

September 2001

Colleagues:

For more than a decade, leaders within Project Kaleidoscope (PKAL) have taken a kaleidoscopic perspective— looking at *why*, *how*, *what*, *where*, and *who*— in the context of exploring and undertaking efforts to strengthen the learning of undergraduates in mathematics, engineering, and the various fields of science.

In all of this, we recognize that faculty (part of the *who*) are key to achieving reforms that are meaningful and long-lived. Thus central to our work are activities related to helping faculty pursue successful careers and meet the expectations placed on them to be productive scholars and contributing members of the community. Our intent is to:

- ♦ ensure that the rising generation of leaders in undergraduate SME&T has the tools, resources, and support that enable them— individually and collectively— to make a difference in the lives and learning of their students, in scientific and technological fields, and in the larger society which education seeks to serve
- ♦ put the spotlight on the work of those faculty whose careers exemplify the scholarly tradition as teacher/researcher/mentor and on those administrators and disciplinary colleagues who actively nurture such careers
- ♦ build networks that connect these faculty to other leading agents of change and to the ideas and materials shaping the future of undergraduate SME&T.

A primary focus of PKAL's faculty initiatives is developing a cadre of leaders in undergraduate SME&T: the PKAL Faculty for the 21st Century (F21). With major support from the ExxonMobil Foundation and the involvement of senior administrators in colleges and universities across the country, a network of F21 members is emerging that is taking responsibility for leadership at the local, regional and national level. It is our hope that this group serves as the core of the human infrastructure needed to sustain and enhance reforms begun in the late 20th century, and that they are the pioneering agents of change within the undergraduate SME&T community for the 21st century.

Attention to F21 faculty, and to their faculty colleagues at all career stages, is woven tightly into the broader set of PKAL activities, in particular the series of workshops supported by a grant from the National Science Foundation, Directorate for Education and Human Resources/Division of Undergraduate Education. A grant from the Fund for the Improvement of Postsecondary Education (FIPSE) of the U.S. Department of Education is being used to analyze the experiences of a select group of institutions. These Core Institutions have experienced visible success and provide benchmarks of quality.

On the following pages we report on some lessons learned over the past several years from many of these activities, and suggest some issues yet to be addressed by the larger community. We hope this report promotes informed discussions about the tangible and intangible investments that must be made in faculty— at all career stages— if this nation is to have an undergraduate SME&T community that truly serves the interest of students, science, and society.

Cordially,



Jeanne L. Narum, Director

Strong faculty are indispensable to healthy learning communities. In addition to providing excellent teaching, faculty serve as role models for their students, provide intellectual stimulation for their colleagues, and catalyze all aspects of the academic process. Faculty who are satisfied with their careers, who enjoy teaching, and who are excited about scholarship serve as dynamic models of the kind of persons we hope to graduate from our colleges and universities....

A vital community of learners can be built and sustained only if there is commitment at all levels within an institution. Faculty and administrators must possess similar visions of the institution's mission, and everyone must work cohesively to achieve common goals. Federal agencies and private and corporate foundations are also key partners in the development of academic communities. By working with colleges and universities to develop new initiatives, they provide both intellectual and fiscal resources that are the lifeblood of faculty development.

– Project Kaleidoscope, *Volume I—What Works: Building Natural Science Communities*, 1991.

TABLE OF CONTENTS

Letter of Transmittal 1

INVESTING IN FACULTY: WAYS AND MEANS

 An Essay 4

 Benchmarks of Excellence: Institutional Vitality 5

The Story: Pursuing a Vision: The University of Portland Story 7

INVESTING IN FACULTY: SHAPING THE FUTURE

The Story: Investing in the Next Generation: The Clark Atlanta University (PRISM-D) Story 9

 An Essay 10

INVESTING IN FACULTY: TOWARD WHAT END?

 An Essay 12

The Story: Connecting Within and Beyond a Disciplinary Community: An F21 Story 14

INVESTING IN FACULTY: THE LEADERSHIP INSTITUTE

 A Statement 16

 Benchmarks of Excellence: The Leadership Perspective 17

The Story: A Personal Perspective: A Leadership Institute Alumnae Story 18

About Project Kaleidoscope: 2000 - 2001 20

About Project Kaleidoscope: 2001 - 2002 21

With Thanks to PKAL Leaders: 2000 - 2001 22

INVESTING IN FACULTY: WAYS AND MEANS

REPORT ON THE PKAL-FIPSE CORE INSTITUTION PROJECT

In 1997, PKAL received a grant from the Fund for the Improvement of Postsecondary Education (FIPSE) of the U.S. Department of Education to analyze the experiences of this group of thirty colleges and universities active within PKAL. One objective of this 'core institution' project was to identify benchmarks of quality on campuses having visible success in building environments for learning for undergraduate students in SME&T. Another objective was to distill the experiences of this group of institutions and develop some rationale and templates for continued action by the larger PKAL community.

Working with a group of thirty core institutions, with FIPSE support PKAL convened three Roundtables on key aspects of planning for the future of undergraduate SME&T: i) facilities that served programs that were research-rich, interdisciplinary and incorporated sophisticated technologies; ii) mechanisms to assess, evaluate and document the impact of reform; and iii) faculty. Representatives of core institutions and other national leaders participated in these Roundtables, with the proceedings from each woven into subsequent PKAL activities (particularly the PKAL 10th Anniversary observance in 1999). In addition to these Roundtables, a team of evaluators from Claremont Graduate University made site visits to eight core institutions. From those site visits, the Roundtables, and the review of core institution files in the PKAL National Office, we have crafted a list of characteristics that seem to describe best the culture of institutions achieving progress in motivating students to study mathematics and science and in getting them to persist and succeed in the study of these fields.

AN ESSAY

If the current generation of efforts to achieve strong undergraduate learning communities in SME&T is to be sustained, colleges and universities must give attention to policies and practices that affect all facets of institutional life— from admissions standards to graduation requirements, curricular planning to campus planning. In the process of setting forth an institutional vision, primary attention must be given to the character and quality of the faculty. A clear understanding of the *why* and the *how* of investing in faculty must be an integral part of the strategic planning process.

We are convinced that as much diligence is necessary to realize a return on the capital investment made in people as is required to realize an appropriate return from an investment in a plant; thus we submit that it is essential to look at costs related to faculty not simply as a critical expense, but as part of an intentional investment strategy meant to produce an important and significant value-added benefit.

Supporting costs incurred in building and sustaining a strong faculty (individually and collectively exemplars of the scholarly tradition) should be part of a larger institutional budgeting and investing strategy. *When we make a tenure decision, it is a \$3 million+ capital investment....* is more than an idle comment. It is an alert that, as significant, long-term resources have been committed, there must be an accompanying commitment— on behalf of the institution and faculty alike— to ensure the highest and best use is made of that investment.

