRESIDENT



Nineteen-hundred and eighty-six has been an excellent year for the Foundation. The year witnessed the completion of an in-depth review of the Foundation beginning with Phase I, a twenty-year historical perspective and Phase II, a critical appraisal of the Foundation's status and future. I would like tender a special thank you to the Review Committee: Chairman—Theodore Cooper, M.D., Ph.D., now Chairman and Chief Executive Officer of The Upjohn Company; and committee members—John Oates, M.D., Professor and Chairman, Department of Medicine, Vanderbilt University, Frederick E. Shideman, M.D., Ph.D., Professor and Chairman, Department of Pharmacology, University of Minnesota, and Norman Weiner, M.D., Vice President, Pharmaceutical Discovery, Abbott Laboratories. The review report and its recommendations have been presented to the Foundation Board of Directors for their consideration and action.

The Foundation Board of Directors, on the recommendation of the Scientific Advisory Committee, approved significant increases in the stipend levels of the Foundation's Research Starter Grant program and the three fellowship programs totalling \$192,000. The Fellowship for Careers in Clinical Pharmacology increased from \$19,000 to \$24,000 per award. Advanced Predoctoral Fellowships in Pharmacology and Toxicology increased from \$5,050 to \$6,552 per award and Fellowships in Pharmacology-Morphology increased from \$14,500 to \$21,000 per award per year. The stipend level of the Research Starter Grant program was increased from \$7,750 to \$10,000 per award per year.

The 1986 Annual Awardee Meeting, usually held during the first week of December in New York City was moved to Washington, D. C. and will take place on February 11-12, 1987. The primary reason for the change in location was due to substantially lower costs and logistics. All future annual awardee meetings will be held in Washington, D. C. during the month of February.

The 1986 PMA Foundation reception and program at the Annual Meeting of the American Society for Pharmacology and Experimental Therapeutics, took place on August 18, 1986, in Baltimore, Maryland. The program featured an excellent keynote presentation by Edson Albuquerque, M.D., Ph.D., Professor and Chairman, Department of Pharmacology and Experimental Therapeutics at the University of Maryland School of Medicine. Dr. Albuquerque's presentation dealt with "New Aspects of the Molecular Pharmacology of Anticholinesterasic Agents." The program and reception were attended by approximately one-hundred scientists and students.

Since 1979, the advanced predoctoral fellowship program administered by the Basic Pharmacology Advisory Committee has made support available for students in pharmaceuticals, in addition to those in basic pharmacology and toxicology. Because of the growing realization by those both within and outside of the PMA Foundation of the need to support the disciplines of pharmaceuticals in a more direct and expanded manner, a new program has been created, to be administered under the direction of a Pharmaceuticals Advisory Committee. The Foundation's Board of Directors, on the recommendation of the Scientific Advisory Committee, recently approved this new program.

The program will offer, on a competitive basis, up to eight two-year predoctoral fellowships to graduate students in pharmaceuticals who have essentially completed the coursework requirements and are starting their research work full-time. Serving on the Pharmaceuticals Advisory Committee are Dr. James Swarbrick of the University of North Carolina at Chapel Hill, Chairman; Dr. William Higuchi of the University of Utah; Dr. Douglas Mendenhall of Abbott Laboratories; Dr. Anthony Sinkula of The Upjohn Company; and Dr. George Zografi of the University of Wisconsin. For the past three years, Dr. Swarbrick has served as a member of the Basic Pharmacology Advisory Committee. The primary task of the pharmaceuticals committee is to review the research proposals and *curricula vitae* of the applicants and make recommendations to the Foundation's Board for support of the most highly qualified candidates.

The fellowship pays tuition, an annual stipend of \$6,552 and \$500 each year for incidentals directly associated with the thesis research, such as books, travel and secretarial assistance. Because the fundamental aspects of pharmacokinetics are covered by the program in basic pharmacology and toxicology, applications and awards in the advanced predoctoral fellowship program in pharmaceuticals will be restricted to basic pharmaceuticals, biopharmaceuticals and pharmaceutical technology. These areas also happen to be the ones with the greatest shortages of qualified personnel.

The Pharmaceuticals Fellowship Program will begin with eight fellowships and an application deadline of February 1, 1987. The starting date for the award will be July 1, 1987.

Maurice Q. Bectel
President

The Pharmaceutical Manufacturers Association Foundation is a nonprofit organization, established in 1965 to promote public health through scientific and medical research. It provides funding for basic research on drugs and for educational training programs in basic and clinical pharmacology and toxicology. Since its formation, approximately \$20 million has been authorized by the PMA Foundation for a variety of workshops, conferences, research projects, and educational programs. Of this amount, slightly more than \$5 million has been used to support research and approximately \$15 million has gone into educational awards. The Foundation continues to provide financial assistance for scientific meetings and small amounts for publications.

Virtually all of the 1986 grants and awards were made within programs sponsored by the Foundation. These include three faculty-level programs of salary and fringe benefit support, four fellowship programs, two post-doctoral—one at the advanced predoctoral level and one at the medical student level—plus a program of research starter grants for beginning investigators wishing to move into areas of independent research. An award to assist in expediting the research efforts of new clinical pharmacology units or those with new directors is also available.

Through these programs in 1986, the Foundation assisted an additional 57 individuals. All of these individuals were helped at a critical time in their professional development. The Foundation has, in its 20 years of existence, helped about 1,000 individuals through its research and educational support program. A twenty-year historical perspective outlining Foundation activities was prepared in 1985 and is available from the PMA Foundation office.

EDUCATION AND TRAINING PROGRAMS

To further its objectives in the field of education, the PMA Foundation sponsors four programs in clinical pharmacology, one in the combined field of pharmacology-morphology, one in pharmacology or toxicology, one in basic pharmacology, one in toxicologic pathology and one in pharmaceuticals.

CLINICAL PHARMACOLOGY

Faculty Awards in Clinical Pharmacology

The four clinical pharmacology programs provide opportunities at the student, fellow and faculty levels. Through the Faculty Development Awards in Clinical Pharmacology program, the Foundation makes two-year awards to medical schools for salary and fringe benefits support of full-time junior faculty members with the opportunity for a third year. However, in 1986, the Clinical Pharmacology Advisory Committee decided to offer the program for three years beginning with the 1988 awards, thus eliminating the

third-year option. The Foundation has set a ceiling of \$30,000 on the amount of its participation in total yearly salary and fringe benefits for any candidate.

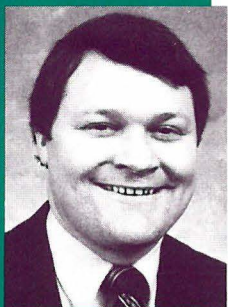
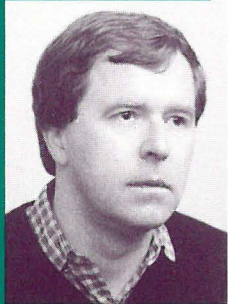
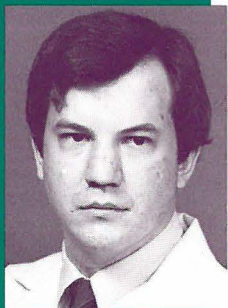
With the awards scheduled to begin July 1, 1987, 78 individuals have been supported under this program since 1967.

