

Florida A&M University: Impact of Private and Federal Funding on the Development of Graduate Pharmaceutical Education and Research

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SUMMARY. Federal, state, and private funding laid the foundation for both graduate pharmaceutical education and research in the Florida A&M University College of Pharmacy and Pharmaceutical Sciences. Initial (1973) Minority Biomedical Research Support Program funding led to the 1976 establishment of the M.S. program in pharmacology/toxicology. The MBRS program's maturation included the implementation of presubmission review procedures for grant proposals which yielded significant improvement in proposal competitiveness. From 1980 to 1984, the MBRS grant increased from six investigators to 12, and a 250% increase in funding. M.S. program success led to the Ph.D. program in pharmaceutical sciences (pharmacology/toxicology, medicinal chemistry, pharmaceuticals, and pharmacy administration) in 1985. The 59 other pharmacy schools with graduate programs produced 13 African Americans with Ph.D. degrees from 1984-89. Florida A&M University graduated 5 in April 1991 to become America's preeminent provider of such personnel. Three of the 5 were McKnight Fellows; all were supported by both MBRS and RCMI. Funds provided by the Centers for Disease Control/Agency for Toxic Substances and Disease Registry cooperative agreement with the Association of Minority Health Professions Schools led to implementation of a Ph.D. track in environmental toxicology in 1990. Federal and corporate funding assists graduate student support, and helped establish an endowed chair. The College successfully competed for a Research Centers at Minority Institutions grant in 1985 which has sparked an increase in refereed publications from 19/year in 1983-87, to 36 in 1989, an 89% increase. Five proposals were submitted in 1983, compared to 30 funded grants in 1990. Grant support increased from \$600,000 in 1983 to \$3.7 million in 1990. The College is now 11th among pharmacy schools in NIH (\$1.7 million) funding. The quality of library services and laboratory animal facilities has been enhanced.

INTRODUCTION

Historically Black or African American Colleges and Universities (HBCUs) have traditionally trained a disproportionately large number of the professionals who provide health care for underserved communities, and students who subsequently earn advanced degrees. The objective of this paper is to report on the impact of private and federal funding on the development of graduate pharmaceutical education and research in the Florida Agricultural and Mechanical University (FAMU) College of Phar-

macy and Pharmaceutical Sciences, the only Historically African American unit of the nine member State University System of Florida.

The Minority Biomedical Research Support (MBRS) Program provided the essential funding of \$23,000 in 1973 to begin research in the College. This funding laid the foundation for both research, and the graduate program which began in 1976 with the M.S. program in pharmacology/toxicology. The MBRS program reached a significant level in 1984, during the efforts of the College to win approval for the Ph.D. degree program in pharmaceutical sciences. Approval was granted and the first students admitted in January 1985 to the initial track, pharmacology/toxicology, with medicinal chemistry, pharmaceuticals, and pharmacy administration approved for the future. While MBRS and R01 supported research yielded significant contributions in several areas, the most notable are the patents of Henry J. Lee, Ph.D., for the highly potent, but less toxic derivatives of prednisolone (U.S. Patent No. 4,588,530, "Anti-inflammatory Prednisolone Steroids," 1986 and U.S. Patent No. 4,762,919, "Anti-inflammatory Carboxy Pregnan Derivatives," 1988).

The College qualified for the Research Centers at Minority Institutions (RCMI) program because of its Doctor of Pharmacy program, which began in January 1978, and the Ph.D. program. The College received the fourth most competitive priority score, and the largest award among the seven initial institutions to receive RCMI funding in 1985. The RCMI awards of both 1985 and 1990 have developed and continue to maintain the infrastructure necessary for a competitive graduate and research program. The impact of RCMI has been significant, measured in terms of the marked increase in the number of refereed publications, and the development of the Clinical Pharmacology Research Unit.

National Aeronautics and Space Administration funding has been realized for both student support, and significant research conducted as part of the Cosmos missions which were launched in 1987 and 1989, on the pineal gland, and ongoing research on stress. As a part of the cooperative agreement between the Association of Minority Health Professions Schools and the Centers for Disease Control and Agency for Toxic Substances and Disease Registry, the College received funding in 1988 to develop environmental toxicology as a track in the graduate program. The Ph.D. program has also attracted funding for students from the Florida Endowment Fund, Delores Auzenne Scholarship, Patricia Roberts-Harris Program, the American Foundation for Pharmaceutical Education, National Aeronautics and Space Administration, and the U.S. Department of Energy.

Pfizer Central Research awarded the first corporate fellowship for a

graduate student in 1990; The Procter & Gamble Company, Research and Development Department awarded a second graduate scholarship in 1991. Of universal benefit, is the entry of FAMU as a producer of minorities with the Ph.D. in pharmaceutical sciences. The seven graduates to date have entered postdoctoral training (4), and become employed (3) in academic institutions, with a pharmaceutical manufacturer, and a government agency. The first to complete postdoctoral training is now employed with a pharmaceutical manufacturer.

THE FOUNDATIONAL ESSENTIALITY OF THE MBRS PROGRAM

One of the maturing experiences that grew out of the MBRS program was the need to improve the quality of proposals through a review process prior to submission. In 1980, prior to the implementation of this procedure, an MBRS proposal entitled "Biochemical and Pharmacological Investigations" earned a priority score of 250. Subsequently, the program director organized an internal review by faculty members for a supplemental application. This proposal received a priority score of 219. In 1983, both the internal and external review procedures were employed on the renewal application, "Biochemical and Pharmacological Investigations," which subsequently received a priority score of 198. In that same year, a proposal was developed to host a national scientific meeting, the "Minority Biomedical Research Support Symposium," and it received a winning priority score of 198. A 1984 supplement to the MBRS parent grant received a priority score of 206. In 1985, applications for two proposals: the "Research Centers at Minority Institutions (RCMI), Florida A&M University Research Center," and the "MBRS Thematic Grant Program: Chronopharmacological and Chronotherapeutic Investigations," were reviewed and subsequently received priority scores of 165 and 126, respectively (1).

The internal review involves fellow scientists who critically evaluate and make suggestions on the proposal. These individuals, who may not be active in the same area of research, can make useful observations on the focus, clarity, and completeness of the proposal. In contrast, the external review involves scientists who are devoid of any affiliation with the principal investigator. The College of Pharmacy retains a pool of

external reviewers, and its RCMI advisory committee members for this purpose. Investigators have the option of nominating alternate reviewers.

MINORITY BIOMEDICAL FUNDING AND RESEARCH TOPICS 1988-92

FAMU has continued receiving MBRS funding since 1973. The latest NIH/MBRS notice of grant award shows that FAMU received a total of \$3.5 million (direct and indirect costs) for the period of March 1989-February 1993 (Table 1). That brings the funding level to an overall total of 11.4 million dollars since 1973. Recipients of the MBRS award were faculty from the College of Pharmacy and Pharmaceutical Sciences as well as the College of Arts and Sciences as shown in Tables 1-5.