These investments must cover both “*fixed and non-fixed asset*” costs. *Fixed asset* costs, those most often considered in the budgeting process, are substantial over the life of a faculty member. An investment over the thirty-year life of a science faculty member (whose initial base annual salary is between \$45,000 - \$60,000, augmented with an average 3-4% COLA adjustment) totals close to \$3,000,000. Institutional salaries differ, but the premise is still pertinent.

What is not often considered in the strategic planning process is the *non-fixed asset* investments in SME&T faculty. Opportunities to make non-fixed asset investments are numerous, including those for additional and differential merit awards and/or recognition for achievement; leadership development; scholarly growth and renewal opportunities (leaves, sabbaticals, workshops, mentoring, internal reassignments, etc.); and for a range of infrastructure needs.

A preliminary analysis suggests that very modest non-fixed asset investments are needed to ensure that the fixed asset investment in faculty is enabled to reach its full potential. On average, ‘non-fixed asset’ investments range between \$200,000 - \$500,000 over the life of an average science faculty member; this is only 20% of the fixed asset investment, but still a critical expenditure. Again, the character of scholarly activity expected and supported by different institutions will have an impact on the extent of such investments.

BENCHMARKS OF EXCELLENCE: INSTITUTIONAL VITALITY

From the analysis of site visits and institutional materials made as a part of the *PKAL-FIPSE Core Institution Project*, the following benchmarks have been identified as key elements that contribute to systemic and sustainable success in the process of reform:

- ◆ An acknowledgment of need, a recognition that students are changing, the societal context is changing, and research advances are transforming scientific and technological worlds
- ◆ A statement of mission and vision of the future that is tightly woven into institutional policies and reflected in practices and programs old and new
- ◆ A willingness to take risks, to explore and try new ideas— at the individual, departmental and institutional level
- ◆ Respect for the work of colleagues exploring and trying new approaches, evident in both the formal review and tenure process and in informal culture and conversations
- ◆ Leaders, within the administration and faculty, committed to supporting colleagues taking risks, addressing needs, moving toward the institutional vision of the future
- ◆ A focus on students that suggests new ways to look at the research activity of faculty and at the facilities used for learning
- ◆ A philosophy of discovery-based, research-rich teaching and learning that pervades all programs, for all students
- ◆ Conversations about student learning that cut across and link disciplines, as well as collaborations on pedagogical reform, course development, research and institutional policies
- ◆ A mechanism to measure the impact of different approaches— what difference they are making and to whom
- ◆ Active connections beyond the campus to scholarly colleagues engaged in similar work, as well as to communities from which students come and those to which they go upon graduation
- ◆ Active involvement in national discussions on public policy and higher education
- ◆ Persistence and an awareness of the need for continuity and sustainability.

CORE INSTITUTION PROJECT REPORT CONTINUED...

In each of the Roundtables and site visits, the role of faculty in facilitating the evolution of effective learning environments was very clear. Equally evident was the role that administrators play in building a culture where ideas flourish, faculty are connected to colleagues within and beyond the campus, and risk-taking in programmatic development (as well as in research) is expected and rewarded. Within the core institution community there was significant involvement with the PKAL F21 Network; this group was also active with PKAL workshops and with a wide range of other reform movements now changing the face of undergraduate SME&T. From the experiences of this group of colleges and universities, including reports from the Roundtable discussions, the accompanying essay was developed.

The failure to provide the necessary support (*non-fixed asset* investments) throughout a career is not a realistically cost-effective or sensible investment strategy for colleges and universities seeking to build and sustain strong programs in mathematics, engineering, and the various fields of science.

Experience demonstrates that a productive return on this modest non-fixed asset investment can make the difference between *maximum* productivity and returns (as measured in student learning outcomes, quality of scholarly productivity and societal service) and more *modest* returns on the initial investment made through fixed asset costs. In many instances non-fixed asset investments are proportionally greater in pre-tenure years, as institutions direct more attention to this stage of faculty careers. In the post-tenure period, where institutions make 80 % of the overall fixed asset investment in faculty, the trend is toward only about 10% investment in the “non-fixed assets” portion. This is puzzling.

Key investments, made at different career stages, can affect the return on an investment in faculty, especially if it is understood that faculty at all career stages have responsibility for:

- ♦ remaining current in his/her discipline and visibly active in their scholarly community
- ♦ providing access for all students to a rigorous and captivating engagement with mathematics and the various fields of science.

AN INVESTMENT ROADMAP

Consider *where* and *how* to invest in faculty from the point of recruitment through pre-tenure years. The first step is to recruit faculty who meet the mission of the program and institution and then— in the process of hiring— to clarify departmental expectations for long-term success in the institutional context and to set forth clear and well-articulated measures of success.

Consider the non-fixed asset costs at this stage, which can include:

- ♦ establishing physical infrastructure to support research activity
- ♦ providing mentoring opportunities
- ♦ providing support for pedagogical development
- ♦ reducing teaching loads for pre-tenure faculty
- ♦ reducing service expectations in the first year
- ♦ providing a pre-tenure leave program, possibly competitive, to undertake full-time research or gain new pedagogical or technical expertise.

Colleges and universities must develop policies and practices that recognize the long-term contribution that each individual faculty member makes to the education of students and the service of the institution over the long-term. Thus, the same attention and support should be available for mid-career and senior faculty as for those at the pre-tenure stage.

Thus, regular interviews concerning institutional expectations must continue for faculty at all career stages with the chair, deans, mentors, colleagues, etc. Requirements for recognition and reward, promotion and tenure must be developed and promulgated widely. Sabbatical leave programs must exist, with faculty held accountable for articulating both their professional needs for a leave and how that professional leave will make a return on the institutional investment.

Support must be available to explore and initiate new approaches in research and teaching. This might include:

- ♦ internal small grants programs for pilot, high-risk projects
- ♦ internal endowment funds for faculty renewal efforts
- ♦ administrative structures and personnel to advise and facilitate career planning
- ♦ staff support for non-faculty duties in laboratories
- ♦ centers for faculty development/ improvement of teaching
- ♦ internal funding opportunities, mentoring programs, proposal writing workshops, internal ‘retooling’ grants
- ♦ laboratories, offices, and equipment adequate to pursue scholarly endeavors
- ♦ travel to professional meetings and workshops related to research and teaching.

PURSuing AN INSTITUTIONAL VISION: THE UNIVERSITY OF PORTLAND STORY

A good example of what happens when an institution—top down and bottom up—takes seriously the work of institutional transformation is the University of Portland (UP). The story began a decade ago when a new president, Father David Tyson, C.S.C., articulated a strong institutional vision for UP to become the premier Catholic teaching institution in the west. Strategic planning grounded in mission and institutional strengths ensued. Short-term successes quickly followed that both excited and convinced a critical mass of faculty leaders to collaborate, plan, and carry out the newly adopted institutional mission.