Recipients of the three awards to begin July 1, 1987 are:

Matthew E. Knight, M.D., Assistant Professor, Pediatrics and Pharmacology, University of Florida. Dr. Knight's research studies the effect of hyperoxia on β receptor stimulation induced surfactant release. The development of the fetal/neonatal lung surfactant system is under the influence of many physiologic factors. During labor, fetal catecholamine levels are very high coincident with an increase in pulmonary surfactant appearance. Thus, Dr. Knight contends that the β receptor in the lung may have a central role in surfactant maturation. Hyperoxia has been shown to cause a reduction (synthesis and release) in pulmonary surfactant. Dr. Knight will perform studies to show the developmental response as well as the influence of hyperoxia on the β receptor stimulation of surfactant release.

Ullrich Schwertschlag, M.D., Ph.D., Assistant Professor of Medicine, Duke University Medical Center. Dr. Schwertschlag's research will focus on the effect of platelet activating factor on vascular tone. The long-term objectives of this proposal are to define the role of platelet activating factor (PAF) on vascular tone and to study the production of PAF by renal tissues. Preliminary studies have shown PAF to be a vasodilator in the isolated perfused rat kidney (IPK). Pretreatment of the IPK with PAF attenuated the response to ANG II but not to norepinephrine. Dr. Schwertschlag proposes that these effects are at least in part mediated by PAF-induced changes in Ca^{2+} metabolism in vascular smooth muscle cells (VSMC), perhaps resulting from alterations in phosphatidylinositol (PI) turnover or indirect effects of PAF on ANG II-mediated PI turnover and Ca^{2+} intake.

Lyle Amos Siddoway, M.D., Assistant Professor, Medicine, Division of Clinical Pharmacology, The Johns Hopkins Hospital. Dr. Siddoway will study the clinical importance of polymorphic metabolism of antiarrhythmic drugs. Pharmacokinetics and concentration-response relations during coadministration of antiarrhythmic drugs linked to the debrisoquine pathway will be analyzed with special attention to potential pharmacokinetic and metabolic interactions. In one of Dr. Siddoway's projects, mexiletine and propafenone, both of which have been reported to inhibit debrisoquine metabolism *in vivo*, will be analyzed individually and in combination for treatment of refractory ventricular arrhythmias. Antiarrhythmic efficacy, electrophysiology and toxicity of the combination will be assessed in extensive and poor metabolizers, and oral clearance and plasma concentrations of the two drugs during single-drug and combination therapy will be compared.



Those individuals whose awards began July 1, 1986 are:

William J. Elliott, M.D., Ph.D., Assistant Professor of Medicine, University of Chicago.

Desmond Fitzgerald, M.D., Instructor in Medicine and Pharmacology, Vanderbilt University.

Douglas G. Roberts, M.D., Assistant Professor of Pediatrics and Pharmacology, Wayne State University School of Medicine.

Theodore Wang, M.D., Assistant Professor of Medicine, Tulane Medical Hospital and Clinic.

Those individuals who entered the second year of their awards in 1986 are:

Eric P. Brass, M.D., Ph.D., Assistant Professor, Medicine and Pharmacology, Division of Clinical Pharmacology and Toxicology, University of Colorado Health Sciences Center.

William Steven Dalton, M.D., Ph.D., Clinical Instructor, Section of Hematology/Oncology, Department of Internal Medicine, Health Sciences Center, The University of Arizona. Dr. Dalton was approved for a third year of his award.

Phyllis I. Gardner, M.D., Assistant Professor of Medicine, Stanford University Medical Center. Dr. Gardner was approved for a third year of her award.

Ruth Margrit Ruprecht, M.D., Ph.D., Assistant Professor, Dana-Farber Cancer Institute, Harvard Medical School. Dr. Ruprecht was approved for a third year of her award.

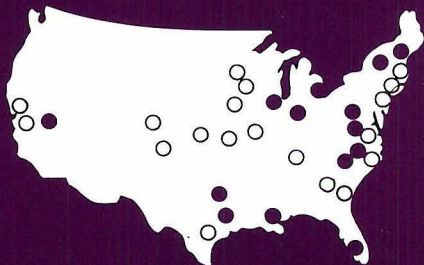
Those who concluded their awards in 1986 are:

Marc S. Ernstoff, M.D., Assistant Professor of Medicine, Department of Internal Medicine/Medical Oncology, Yale University School of Medicine.

Marilynn C. Frederiksen, M.D., Assistant Professor, Department of Obstetrics and Gynecology, Northwestern University Medical School.

Howard R. Knapp, Ph.D., M.D., Assistant Professor, Department of Pharmacology and Medicine, Vanderbilt University School of Medicine.

Charles E. Riggs, Jr., M.D., Assistant Professor, Department of Internal Medicine, University of Iowa College of Medicine.



Geographical distribution of Foundation awards under the "Faculty Development Awards in Clinical Pharmacology" program, 1967-1986.

- One
- More than one

Fellowships for Careers in Clinical Pharmacology

The second program provides Fellowships for Careers in Clinical Pharmacology. This award offers 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 the basic pharmacologic sciences needed to complement his clinical skills.

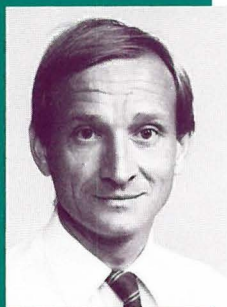
The program was amended in 1982 to allow an individual to apply for a fellowship two years in advance of the activation date of the award. For example, those applying for a fellowship in the Fall of 1987 may elect to ask that the fellowship begin July 1988 or July 1989.

The first awards under this program were made in 1973. Since that time, 41 fellowships have been awarded.

Recipients of the three fellowships beginning July 1, 1987 are:

Dawn Merton Boothe, D.V.M., Department of Veterinary Physiology and Pharmacology, College of Veterinary Medicine, Texas A&M University. Dr. Boothe's research involves the disposition kinetics of antipyrine, diazepam and indocyanine green as predictors of altered drug metabolism induced by liver disease in the dog. Pharmacokinetics of a flow-limited drug (indocyanine green), a capacity-limited, binding-insensitive drug (antipyrine) and a capacity-limited, binding-sensitive drug (diazepam) will be measured using plasma concentrations (*in-vivo*) studies and microsomal assay (*in-vitro*) techniques in 6 normal dogs (control group). The same kinetic studies will be performed in dogs with liver disease at various stages. Relationships will be estimated three ways: (1) between *in vivo* and *in-vitro* kinetics for each drug; (2) between each stage of liver disease for each drug; and (3) between drug kinetics, clinical pathology and histopathology.

Christian Leon Hadrzynski, M.D., Pediatric Clinical Pharmacology, University of Texas Medical Branch at Galveston. Dr. Hadrzynski research is designed to investigate nucleophile blockade of phenytoin teratogenicity. Fetal hydantoin syndrome leads to mental retardation, cleft palate or other birth defects in 600 to 1200 infants born each year in the U. S. to approximately 6,000 pregnant women taking phenytoin (Dilantin, diphenylhydantoin) for treatment of epilepsy. The long-term objective of this project is to develop a chemically rational antidote to prevent phenytoin-induced birth defects. The studies proposed by Dr. Hadrzynski will use a mouse animal model to test the hypothesis that fetal hydantoin syndrome results from formation of a toxic metabolite (arene oxide or epoxide) of phenytoin, and that this electrophilic metabolite may be inactivated *in vivo* by binding to intracellular glutathione, a nucleophile.



Those individuals whose fellowships began July 1, 1986 are:

Patrick Taylor Horn, M.D., Ph.D., Division of Clinical Pharmacology, University of Minnesota.

Richard D. Huhn, M.D., Fellow in Clinical Pharmacology, Department of Medicine, Brown University.

Susan L. Kelley, M.D., Fellow in Medical Oncology, Department of Pharmacology, Yale University School of Medicine (for one year).

Therese M. Kitt, Fellow in Clinical Pharmacology, Department of Pharmacology, Internal Medicine, University of Iowa.