The objectives of the current award are to expand and strengthen the capabilities of FAMU investigators in the area of biomedical sciences research, to provide undergraduate students with hands-on experience in the fundamentals of scientific research, and to motivate them to pursue biomedical research careers. It also has the purpose, to train graduate students in the state-of-the-art research in the biomedical sciences with emphasis on pharmacology, toxicology, medicinal chemistry, biochemistry or molecular biology. Tables 2, 3, 4 and 5 provide a detailed accounting of principal investigators, their funding, and research topics for 1984-89, 1981-84, 1978-81 and 1973-78, respectively. Table 6 shows that over the several award periods, 996 students (930 undergraduate and 66 graduate) have received MBRS support. Ninety percent of the students were African American, and 10% were Hispanics and Asian-Americans.

The MBRS support of undergraduate students (Table 7) allows them time to focus on solving a research problem designed to develop their understanding of the science. Most undergraduates present a paper(s) at the annual MBRS Symposium, America's largest gathering of minority scientists, and students. The students also present their research results at other meetings (American Society of Pharmacology and Therapeutics, Society of Toxicology, Federation of American Societies of Experimental Biology, and the American Chemical Society) where they gain valuable experiences and perspectives on research careers. A common experience of undergraduate students is being mistaken for graduate students as a result of their professional handling of both the presentation and resulting questions. It is our assessment that both the presentation and laboratory

Table 1. MBRS Principal Investigators, Funding Level and Research Topics, 1989-1993.

Principal Investigator	Research Topic	1989-1993
Blyden, G. T	Clinical Pharmacology	\$ 211,787
Dhanarajan, Z. C. ^a	Biochemistry	271,609
Early, II, J. L.	Selenium-Induced Hyperglycemia	259,898
Fitzgerald, T. J.	Synth. Med. Chem./Colchicine	316,864
Friedman, R. O. ^b	Biological Sciences	117,013
Hamilton, F. D. ^a	Biochemistry	133,251
Lee, H. L.	Synth. Med. Chem./Steroids	140,551
Ollapally, A. P. ^a	Synth. Org. Chem./Anticancer	216,799
Redda, K. K.	(Administration Grant)	271,770
Redda, K. K.	Synth. Med. Chem./N-Heterocyc.	345,526
Soliman, K. F.	Neuropharmacology/Physiology	156,892
Soliman, M. I.	Chronopharmacology	124,770
Total direct cost:		\$2,566,730
Indirect cost:		<u>949,673</u>
Overall Total:		\$3,516,403

^aChemistry department.

^bBiology department.

skills of an undergraduate student of two years' training are equivalent to those of a first-year graduate student. Moreover, MBRS students are found to be more likely than their non-MBRS counterparts to enter graduate school. Former students are recipients of: doctor of philosophy degrees in pharmacokinetics, pharmacology/toxicology, and biochemistry; doctor of medicine and of professional pharmacy degrees. Several are enrolled in similar programs.

The Research Apprentice Programs of NIH and NSF have served as

Table 2. MBRS Principal Investigator, Funding Level, and Research Topics, 1984-1989.

Principal Investigator	Research Topic	1984-1989
Bradshaw, W. G.	Clinical Psychologist	\$ 90,730
Cottrell, P. T. ^a	Physical Chem./Electrooxidation	167,663
Early, II, J. L. (84-88)	MBRS Administrative Grant	221,180
Early, II, J. L.	Pharmacology/Toxico. Selenium	396,611
Early, II, J. L. (1985)	National MBRS Symposium	122,998
Early, II, J. L. (1986)	National MBRS Symposium	139,295
Early, II, J. L. (1987-88)	Student Income Supplement	13,207
Fitzgerald, T. J.	Synthetic Med. Chem./ Colchicine	205,999
Holder, M. S.	Cardiovascular Physiology	35,554
Lamba, S. S.	Synthetic/National Prod. Chem.	72,219
Lee, H. J.	Synthetic Med. Chem./ Steroids	168,857
Ollapally, A. P. ^a	Synthetic Org. Chem./ Anti-Cancer	366,861
Parker, V. D.	Clinical Pharmacology	71,060
Redda, K. K.	Synthetic Med. Chem./ N-Heterocycles	186,256
Redda, K. K. (1988-89)	MBRS Administrative Grant	37,060
Redda, K. K. (1989)	Student Income Supplement	72,382
Soliman, K. F.	Neuropharmacology/ Physiology	144,035
Soliman, M. I.	Instrument Grant	25,000
Tterlikkis, L. P.	Physical/Biol. Chem.	264,092
Walker, C. A.	Chronopharmacology	83,840
	Total Direct Cost	\$2,884,899
	Indirect Cost	786,135
	Overall Total	\$3,671,034

^aChemistry department.

Table 3. MBRS Principal Investigator, Funding Level, and Research Topics, 1981-1984.

Principal Investigator	Research Topic	1981-84
Day, J. L.	Medicinal Chemistry/Anti-cancer	\$ 158,685
Early, II, J. L.	MBRS Administration Grant	251,374
Early, II, J. L.	Toxicology/Selenium	190,023
Fitzgerald, T. J.	Synthetic Med. Chem/Colchicine	100,792
Holder, M. S.	Cardiovascular Physiology	106,840
Lee, H. J.	Synthetic Med. Chemistry/Steroids	128,002
Lewis, B. A.	Microbiology	46,648
Nwangwu, P.	Medicinal Chemistry	38,006
Ollapally, A. P.	Synth. Organic Chem./Anti-Cancer	138,333
Shetty, A. S. ^b	Biological Sciences	147,293
Soliman, K. F.	Chornopharmacology/Physiology	82,012
Turner, R. W. ^a	Organic Chemistry	167,226
Total Direct Cost		\$1,555,234
Indirect Cost		<u>588,596</u>
Overall Total		\$2,143,830

^aChemistry department.

^bBiology department.

linkages for the MBRS program. Since 1982, the College of Pharmacy offered opportunities for summer research to FAMU Developmental Research School and other high school students in the Research Apprentice Program funded by either NIH, Division of National Institute of General Medical Sciences, or National Science Foundation. Federal funding is supplemented by institutional funds to allow greater student participation. Ten participants have entered the College of Pharmacy, and 5 have graduated. Several others have matriculated in the natural sciences

Table 4. MBRS Principal Investigator, Funding Level, and Research Topics, 1978-1981.

Principal Investigator	Research Topic	1978-81
Early, II, J. L.	MBRS Administration Grant	\$ 45,577
Early, II, J. L.	Toxicology/Selenium	35,850
Ikediohi, C. ^a	Biochemistry	41,441
Ollapally, A. P. ^a	Synth. Organic Chem./Anti-Cancer	111,748
Lee, H. J.	Synthetic Med. Chemistry/Steroids	128,002
Shetty, A. S. ^b	Biochemistry	105,515
Tterlikkis, L. P.	Administration Grant	91,084
Tterlikkis, L. P.	Pharmaceutics	234,260
Total Direct Cost		\$ 805,734
Indirect Cost		322,299
Overall Total		\$1,128,028

^aChemistry department.

