

The AT&T Labs Fellowship Program— 35 Years of Mentoring Women and Underrepresented Minorities—An Update

Elaine P. Laws*, Elizabeth Loia[†], Michael Merritt[†]

*AT&T Labs (retired) / [†]AT&T Labs Research

Abstract--The AT&T Labs Fellowship Program (ALFP) has a 35-year history of mentoring women and under-represented minorities pursuing doctoral degrees in science and engineering. Five years ago during its 30th anniversary ALFP and its predecessor programs were celebrated at a joint AT&T Labs and Lucent Bell Labs conference¹ and at the American Society for Engineering Education Annual Conference and Exposition.² An earlier paper presented at these venues reported on the programs' history, participants, and impact. In this new paper the authors provide an update of the current program at AT&T Labs and its evolution and results over the last several years as the company and industry have changed. Significantly, the need for new graduates in science, mathematics and engineering has remained a nationwide imperative, and the challenges of students competing in these areas continue to require mentoring and professional development to succeed in advanced studies and be well-prepared for the dynamics of careers in technology. We discuss current aspects of the ALFP, its selection process, program requirements, mentoring, and internship components as well as the unique community of researchers who support the program. Information on the sources of candidates, the disciplines they pursue, the institutions at which they conduct their studies and the areas and fields they intend to enter upon completing their degrees are updated from the 2002 paper. Additionally, discussion of the mentoring networks provided to students in the programs and comments from recent and current students and their mentors are summarized to describe the benefits of the program.³

Introduction

Over ALFP's 35-year history unprecedented changes have occurred in rapid succession. Some of these changes include the advance of information technology, the introduction of the Internet, personal computers, and wireless technologies throughout business and culture, the evolution of the civil rights and women's movements, the recognition of environmental concerns, and the globalization of business and communications. These technological, cultural and business advances relied on a diverse and aware population of university graduates schooled to think differently and to investigate new ways of doing things. The ALFP has strived to identify and support these types of thinkers and innovators over the years. Additionally, the program has evolved through the changes in

¹ Mentoring for Success, Joint Conference of AT&T Labs and Lucent Bell Laboratories, October, 2002.

² American Society for Engineering Education Annual Conference & Exposition, June, 2003.

³ The paper reflects data from the AT&T Labs program only (from 1996-2006); the programs at Lucent Bell Labs are not included in this report and information on those programs is most appropriately obtained from that source, although we acknowledge that company's continued efforts in supporting students in technology fields and recognize our common history in this effort.

the telecommunications industry and related businesses and the reorganizations of AT&T in 1984 (divestiture), 1996 (trivestiture), and more recently in 2005 (acquired by SBC, an evolved off-spring of the 1984 divestiture) and 2007 (acquisition of BellSouth and full ownership of Cingular). Over the years, the program has selected students in disciplines reflective of the work of the company and has adjusted these as its focus and business as well as technology have changed. Prior to the 1980s, a major focus of research was in the physical sciences; computer science and electrical engineering were in their developmental years; in the last 30 years substantial changes have occurred in these disciplines. Now these and other evolving technologies lead the way to the developments of the future. Most importantly, the program continues to attract women and under-represented minorities and to financially support, mentor and graduate them as Ph.D. researchers in the fields of computer science, electrical engineering, mathematics, operations research, and related fields.

While this paper will focus on the aspects and results of the ALFP over the past 10 years, it is noteworthy that, to date, over 500 students (Table 1) have been selected and supported by the predecessor programs over the last 35 years.

Fellowship Program Awards

1972 – 1995	368
1996 – 2001	121*
2002 – 2006	20
Total	509

Table 1— Total Awards 1972 - 2005

***Includes 87 awards funded by Lucent Bell Labs**

The current 78% rate of ALFP students completing Ph.D.s is consistent with the past rate that was in the range of 70-78%. The hallmarks of program support continue to include financial support, mentoring, paid internships, and interaction with the AT&T Labs research community, all of which are considered to contribute to the success rate of students selected for the program.