Thomas C. Shea, M.D., Cancer Pharmacology Division, Harvard University, Dana-Farber Cancer Institute.

Those individuals who entered the second year of their fellowships in 1986 are:

David Hayden S. Iansmith, A.B., M.D., Ph.D., Clinical and Research Fellow, Division of Cardiology and Clinical Pharmacology, Vanderbilt University.

Sidney Alexander Scudder, M.D., Fellow, Division of Oncology, Stanford University.

James R. Voelker, Ph.D., Post-doctoral Fellow, Clinical Pharmacology, Indiana University. Dr. Voelker was awarded a third year of his award.

Those individuals whose awards concluded in 1986 are:

Nancy Jo Braden, M.D., Fellow, Department of Pediatrics, the Ohio State University College of Medicine.

Gregory G. Gaar, M.D., Fellow, Department of Pediatrics and Pharmacology, University of Arizona College of Medicine.

Celine M. Stahl, M.D., Fellow, Department of Pharmacology and Medicine, Cornell University Medical College.

Geographical distribution of Foundation "Fellowships for Careers in Clinical Pharmacology" program, 1973-1986.

- One
- More than one

Medical Student Research Fellowships in Pharmacology-Clinical Pharmacology

The third program is the Medical Student Research Fellowships in Pharmacology-Clinical Pharmacology. This program, which began in 1974, provides students an opportunity to spend up to one year full-time conducting an investigative project in pharmacology-clinical pharmacology. The minimum period of the award is three months. It is hoped that by having students become involved in investigative projects at a point when career choices are still relatively flexible, they will opt for research careers in clinical pharmacology. Seventy-six awards have been made since 1974.

Those individuals who received awards during 1986-87 are:

Stephen A. Back, University of California, Irvine, has a twelve-month fellowship. His principal advisor is Dr. Charles Gorenstein, Assistant Professor, Department of Pharmacology.

Christopher D. Breder, University of Chicago, Pritzker School of Medicine, has a four-month fellowship. His principal advisor is Leon I. Goldberg, M.D., Ph.D., Professor and Chairman, Department of Pharmacology.

Theodore D. Chung, University of Maryland, School of Medicine, has a twelve-month fellowship. His principal advisor is Laure Aurelian, Ph.D., Professor of Pharmacology and Experimental Therapeutics.

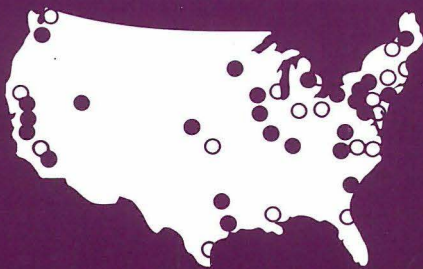
Paul Arthur Leonard, University of Iowa has a twelve-month fellowship. His principal advisor is Dr. John Paul Long, Carver Professor of Pharmacology.

Ann Marie Morvai, Ohio State University, College of Medicine, has a three-month fellowship. Her principal advisor is Dr. Philip D. Walson, M.D., Chief, Clinical Pharmacology/Toxicology.

Amelia A. Russo, University of California, Irvine has a twelve-month fellowship. Her principal advisor is Andrej Rotter, Ph.D., Assistant Professor, Department of Pharmacology.

Thomas Patrick Shanley, University of Chicago, has a twelve-month fellowship. His principal advisory is William Woolverton, Ph.D., Research Associate, University of Chicago, Pritzker School of Medicine.

James Paul Wymer, University of Maryland, has a twelve-month fellowship. His principal advisor is Laure Aurelian, Ph.D., Professor of Pharmacology and Experimental Therapeutics.



Geographical distribution of Foundation "Medical Student Research Fellowships in Pharmacology-Clinical Pharmacology" program, 1974-1986.

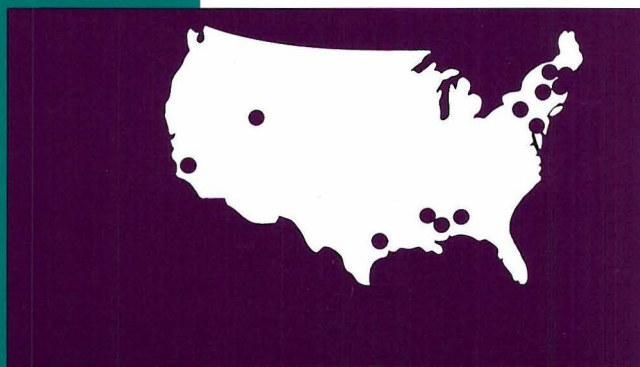
- One
- More than one

Clinical Pharmacology Unit Support

This program is designed to assist directors of clinical pharmacology units established within the prior two years of the award and for units with a change in directorship during that period. The grant provides a total of \$50,000 which may be used at any time during a three-year period. The program is aimed at providing some initial funds to enable the unit's research efforts to be maintained until other research grants are obtained. The first grants were made in 1978. The total number of awards made to date is fourteen.

The award beginning July 1, 1986 was made to:

Division of Clinical Pharmacology, University of Alabama at Birmingham. Robert B. Diasio, M.D., Professor of Medicine, Hematology-Oncology, and Director and Senior Scientist, Pharmacology Program of the Cancer Center, was made Director of the Division. The division's general research interest lies in two major areas. The first is to set up a dedicated laboratory to be used for drug analysis and clinical pharmacologic and pharmacokinetic studies, particularly of new drugs. Another major interest of the division is to better understand how drugs are metabolized in man. In addition to studies of drugs in man, an attempt will be made to study drug metabolism in laboratory models including the use of isolated human hepatocytes and human intestinal microflora in semi-continuous culture and lastly the use of human bone marrow and human tumor to screen drugs for anticancer as well as host toxicity.



Geographical distribution of Foundation "Clinical Pharmacology Unit" program, 1978-1986.

- One
- More than one

BASIC PHARMACOLOGY

Faculty Development Awards in Basic Pharmacology

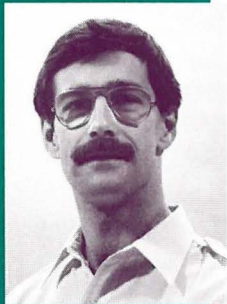
The purpose of these Faculty Development Awards is to strengthen basic pharmacology by helping maintain existing academic capability and, ultimately, to expand it by enlarging the faculty base. To accomplish these goals, support is provided to full-time junior faculty members committed to careers in pharmacology who give promise of outstanding accomplishments.

The first awards were made in 1973 and continue to be for a two-year period. The program provides salary and fringe benefits. The Foundation has set a ceiling of \$25,000 on the amount of its participation in the total yearly salary and fringe benefits for awardees. The total number of awards made to date is 40.

Those who will receive awards beginning July 1, 1987 are:

Edward T. Morgan, Ph.D., Assistant Professor, Department of Pharmacology, Emory University. Dr. Morgan's research centers around growth hormone regulation of sexually differentiated hepatic isozymes of cytochrom P-450. The sexually differentiated expression of at least two hepatic isozymes of rat cytochrome P-450 is regulated by the episodic pattern of pituitary growth hormone (GH) secretion. As a primary approach to elucidation of the mechanism of GH action, cDNAs and genes for GH regulated P-450 isozymes will be cloned. The cloned cDNAs will be used subsequently to clone the genomic, GH-regulated P-450 genes and 5' flanking regions. In time course of GH induction and repression of P-450 proteins and mRNAs, and the role of insulin in regulation of expression of the sexually differentiated isozymes will be investigated. In particular, the question of whether insulin acts directly on the liver to regulate P-450 isozymes will be addressed.