^bBiology department.

and engineering at FAMU, and other institutions. To date, Leonard K. Holt, is currently a Ph.D. candidate in Science and Education at the University of Pittsburgh. And, Zeldia D. Johnson was the first to earn the Doctor of Pharmacy degree.

NIH/MBRS THEMATIC GRANT

The thematic grant entitled "Chronopharmacological and Chronotherapeutic Investigations" funded in 1985, was instrumental in increasing the involvement of the College in chronopharmacological research and helped in establishing national and international recognition of the leading role of the FAMU College of Pharmacy in this research area. This grant (Table 8) also provided the opportunity for training of undergraduate and graduate students, as well as research fellows in chronopharmacology and chronotherapeutics.

Table 5. MBRS Principal Investigator, Funding Level, and Research Topics, 1973-1978.

Principal Investigator	Research Topic	1973-78
Cottrel, P. T. ^a	Physical Chem.	\$ 60,252
Day, J. L.	Pharmaceutics	118,688
Lamba, S. S.	Synthetic/Natural Prod. Chem.	57,042
Ollapally, A. P. ^a	Synth. Organic Chem./Anti-Cancer	164,327
Shetty, A. S. ^b	Biochemistry	109,551
Soliman, K. F.	Pharmacology	92,612
Trottier, R. W.	Pharmacology	52,850
Tterlikkis, L. P.	Pharmaceutics	182,241
Tterlikkis, L. P.	Administration Grant	98,399
Total Direct Cost		\$ 935,961
Indirect Cost		32,975
Overall Total		\$ 968,936

^aChemistry department.

^bBiology department.

IMPACT OF THE MBRS PROGRAM ON THE DEVELOPMENT OF THE GRADUATE PROGRAM

In the fall of 1971, Drs. Geraldine P. Woods and Charles A. Miller visited from the National Institutes of Health (NIH), Division of Basic Medical Sciences. Their mission was to explore the possibility of initiating a research program in predominantly black schools. In January 1972, Dr. Robert Gibbs from the NIH, Division of Research Resources visited and requested FAMU to submit a Comprehensive Institutional Research Proposal. The research proposal was submitted in February 1972 and research funds were awarded for five years beginning in the fall of 1973.

Discussion concerning a graduate program in science and engineering

Table 6. Tabulation of MBRS Students by Year.

Year	Number of Graduate Students	Number of Undergraduate Students
1973-83	4	153
1983-85	4	144
1985-87	5	97
1987-89	8	35
1989-91	12	36
1973-91	33	465
Totals	66	930

Table 7. Current Graduate and Undergraduate MBRS Students' Support.

	Graduate		Undergraduate
	MS	PhD	
Salary/Year	\$7,500	\$8,500	\$6,000
Tuition & Fees/Year	2,300	2,300	
Travel	600	600	600
Totals	\$10,400	\$11,400	\$6,600

began in the spring of 1972, when the Office of Equal Opportunity visited with university faculty and administrators to assess future graduate programs at FAMU. In the same period, present Governor Lawton Chiles, then a U.S. Senator, visited the campus and met with faculty and administrators. The focus of his meeting was to support FAMU in securing a graduate program in the near future. Governor Chiles stated that "to have a viable graduate program, it is absolutely essential for the institution to have a strong research program."

In the fall of 1973, the School of Pharmacy's (the name was changed to College of Pharmacy and Pharmaceutical Sciences in 1983) administration and faculty were in a position to initiate a graduate program at the master of science level in pharmaceutical sciences. In the fall of 1975, a proposal was submitted to the Florida Board of Regents (BOR)

Table 8. NIH/MBRS Thematic Principal Investigators, Funding Level and Research Topics, 1985-1991.

Principal Investigator	Research Topic	1985-91
Walker, C. A.	Administration	\$ 13,560
Walker, C. A. & Soliman, M. I.	Chronobiotic Drugs	84,924
Soliman, M. I.	Administration	154,996
Soliman, M. I.	Chronobiotic Drugs	149,751
Lee, H. J.	Chronopharmacology of Antiinflammatory steroids	321,353
Total Direct Cost		\$ 724,584
Indirect Cost		248,540
Overall Total		\$ 973,124

and subsequently approved for the masters program. In the summer of 1976, a graduate program in pharmacology/toxicology was initiated.

The effort to obtain Doctor of Philosophy (Ph.D.) programs at FAMU began with informal conversations between Dr. Charles Walker, Dean of the College of Pharmacy and Pharmaceutical Sciences and Dr. Charles U. Smith, Director of Graduate Studies. These two persons agreed in 1979-80 that in order for FAMU to achieve full peer status in the State University System and the appropriate recognition and level of respect in the national higher education community, advanced graduate degree programs were essential.

While four new master degree programs were added to FAMU's existing postgraduate programs in education during the middle and late 1970s, the institution was widely regarded, intramurally and extramurally, as basically an undergraduate school. Further, Walker and Smith were highly cognizant of the fact that FAMU was historically black and located just a few blocks from the predominantly white Florida State University (FSU), that already had many doctoral programs, that the BOR would not allow FAMU to duplicate.

Despite these obstacles, and knowing that the U.S. Office of Civil Rights had mandated that FAMU be allowed to establish curricula, programs, and degrees that would make it equal in attractiveness to FSU and the University of Florida, Drs. Walker and Smith proceeded to take their argument for Ph.D. programs to the FAMU Graduate Council. Resistance

by some members of the Graduate Council, reflecting the traditional view of FAMU's scope and role, as well as a sense of futility about the BOR reaction, were soon abated, and turned into support for the Ph.D. initiatives when President Walter Smith gave his unqualified endorsement to the proposals.

In 1982, President Walter Smith was given approval by the BOR to prepare the first phase of the Ph.D. proposals for pharmacy and applied social science. Dr. Charles Walker, college dean coordinated the preparation of Phase I for the pharmacy Ph.D., and Dr. Charles U. Smith, graduate director and a sociologist was instrumental in the preparation of the proposal for their interdisciplinary social sciences Ph.D.

Recognizing the dearth of African American Ph.D.s in the sciences in general, and pharmacy specifically, the dean of the College of Pharmacy met with the President to set the stage for waging the perceived hard battle to establish FAMU's first doctor of philosophy degree.

As perceived it was not easy. Resistance, based on institutional mission which indicated no degrees for FAMU beyond the masters level made it more difficult. However, the tenacity of President Smith, Vice Presidents Gertrude Simmons, Leedell W. Neyland and former Dean Charles Walker to lead the fight, the endurance of the faculty and staff led by administrators like Drs. Johnnie L. Early, II and Henry Lewis, III provided basic support. Outstanding teaching and research results by faculty like Drs. Henry J. Lee, Maurice S. Holder, Karam F. A. Soliman, Surrendar S. Lamba, Arcelia Johnson-Fannin, Doris M. Stewart, and Thomas J. Fitzgerald reinforced the efforts.