Program Overview

The AT&T Labs Fellowship Program continues to be available to outstanding under-represented minority and women students who are U.S. Citizens and Permanent Residents who are pursuing Ph.D. studies in computer and communications-related fields. Fellowship awards are provided for 3 years and are contingent on an annual review that demonstrates the recipient is making satisfactory progress toward their Ph.D.⁴ Financial support covers tuition, books, fees, approved travel expenses to professional conferences, a living expense stipend and education expenses for summer study or

⁴ Prior to 2003, awards were for a maximum of 6 years, contingent on satisfactory progress towards the Ph.D.

university research. During the first summer after receipt of the award, students are required to complete a summer internship at AT&T Labs.

The mentoring relationships provided by the program emphasize close interaction between the student and an AT&T Labs research staff member knowledgeable in the student's selected field of study. Significantly, the commitment of the AT&T Labs staff that selects and mentors students continues to be strong and resolute. Prospective candidates are matched to mentors based on the candidate's interests. Only if such a match is possible is the candidate selected. AT&T Labs mentors work with first year fellowship students during the first summer of their awards on site at AT&T and are in contact with them throughout their university studies. Often, mentors will visit students during the school year to support the progress of their work, and will, if appropriate, advocate for additional summer internship assignments at AT&T Labs for the student beyond the first year internship. (Such additional assignments, however, are competitive and fellowship students must compete with other summer internship applicants after their initial summer internship assignment.)

Fellowship students work as members of research teams on various ongoing projects within AT&T Labs. The interaction by the student with the AT&T Labs research community while working as an intern provides a special opportunity to the student to learn about an industrial research facility and to attend technical talks and symposia conducted by the organization. Students are welcomed as research collaborators and the typical measure of a successful summer is an external technical publication. For many students, this is their first experience being treated as a peer team member, very distinct from typical hierarchical academic environments. As a result, over the years it is not surprising that students develop into peer researchers alongside their mentors. Some program graduates go on to act as role models to students from backgrounds like their own, encouraging them to explore work in the fields of science, mathematics, and engineering.

Students are invited to submit applications for the ALFP and are asked to complete an application form, provide official transcripts of grades from all undergraduate schools attended, provide Graduate Record Examination scores, and provide three letters of recommendation from college professors who can evaluate the applicant's ability and potential for research. Additionally, the applicant must provide a written statement of interest and research and career goals. Applications are accepted until January 31 of each year. Student applications are reviewed by the ALFP committee, which is comprised of Ph.D. research and development professionals in AT&T Labs. A limited number of qualified students are invited to interview with AT&T Labs R&D staff in the March timeframe and final selections are made in April with student internship assignments beginning in late May or June.

ALFP currently receives approximately 40 applications annually from qualified students and invites about twelve applicants to meet with researchers to compete for the 5 fellowships awarded annually, reflecting about a 12% acceptance rate of applicants. The

areas in which students concentrate reflect the work the company is currently pursuing, and has technical and mentoring expertise. The disciplines shown below (Table 2) over the last ten years indicate the focus on computer and electrical engineering fields versus past concentrations in physics and chemistry (Table 3).

1996 – 2006 Awards by Discipline

CS	EE	Other Engin	OR/IE	Math/Stat	Other	TOTAL
21	9	9*	5	4	6**	54

Table 2—Disciplines—1996 –2006 (AT&T funded only)

*** Includes Engineering, Acoustic Eng, CE, Eng. Psy, HCI, ISE, Opt Eng**

**** Includes IT, Mat'l Sci, Robotics, Physics**

1972 – 1995 Awards by Discipline

Physics	Chemistry	Math	Engin	CS	Other	TOTAL
72	47	28	159	57	5	368

Table 3—Disciplines 1972-1995

While ALFP students are specifically mentored by AT&T Labs staff throughout the years they are funded by the program, they are as well a part of a larger community of approximately 40 interns who annually are selected for key internships primarily during the summer. The work these interns do is very valued by AT&T Labs and it is noteworthy that they are doing “real” company work. At the end of the summer, all interns present talks or papers on the work they have completed and such forums are well-attended by regular Labs staff who seek to learn from the students as well as link them to other efforts that may be related to their work.