Rick G. Schnellmann, Assistant Professor, Department of Physiology and Pharmacology, the University of Georgia. Dr. Schnellmann's research will deal with the mechanisms of halogenated hydrocarbon (HH)-induced nephrotoxicity. The main objective of his research is to determine the mechanism(s) by which HH induce toxicity to kidney mitochondria. Using a well-defined suspension of rabbit proximal tubules, and two model HHs, experiments are designed to (1) selectively probe mitochondrial function in the tubule itself and in isolated mitochondria to identify the site of toxicity; and (2) determine whether altered mitochondrial function is the result of protein alkylation or oxidation. The critical importance of this work is easily seen. By understanding how these chemicals induce toxicity, it may be possible to (1) alter their structure to maintain their usefulness but not their toxicity; (2) develop antidotal treatments, and (3) gain a better understanding of normal cellular function.





Rochelle D. Schwartz, Assistant Professor, Department of Pharmacology, Duke University. Dr. Schwartz's major focus of research is to study the regulation of the "symbol"-aminobutyric acid (GABA) receptor/chloride ion channel in brain. This will be accomplished using both receptor binding assays and a functional assay of GABA receptor activity, chloride transport in brain vesicles. The cellular mechanisms controlling GABA receptor activity (i.e. desensitization, alterations in phospholipids and phosphorylation) will be investigated. Subsequently, the role of these cellular processes in the pharmacologic regulation of this receptor complex in vivo will be examined.

Those who received awards beginning July, 1986 are:

Kelvin W. Gee, Ph.D., Assistant Professor, Department of Pharmacology, University of Southern California.

Jonathan Maybaum, Ph.D., Assistant Professor, Department of Pharmacology, University of Michigan.

Entering the second year of his award in 1986:

William Thomas Gerthoffer, Ph.D., Assistant Professor, Department of Pharmacology, University of Nevada School of Medicine.

Those whose awards concluded in 1986 are:

James R. Halpert, Ph.D., Assistant Professor, Department of Pharmacology and Toxicology, University of Arizona College of Pharmacy.

Kevin M. Mullane, Ph.D., Assistant Professor, Department of Pharmacology, New York Medical College.

Nancy Zahniser, Ph.D., Assistant Professor, Department of Pharmacology, University of Colorado School of Medicine.



Geographical distribution of Foundation awards under the "Faculty Development Awards in Pharmacology" program, 1973-1986.

- One
- More than one

Fellowships for Advanced Predoctoral Training in Pharmacology or Toxicology

The program, offered initially in 1977, is designed to assist those candidates who have one or two years remaining in their predoctoral training, the time during which they are engaged in their thesis research.

The fellowship program provides a stipend of \$6,552 a year, payment of tuition and \$500 a year for incidentals directly associated with the thesis research preparation. The program has been funded to provide eight fellowships each year. However, because of the exceptional quality of the applications and additional funds available, ten additional fellowships were authorized for 1987. A total of 112 fellowships have been made since 1977.

Those who will receive fellowships which begin between January and August 1987 are:

Que T. N. Bui, Texas A&M University, Medical Pharmacology and Toxicology. Her advisor is Dr. James Way, Professor, Medical Pharmacology and Toxicology. Ms. Bui will study cell carrier mechanisms in drug antagonism.

David Chatterjee, Brown University. His advisor is Dr. T. M. Savarese, Assistant Professor of Medical Science, Biochemistry, Pharmacology. Mr. Chatterjee will research proto-oncogene suppression by glutathione depleting agents in human colon carcinoma cells.

Trudy L. Cornwell, University of South Alabama, College of Medicine. Her advisor is Dr. Thomas M. Lincoln, Associate Professor, Department of Pharmacology. Ms. Cornwell's research is focused on the regulation of Ca^{2+} by guanosine 3',5' cyclic monophosphate (cGMP) in rat aortic smooth muscle cells.

Amy J. Davidoff, University of Rhode Island. Her advisor is Dr. Robert L. Rodgers, Assistant Professor, Department of Pharmacology and Toxicology. Ms. Davidoff's research will involve the effects of T_3 and insulin replacement therapy on cardiac functions of the diabetic-SHR.

Thomas E. Ellenberger, Harvard Medical School. His advisor is Dr. Stephen Beverley, Assistant Professor, Department of Pharmacology. Mr. Ellenberger's research is focused on the characterization of a drug resistance element in *Leishmania major*.

Laura A. Fink, Yale University. Her advisor is Len K. Kaczmarek, Ph.D., Professor of Pharmacology and Physiology. Ms. Fink's research is aimed at the modulation of neuronal excitability by inositol trisphosphate.

Gregory Howard Hockerman, University of Wisconsin Medical School. His advisor is Dr. Arnold Ruoho, Professor, Department of Pharmacology. Mr. Hockerman's research deals with identification of the beta adrenergic receptor ligand binding site.

Jonathan K. Ivins, University of Pennsylvania, School of Medicine. His advisor is Dr. Randall N. Pittman, Assistant Professor, Department of Pharmacology. Mr. Ivins' research is centered around the plasminogen activator inhibitor involvement in neurite outgrowth.

Anne Bennett Jefferson, Stanford University, School of Medicine. Her advisor is Dr. Howard Schulman, Associate Professor of Pharmacology. Ms. Jefferson's research involves the study of the activation of the Ca^{2+} /calmodulin-dependent protein kinase and its phosphorylation of MAP-2 *in vivo*.

Sheri Ann Keitz, Mount Sinai School of Medicine. Her advisor is Saul Maayani, Ph.D., Associate Professor, Department of Pharmacology. Ms. Keitz's research is directed toward kinetic studies of desensitization and functional antagonism between alpha and beta receptors in the isolated rabbit aorta.

Rita C. Lucas, Northwestern University Medical School. Her advisor is Dr. Paula H. Stern, Professor of Pharmacology. Ms. Lucas' research focuses on the role of polyamines in bone resorption stimulated by PTH or $1,25\text{-(OH)}_2\text{D}_3$.

James N. MacLeod, University of Pennsylvania, Department of Pathobiology. His advisor is Dr. Bernard H. Shapiro, Associate Professor, Department of Pathobiology. Mr. MacLeod's research looks toward the hormonal regulation of hepatic monooxygenase activity in the mouse.

Jean-Marc Mienville, Georgetown University. His advisor is Dr. E. Costa, Director, Fidia-Georgetown Institute for the Neurosciences. Mr. Mienville will perform a patch clamp study of the modulation of the GABA receptor-chloride ionophore complex in dissociated rat cortical neurons.

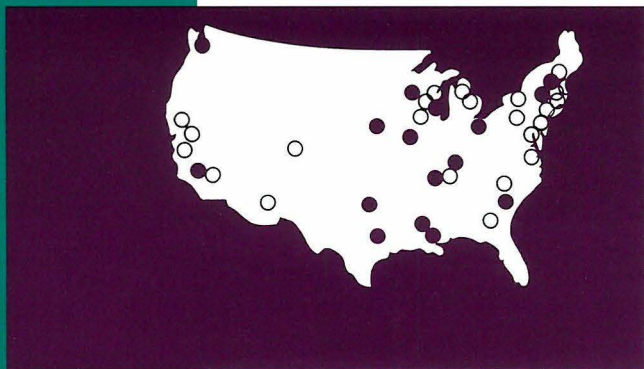
Christopher Miller, Michigan State University. His advisor is Dr. Lawrence J. Fischer, Professor, Department of Pharmacology/Toxicology. Mr. Miller's research involves *in vitro* pancreatic islet cell culture systems as models for the study of diabetogenic chemicals.