Outstanding performance by the students on the licensure board helped the University and the College of Pharmacy and Pharmaceutical Sciences leadership to present a perfect case for the new degree program.

Ironically, the setting for the presentation was perfect. It was on the Florida A&M University campus, in the shiny new auditorium in the Ware-Rhaney building for Allied Health and Nursing that President Smith, Drs. Walker and Charles U. Smith made the first presentations (June 15, 1983) and participated in the debate in support of the proposed new program with the BOR Program Committee, chaired by Regent William Malloy. Dr. Walker had the foresight to make quiet contact with the Academic Program office of the BOR, prior to the formal presentations. After discussion, Regent Malloy relinquished the chair, and made the motion to approve the 2 Ph.D. program requests, which was assessed by the Program Committee. In the afternoon, following the recommendation of the BOR Program Committee, the full BOR approved planning for Phase II of the 2 programs.

Cooperative planning did take place. Over the next year, plans, strategies, and ensuing battles to overcome the resistant Post Secondary Education Planning Commission (PEPC) were waged. The BOR was a participant early on and remained steadfast throughout. Dr. Tribble, the Associate Vice Chancellor for Academic Programs was the key contact person for the BOR.

FAMU students performed outstandingly at the National MBRS Symposium in Washington, DC, in part, as an outcome of their participation in the Student Research Forum. The Student Research Forum was initiated by the Assistant Dean for Research and MBRS Program Director in 1981. And, the Forum under the leadership of the current MBRS Program Director, continues to prepare students for national meetings. FAMU graduates maintained high passing marks on the boards, and Dr. Henry Lee announced that his "steroids" research was ready for patent application and publication.

These activities coupled with a high visibility reception at the president's residence for Dr. Hans Mark, Deputy Administrator of NASA where Dr. Mark announced FAMU's special role in NASA's motion sickness research program, a \$300,000 commitment by Warner-Lambert Pharmaceutical Company to help fund an Eminent Scholar's Chair in the Pharmaceutical Sciences, increased NIH funding, and the receipt of an endowment funded by the Plough Foundation for professional student scholarships, made the final battles easier.

Dr. Charles A. Walker, former Chancellor of the University of Arkansas at Pine Bluff, was very instrumental in the initiation of the Ph.D. program in 1985 and reflected on the struggle:

It was very difficult because there were people who felt at that time, that a doctoral program of any kind should probably not be at FAMU. But now, we're finding that with the tremendous decrease of minorities earning the Ph.D. in the basic sciences, that the Ph.D. programs at predominately African American institutions are very significant and are going to become even more significant in the future as the need for Ph.D. level scientists is going to be required in the workforce.

In January 1984, the BOR authorized FAMU to plan a new Ph.D. program in pharmaceutical sciences with specialization in pharmacology/toxicology. Two independent consultants were contracted by the BOR

to review the College's request for authorization to conduct a feasibility study, and to conduct site visits. The evaluations of the consultants, Dr. Hugh F. Kabat, College of Pharmacy, University of Minnesota, now with the University of New Mexico, College of Pharmacy, Albuquerque, NM and Dr. John W. Schermerhorn, Dean, College of Allied Health Sciences, University of Texas, Health Sciences Center, Dallas, TX, supported the development of the proposed program with no qualifications or reservations. The BOR staff recommended that authorization be given to plan the program.

On July 13, 1984, the 13 member BOR, with Dr. Barbara Newell, Chancellor, and Attorney Robin Gibson, Chairman, approved the Ph.D. program for implementation in January 1985 with any additional resources to be obtained through reallocation of existing sources. Four tracks were approved: pharmacology/toxicology, medicinal chemistry, pharmaceuticals, and pharmacy administration. In giving its approval, the Board of Regents noted that the M.S. program had been designated by the Regents as a Program of Emphasis; graduate research capabilities of the College are commensurate with Ph.D. level training; and the realization that more than 50% of the M.S. graduates were continuing their education in Ph.D. and M.D. programs elsewhere.

Changes in the composition of BOR, with new perspectives among its membership resulted in a reversal of the final planning and implementation of the Ph.D. in applied social sciences.

After BOR approval, the next step required concurrence from the PEPC. PEPC listened to the presentations and struggled with the evidence and the weight of the BOR decision. PEPC decided that the BOR decision was inconsistent with the overall statewide plan. The vote was a divided no on the Ph.D. program. The issue was referred back to the BOR at their next meeting and it then received a unanimous vote and implementation began.

DEVELOPMENT OF THE PH.D. TRACK IN ENVIRONMENTAL TOXICOLOGY

A Cooperative Agreement was implemented between the Centers for Disease Control, Agency for Toxic Substances and Disease Registry (ATSDR), and the eight member Association of Minority Health Professions Schools in 1988. The agreement focuses on the health problems of minorities through the application of the considerable research and

training capabilities of minority health professions schools. The agreement currently encompasses: research in toxicology, risk assessment, and a Ph.D. program in environmental toxicology at FAMU.

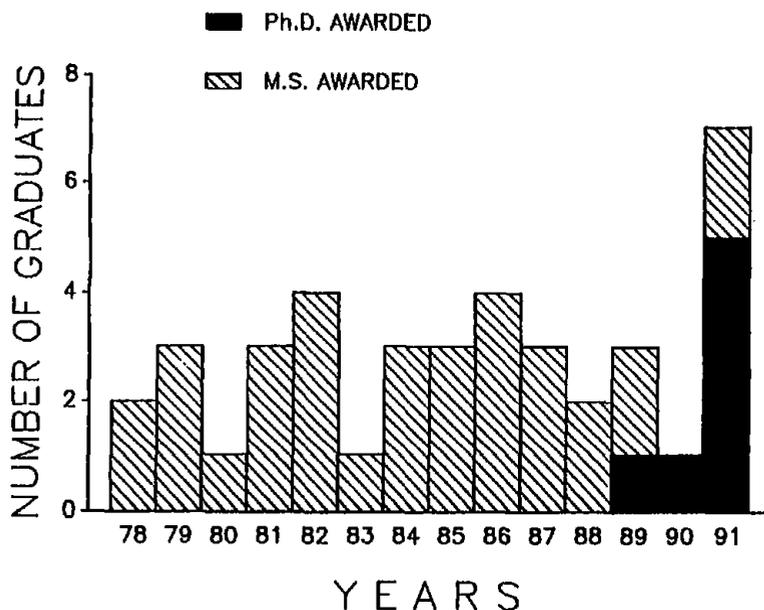
The College received funding to form an advisory committee, composed of toxicologists from ATSDR, academia, Battelle Laboratories, Seattle, Washington, the National Center for Toxicological Research, and FAMU. The resulting curriculum was established in August 1990, and both the recruitment and enrollment of students proceeded. Funding for a fellowship was secured through a competitive grant from the U.S. Department of Energy.