Some awardees obtain alternative financial support, in which case their ALFP support is reduced to an annual grant and travel support. This financial link serves to encourage and reinforce the mentoring relationship forged during the initial summer internship.

Currently in the ALFP there are 22 students in progress, receiving support from AT&T Labs in the form of funding, internships, and mentoring. Table 4 reflects the sex and diversity breakdown of the 2001- 2006 student cohorts.

ALFP Student Cohorts 2001- 2006

Male	37%
Female	63%

Ethnicity

African American	27%
Hispanic	27%
White (female)	36%
Asian (female)	9%

Table 4—Current ALFP student population

Students currently funded by ALFP were drawn from a large cross-section of US universities as they have been over the history of the programs. The schools include a mix of state and private institutions as well as Historically Black Colleges and Universities and Hispanic Serving Institutions. Table 5 below reflects the undergraduate school sources of students in the 2001-2006 cohorts.

Undergraduate Schools of 2001-2006 ALFP Students

Alabama A&M	Princeton University
Arizona State University	Rice University
Brown University	Swarthmore College
Carnegie Mellon University	University of California—Berkeley
Colorado State University	University of Colorado—Boulder
Florida State University	University of Michigan—Ann Arbor
Georgia Institute of Technology	University of North Carolina
Harvard University	University of Oregon
Johns Hopkins University	University of Pittsburgh
Michigan State University	University of Puerto Rico
Mississippi State University	University of Rochester
Morehouse College	Washington State University

Table 5—Sources of current ALFP students

Students in the ALFP are accepted into Ph.D. programs at a wide range of schools. Table 6 below provides the list of Ph. D. schools attended by the 1996-2006 cohorts of students. (Schools attended by currently funded students are noted with an asterisk.)

Universities Attended by ALFP Ph.D. Students -- 1996- 2006 Cohorts

Alabama A& M University Arizona State University Brown University California Institute of Technology* Carnegie Mellon University* Colorado State University Cornell University* Florida State University Georgia Institute of Technology* Harvard University* Massachusetts Institute of Technology* Michigan State University Mississippi State University North Carolina State University Pennsylvania State University* Princeton University*	Purdue University Rensselaer Polytechnic University* Rice University State University of New York—Binghamton* State University of New York—Stony Brook University of California—Berkeley* University of California—San Diego* University of Colorado—Boulder* University of Illinois—Urbana* University of Maryland* University of Michigan—Ann Arbor* University of Pittsburgh University of Southern California University of Texas—Austin* University of Wisconsin--Madison
---	--

Table 6—Graduate Schools Attended by ALFP students
*** Indicates schools attended by currently funded students**

Program Value

While ALFP has been described as “the opportunity of a lifetime,” many students accepted into the program understand quickly that while the financial support is important to their success, the mentoring aspects of the program make the difference in a student’s Ph.D. career. Other Ph.D. scholarship opportunity programs provide financial support, but rarely provide the one-to-one mentoring relationship of ALFP. A recent graduate of the program notes that while the financial support and internship experience were excellent, the support of their mentor made the difference for them as they progressed through their Ph.D. studies.

“ If anything goes wrong at the university (poor relationship with your advisor, overt discrimination, difficulty with coursework) the mentor is experienced enough in academia to offer good advice and moral support. This prevents students [from] becoming demoralized and quitting. In my case I had a difficult relationship with my advisor (although it improved by the end) and the ability to discuss how to manage him with someone outside of the university was very helpful.”

Another student comments on how the mentor helped them think through decisions when it was not as easy to communicate with an advisor, while still another notes the value and respect they have for their mentor’s opinions.

“ I have at times had difficulties with my [university] advisor, due to very different communication and working styles. At these times, it was reassuring to know that I could pick up the phone anytime and talk to my mentor about things, get advice when I needed to make a decision, or just have someone to talk to.”