Jodi M. Nunnari, Vanderbilt University School of Medicine. Her advisor is Lee E. Limbird, Ph.D., Professor, Department of Pharmacology. Ms. Nunnari's research deals with the determination of the molecular basis of the Na^+/O_2 -adrenergic receptor interaction.

Patricia Tyson, SUNY Health Science Center at Syracuse. Her advisor is Dr. Marcia Steinberg, Associate Professor, Department of Pharmacology. Ms. Tyson's research is directed toward conformational states of the Na,K -ATPase.

Todd Verdoorn, University of North Carolina, Chapel Hill. His advisor is Dr. Raoumond Dingledine, Associate Professor, Department of Pharmacology. Mr. Verdoorn's research is directed toward pharmacological studies of rat brain excitatory amino acid receptors expressed in xenopus oocytes.

Mark Scott Williams, University of Michigan, Ann Arbor. His advisor is William R. Mancini, Assistant Professor, Department of Pharmacology. Mr. Williams will research the mechanism of cytotoxicity for 3'-amino-2',3'-dideoxycytidine.



Geographical distribution of Foundation awards under the "Fellowships for Advanced Predoctoral Training in Pharmacology/Toxicology" program, 1972-1986.

- One
- More than one

Fellowship Awards in Pharmacology-Morphology

The aim of this program is to advance understanding of drug action through the discovery of specifically related cellular and tissue changes; and, concurrently, to uncover associations between normal and abnormal function in particular tissue and cellular structure.

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. Since 1968 when the first fellowships were offered, 64 awards have been made.

The program requires that the candidate be qualified primarily either in a morphologic specialty or in pharmacology. However, training to be achieved under the fellowship in the complementary discipline need not be formal. The candidate's program should result in a familiarity with a new discipline approach by using his primary discipline as a medium for acquiring the second.

The recipients of the fellowships which began July 1, 1986 are:

Annette L. Kirchgessner, Ph.D., Columbia University, College of Physicians and Surgeons, Department of Anatomy and Cell Biology. Dr. Kirchgessner intends to test the hypothesis that the intrinsic primary afferent neurons of the enteric nervous system are submucosal pseudounipolar neurons that project to the mucosa and myenteric plexus, and receive no synaptic input. Candidate neurons will first be identified and double-labeling techniques and characterized physiologically. Putative transmitters will be examined immunocytochemically. Responsiveness of the cells to mucosal pressure and serotonin (5-HT) will be evaluated physiologically to be certain that primary afferent neurons, as predicted, become active when stimulated by 5-HT and pressure. Finally, the characterization of the response will be determined pharmacologically to be certain that responses to pressure and 5-HT are mediated by enteric-type 5-HT receptors, a unique third type of 5-HT receptor.



Diane L. Rosin, Ph.D., Yale University, Department of Pharmacology. Dr. Rosin proposes to prepare monoclonal antibodies directed against the phosphorylated (activated) and unphosphorylated (native) forms of tyrosine hydroxylase in brain sections by immunohistochemistry. This technique will be applied to an *in vivo* assessment of the functional activity of dopamine (DA) neurons following various pharmacological and environmental stimuli which stimulate DA synthesis. In addition, the role of phosphorylation in regulation of DA synthesis will be evaluated immunohistochemically. These anatomical and biochemical studies will focus on a comparison of DA systems in which presence (nigrostriatal) or absence (mesoprefrontal) of synthesis-modulating DA receptors has been demonstrated and the results should indicate differences in regulatory mechanisms in these two biochemically and pharmacologically heterogeneous systems.

Faith Winningham-Major, Ph.D., Vanderbilt University, Department of Pharmacology. Dr. Winningham-Major's project is designed to determine the effects of the calcium modulated protein, S100, in normal cellular functions and in mechanisms of pathophysiology. She plans to investigate: (1) the levels of S100 in rat C6 glioma cells and conditioned media as a function of cellular growth in the untreated cell; (2) the effects of drugs, hormones and growth factors on intracellular and secreted S100 levels; (3) the existence of an S100 receptor on rat PC12 cells; (4) the effects of drugs, hormones, and growth factors on S100 receptor binding, neurite extension factor activity, and S100 binding proteins. The primary objectives of this research project are to determine the effects of drugs, hormones, and growth factors on S100 function and to determine the effects of these agents on the intracellular levels and cellular secretion of S100.

Those who entered the second year of their fellowship in 1986 are:

Paul J. Millard, Ph.D., Department of Pharmacology, Cornell University.

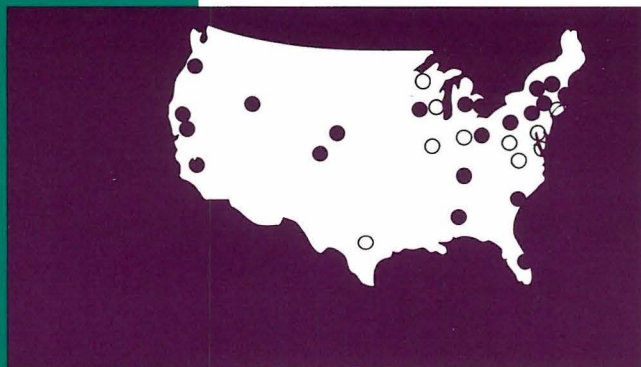
Gary M. Mawe, Ph.D., Department of Anatomy and Cell Biology, College of Physicians and Surgeons of Columbia University.

Those individuals whose fellowship concluded in 1986 are:

Robert S. Garofalo, Ph.D., Department of Anatomy and Cell Biology, College of Physicians & Surgeons of Columbia University.

Michele S. Moss, Ph.D., Department of Obstetrics, Gynecology & Reproductive Sciences, University of California, San Francisco.





Geographical distribution of Foundation "Fellowship Awards in Pharmacology-Morphology" program, 1968-1986.

- One
- More than one

Faculty Awards in Toxicologic Pathology

This award began as a pilot program in 1983 and was made permanent in 1985. It was developed to attract scientists interested in analyzing, reviewing and questioning, where appropriate, the present state of the art in the field of toxicology. The goal of the program is to attract veterinary and comparative pathologists who are interested in spending two years in drug toxicology research. In 1986 one award was made, bringing the total number of awards to nine.

Receiving the award to begin July, 1987:

Michael W. Conner, D.V.M., Assistant Professor, Department of Pathology, Boston University. Dr. Conner plans to continue his work in two areas. The first area is drug-induced testicular injury. The purpose of these studies is to evaluate, in rats, the functional significance of drug-induced changes in testicular morphology and rates of sister chromatid exchange. Emphasis will be placed upon the effects of antineoplastic chemotherapeutic agents, drugs which are known to injure rapidly dividing cell populations such as are present in the testis. Dr. Conner also will be studying the effects of surface chemistry on the pulmonary toxicity of ultrafine metal oxide particles. Of particular interest in these studies are the effects of sulfur dioxide and water vapor on particle chemistry and toxicity since these gases, which are substrates for formation of sulfuric acid, are present during formation of metal oxide particles generated by fossil fuel combustion.

Those who received awards beginning July, 1986 are:

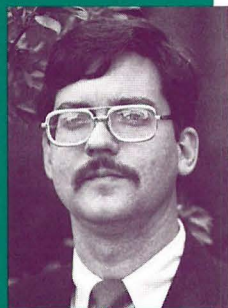
Merl F. Raisbeck, D.V.M., Ph.D., Assistant Professor, Department of Veterinary Pathology, University of Missouri.

Dennis W. Wilson, D.V.M., Ph.D., Assistant Professor, Department of Veterinary Pathology, University of California, Davis.