Marlene Moore, then chair of the science departments and professor of biology, and now Dean of Arts and Sciences (and still professor), acknowledged the need for change, served as strategist, and led the faculty to focus laser-like on student learning. She attended the 1991 National Colloquium in Washington and PKAL's 1993 Facilities Workshop. Subsequently, the sciences on The Bluff adopted the philosophy of discovery-based, research-rich teaching and learning, and modified their curricula to reflect this thinking. Several faculty members, including Terry Favero, a 1996 class member of the PKAL Faculty for the 21st Century and 1997 Oregon Carnegie Foundation Professor of the Year, began to seek external partners and collaborators as they explored and adapted new and emerging paradigms for teaching and learning.

For the university, PKAL offered opportunities to connect with other colleges, universities, and organizations working on the cutting edge of undergraduate SME&T education.

Those early risks paid dividends as the curricular changes brought both challenges and opportunities. Student enrollment in the sciences doubled, and a young but emerging research community began to take root, both of which cried out for more appropriate spaces.

Because the sciences had focused on students and their learning and because of the widespread recognition that teaching, learning, research and collaboration would require facilities that allow those activities to prosper, the institution embarked on a campaign to support these thriving programs. The new science building, Swindells Hall (opened in 1999) provides facilities for both teaching space and appropriate space for both faculty- and student-centered research. The new building design supports the University's undergraduate model of investigative science learning and undergraduate science research. Additionally, the new building allows the University to enhance its commitment to science education programs for students preparing for jobs in K-12 education. And finally, the building serves as physical proof of the University's dedication to environmental concerns by incorporating environmentally sensitive architecture and construction.

Following that building project, the institution could have rested and considered the transformation complete. However, it was clear that teaching and learning in the 21st century would require conversations

about student learning that cut across departmental lines and link disciplines. In response, UP has developed an interdisciplinary environmental studies major bringing together the natural and physical sciences, the social sciences and the humanities where students come together in a capstone integrative course in which teams work on real world environmental issues. The spirit of reform has begun to excite and incite risk taking in other disciplines that recognize and acknowledge the need for opportunity for reform. Recently, Dean Moore engaged the psychology department in the process of reform by being part of an institutional team at the 2000 PKAL Summer Institute workshop on introductory psychology. That experience incited the group to focus on pedagogical and curricular reform. The follow-up visit by a Keck/PKAL Consultant team resulted in modifying a search for a new faculty member to one more consistent with the philosophy of inquiry-based learning and faculty student research partnerships.

A decade ago, the institution embarked on a new mission following a strong vision articulated by the president. The institution has thrived because of successful partnerships among faculty across disciplines, faculty and administration, and the institution and external partners that were forged by focusing on students and their needs. The university has done all this with a clear understanding that the 21st century will require new paradigms of teaching and learning. Systemic and sustainable reform is alive and well at the University of Portland and will be paying dividends for students and faculty for years to come.

WAYS TO FINANCE THIS INVESTMENT

Securing resources adequate to make a critical investment of faculty at all career stages requires instituting policies and practices that use current resources in a more targeted fashion, reallocating existing resources, and increasing designated gifts and grants.

Strategic planning must recognize investing in faculty as a priority of the institution, not merely an item on the cost side of the budget. This must then lead to an appropriate allocation and reallocation of resources to meet those expectations. Periodic evaluations of resource allocations must be made to make certain that expenditures have the greatest impact on faculty careers, and on institutional goals. Early planning and institutional conversations must occur if operational funds are needed, and if development campaigns are to support new and increased investments. Such conversations should consider:

- ◆ multi-year rather than annual budget planning
- ◆ the expectation of 3-5 year faculty career plans
- ◆ faculty grants, technology enhancements and capital equipment matching funds as standard budget items
- ◆ establishing endowments for programs elements outlined in this investment strategy.

Strong and continued interactions between development officers and faculty must be encouraged. The development office must be included

in the planning process for programs and must work with faculty (and vice-versa) in proposal writing and in alumni outreach effort. Faculty should be expected to write proposals to secure external support for their individual scholarly needs as well as for departmental and institutional needs.

ASSESSING THE RETURN ON AN INVESTMENT IN FACULTY

There are several means by which to measure the return on investment in faculty:

- ◆ high retention of vital and committed faculty results in continuity and continued strengthening of the program, and recognition of quality programs brings distinction to the institution
- ◆ visibility as an institution of distinction aids in attracting and retaining subsequent generations of good faculty
- ◆ this visibility also attracts increasing support from alumni, foundations, extramural agencies, industries, etc. (strong faculty are more competitive in the search for external support)
- ◆ good students are attracted, admissions and retention goes up, and the bottom line is strong.

Because of all this, the institution enjoys increasing distinction and market share, and is able to provide a better education to students who then become satisfied alumni. There are other, equally beneficial returns on a carefully-targeted investment in faculty. These include:

- ◆ more productive use of resources (including time)
- ◆ identification of non-productive expenditures of limited resources
- ◆ a sense of community built on agreement about common goals and the means to achieve those goals
- ◆ an increased level of trust between the institution and faculty built on clearly communicated expectations
- ◆ a visible commitment to building and sustaining a strong faculty, in the context of institutional mission and identification of changing societal needs, brings recognition of distinctiveness.

If the assessment reveals that the current investment strategies are not achieving desired (or desirable) goals, then institutions must be creative and tenacious in realigning resources so that goals are met. To visualize a strategy, one must understand that it is the institutional strategic planning that leads to financing strategies. Financing strategies then identify funds for investment from several places including operating budgets that receive money from gifts and grants, endowment income, partnerships and joint ventures, and tuition and fees. As raising new funds through sponsored projects and fundraising for current and capital expenditures, cost-increases and partnerships are strategies already being pursued at most institutions, it may be that significant restructuring and reallocation is in order.

INVESTING IN THE NEXT GENERATION: THE CLARK ATLANTA UNIVERSITY (PRISM-D) STORY

The story of investing in faculty at Clark Atlanta University emerges from the institutional statement of purpose and mission. Clark Atlanta University (CAU) is to:

... provide the highest quality education and training for a student body which is predominately Black, but which is becoming increasingly diversified To achieve its mission the University must attract and maintain a faculty dedicated to that mission and possessing the highest professional standards, significant scholarly achievements, and excellence, creativity and humanness in teaching.

Attracting and maintaining such a faculty calls for a significant investment of time and energy of persons such as Melvin D. Webb, a Professor of Biology at CAU since 1972. Melvin (who intends to keep serving CAU for many years) has spent his career identifying younger talent and working to nurture and direct that talent toward success in the sciences. His passion for students is reflected in his work with the PRISM-D program (Program for Research Integration and Support for Matriculation to the Doctorate), a program he initiated which reflects CAU's commitment to provide an environment in which students thrive, and to increase the number of Black faculty members who obtain doctoral degrees in the critical areas of natural and mathematical sciences.