“My mentor has been someone I know, trust, and respect, and whose advice is a telephone call away [which] has been useful on numerous occasions.”

In her book Leaving the Ivory Tower, Lovitts notes that many Ph.D. students withdraw from doctoral programs although they are more than capable of completing them. The reason suggested is that those who have a higher frequency of interaction with their advisers are able to develop professionally to a greater degree than students who do not. With ALFP mentors in frequent contact with students supported by the program, students have access to advice, professional information and ideas that other students do not. They also have access to the formal and informal networks that are inherent in AT&T Labs R&D and internship community. In the quotes below, students comment on the value of the relationship between the mentor and protégé and professional technical community.

“ The mentor can integrate the student into a community of researchers. People are more inclined to give credibility (and thus jobs, internships, funding) to people they know have worked with people they respect. The mentor provides the seeds of this for the student. The summer internship is the key to this. There is no substitute for getting to know people in the work environment.”

“ The main difference between AT&T and other fellowships is that as an AT&T fellow, I feel that there’s a group of people out there that are genuinely interested in my success. It’s akin to having a family support structure, but in an academic setting.”

The internship community is viewed as a special and significant workforce at AT&T Labs and is considered to represent the rising talent in the field of research. Interns are valued for their fresh ideas, new approaches and enthusiasm. In return they are exposed to research and project management skills and have the opportunity to hone their analysis and presentation skills under the direction of seasoned researchers.

“The AT&T ALFP is a great way to learn about new research but most importantly to work with researchers and gain insight into the broad perspectives of a world-class researcher. It is also a great way to establish relationships with other interns who will become professional peers.”

Additionally, mentors with diverse backgrounds can add their personal experiences to their interactions with students, providing additional credibility to their advice to students in similar situations. Professor Charles Thompson, a past fellowship graduate and advisor to the program, now at the University of Massachusetts—Lowell, mentored many ALFP students over the years, advising them and working with AT&T Labs mentors and university advisors to ensure that the students progressed successfully through their studies.

“Both [my AT&T Labs mentor] and Charles Thompson were significantly helpful. Charles Thompson actually made a visit to [my school] to talk to me [when I had a difficult relationship with my advisor] and later invited me for a visit to [his university].”

Other students find that their shared experiences with mentors of similar backgrounds are invaluable to their success in their studies.

“My mentor has helped me in numerous concrete ways.... More subtly, though she understands the nature of some of the difficulties I encounter, perhaps through a similar female pedigree, but also because she has spent time befriending me during my internship and via email over the last four years. Not only can she provide bonafide reassurance, but also caveats and concern when she is aware I need to hear it....”

And other students, interning at other research organizations, have found that not all mentoring is as effective.

“A few summers after my ALFP internship, I was chosen as a summer intern at [another outside corporate research organization]....Both programs required me to give a talk at the end of the summer.... My ALFP experience was better in that my ALFP advisor knew my weaknesses and worked with me to strengthen them throughout the summer; at [the other company] my main mentor left ...midsummer, leaving me to figure out difficult concepts in my own. The backup mentor...knew VERY little about the project I was working on. I struggled by myself to prepare a sensible talk.”

Professor Armando (Antonio) Rodriguez, also a past fellowship recipient like Dr. Thompson, who is now at Arizona State University, has initiated mentoring programs at his university, giving back to the profession and community. Both Dr. Rodriguez and Dr. Thompson have been recognized for their specific mentoring contributions and have received Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring. Other ALFP graduates and participants in the program have found that, having been mentored, they are willing to mentor others, giving back a little of the benefits that have been given to them through mentoring. Their comments below indicate their efforts with mentoring more junior students, women, those from disadvantaged backgrounds and even at risk high school students.

“I take every opportunity to mentor and encourage students to be the very best that they can be in relationship to their academic careers. I try to encourage them by sharing the many opportunities that are available to them, and use myself as an example that they can do it.”