The national impact of the graduate program was illustrated with the April 1991 graduation of five African Americans with the Ph.D. in the pharmaceutical sciences. This was the first occurrence, among the 61 pharmacy schools with graduate programs, of such a number of African Americans simultaneously graduating. FAMU has graduated seven Ph.D.s through 1991 (Figure 1). According to the American Association of College of Pharmacy statistics, only 14 African Americans received their Ph.D. degree from 1984 through 1989, or an annual average of 2.8. The future admissions to the program appear positive as the number of applications since the implementation of the Ph.D. program have increased (Figure 2).

The intensive recruitment efforts for graduate students have been further augmented by the assistance of both the Florida Endowment Fund and Upjohn. Prospective students and their mentors are invited to attend a Colloquium on Graduate Pharmaceutical education during the MBRS/Minority Access to Research Careers Symposium, and the National Institute of Science, Beta Kappa Chi Convention. The students are given a graduate program and Florida Endowment Fund program overview, and a scientific presentation by a current McKnight Fellow. Faculty and graduate students then discuss the program with prospective students. A key feature of the graduate program is the requirement for both presentations and publications. At the masters level, students are required to submit a paper for publication in a refereed journal, and to present a paper at a national scientific meeting. At the Ph.D. level, two publications and presentations are required. The rate of publications with graduate student authors or coauthors (Figure 3) has grown steadily from two in 1983 to ten in 1989 and nine in 1990. Presentations numbered 20 in 1984, 16 in 1989, and 27 in 1990.

The research of each graduate student was supported by both the MBRS and RCMI programs. A NASA grant partially supported two (Hyacinth Akunne and Ebenezer Oriaku) students. All were MBRS trainees at the beginning of their studies, but three (Marcus B. Iszard, Joyce V. Lee, and

Figure 1. NUMBER OF GRADUATE DEGREES AWARDED

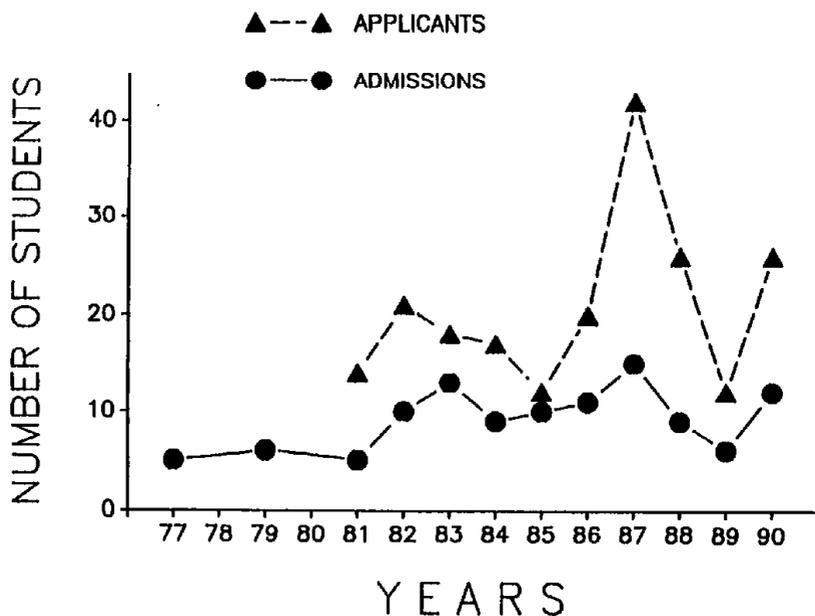


Robert Williams) graduated as McKnight Fellows (see the Florida Endowment Fund for Higher Education, below). One (Hugh M. McLean), was supported by a Patricia Roberts-Harris Fellowship (see the Patricia Roberts-Harris Fellowship Program, below) and a 3M Scholarship. The seven graduates have entered postdoctoral training (National Institute of Mental Health, National Center for Toxicological Research, Pfizer Pharmaceuticals, University of Kansas Medical Center), assumed positions in the pharmaceutical industry (3M Pharmaceuticals, Parke-Davis), in academia (FAMU and the University of Arkansas at Pine Bluff) and the federal government (Agency for Toxic Substances and Disease Registry).

FELLOWSHIPS

The College has benefitted tremendously from several federal, state, foundation, and corporate mechanisms of graduate and Pharm.D. student support. Each mechanism brings prestige to both the recipient and the College. And, more importantly, stability to the graduate program which

Figure 2. GRADUATE STUDENT APPLICATIONS



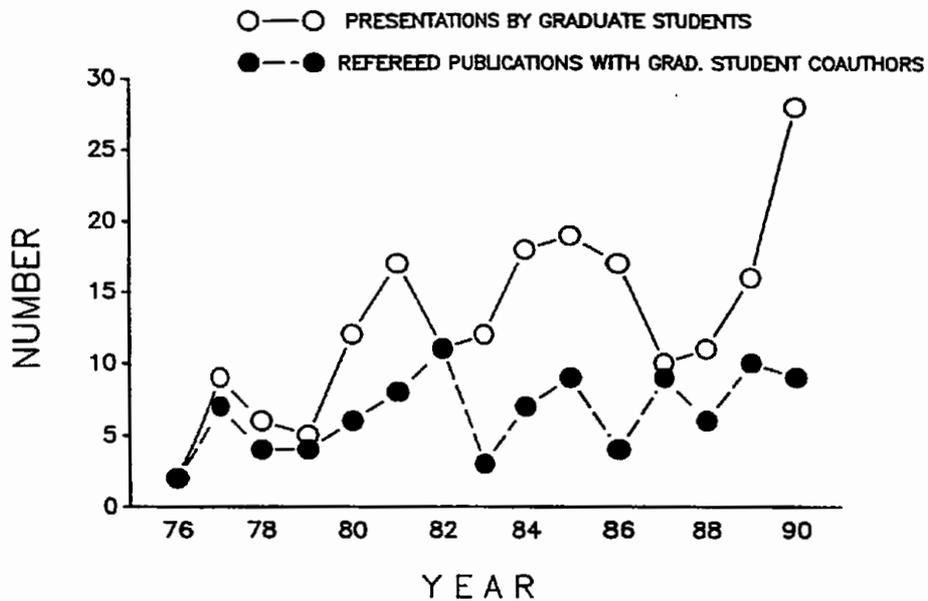
is highly dependent on extramural sources of support. The retention of graduate students is undoubtedly enhanced by this support.

THE FLORIDA ENDOWMENT FUND FOR HIGHER EDUCATION

The Florida Endowment Fund (FEF) for Higher Education was established as a result of a dialogue and synergy between political leadership and all sectors of higher education in the State of Florida. An agreement was reached in 1983 that led to the development of an agenda for the advancement of higher education which would project Florida well into the 21st Century.

One of the main features of FEF is the McKnight Doctoral Fellowship Program which supports African-American students pursuing the Ph.D. degree. The program provides initially up to 69 fellows to pursue Ph.D.s in the State of Florida.