Begun in 1989 with a wide range of support from federal agencies (NSF, ONR), PRISM-D is designed to identify, recruit, and retain students in the SEM education pipelines. As with other stories of student success in SME&T, this story is one of what happens when challenging goals are set for student learning and when there is a full-court press across the institution to ensure those goals are met. Believing in the PKAL mantra that students who are expected to succeed do, the retention rate of the first seven student cohorts is over 90% through the BS degree and over 50% through the MS. By crafting a coordinated set of rigorous learning opportunities for bright and talented students beginning with programs while they are in high school through a five-year articulated honors curricula, in mathematics, natural sciences and engineering, in recent years forty-four (44) PRISM-D alumni have gone on to graduate or professional schools.

But Melvin's vision of the future brings him into active involvement with mentoring the faculty of today at Clark Atlanta University. What is important to Melvin is that his colleagues come to share his passion for helping students thrive, as well as his conviction that research experiences with faculty (and industrial colleagues) are key to student interest, motivation and success. Melvin's passion attracted Ishrat Khan, a younger member of the CAU faculty (who had been on the graduate faculty at Atlanta University before the CAU

merger). Ishrat's passion is for biomaterial and biofunctional materials research, and his vision of the future is that CAU has one of the top programs in the world in these fields.

He credits Melvin for getting him started in educational reform, for showing him how strong research programs build and enhance strong education programs (and how strong education enhances research). Ishrat, nominated in 1995 by Melvin for the PKAL Faculty for the 21st Century, says about the environment at CAU: "This is a dream setting. We are working together to give all biology and chemistry students research opportunities in cutting-edge science. Our Cancer Research Center is expanding, and within five years we will be carrying out basic cancer (interdisciplinary) research via training of undergraduate and graduate students—our commitment to research has students at the center."

Ishrat credits long conversations with Melvin ("I was in awe of his passion") to transforming his career, by keeping him ever mindful of the CAU mission as he shaped his own scholarly agenda. It is clear, however, the mentoring has gone both ways, that the boundary between mentor and mentee has dissolved into a relationship where Melvin and Ishrat each take responsibility for and pride in the achievements of the other, and that CAU's investments in faculty have realized their goal of building and maintaining a faculty of *...the highest professional standards.*

INVESTING IN FACULTY: SHAPING THE FUTURE

REPORT ON THE PKAL FACULTY FOR THE 21ST CENTURY

The PKAL Faculty for the 21st Century (F21) network emerged from discussions among the early leadership groups within PKAL.

They spent much time imagining the future of undergraduate programs in mathematics and the various fields of science, and came to realize that basic infrastructure had to be reshaped and strengthened if effective reforms were to take root and flourish over the long-term.

It was recognized that human infrastructure was key— that it is the quality and character of faculty that determine the robustness of programs. In looking at their own careers and at the challenges for the coming decade, it was clear to those in the initial leadership of PKAL that a new kind of support system was needed to attract and sustain faculty interest in the work of institutional reform. These leaders were convinced of the value of collegial relationships in the educational area, relationships that mirrored those within the research community; they also recognized the essential need for visible and persistent support by senior academics for building and sustaining such relationships.

That was the genesis of the PKAL Faculty 21 network, which is supported by major grants from the ExxonMobil Foundation. The network of F21 members, now over 1100 strong, is unique in higher education, as it brings together faculty across boundaries of discipline, geography, and sectors of higher education to focus on building research-rich environments for learning mathematics and the various fields of science— for all undergraduate students.

AN ESSAY

Taking time to plan for and make connections to realize a productive career is one of the single most important investment that individual members of the F21 network make. The opportunity to build new connections is one of the more visible benefits of engagement with the F21 network, and knowing what kind of connections have been important to this group of faculty sheds light on what works in building careers of those who will have responsibility for leadership in undergraduate SME&T for the coming decades.

Lessons learned from the F21 experience could help shape policies and practices that affect faculty careers— and the nature of such investments. In speaking about the varied range of connections afforded through the PKAL community, F21 members say they have:

- ◆ . . . met role models who balance many different roles all at once (research and teaching, leadership at the campus and national level) because they believe in what they are doing and in themselves
- ◆ . . . had annual opportunities to network with an exciting group of colleagues across all the disciplines and to talk about career-related issues that go beyond disciplinary boundaries.

Ensuring that faculty have opportunities to connect— within and beyond their home campus— should be a prime consideration for those determining faculty and curricular development budgets.

The connection to mentors is seen as most valuable, particularly as the cadre of PKAL F21 mentors is experienced in dealing with the range of issues leaders in undergraduate SME&T are now facing. Mentors can speak from personal knowledge about *what works* in building and sustaining a meaningful career from the perspective of one with a compelling vision of the future of undergraduate SME&T and a determination to continue to have an active role in shaping that future.

My earliest mentor, an undergraduate advisor, exposed me to the excitement of discovery in chemical research and to the joy in searching for answers. My graduate advisor taught me the rigorous process of asking questions, finding appropriate ways to seek reasonable and clear answers to those questions, and to communicate ideas effectively; my postdoctoral advisor inculcated in me the ability to be independent and original in the evaluation of my own work, and my current mentor— a senior colleague— continually shows me by example that teaching is a skilled profession, one that is learned through much study and experience.

— Ramesh D. Arasasingham,
University of California, Irvine

The impact of mentors— on and off-campus— should be actively explored by those making investments in the faculties of the future— academic institutions and funding agencies alike. One unexpected outcome of the grant from ExxonMobil to PKAL is the development of a substantial group of F21 faculty leaders who— recognizing the role mentors have played in their lives— are now assuming that role with their colleagues.

Most F21 activities are directed, one way or another, on shaping the future of undergraduate SME&T. Some F21 perspectives on those advances were captured in their annual statements:

- ◆ *My colleagues and I have developed entry-level courses that stress the multidisciplinary nature of current scientific practices. ...the biological, chemical, medical, physical and historical as well as social and ethical importance of given principles are presented in integrated form. Students leaving these courses should be keenly aware of these connections and their impact on the quality of life.*
– Cornelius Watson, Roosevelt University
- ◆ *Because of the growing importance of quantitation to the biological sciences, neither a program for biology majors, nor a biology breadth requirement for non-majors, would be complete without some discussion of why quantitative thinking is essential to biology, and instruction on some of the basic skills and their relevant applications. As biology approaches engineering, we need more biology students who are trained more similarly to engineers. No student is expected to pass a physics or chemistry course without learning equations that describe physical laws and how to apply them, yet they frequently begin biology with the notion that it is a purely descriptive field. Despite this initial reaction, I have found most students very willing to learn quantitative concepts once they understand their applicability.*
– Jennifer Foss, The University of Chicago

Finding time to anticipate and explore the future is always a challenge for faculty, thus an annual ‘anticipating the future’ exercise is a valuable aspect of the PKAL F21 experience. One F21 member indicates that from doing this regularly she had become more comfortable thinking like a pioneer. In the crafting of an agenda for action that is central to all PKAL activities, F21 members begin to sort out options and priorities, considering questions such as:

- ◆ What would I like to accomplish in my scholarly life in the coming year, in the next three years?
- ◆ What is my current reality and what will it take to accomplish my dreams ?