“ I am in the final year of my Ph.D., now, and mentoring other junior students to continue my research, as well as mentoring new department graduate students who have yet to be adopted by a research group. Mentoring is hard. You need to be reliable, responsible, and most of all, have the respect of your mentee. You need to have the patience to listen, and the skill to filter out emerging problems from the general friendly exchange. Not everyone can do it....”

“I started a women in physics group for mentoring freshman women thinking of majoring in physics...taught Saturday morning physics classes for high school students from disadvantaged

backgrounds...started a series of sessions for undergrads in physics to learn about careers of graduating students and alums, and started a website for liberal arts students thinking of applying for fellowships....”

“I’m involved with Open Mentoring at my school, which pairs undergrads and graduate student mentors in a particular subject area.”

“I was a keynote speaker at a kickoff program for mentoring high school students...I generally do a lot of motivational speaking in high schools to encourage at-risk students to reach beyond high school to college and beyond.”

In thinking about the value of a program such as ALFP, it is important to be aware that students in the program are viewed by the university departments in which they study to be top notch focused researchers. The faculties understand that these students have support and guidance from some of the leading research and development professionals in their fields. This recognition and the support from AT&T Labs mentors place the typical ALFP recipient in a special category: they are apprentices in a field where it is understood that they will become full-fledged members of their professions during their careers. As a result, ALFP students and alumni are able to build on their burgeoning networks and experiences to become valued experts.

While mentoring is key to the success of ALFP students, the value of the first summer internship must be recognized as well. Often, the internship is the student’s first experience in an industrial research lab. While they may have had prior summer internships in other companies, being a student in the ALFP is a bit different as summarized in the student quotes below.

“I believe that the internship was the most important component of the ALFP. Before being accepted, I had never worked in a research-based professional environment, surrounded by seasoned academics. It’s an experience that grad students do not usually get until they finish school. I learned a plethora of skills during those four months, including new technical skills, project ideas, different methods of analysis, and even subtle things like how to write better papers....Those skills even helped me secure a second equally professional internship...the following year. The ALFP added to the “snowball” of education for me as a graduate student....”

And other students comment on the value of the knowledge they received as a result of their summer internships and the impact it has had on their technical skills and careers.

“The internships that I had previously were not research-oriented and were tailored toward applying my knowledge of a particular tool or language to solve a problem. With the ALFP internship, I had no previous experience with the infrastructure, tools or research area. So it was an amazing learning opportunity for me.”

“The summer internship was...invaluable. I learned a lot that summer, more than I ever learned in a classroom.”

“ The summer internship was a great way for me to sharpen my technical skills....I learned new approaches to problems and developed relationships with experts in the area....I also made strong contacts with other students who are pursuing the same dreams...and I am still friends with those people and we continue to support each other as we reach our goals.”

“Though I’m only in my first year of graduate study, the internship at AT&T has been a very strong influence on my thinking about my professional future....My interactions with my mentor and with other members of the statistics department at AT&T have been inspiring, and the specific statistical ideas I was exposed to last summer have already influenced my academic choices.”

“...I spent three summers working with [my mentor] before joining his department [as an AT&T Labs employee]....The internship opportunities, and the direct connection with my mentor, were a big part of why the [internship] experience was such a big positive for me, and why I decided to join AT&T when I graduated.”

Program Results

In looking at the student cohorts funded during the 1996-2000 timeframe, we find that of a total of 32 students funded, 22 completed Ph.D.s through 2006. This reflects a 78% completion rate for students during this period (Figure 1). Of those that did not complete Ph.D.s., 4 are currently still in Ph.D. programs, 2 received Masters degrees, one completed a degree in law and of the three who withdrew, one has started their own business. While students sometimes do not complete Ph.D.s during program sponsorship, it is not impossible that they might complete their studies at some future time. (Recently, one of the ALFP mentors learned that a student from the early 1980s who left the program without completing her Ph.D., completed it in 2005 after almost a 20-year break. This individual also reported working for several research labs, starting her own business and becoming a world class stunt pilot over that 20 year period, all outstanding accomplishments in their own right!)