Figure 3. GRADUATE STUDENT PRESENTATIONS AND PUBLICATIONS



Florida A&M University has received support for twelve African-American Ph.D. candidates (6 males and 6 females) between the years of 1985-91. The FEF program has lost only one student of the twelve who have been supported to give a retention rate of 92 percent. Statewide, McKnight Fellows have been retained at a rate of 86 percent. The FEF provides \$15,000/year support for each student (stipend, tuition fees, books and travel) for a period of three years. FAMU then provides the same level of support for the candidate until he or she completes the Ph.D. degree program.

THE PATRICIA ROBERTS-HARRIS FELLOWSHIP PROGRAM

The Patricia Roberts-Harris (PRH) Fellowship Program began at FAMU in 1979 as the Graduate and Professional Opportunities Program. Initially the program included only postbaccalaureate Pharm.D. students. The program was later extended to include the M.S./Ph.D. in pharmaceutical sciences students. The PRH funding is and was the only source of financial assistance for the Postbaccalaureate Pharm.D. students at FAMU. These funds provide a stipend of \$10,000 annually (tuition, books and a travel allowance). To date 1979-1991, FAMU has graduated forty-two PRH fellows (forty Pharm.D. and two Ph.D. graduates). It is of interest to note that 90% of the graduates of the Pharm.D. program found employment prior to graduation. This speaks for the demand for individuals with this type of training, particularly minorities. In addition, the faculties of the four historically African American and other pharmacy schools are actively seeking role models for their programs, and FAMU has been a prime source for these individuals. PRH Fellows from FAMU have been and are on the faculties of: Howard University, The University of Cincinnati, St. John's University, Texas Southern University, Xavier University of Louisiana, and FAMU. The first PRH Ph.D. graduate is completing a postdoctoral fellowship at Pfizer Pharmaceuticals.

AMERICAN FOUNDATION FOR PHARMACEUTICAL EDUCATION FELLOWSHIP AND DELORES AUZENNE SCHOLARSHIP

Important graduate student support is also received from the American Foundation for Pharmaceutical Education (AFPE). A Ph.D. student has received a regular fellowship of \$6,000 in 1990, and a Sydnor Barksdale

Penick Memorial Fellowship of \$4,000 in 1991. Others have received the Delores Auzenne Scholarship (\$5,000), a State of Florida program for minority graduate students.

RESEARCH CENTERS AT MINORITY INSTITUTIONS: PROVISION OF ESSENTIAL INFRASTRUCTURE SUPPORT

The Research Centers at Minority Institutions Program was established on July 26, 1984 by the Labor, Health and Human Services, and Education and Related Agencies Appropriation Bill (H.R. 6028). The House Report (pages 78, 79) on the FY 1985 referenced the Secretary's most recent annual report on Health in the U.S., which focused renewed attention on disparities in health status between minority and white Americans. The RCMI Program is designed to expand the national capability for research in the health sciences by assisting, through grant support, predominantly minority institutions that offer the doctorate in the health professions and/or health-related sciences. The RCMI Program is intended to enhance significantly the capacity for the conduct of biomedical and/or behavioral research at such minority institutions by strengthening their research environment. To be eligible to participate, an institution must have more than 50 percent minority student enrollment, award an M.D., a DDS, a D.V.M. or other doctoral degree in the health professions and/or a Ph.D. in the sciences related to health. FAMU offers both the Doctor of Pharmacy and Ph.D. degrees.

Support Staff

A key component of the FAMU RCMI program is the provision of staff which are essential to the research infrastructure. In addition to well-trained and experienced research support office staff, there is a statistician who reviews the experimental design, and assists with the evaluation of data. His skill eliminates the common errors of: excessive numbers of animals, poor design and inappropriate statistical tests. The scientific editor's skill has increased clarity and completeness, reduced the criticism of grammatical errors, and along with word processing programs, the presence of numerous typographical errors which detract from the readability and competitiveness of proposals. The art editor has significantly improved our capability in producing high quality graphics for both publications and presentations. While some needs are met through computer

programs, many require the human touch. In each instance, the presence of such personnel not only improves the quality of proposals and the like, but they also reduce the time and cost of production in contrast to where-withal required by ad hoc consultants.

Research Associates

The primary goal of this RCMI activity is to provide research experiences for minority recipients of the Ph.D., D.V.M., M.D. and Pharm.D. degrees in pharmacology/toxicology, pharmaceuticals, and clinical pharmacy. Both the research capability of the College and the competitiveness of the involved faculty member should be enhanced. Moreover, the nation should benefit from the emergence of both basic and clinical scientists who have strengthened their research capability through an intensive research experience.

The selection of the faculty to whom a research associate is to be assigned is determined by a peer committee based on the following criteria. The investigator should: (1) have a viable research program as evidenced by: (a) funded research grant(s); (b) refereed publications from research completed at FAMU in the last two years; and (c) published abstracts or presentations during the last two years; (2) the absence of research associate position on any other grant; and (3) engagement in research activity which is expected to lead to a proposal. Research associate appointments are two years in duration.

The selection of the research associate is based on the following criteria: (1) the applicant must have a doctoral degree (Ph.D., Pharm.D., M.D. or D.V.M.); (2) the time between the research associate's graduation date and FAMU's appointment should not exceed three years; and (3) the applicant should be recommended by three persons with whom he/she has had contact. A research associate is expected to: perform research work which is of high caliber; publish or present research work at national meetings; and generate data which can be utilized in writing research proposals.

Impact of Research Associates on the Faculty

Faculty who obtained research associates increased their publication rate in the period 1985-1990. When comparing the faculty members that have research associates working in their labs with those who do not, six faculty members who had RCMI supported research associates published

44 papers during the last two years, an average of 7.33 publications per faculty member. The eighteen faculty members without RCMI supported research associates published only eleven papers. This gave them an average of 0.61 papers per faculty.

Impact of Research Associates on the National Need for Biomedical Scientists

Two research associates are now-faculty members at minority institutions. One is currently assistant professor of pharmaceuticals at the College of Pharmacy and Pharmaceutical Sciences, Howard University, and the other is currently an associate professor of toxicology at the University of Arkansas at Pine Bluff.

Research Productivity

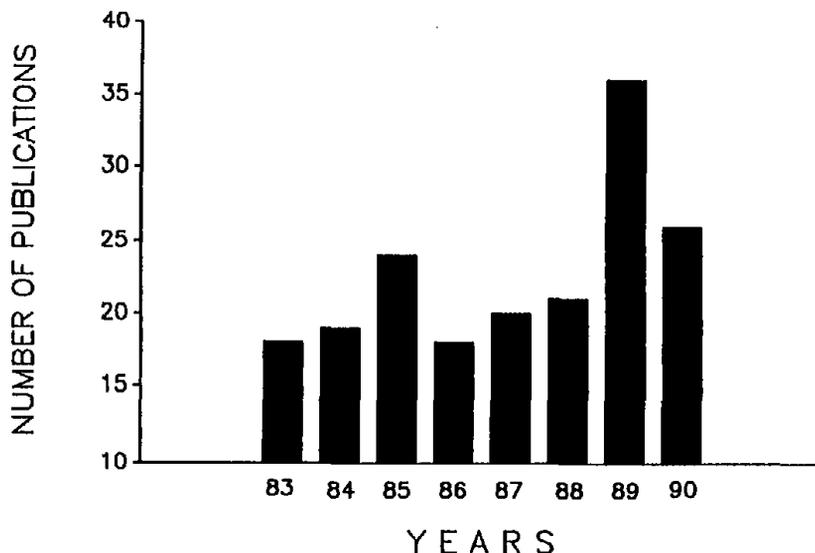
During the period from 1983 to 1987, there was an average of about nineteen published, refereed papers annually by pharmacy faculty (Figure 4). Since initiation of the RCMI grant in October, 1985, there has been a great increase in the research activity. In 1988, there were twenty-one publications, an increase of about 11 percent more than the previous five-year average. This increase in publications for 1988 reflects the beginning of published data generated by the RCMI grant.