In doing this they begin to sort out options and priorities and to consider issues about timing from the personal and professional perspective.

FACULTY FOR THE 21ST CENTURY REPORT CONTINUED...

The step to becoming a member of the F21 network begins on the home campus, with the nomination by a senior administrator of a faculty colleague who is demonstrating significant capacity for leadership at the local and national level.

PKAL’s contract with the F21 campuses is to provide a diverse set of opportunities for F21 members to enhance and practice their leadership skills. The agreement is that this will be done in cooperation with deans and other national leaders in the academic and scientific communities.

The annual PKAL F21 National Assembly is a primary occasion to connect with others whose ideas are shaping the future of undergraduate SME&T. Involvement in planning PKAL workshops and publications, regional meetings and gatherings at disciplinary societies are other opportunities for F21 members.

Many national groups see the F21 community as a resource for their efforts, and alert F21 members to special issues being addressed for which their advice is needed.

F21 activities in 2001 -2002 will focus on how cutting-edge science can be woven into the learning experiences of today’s undergraduates.

INVESTING IN FACULTY: TOWARD WHAT END?

REPORT ON PKAL WORKSHOPS AND INSTITUTES

PKAL's aim is to foster, within the undergraduate SME&T community, vital connections to the ideas and activities, people and institutions shaping the future, and thus to facilitate informed and persistent action. Our goal is that all students in the nation's colleges and universities have access to rigorous programs in mathematics and the various fields of science, and are motivated to succeed.

Begun with support from the National Science Foundation (NSF) in 1989, PKAL has hosted over 125 topical workshops and national gatherings since 1991. These events have engaged representatives from over 850 academic institutions in a reexamination of the culture of teaching and learning in SME&T fields.

Participants in PKAL activities are challenged to consider the *why* of reform: new directions in science, advances in technologies, changing societal demands; they also deal with the *how*: considering pedagogical approaches that build skills of communicating and collaborating; of posing, exploring and asking critical questions; and making research an integral part of the learning experience— from discovery-based intro courses through independent work at upper levels.

Regular workshops, with print and Web materials prepared for and emerging from those workshops, have been the primary mechanism for PKAL's engagement with the community. Significant grants from the National Science Foundation, Directorate for Education and Human Resources— Division of Undergraduate Education support this dimension of PKAL.

AN ESSAY

The workshops sponsored by PKAL, particularly those in the new Summer Institutes, are one opportunity for colleges and universities to invest in their faculty. The significance of such an investment in faculty can be determined in several ways. For institutions involved with Project Kaleidoscope, the *what difference does this make* question ultimately relates to students. Whether evaluation questions are about activities within a department or program, or those that have an impact across campus, persons making decisions about institutional policies and budgets ask:

- ◆ Has student learning been strengthened?
- ◆ Are more students finding the study of mathematics and/or the various fields of science personally satisfying, and are they being motivated to continue beyond required courses?
- ◆ Are we capturing the attention of all students who should be considering scientific or technological career fields, giving them ample learning opportunities in a research-rich environment?
- ◆ Are we giving all students opportunity to gain the understandings that our alumni will need if they are to be responsible citizen leaders in a world increasingly dominated by science and technology?

From those about students, further questions can be asked to determine where the most timely investments could be made, given current circumstances within the institution and within the broader academic and scientific communities.

Some colleges and universities face extraordinary faculty turnover in the coming decade; this presents both opportunity and challenge. The opportunity is that faculty with recent doctorates may be more comfortable with emerging scientific fields that cut across disciplines and combine disciplines in new ways (computational sciences, bioinformatics, etc.) The challenge is to socialize a new cadre of faculty into a culture that is increasingly stressing the integration of research and education, and to provide each of them the resources to build a research career compatible with goals for a strong undergraduate environment for learning. Conversely, if no major infusion of new faculty is anticipated for the coming decade, decision-makers have to look at current faculty strengths and plan strategically to ensure that advances in science and technology are reflected— in depth and breadth— in their academic programs.

Thus, in thinking about an investment strategy, academic leaders must ask, within our faculty is there interest and expertise:

- ◆ in addressing some of the cutting-edge questions intriguing today's researchers in scientific and technological realms?
- ◆ in bringing new understandings about how people learn into the process of curricular planning?
- ◆ in infusing technologies into teaching in ways that enhance learning?
- ◆ in bringing all students on our campus to an awareness of the power and potential of science and technology in their world?

- ◆ in connecting to peers on other campuses and in disciplinary societies actively engaged in shaping the future of undergraduate SME&T?

Academic leaders shaping PKAL workshops know these are critical questions to be addressed at both the local and national level. Thus, they recognize the need to have an orchestrated set of development opportunities that make it possible for new science, new pedagogies, new technologies and new networks to become standard practice in this nation's undergraduate SME&T community.

PKAL workshops are organized on the premise that the following benefits can be realized:

- ◆ Reforms on an individual campus can be pursued more cost-effectively. Given the momentum of the past decade of reform, most common problems have been solved somewhere, and scarce institutional dollars need not be spent in reinventing a solution.
- ◆ Collaborations across and within campuses build a community of scholars pursuing educational transformation in the same way that the community of scholars pursuing cutting-edge research questions interact. They share questions, outcomes of initial and final experiments, ideas about use of instrumentation, developing a common language, and shaping of spaces.

- ◆ Agendas for action can be developed, implemented, and evaluated that reflect broader scientific, institutional and societal goals, rather than the plans of an individual faculty member.
- ◆ Issues about the politics of reform can be addressed more intelligently and aggressively.

Material from the PKAL institute was used in two ways. First, several colleagues in the sciences who were unaware of or skeptical about the curriculum innovations were convinced to “come on board” and accept the master syllabus as a template for development of courses. Furthermore, extensive reference to the ideas developed at the institute allowed us to convince colleagues not in the sciences of the necessity and validity of the new science requirement in the curriculum. For example, we now have a commitment to deliver science “literacy” by discussing fundamental concepts in the context of societal and cultural issues.

– 2000 PKAL Summer Institute Participant

WORKSHOPS AND INSTITUTES REPORT CONTINUED...

Beginning in 2000, a series of Summer Institutes was initiated as a larger forum for the cross-cutting dialogue essential if there is to be wide-spread awareness of best practices and of how to adapt those practices most effectively.

Increasingly PKAL will be weaving issues of leadership at the departmental and institutional level into workshop discussions, including how to:

- ◆ set a vision for the community that continues building the foundation for sustainable reform
- ◆ generate informed discussions about how that vision can be translated into a feasible agenda for action
- ◆ ensure that there is intentional collaborative action in implementing and evaluating that agenda.