Those who entered the second year of their award in 1986 are:

Kim Boekelheide, M.D., Ph.D., Assistant Professor, Department of Pathology and Laboratory Medicine, Brown University.

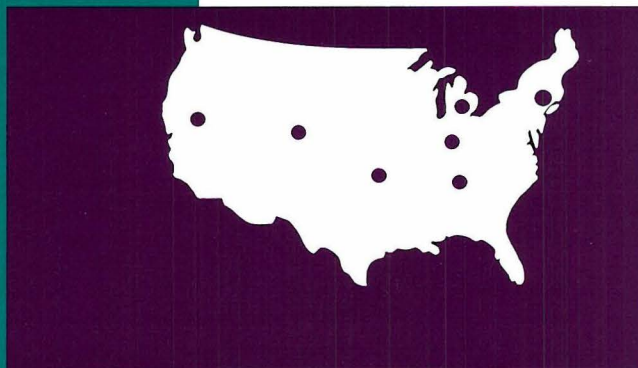
Kevin P. Keenan, D.V.M., Ph.D., Assistant Professor, Department of Pathology, University of Maryland at Baltimore.



Those individuals whose awards concluded in 1986 are:

R. Gayman Helman, D.V.M., Ph.D., Assistant Professor, Department of Veterinary Pathobiology, University of Tennessee College of Veterinary Medicine.

Richard K. Jensen, D.V.M., Ph.D., Assistant Professor, Department of Pathology, Michigan State University, College of Veterinary Medicine.

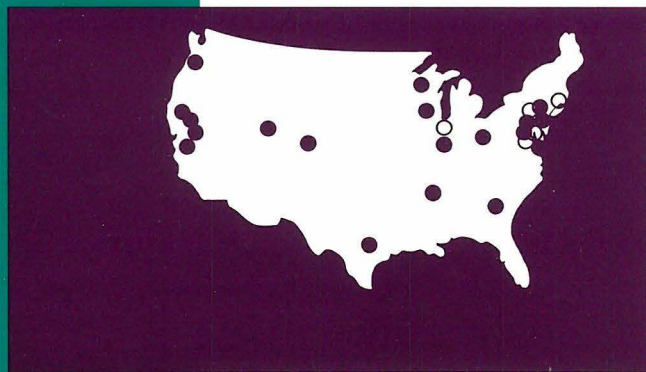


Geographical distribution of Foundation awards under the "Faculty Awards in Toxicology-Pathology" program, 1982-1986.

- One
- More than one

RESEARCH GRANTS

An important aspect of the PMA Foundation effort has been the support of fundamental research in drug toxicology. Between 1966 and 1971, 26 research awards of relatively large amounts for two to five years were awarded, principally to established investigators to either extend existing research or to provide "seed" monies to follow a promising lead. In 1971 a change in emphasis within the Foundation programs shifted the bulk of the funds into educational support programs and, therefore, less into research. It is understood, however, that these educational programs place high emphasis on the research programs of the applicants for each award. In this sense, these educational support programs are in fact also supporting research. The Foundation does, however, continue to accept requests for 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.



Geographical distribution of Foundation general research grants, 1966-1986.

- One
- More than one
- ★ Outside continental U.S.

Ethical Considerations

The Scientific Advisory Committee as well as the program advisory committees of the PMA 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, adherence to prevailing standards of ethical research practices, including Institutional Review Board approval before initiation of any research projects. In addition, for human research, assurance of informed consent will be required.

Research Starter Grants

As part of the change of emphasis in 1971 which sought to direct monies more toward the development of the individual, a program of Research Starter Grants was initiated. These grants are intended to provide financial support for beginning investigators. The program allows for approximately 20 research starter grants each year. The first awards were made in 1972. A total of 366 research starter grants have been made, including the 15 awards beginning January 1, 1987.

The recipients of the grants beginning January 1987 are:

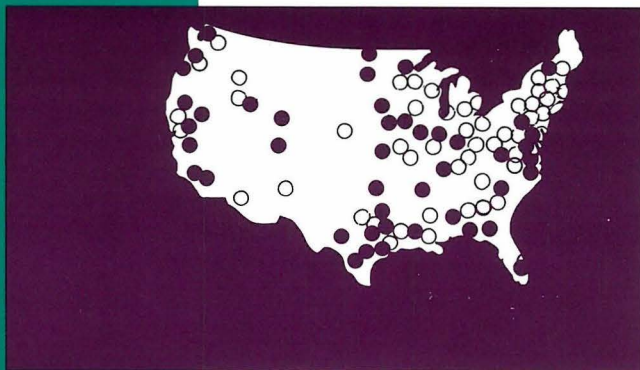
Rodrigo Andrade, Ph.D.
University of California, San Francisco
Sondra Hebert Berger, Ph.D.
University of South Carolina
School of Pharmacy
Frances M. Brodsky, D.Phil.
University of California, San Francisco
School of Pharmacy
Kim L. Rowse Brouwer, Ph.D.
University of North Carolina
Division of Pharmaceutics
Kenneth T. Cheng, Ph.D.
University of New Mexico
Daniel R. Doerge, Ph.D.
University of Hawaii
Margarethe Hoenig, D.V.M., Ph.D.
University of Georgia
College of Veterinary Medicine
Susan M. J. Dunn, Ph.D.
University of Iowa

Robert William Mercer, Ph.D.
Yale University
School of Medicine
Kip L. McGilliard, Ph.D.
Eastern Illinois University
Edward T. Morgan, Ph.D.
Emory University
School of Medicine
L. Bruce Pearce, Ph.D.
Harvard Medical School
Rick G. Schnellmann, Ph.D.
University of Georgia
College of Veterinary Medicine
John L. Szarek, Ph.D.
Marshall University
School of Medicine
Solomon Zimm, M.D.
University of California, San Diego

Based on need for funds, a review of the 20 research starter grantees whose awards began January 1, 1986 for a second year of the awards resulted in 16 of them having their awards continued. These are:

Alan P. Agins, Ph.D.
Brown University
Richard H. Alper, Ph.D.
University of Kansas
Kelvin W. Gee, Ph.D.
University of Southern California
Steven S. Gross, Ph.D.,
Cornell University
Robert P. Hartshorne, Ph.D.
Oregon Health Sciences University
Cecilia J. Hillard, Ph.D.
Medical College of Wisconsin
David S. Loose, Ph.D.
University of Texas Health Science Center,
Houston
Michael J. Meldrum, Ph.D.
University of Florida
S. M. Periyasamy, Ph.D.
Medical College of Ohio

Richard W. Pfeifer, Ph.D.
Purdue University
Gregory A. Reed, Ph.D.
University of Kansas
Daniel I. Sessler, M.D.
University of California, San Francisco
Paul F. Shanley, M.D.
University of Colorado Health Sciences Center
William L. Strauss, Ph.D.
University of Miami
Thea Dorothy Tlsty, Ph.D.
University of North Carolina at
Chapel Hill
Bryan K. Yamamoto, Ph.D.
Northeastern Ohio Universities
College of Medicine



Geographical distribution of Foundation awards under the "Research Starter Grants" program, 1972-1986.

- One
- More than one

OTHER SUPPORT

A special fund was made available to the PMA Foundation to provide support for projects in postmarketing drug monitoring. The Foundation decided to focus on providing a methodological grant. The intent of the grant was to fund studies aimed at extending or developing imaginative, feasible methodologies to systematically generate information about prescription medications as they are customarily used in the non-hospitalized population, with particular application to the study of adverse reactions.

Final year of support in 1986 for a one-time grant is:

Holly L. Mason, Ph.D., Assistant Professor of Pharmacy Administration, principal investigator, and **Robert K. Chalmers**, Ph.D., Professor of Pharmacy Practice, co-investigator, Purdue University School of Pharmacy and Pharmacal Sciences.