In 1990, faculty published 26 refereed articles. In 1989, there were 36 publications, an increase of about 89 percent over the 1983 to 1987 yearly average. During 1988-1989, when the influence of the RCMI grant on the publications rate could first be seen, the faculty published 57 papers. Since there are 24 faculty members, there was an average of 2.4 publications per faculty member. The six faculty members who had RCMI supported faculty development experience opportunities, published 15 papers with an overall average of 2.5 publications per faculty member during the last two years. Thus, the RCMI grant has significantly boosted the rate of publications in the College.

Grant Applications Submitted

The number of research grants awarded increased from five grants in 1983 to 30 awarded in 1990 (Figure 5). This increase reflects the impact

Figure 4. FACULTY PUBLICATIONS



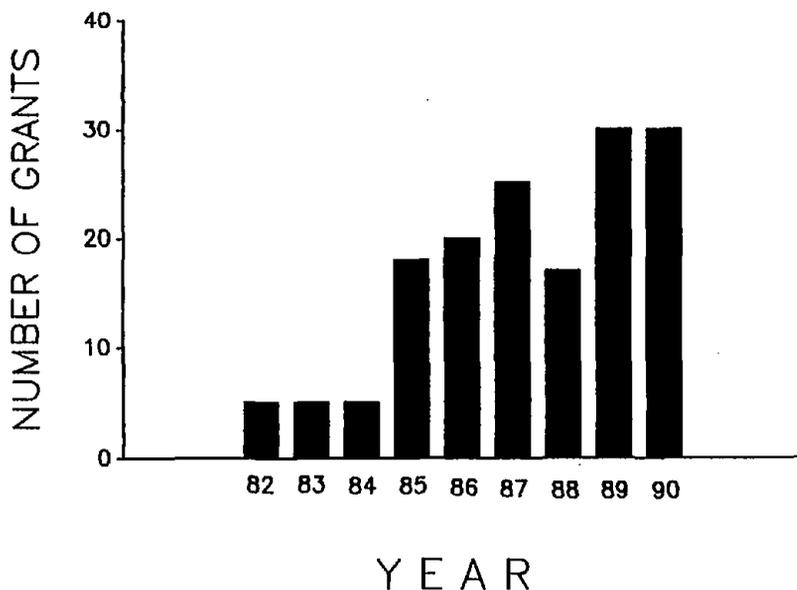
of the presubmission review procedure that started in 1981, and the Ph.D. program which was approved in 1984, but started in 1985. The actual grant support increased from \$600,000 in 1983 to \$3.7 million in 1990 (Figure 6).

Library Resources

The College of Pharmacy Library is a branch library of the Samuel H. Coleman Library at Florida Agricultural and Mechanical University. It is physically located within the College of Pharmacy in the Clifton G. Dyson Building, room 200. Until 1985, nearly all of the costs of the program were absorbed by the Coleman Library. With the advent of RCMI funding in 1985, several major alterations took place in the College of Pharmacy Library environment.

The RCMI funds impacted significantly on the quality of services available to students during extended hours. Until RCMI, library staff

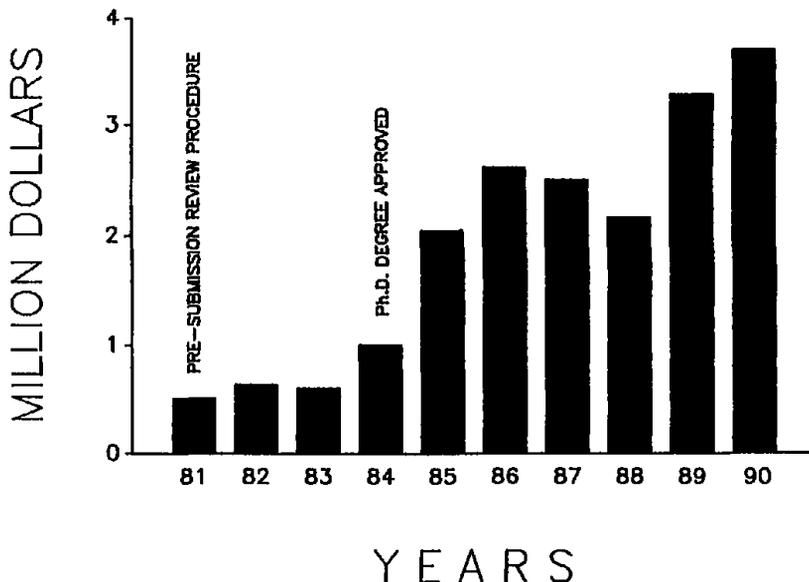
Figure 5. GRANTS AWARDED



was limited to one professional librarian assigned by the Coleman Library. Extended hours beyond the 40 hours provided for by Coleman Library were operated using graduate pharmacy school students. Coleman Library also provided funds for several FAMU student assistants to help the librarian with routine tasks. RCMF funds were used to employ two, part-time professional librarians and one clerical assistant during nights and weekend open hours. Students now have access to the full range of professional librarian research assistance during all library open hours of operation.

Projects to provide on-line computerized searching and free end-user database searching were initiated and developed using the RCMF funds. The library now offers on-line searching of medical and health sciences literature to FAMU students and faculty. Subscriptions to DIALOG on-line databases, MEDLINE on CDROM, DRUGDEX, and POISINDEX Computerized Clinical Information System (CCIS) on CDROM are cur-

Figure 6. GRANT SUPPORT



rently owned. Students have access to both on-line intermediary searching by the professional librarians, as well as hands-on CDROM self-searching privileges.

RCMI provided increased funding for books and materials. The support was especially useful in updating and refurbishing the Reference collection and strengthening pharmacology and toxicology library books holdings on the graduate level. Expensive reference texts held at Coleman Library are seldom duplicated in branch libraries, especially titles that are multidisciplinary in subject treatment. As a result of the policy, general encyclopedias and dictionaries as well as multidisciplinary health science materials basic to reference and research needs were out-of-date or nonexistent in the Pharmacy Library. RCMi funds were used to purchase these as well as duplicate volumes of heavily used reserve books.