Our conviction is that those colleges and universities recognized as strong leaders in the 21st century will be those with first-rate faculty, students, programs and facilities in mathematics and the various fields of science. Our aim is to be a part of making that happen.

CONNECTING WITHIN AND BEYOND A DISCIPLINARY COMMUNITY: AN F21 STORY

Psychology has emerged as a discipline firmly integrated within PKAL. While many people inside and outside the PKAL community helped this happen, four members of the F21 network who are psychologists had a leadership role. Their story is a tale of how connections work: within the F21 community of psychologists, among psychology and other disciplines with the PKAL community, and those between PKAL and disciplinary societies such as the American Psychological Association (APA).

As individual faculty, psychologists have been a part of F21 since the beginning. Three psychologists attended the first F21 National Assembly in Atlanta in 1994. Two of these, John Newman and Suzanne Baker, remained in contact via email, enjoying discussions on both professional and personal aspects of academic life. Ken Sufka and Mark Zrull met for the first time at the 1996 Kansas City F21 National Assembly. Both recall that few other psychologists were there, and that those that were tended to refer to themselves as neuroscientist. So, Ken and Mark (both interested in brain-behavior issues) took to calling themselves neuroscientists when at PKAL functions, and kept in touch at continuing F21 events and at meetings of the Society for Neuroscience.

At that time, there didn't seem to be much of a place for psychology within PKAL's disciplinary portfolio, but that really wasn't the case. It just took John, Ken, Suzanne, and Mark (and some others) to make the connection work.

It started to come together at the 1998 Chicago F21 National Assembly. Prior to this time, Suzanne (James Madison University) and Ken (University of Mississippi) were working on the APA's P3 Project, an effort that involved prominent psychologist/educators like Jane Halonen and Jill Reich. John (now at MIT) attended a PKAL F21 Leadership Institute and published an article in *American Psychologist* on rapprochement between psychology and other fields of SME&T. Mark was focusing on nurturing a culture supportive of collaborative research with undergraduates at Appalachian State University. He was having some success, and had decided it was time to try to get involved nationally.

For the Chicago Assembly, John had been invited to lead the psychology "birds-of-a-feather" discussion, into which Mark and Ken walked and began pushing the issue of teaching psychology as a science. In standard PKAL practice, the discussion became charged, and led to the idea that PKAL should sponsor a series of workshops on the teaching of psychology in the undergraduate setting as a science. However, subsequent discussions made it clear that rather than a separate series, the psychology workshops

would fit into the summer institute that was in the planning stage. After Chicago, John and Ken talked, and through email and APA meetings, got Mark and Suzanne actively involved.

As planning proceeded, John and Ken recognized the importance of PKAL's emphasis on connecting emerging leaders and elders and gurus within the community. It is likely that the first elder to be identified was Charles Brewer who had contacts with the APA, the Society for the Teaching of Psychology (STP), and most organizations with any investment in teaching psychology. Charles willingly brought his wisdom to a planning group that ultimately included many of those with national responsibility for shaping undergraduate programs in psychology. They gave the F21 group their advice and wisdom, and it's likely that the PKAL F21 planners gave the gurus and elders a bit of the "what works" PKAL philosophy.

The first two PKAL Psychology Summer Institute workshops, at Keystone, drew 64 participants, mostly institutional teams, many of which included deans. For most, it was the first opportunity for extended discussion with peers about the structure and content of undergraduate programs. The fact that other disciplines represented at the Summer Institute were exploring similar questions and issues heightened the experience.

In addition to the value of these workshops to participating teams, the four F21 planner/leaders had the opportunity to connect with national leaders in the teaching of psychology, and to connect these leaders to the larger PKAL community. The keynote address of Diane Halpern (California State University, San Bernardino) at Keystone solidified the field of psychology as a critical part of the scientific community. (Many other disciplines in the audience, before hearing her, probably did not have a clear sense that psychology was on the same page.)

Following the 2000 Summer Institute, connections continued to form and mature. John and Ken were recognized for their efforts with a Presidential Citation from the APA, a recognition John considered important in obtaining his current position. Ken and Suzanne continued in a leadership role within APA P3, and Ken gained greater visibility among APA's Education Directorate. David Elmes (Council on Undergraduate Research) engaged Suzanne and Mark as part of a CUR evaluation team (which earned great reviews), and Suzanne took part in a Keck/PKAL consultancy with Julio Ramirez (Davidson College), which she describes as one of her most rewarding PKAL experiences. John became part of Diane Halpern's and Milton Hakel's group on *applying the science of learning to the university and beyond*. Mark became a CUR Councilor. They agreed to stay on as a core group to plan the psychology workshop at the 2001 Summer Institute.

I think that it's an interesting and telling point that I can't actually remember where we met, and that it feels like we've known each other much longer! In fact, one of the Summer Institute participants was very surprised that we hadn't known each other for years. This says something about the coalescing of this group around issues that are important to all of us – and also, I think, about the atmosphere of service and generosity which one finds at PKAL gatherings and other events where teaching and undergraduate education is the focus. (Suzanne Baker)

Connections continue to build around the issue of undergraduate psychology. The psychology elders (Jill Reich, Jane Halonen, Ginny Mathie, Barney Beins, Nancy Dess, David Elmes, Douglas Bernstein, Carole Wade and Diane Halpern) kept actively involved with planning. All participants contributed to revising a draft of new APA-sanctioned Standards for Undergraduate Psychology Programs, in addition to taking home good action plans for developing their own quality undergraduate psychology programs.

As PKAL F21 members, John, Ken, Suzanne and Mark have had the opportunity to make connections with each other and to take responsibility for connecting psychology and PKAL together, or maybe just to help psychology emerge from within the PKAL community.

Final words at the 2001 PKAL Summer Institute from one of psychology's elders, Charles Brewer, are good reminders to us all.

. . . Your good work here, however, is the beginning rather than the end. The challenges will come when you return to your departments and try to get your colleagues as excited about your ideas as you are Teach with passion

INVESTING IN FACULTY: THE LEADERSHIP INSTITUTES

REPORT ON THE PKAL F21 LEADERSHIP INSTITUTES

Since 1996, with support from the Directorate for Biological Sciences at the National Science Foundation, PKAL has hosted a series of Leadership Institutes for a select number of F21 members. Institute participants are currently in or anticipating assuming major leadership roles on their campus and/or within their professional community. The Leadership Institutes were designed as an opportunity to learn about and discuss the philosophical and practical issues that must be addressed in fulfilling those responsibilities.