The methodology is designed to examine the possible role of community pharmacists in gathering information on prescription drugs from patients.

This project was completed on August 31, 1986, and a final report will be submitted in early 1987.

Foundation Programs

Name of Program	Number of Yearly Awards Budgeted/ Length of Award	Program Budget	Application Deadline Announcements/ Starting Times
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Clinical Pharmacology Advisory Committee

1. Faculty Awards in Clinical Pharmacology	3 budgeted/ 3 years	\$270,000 total \$ 30,000 per award/ per year	October 1 December 15 July 1
2. Fellowships for Careers in Clinical Pharmacology	4 budgeted/ 2 years	\$192,000 total \$ 24,000 per award/ per year	October 1 December 15 July 1
3. Medical Student Research Fellowships	6 budgeted 3 months to one year	\$ 36,000 total \$ 500 per month/ maximum \$6,000	January 15 March 15 July 1
4. Development Grants for Clinical Pharmacology Units	1 budgeted/ 3 years to use funds	\$ 50,000 per award	January 15 March 15 July 1

Basic Pharmacology Advisory Committee

5. Faculty Awards in Basic Pharmacology	3 authorized but only 2 funded/ 2 years	\$100,000 total \$ 25,000 per award/ per year	September 15 December 15 July 1
6. Research Starter Grants	20 budgeted 2 years	\$400,000 total \$ 10,000 per award/ per year	September 1 November 15 January 1
7. Advanced Predoctoral Fellowships in Pharmacology/Toxicology	8 budgeted 2 years	\$160,832 total \$ 10,052 per award/ per year	September 15 December 15 January 1

Pharmacology-Morphology Advisory Committee

8. Fellowships in Pharmacology-Morphology	3 budgeted 2 years	\$126,000 total \$ 21,000 per award/ per year	January 15 March 15 July 1
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Toxicology-Pathology Advisory Committee

9. Faculty Awards in Toxicologic-Pathology	1 budgeted/ 2 years	\$ 50,000 total \$ 25,000 per award per year	September 1 December 15 July 1
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Pharmaceutics Advisory Committee

10. Advanced Predoctoral Fellowship in Pharmaceutics	8 budgeted 2 years	\$160,832 total \$ 10,052 per award per year	September 1 November 15 July 1
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The PMA Foundation was established to promote the betterment of public health through scientific and medical research, with particular reference to the study and development of the science of therapeutics. In achieving this goal, the Foundation plans and initiates scientific and medical research activities, collects and disseminates the results of these activities, and provides financial support and aid to individuals or institutions whose purposes are scientific, educational or charitable.

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

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 who hold the highest promise of advancing the purposes of the Foundation.

Those areas not supported within the existing guidelines are:

(1) Research on specific drugs. 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.

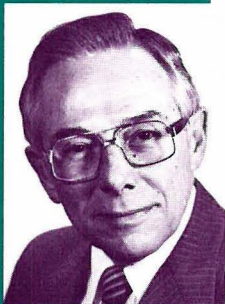
(4) Funds to cover entertainment costs.

In 1971, the Board of Directors authorized a major shift in program emphasis. While Foundation support of research continues, such support is to be primarily available in a redirected fashion, such as the Research Starter Grants program discussed on page 21.

In line with this change of emphasis, the Foundation is expanding support within its current educational programs as outlined in the Education and Training Programs Section on page 6.

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

REPORT OF THE TREASURER



Hazen L. Richardson

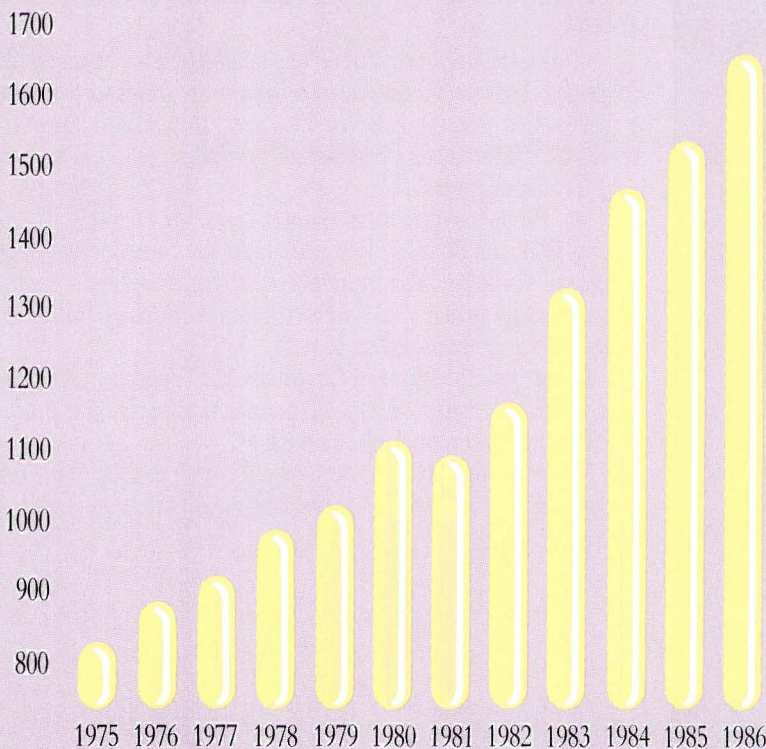
The total income of the Foundation in 1986 was \$1,777,102. Of this amount, \$1,666,350 came from contributions. The balance of \$110,752 came from investments, gain on sale of stock, and refunds of unexpended balances from grants.

Contributions were received from approximately four out of every five PMA Members Firms. Contributions were also received during 1986 from other groups in the health field.

Grants, Foundation-sponsored programs, special meetings and other expenses for 1986 amounted to \$1,573,786. Of this total, \$1,250,762 represent expenditures for grants. The total fund balance as of December 31, 1986 was \$2,754,531. 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, 1986, the contingency liability for 1987 was approximately \$2,254,159.

The Foundation's financial position as of December 31, 1986, has been audited by the Washington D. C. accounting firm of Buchanan & Company.

PMA Foundation Contribution Income 1975-1986 (Thousands)



Settlement of Income and Expenditures For the Year Ended December 31, 1986

Income

Contributions	1,666,350
Income from investments	70,449
Miscellaneous Income	<u>40,303</u>
Total Income	1,777,102

Expenditures

Grants — Note A	
Clinical Pharmacology Faculty Awards	240,000
Clinical Pharmacology Fellowships	163,709
Clinical Pharmacology Unit Support	77,447
Basic Pharmacology Faculty Awards	87,163
Medical Student Research Fellowships	39,500
Pharmacology-Morphology Fellowships	98,701
Research Starter Grants	308,000
Advanced predoctoral Fellowships	148,242
Toxicologic Pathology Faculty Awards	<u>87,500</u>
	1,250,762

Administrative, December Awardee

Meeting and Other Expenses	323,024
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TOTAL EXPENDITURES	1,573,786
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Excess of income over expenditures	203,316
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Operating Fund balance at January 1, 1986	1,014,010
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Operating fund balance December 31, 1986	1,217,326
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Future Commitment Fund (Reserve Fund)

(Note B)	<u>1,537,205</u>
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Total fund balance at December 31, 1986	2,754,531
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Note A — In addition to the amounts shown, the Foundation is committed, subject to annual review, to make certain grants. At December 31, 1986, the amounts still to be disbursed with respect to these grants amounted to approximately \$2,254,159 with approximately \$1,324,090 of this to be disbursed during 1987.