Phase I of a project to replace missing issues of journals held was realized. The funds provided for purchase of journals on microfilm reels covering issues missing from volumes for titles A through J. The library

currently has full runs of back issues for more than half of the titles that were recorded on the missing issues list.

The following is a breakdown of biomedical books added since 1978.

<u>Year</u>	<u>Number of Books Added</u>
1979-80	927
1980-81	125
1981-82	18
1982-83	563
1983-84	783
1984-85	847
1985-86	567
1986-87	281
1987-88	802
1988-89	614
1989-90	<u>419</u>
Total	5,946

This total increases the current monograph holdings to 14,487 biomedical books. Approximately ten percent of the annual increases in monograph volumes are attributable to RCMI expenditures.

Laboratory Animal Facility

The laboratory animal facility in the Dyson Pharmacy Building was renovated and upgraded to meet all PHS and NIH guidelines. An additional two rooms were added to this facility for housing animals used in chronopharmacological research. A satellite animal suite was also renovated in the Psychology Department of the Gore Education Building. The animal holding area increased in Dyson Pharmacy Building from 570 to 1,111 square feet and the ventilation system upgraded to 15 air changes per hour. The facility is also supported by an emergency generator. These renovations, upgrading and additions were made possible through funds provided by RCMI, MBRS, and institutional funds. Through the MBRS supplemental grant (#RR08111) of \$100,000, new areas were added including a storage room and the ventilation system was upgraded to provide the required air exchanges. In addition, MBRS funds were allocated to provide one-month training of the animal facility supervisor at the University of Florida animal facility which is AAALAC accredited. This training was beneficial in improving the operational procedures of

the facility to provide excellent animal husbandry. Additional cages and racks were purchased through RCMI funds.

In order to increase the efficient utilization of space for housing animals, Duo-Flo units and ventilated racks are being purchased through funds provided by RCMI grant. These expansions resulted in doubling the animal holding capability and helped in meeting the increasing laboratory animal needs for research. There are currently three operational animal facilities on campus. Two facilities are located in Dyson Pharmacy Building (DPB). The DPB facilities include two rooms designed to house animals used in chronopharmacological research. The third facility (420 sq. ft.) is located in the Psychology Department. All three facilities conform with PHS guidelines and regulations and are controlled for lighting, humidity and temperature. The HVAC system of DPB facilities is supported by a functioning emergency generator.

Chemical Storeroom

The RCMI program funded the establishment of the first chemical storeroom on campus. This is a centralized facility used for the procurement of over 200 chemicals, a wide selection of glassware, and a limited offering of surgical supplies. Investigators can now avoid the time delay previously associated with procurement of common supply items. The storeroom also facilitates the service ordering directly, via computer modem, from vendors (Sigma and Fisher).

Instrumentation Grant

Through an instrumentation grant from NIH/MBRS, it was possible to purchase a state-of-the-art LKB liquid scintillation counter. This instrument is extensively used by many investigators and their graduate students working with radioisotopes in metabolism studies and receptor assays. Moreover, both the MBRS and RCMI programs have provided equipment necessary for the conduct of research. While the MBRS program primarily provided equipment for specific research projects, RCMI provided major equipment which is essential for a competitive research environment. Among the major items of equipment are 60mHz NMR and an IR to enable researchers to identify new compounds. An explosion proof fume hood was installed, and existing fume hoods were repaired and/or adjusted. The College is now equipped with centrifuges, spectrophotometers and HPLCs to meet the basic research needs of the community.

Audiovisual equipment was acquired to allow the art editor to prepare high quality charts, graphs and photographs. A donation from 3M provided for some equipment. The College renovated space to accommodate this service. Both the Upjohn Company and the Merck Company Foundation have provided support for equipment.

Clinical Pharmacology Research Unit

The Clinical Pharmacology Research Unit (CPRU), located in Miami, Florida, is a core laboratory open to all FAMU faculty members and students, and to other collaborators. It is supported by both FAMU and the RCMI grant for the purpose of conducting human drug studies. Staffing includes an M.D./Ph.D., administrative assistant, nurse, and an analytical chemist.

The future of graduate pharmaceutical education and research appears bright at FAMU because of three factors. President Humphries not only urges students to enter graduate and professional schools, he has implemented a graduate feeder program with 25 universities. The feeder program serves as a key and effective means of interfacing on behalf of students, with graduate and professional degree providers. This program will further promote the tradition of graduate study among our students (2). A key development is the acceptance of a 1991 B.S. pharmacy graduate for admission in the fall semester, 1991, and, the announcements of other pharmacy students of their intent to apply beginning in 1991. Both President Humphries and Provost and Vice President Richard A. Hogg, scientists in their own right, are aggressively supporting both research, and the development of graduate programs in the sciences. The provision of state lines and fiscal resources promote greater achievements. Moreover, key decisions by President Humphries, who is also the RCMI principal investigator, have created an enhanced research environment.

Second, the construction of the basic science research building is planned in 1992 for a \$10.9 million 59,210 sq. ft. facility. The College will occupy 11,440 sq. ft. (if the legislature provides funding as requested). At this writing, we are assured of only \$6 million. Clearly, the success of the College played a key role in the approval of this facility, the first in this decade, and the first new building on the FAMU campus since 1985.

Third, the success of the College attracted yet another major contribution to its effort. On February 16, 1989, the University's first endowed chair was established in the College through the contributions of the Warner Lambert Company (\$300,000), FAMU's Centennial Campaign

(\$300,000), and the State of Florida (\$400,000). The Warner Lambert Eminent Scholar Chair in the Biomedical Sciences will be utilized to further develop an academic and research program of international distinction.

CONCLUSIONS

Since the first MBRS award, extramural federal support has been essential to the development and growth of both research and graduate pharmaceutical research at FAMU. Support of fellowships and scholarships by foundations, federal programs, and pharmaceutical manufacturers fills the gap between state funding and needs. Graduate pharmaceutical education exists because of a receptive Board of Regents, a capable faculty, visionary and determined college talented students, administrators, supportive central administration, and extramural support. These factors have enabled the College to become the nation's preeminent provider of African Americans with the Ph.D. degree in the pharmaceutical sciences.

Similarly, the College has become more competitive in securing extramural funds due to the maturation afforded by the MBRS program and the infrastructure provided by the RCMI program. The MBRS program formed the essential foundation for research and graduate pharmaceutical education. Clearly, the College was well prepared in 1984 to implement a Ph.D. program, on the strength of an MBRS award which included twelve subprojects versus six in the 1980 grant, and was funded at \$535,000 or a 250 percent increase over the previous award. The RCMI program has enabled the College beyond the resources provided by state appropriations. Moreover, in comparing the College with other pharmacy schools, which receive NIH biomedical research support grant awards, the College now ranks number eleven with \$1.7 million in NIH funding.

It is evident from the data presented, beginning in 1973, that African American institutions can achieve in the research arena when provided with the opportunity and support. It is also evident that HBCUs play a vital role in the correction of the underrepresentation of minorities at the Ph.D. level in the biomedical sciences.

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