Applicants to the Leadership Institute sought an opportunity to:

- ♦ broaden their understanding of the context for leadership: public policy issues, advances in science and technology, the challenges facing higher education, etc.
- ♦ gain new insights about their personal capacity for leadership—strengths and weaknesses, as well as about the various approaches to leadership
- ♦ practice essential skills of leadership (communicating a vision, listening to all voices, team-building and collaborating in problem-solving, planning strategically) in a non-threatening environment
- ♦ assess, reassess and set an agenda for their professional future.

The goal of the Institute is to move participants out of their normal comfort zones, to encourage the exploration of new, risk-taking opportunities—on their home campus and beyond.

A STATEMENT

The following statement on the impact of the PKAL F21 Leadership Institutes was developed by a cadre of Leadership Institute alumni in July 2001.

For many of us, participation in the PKAL F21 Leadership Institute (LI) was a “life-changing experience.” Most of us experienced a fundamental change in our view of leadership that has altered our perceptions of ourselves as leaders. The LI provided us with support and confidence to take risks and assume leadership roles from a variety of positions and arenas that could lead to positive change to the SME&T community. For others of us, participation in the LI reinforced our personal vision of leadership and reaffirmed our professional direction as leaders in the SME&T community.

One of the most valued components of the LI was our interaction with mentors. These senior faculty and administrators, by sharing their personal journeys through leadership, served [and continue to serve] as role-models. They offered constructive criticism that allowed us to “think outside the box” in devising our personal approaches to leadership. They were instrumental in helping us develop personal action plans that continue to move us forward as leaders.

The new vision of leadership we developed encompasses an understanding of the multiple styles and arenas of leadership. The concept of servant-leadership emerged for many and reinforced

the idea of shared work. The value of working from within the group was recognized, “the leader is not always the head of the parade, sometimes she is the one who makes the parade happen.” We learned to value the contributions of others through active-listening, role-playing, and conflict resolution, and that leadership involves moving the team toward a common vision as well as knowing when to take action. We learned that it is essential to take time for self-reflection and assessment in order to be effective leaders.

This changed vision of leadership has led to our increased involvement both on campus and in the broader community. Some of us, who entered the LI not perceiving ourselves as leaders, emerged with a new sense of confidence in our leadership abilities. Since our participation in the LI, we have felt more comfortable taking risks and have been able to “turn obstacles into opportunities.” We developed a greater ability to focus our time and energy, and have been more selective in our commitments. This has allowed us to regain balance in our professional and personal lives. The Leadership Institute experience left most of us with the sense of responsibility “to dream new dreams and to turn those dreams into action.”

BENCHMARKS OF EXCELLENCE: THE LEADERSHIP PERSPECTIVE

F21 Leadership Institute alumni working at the 2001 PKAL Summer Institute developed a set of *benchmarks of excellence on the leadership perspective*, based on an analysis of evaluation surveys from alumni, their senior administrators and Institute mentors.

Faculty leaders:

- ◆ Demonstrate willingness to take intellectual and pedagogical risks, and are actively engaged:
 - in exploring and developing new curricular approaches
 - in teaching, research and learning across traditional disciplinary boundaries
 - in pursuing cutting-edge questions in their field of research interest
 - in seeking external support for their scholarly work
 - as a departmental advocate for science, being assertive in pressing their case with the powers that be and within the larger campus community
 - with outreach to the community beyond the campus.
- ◆ Demonstrate heightened self-awareness in both their professional and personal lives, and in the interaction of the two, by:
 - making time for reflection
 - thinking about the appropriateness of vocation/work
 - engaging others in the discussion of such issues
 - being willing to seek advice and guidance in these areas
 - being available as a good colleague and mentor.
- ◆ Demonstrate an understanding of and appreciation for differences:
 - among their colleagues in styles of working/teaching among their students in styles of learning
 - based on culture and gender
 - of activities for individuals and those designed for teams.
- ◆ Are active disseminators of best practices in:
 - bringing new pedagogies into the curriculum
 - engaging students with the content of science/mathematics
 - infusing research into the educational experience
 - leadership in higher education.

Faculty leaders demonstrate a working understanding of the theories, processes, and tools of leadership, that there are multiple styles of leadership and multiple contexts for leadership.

LEADERSHIP INSTITUTES REPORT CONTINUED...

The agenda for the five-day Institute is full, ranging from early morning experiential leadership initiatives to late night consultations with mentors. Through assigned readings, case studies and group activities, participants considered critical leadership issues: the politics of reform, the impact of societal changes on higher education, the new demands for a well-equipped work force, the challenges of an increasingly diverse student body.

Each participant worked with a mentor (senior academics and scientists) to reflect on their career journey and outline next steps.

Ninety-three F21 members participated in the Leadership Institutes and PKAL has been conscientiously monitoring their careers. From this group we are gaining important insights about the impact of involvement in a formal national network, as well as the impact of setting leadership goals in the context of a supportive community.

A PERSONAL PERSPECTIVE: A LEADERSHIP INSTITUTE ALUMNAE STORY

In 1997 Dr. Candace Collmer took the opportunity to attend PKAL's Leadership Institute in Crestone, Colorado, at the Colorado College Baca Campus. Candace came away inspired to lead her students at Wells College along under-explored avenues of experiential learning and found herself in a position of willingness to serve in broader arenas. Candace has met the personal and professional challenges that grew out of her time with PKAL LI colleagues— taking on new areas of research, new positions of responsibility within the college and expanding her work with both Wells students and building a web of professional colleagues across the U.S. and into other countries.

She writes:

I didn't expect to be so transformed by the Leadership Institute (LI) and I wondered if, upon leaving there and arriving back in the safety of my college, I would be able to maintain my expanded vision of leadership and to transfer this energy and enthusiasm to my colleagues and students. Now, four years later, I can say that I continue to draw upon my Leadership Institute experience.

After the PKAL LI, I found my notion of successful leadership changing. I realized that a leader does not have "all of the answers" nor does a leader have to know the best way to accomplish all of the goals. Rather, a good leader has a

much more important job— making sure that all of those with whom she is working are valued, and to find ways to create and maintain a space in which creativity can flourish. The best "answers" come from full group interaction. One of the greatest changes I've seen in my own leadership style has been a shift towards taking responsibility to facilitate discussion and debate, and serving as a source of information, not just providing answers.

Most importantly, the PKAL LI experience strengthened my resolve to take risks. Once I opened myself to serve in broader arenas, and to take more risks, I soon saw that new directions and opportunities presented themselves. It was this feeling of responsibility and the courage to try something new that led me to develop a non-majors course on human genetics and to lead discussions on ethical issues. This then led to the completion of a successful proposal to attend a national Bioethics Institute which expanded my network of colleagues. I continued on and developed a freshman writing seminar course on genes and ethics — and I could go on, one opportunity just gave rise to the next once I opened myself up to taking that initial risk.