In the previous study conducted in 2002, the completion rate of students in the fellowship programs (reflecting the programs for under-represented minorities and women individually) over the history of the programs was in the 70% to 78% range. Both the present and the past completion rates, however, indicate a higher completion rate than that of overall Ph.D. programs which have been consistently reported a completion rate of about 50% of students entering Ph.D. programs.

ALFP Program Success—1996-2000 cohorts

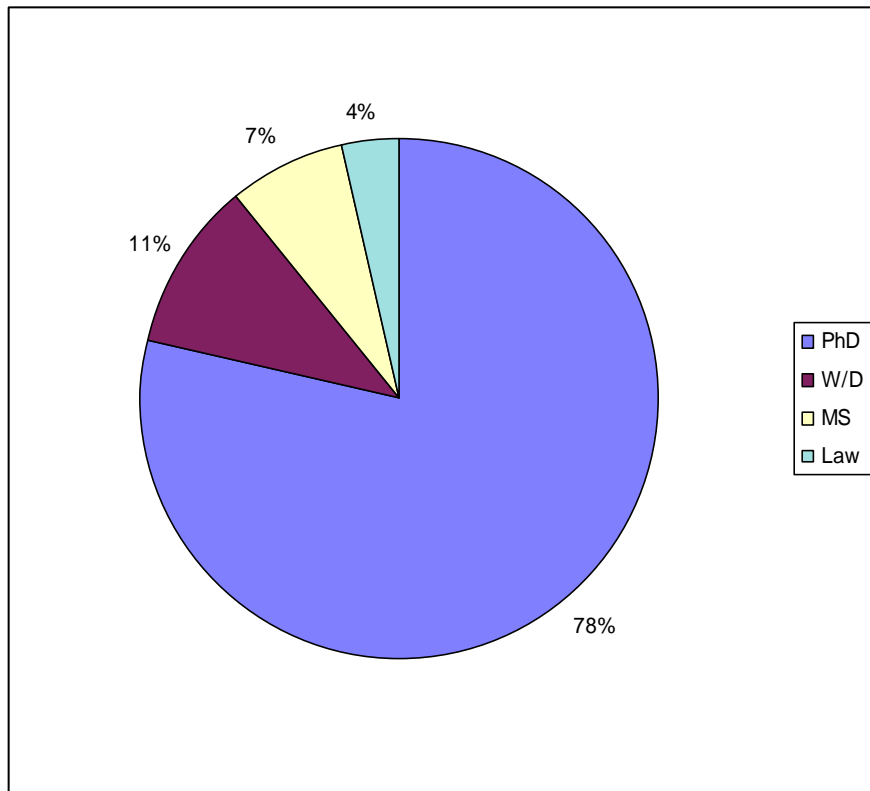


Figure 1—Percentages reflecting completed Ph.D.s, withdrawals, and other degrees

Considering some of the career experiences of some past graduates of the ALFP we can understand more of the value of the program. For example, two women graduates of the program from the 1990s, one a Latina American and the other White, both chose to work at AT&T Labs after their degrees were completed. Dr. Mary Fernandez has been a valued researcher in programming languages and databases for over a dozen years, has mentored twelve summer interns and is a member of the Advisory Board of MentorNet,⁵ has published over forty papers and held leadership positions in conferences, symposia, and professional organizations. Dr. Jennifer Rexford worked at AT&T Labs for eight years before accepting a full professorship at Princeton. She has been officially commended for her teaching at Princeton, was awarded the ACM Grace Murray Hopper Award for outstanding young computer professional of the year in 2005, is the chair of the SIGCOMM professional society, and is on the Computer Research Association board of directors.

Dr. Charles Isbell is another graduate recently in the news who had worked with both AT&T Labs and Lucent Technologies before joining the faculty at the Georgia Tech

⁵ MentorNet , the E-mentoring network for diversity in engineering and science (<http://www.mentornet.net>).

College of Computing. There he has co-created an innovative undergraduate curriculum, Threads, which is intended to prepare computer scientists to compete effectively in the global economy. In 2006 Dr. Isbell was given an NSF Faculty Early Career Development Award to recognize and support his research in statistical machine learning.