Note B — The Future Commitment Fund is a reserve fund established by the Foundation to ensure the continuation of existing grants.

Income from Investments	80,209
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Gain on Sale of Stock	<u>128,395</u>
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208,504

Less: Trust Commission Expense	<u>3,265</u>
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205,239

Future Commitment Fund Balance at

January 1, 1986	1,331,966
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Future Commitment Fund Balance at

December 31, 1986	1,537,205
-------------------------	-----------

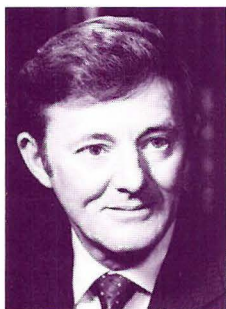
ORGANIZATION AND ADMINISTRATION

The PMA Foundation operates through its officers, Board of Directors and six advisory committees. In April, 1986, Irwin Lerner, President and Chief Executive Officer, Hoffmann-La Roche Inc., was re-elected Chairman of the Board, Albert Bowers, Ph.D., Chairman, President and Chief Executive Officer, Syntex Corporation, was re-elected Vice Chairman and Hazen L. Richardson, Vice President, Medical Products Department, E. I. du Pont de Nemours & Co., was elected Secretary-Treasurer. Mr. Maurice Q. Bectel served as the Foundation's President with Irwin C. Winter, M.D., Ph.D. and C. Joseph Stetler serving as staff consultants.

Officers and Staff



Irwin Lerner
Chairman



Albert Bowers, Ph.D.
Vice Chairman



Hazen L. Richardson
Secretary-Treasurer

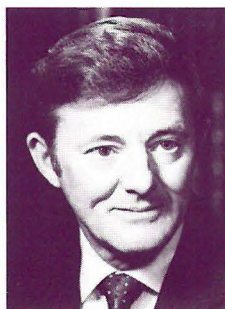


Maurice Q. Bectel
President

Board of Directors



Irwin Lerner
President and
Chief Executive Officer
Hoffmann-La Roche Inc.
Nutley, New Jersey
Chairman of the Board
PMA Foundation



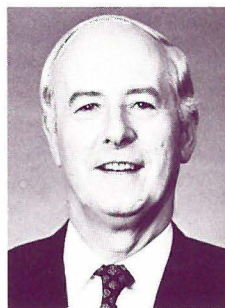
Albert Bowers, Ph.D.
Chairman and
Chief Executive Officer
Syntex Corporation
Palo Alto, California
Vice Chairman
PMA Foundation



Hazen L. Richardson
Vice President
Medical Products Department
E. I. du Pont de Nemours & Co.
Wilmington, Delaware
Secretary-Treasurer
PMA Foundation



Richard J. Kogan
President and
Chief Operating Officer
Schering-Plough Corporation
Madison, New Jersey



William R. Miller
Vice Chairman of the Board
Bristol-Myers Company
New York, New York



Jerry E. Robertson, Ph.D.
Executive Vice President
Life Sciences Sector
3M Company
St. Paul, Minnesota



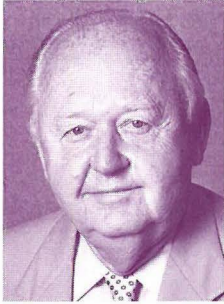
Joseph J. Ruvane, Jr.
Chairman and
Chief Executive Officer
Glaxo Inc.
Research Triangle Park, N.C.

Ex-Officio Member

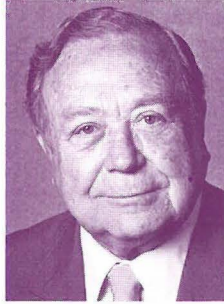
Gerald J. Mossinghoff
President
Pharmaceutical
Manufacturers Association



Staff Consultants



C. Joseph Stetler



Irwin C. Winter, M.D., Ph.D.

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Professor of Pharmacology
University of Medicine & Dentistry
of New Jersey
Newark, New Jersey

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Chairman

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Brown University
Providence, Rhode Island

Roy A. Ellis, M.D.
Senior Vice President-Medical Director
Pharmaceuticals Division
CIBA-GEIGY Corporation
Summit, New Jersey

Leon I. Goldberg, M.D., Ph.D.
Chairman, Committee on Clinical
Pharmacology

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Physiological Sciences
University of Chicago
Chicago, Illinois

Michael D. Gershon, M.D.
Professor and Chairman
Department of Anatomy & Cell Biology
Columbia University
College of Physicians and Surgeons
New York, New York

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Vice President

Drug Regulatory Affairs
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New Brunswick, New Jersey

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Vice President, Research & Development
Ayerst Laboratories
New York, New York

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Vice President, Drug Safety Assessment
Merrell Dow Pharmaceuticals Inc.
Cincinnati, Ohio

Walter F. Riker, Jr., M.D.
Revlon Professor of Pharmacology
Department of Pharmacology
Cornell University Medical College
New York, New York

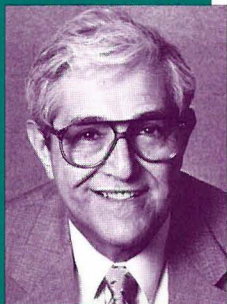
William K. Riker, M.D.
Professor and Chairman
Department of Pharmacology
University of Oregon
Medical School
Portland, Oregon

Jacob C. Stucki, Ph.D.
Pharmaceutical Research
The Upjohn Company
Kalamazoo, Michigan

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Professor and Chairman
Division of Pharmaceutics
University of North Carolina, Chapel Hill
School of Pharmacy
Chapel Hill, North Carolina

E. Leong Way, Ph.D.
Professor
Department of Pharmacology
University of California
School of Medicine
San Francisco, California

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Committee on Clinical

Pharmacology

Department of Pharmacological and

Physiological Sciences

University of Chicago

Chicago, Illinois

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Executive Director

Clinical Research

Merck Sharp & Dohme Research Laboratories

West Point, Pennsylvania

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Chairman

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Department of Pharmacology and

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Medical Investigator

Veterans Administration Hospital

Palo Alto, California

Louis Lemberger, M.D., Ph.D.

Director of Clinical Pharmacology

Lilly Laboratory for Clinical Research

and Psychiatry

Indianapolis, Indiana

Gilbert Mannering, Ph.D.

Professor

Department of Pharmacology

University of Minnesota

Medical School

Minneapolis, Minnesota

Philip S. Schein, M.D.

Vice President

Clinical Research & Development

Smith Kline & French Laboratories

Philadelphia, Pennsylvania

Albert Sjoerdsma, M.D., Ph.D.

President

Merrell Dow Research Institute

Cincinnati, Ohio

Lester E. Soyka, M.D.

Therapeutic Area Clinical Director

Bristol-Myers Research Center

Wallingford, Connecticut

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Drug Safety Assessment
Merrell Dow Pharmaceuticals Inc.
Cincinnati, Ohio

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Professor and Chairman
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University of Missouri
Columbia, Missouri

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Department of Veterinary
Microbiology, Pathology and
Public Health
Purdue University
School of Veterinary Medicine
West Lafayette, Indiana

G. H. Hottendorf, D.V.M., Ph.D.

Professor of Comparative Medicine
Medical University of South Carolina
Charleston, South Carolina

Paul M. Newberne, D.V.M., Ph.D.

Mallory Institute of Pathology
Boston University School of Medicine

Basic Pharmacology Advisory Committee

Edward J. Cafruny, M.D., Ph.D. (Chairman)

Dean of the Graduate School of
Biomedical Sciences
University of Medicine & Dentistry
of New Jersey
Professor of Pharmacology
Newark, New Jersey

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