Many graduates of the ALFP programs go on to become members of university faculties and to work at AT&T as well as in industries outside the telecommunications arena (see Tables 7 and 8 below). They comprise an informal network of professionals supportive of women and under-represented minority students in technical fields, and quietly appreciate the opportunities they have been provided by the ALFP support and mentoring and often share the benefit of this support with others pursuing similar courses of study and careers. The companies and universities at which they work reflect both well-known and lesser-known firms and institutions. The career choice each graduate makes is based on his or her personal choices; the ALFP does not require that graduates work for AT&T upon completion of their degrees.

Universities Employing ALFP Graduates from 1996-2000 Cohorts

Colorado State University Drexel University Duke University Fashion Institute of Technology Georgia Institute of Technology Lehigh University	New York University Norfolk State University Purdue University Texas A&M Yale University
--	--

Table 7—1996-2000 Cohort Employers--Universities

Companies Employing ALFP Graduates from 1996-2000 Cohorts

AT&T Air Force Research BNN Technologies Draper Labs Fabulous Sites Intel Los Alamos National Labs	Max Planck Institute MIT Lincoln Lab Microsoft National Institutes of Health Nokia SA Technologies
--	---

Table 8—1996-2000 Cohort Employers--Companies

These graduates augment the alumni of the program previously hired by over 35 companies and 55 universities.⁶ These companies range from those in software and hardware development to telecommunications and communications-related industries and reflect a broad cross section of geography. The universities and colleges employing graduates before 2002 also reflect top universities as well as local and diverse schools.

While the numbers, schools and companies employing ALFP graduates reflected above tell a story of program success, another success of the program is its ability to nurture diverse talent that then enters the workforce and can act as role models to students from diverse backgrounds. The graduates of the ALFP, while perhaps small in numbers, continue to “give back” some of the gifts they received by mentoring others and by being leaders in their fields. The commitment to teaching as evidenced by the numbers of graduates who are professors at universities indicates this. These graduates, as university professors, are always looking for new talent and encouraging them to pursue dreams that they themselves have found to be achievable.

Looking to the Future

Interest and support of the ALFP by the AT&T Labs Research community remains strong. The committee members who recruit, interview and select ALFP students and later mentor them are enthusiastic about finding new and diverse talent to work in research areas. They realize that the commitment to the students during on-site internships and the subsequent mentoring while the student is pursuing their studies is demanding but also energizing. The contribution of diverse talent in new technology fields and the growing number of role model graduates who go on to mentor others continue to stimulate those who support the program. AT&T Labs takes pride in the fact that the ALFP was recognized for its value in 1998 when the program received the Presidential Award for Excellence in Science Mathematics and Engineering Mentoring and the Women in Engineering Program and Advocates Network Breakthrough Award.

Over the history of the ALFP and its predecessor programs, the interest of the research community to sustain and support the program and its students has contributed to its success and survival. This commitment continues for the future. The program has survived company and industry reorganizations and changes and will likely continue to be challenged but will continue to strive to identify students who can be nurtured to grow in the field of research and who can become strong contributors, adding vitality and diversity in technological fields. Dr. Patricia Wirth, who recently retired from AT&T Labs and who for many years was the ALFP committee chairperson responsible for the program and a mentor to many Ph.D. students, views the program as “a model with a demonstrated track record for successfully supporting women and under-represented minorities through their Ph.D.s in the sciences and engineering.” The program’s successes over 35 years show this to be true. Dr. Wirth, however, wonders “why this model has not been more widely adopted by others in industry, government and

⁶See Tables 5 and 6, Laws, E. P., “Looking Back Over 30 Years--AT&T Labs and Lucent Bell Laboratories Ph.D. Fellowship Programs, 1972-2002.”

universities as a means to meet the national imperative” to increase the numbers and diversity of new graduates in science, mathematics and engineering.

Table 9 below summarizes the percentage of the 1996-2000 ALFP cohort graduates of the total diverse candidates receiving Ph.D.s. While the numbers and percentages of diverse candidates who comprise students receiving Ph.D.s as a result of ALFP support are modest, it is important to remember that while the program is small overall, its impact

Percentage of ALFP Graduates (1996-2000 cohorts) Completing Ph.D.s of Total Diverse Ph.D. Recipient Population

	W/F	AfAm/F	AfAm/M	H/M	H/F	Asn/F
Computer Science	0.8%	1.0%	2.4%	5.2%	--	0.7%
Operations Research	0.2%	1.1%	2.4%	--	--	--
Engineering	0.2%	0.6%	0.3%	0.2%	--	0.3%
Physics	--	0.6%	--	--	--	--
Stat/Math	0.2%	--	--	--	--	--

Table 9—Percentages derived from diversity data for all Ph.D. recipients: NSF—Women, Minorities and Persons with Disabilities in Science and Engineering:2004, 1997-2004, NSF Table F-11.

in contributing diverse talent in technology is greater than the numbers might indicate. Even after 35 years of the ALFP and related programs, some diverse populations are still very few in number in particular disciplines (such as Hispanic male computer scientists). Hence even a small program can have a significant percentage impact. The need to continue to increase the currently small numbers of women and under-represented minorities completing Ph.D.s in technology fields further shows the importance of even modest programs like ALFP and its ongoing value to the future of technology research. Moreover, these students represent, as past graduates do, burgeoning leaders whose influences will be seen over time and will not necessarily be measured by numbers or percentages alone.

References

Laws, E. P. (2003), Looking Back Over 30 Years—AT&T Labs and Lucent Bell Laboratories Ph.D. Fellowship Programs 1972-2002. Proceedings of the 2003 American Society for Engineering Education Annual Conference and Exposition, American Society for Engineering Education.

Bush, G. W. (January, 2006). State of the Union Message, Retrieved (n.d.) from <http://www.whitehouse.gov/news/releases/2006/01/print/20060131-5.html>.

AT&T Labs Fellowship Program Description. Retrieved (n.d.) from <http://www.research.att.com/academic/alfp.html>.

Graduate Fellowships. Retrieved (n.d) from http://www.cs.Dartmouth.edu/gr_fellow.php.

Lovitts, B. E. (2001). *Leaving the Ivory Tower*. Maryland: Rowman & Littlefield.

National Science Foundation Award Abstract #9724858. Retrieved (n.d.) from <https://www.fastlane.nsf.gov/servlet/showaward?award9724858>.

National Science Foundation Award Abstract #9814738. Retrieved (n.d) from <https://www.fastlane.nsf.gov/servlet/showaward?awards9814738>.

Fernandez, Mary. Retrieved (n.d.) from <http://www.research.att.com/~mff/cv.pdf>.

Rexford, Jennifer. Retrieved (n.d.) from <http://www.cs.princeton.edu/~jrex/>.

Georgia Tech College of Computing. College of Computing Debuts Transformational Change to Undergraduate Computer Science Education—Innovative Threads Curriculum Focuses on Best Preparing Students for Successful and Sustainable Careers in a Competitive Global Economy. Retrieved (n.d.) from <http://www.cc.gatech.edu/content/view/1137/>.

Georgia Tech College of Computing. Charles Isbell receives NSF Career Award. Retrieved (n.d.) from <http://www.cc.gatech.edu/content/view/125>.

National Science Foundation News. (1998, September 10). Presidential Awards Honor Science, Mathematics, and Engineering Mentoring, NSF PR 98-49.

Women in Engineering Programs and Advocates Network Breakthrough Award (WEPAN). Retrieved (n.d.) from <http://engr.psu.edu/wep/corporate/wepanbreakthrough.html#winners>.

National Science Foundation. (2004). Women, Minorities and Persons with Disabilities in Science and Engineering: 2004.

Elaine P. Laws, elaineplaws@aol.com

Elizabeth Loia, eloia@research.att.com

Michael Merritt, mischu@research.att.com