Since the Institute I am now in my third year as the Departmental Chair of Biological and Chemical Sciences, I served for two years as the representative to the Board of Trustees of the Academic Program and Policy Committee, and I serve as a

faculty advisor to our Pre-Health Profession students at Wells. I initiated a new interdisciplinary team-taught course with our philosopher on the ethical, legal and social implications of the Human Genome Project and am collaborating with fellow Wells faculty members and off-campus scientists to design new undergraduate research projects within a totally new research system — very exciting!

A sense of responsibility to assume leadership roles, as well as the courage to step forward even when not every step ahead is clear at the moment, came from my experiences at the Leadership Institute. There have been times when the situation has been difficult and when leading meetings has been tricky. Courage and joy, and faith in my vision were essential ingredients in accomplishing my task. Reflecting back to my time at the PKAL LI provides me the chance to revisit and refocus on the important lessons I learned there and to remind myself about how energizing they have been in helping me to keep moving toward my visions for the future.

I shall take it as self-evident that each generation must define afresh the nature, direction, and aims of education to assure such freedom and rationality as can be attained for a future generation. For there are changes both in circumstances and in knowledge that impose constraints on and give opportunities to the teacher in each succeeding generation. It is in this sense that education is in constant process of invention.

– Jerome S. Bruner, *Toward a Theory of Instruction*, 1996.

ABOUT PROJECT KALEIDOSCOPE: 2000 - 2001

2000

- ◆ **Education in the Context of Local/Regional Environment**
Biosphere 2 Center, Columbia University (AZ) –
January 7 - 9, 2000
- ◆ **PKAL F21 Leadership Institute**
Baca Campus of The Colorado College (CO) –
June 10 - 15, 2000
- ◆ **Bridges in Undergraduate Education:
Connecting Mathematics and Partner Disciplines**
United States Military Academy (NY) –
June 16 - 18, 2000
- ◆ **PKAL 2000 Summer Institute**
Keystone (CO) – July 16 - 29, 2000
 - Psychology I & II
 - Science for All Students I & II: Developing Courses the Link to Themes and Goals in Project 2061 (AAAS)
 - Building K-16 Connections: Designing Collaborations to Strengthen K-12 Science and Mathematics Education
 - Earth and Planetary Sciences: Bringing the Earth into the Classroom Using Data, Images, Models, and Problems
 - Just-in-Time Teaching
 - Planning Facilities for Undergraduate Natural Science Communities
 - Biochemistry– Biology or Chemistry?
 - The Future of Plant Biology
 - Leadership in the Reform of SME&T: The Liberal Arts Context
 - Leadership in the Reform of SME&T: The Comprehensive University Context
 - Leadership in the Reform of SME&T: The Research University Context
 - Leadership in the Reform of SME&T: The PKAL Core Institution Project
- ◆ **Education in the Context of Regional Environment**
University of Portland (OR) – August 18 - 20, 2000
- ◆ **DSEA Alliance: Initial Meeting**
National Research Council (DC) – September 29, 2000
- ◆ **DSEA Alliance: Preparing Our Students for 21st Century Careers**
American Society of Microbiology (DC) –
November 28, 2000
- ◆ **PKAL F21 2000 National Assembly**
Tucson and Biosphere 2 Center, Columbia University (AZ)
December 1 - 2, 2000

2001

- ◆ **DSEA Alliance: Developing and Nurturing Successful Faculty Careers**
National Center for Higher Education (DC) –
January 30, 2001
- ◆ **PKAL Regional Event - What Works: Teaching Science as Science is Done at the K-16 Levels**
Widener University (PA) – February 17, 2001
- ◆ **PKAL Change Agents Roundtable on the Future: How Can Information Technology Be Best Used to Enhance Undergraduate SME&T?**
ExxonMobil Foundation Headquarters (TX) –
March 2 - 4, 2001
- ◆ **DSEA Alliance: Developing and Nurturing Successful Faculty Careers II**
American Society for Microbiology (DC) –
March 20, 2001
- ◆ **PKAL Regional Event**
Kennesaw State University (GA) – May 5, 2001
- ◆ **DSEA Alliance: The Shape and Shaping of Introductory Courses**
National Research Council (DC) – May 22, 2001
- ◆ **PKAL F21 Leadership Institute**
Baca Campus of The Colorado College (CO) –
June 9 - 14, 2001
- ◆ **Undergraduate Neuroscience Education: From the Enchanted Loom to the World Wide Web**
Trinity College (CT) – June 22 - 24, 2001
- ◆ **PKAL 2001 Summer Institute**
Snowbird (UT) – July 15 - 28, 2001
 - Just-in-Time Teaching
 - Computational Sciences Across the Curriculum
 - Technology in Classrooms Large and Small and in Research-Training Environments
 - Building a Research-Rich Environment
 - Developing and Sustaining Interdisciplinary Programs
 - Focusing on Student Learning and Measuring Institutional Effectiveness
 - Making Connections Within and Beyond the Campus
 - Science for All: Beginning Chemistry
 - Science for All: Integrative Biology
 - Science for All: Quantitative Literacy Beyond Mathematics
 - Science for All: The Campus as Learning Environment
 - Biochemistry and Molecular Biology
 - Just-in-Time Computer Education for the 21st Century
 - Developing Successful Programs for Earth and Planetary Science Majors
 - Quality Undergraduate Psychology Programs

ABOUT PROJECT KALEIDOSCOPE: 2001 - 2002

2001 – 2002 (AS OF 9/2001)

- ◆ **DSEA Alliance: The Assessment of Student Learning-
At the Level of Individual Courses and Labs**
American Sociological Association (DC)
September 25, 2001
- ◆ **PKAL F21 2001 National Assembly**
University of Wisconsin-Madison and Promega Corporation (WI)
October 19 - 21, 2001
- ◆ **PKAL Regional Event**
Widener University (PA) – November 10, 2001
- ◆ **Workshop on Planning Facilities for Undergraduate
Science and Mathematics**
Ursinus College (PA)
November 16 - 18, 2001
- ◆ **The World Wide Web: Strengthening the Student Learning Environment**
United States Air Force Academy (CO)
February 8 - 10, 2002
- ◆ **PKAL Change Agents Roundtable on the Future:
Assessment in the Service of Student Learning**
Duke University (NC)
March 1 - 3, 2002 (*By Invitation*)
- ◆ **Deadline for Nominations: PKAL Faculty for the 21st Century (F21)**
May 1, 2002
- ◆ **PKAL 2002 Summer Institute**
Williamsburg (VA)
May 29 - June 5, 2002
*Cross-Cutting Programs & Issues
for the Future **
 - Academic Leadership
 - Assessment
 - Biochemistry
 - Environmental Sciences
 - Facilities
 - Information Technologies
 - National Science Digital Library
 - Quantitative Literacy
- ◆ **PKAL F21 2002 National Assembly**
Washington and National Academy of Sciences (DC) – October 11 - 13, 2001

*Academic Structures The Department of the Future **

- Biology
- Chemistry
- Computer Sciences
- Earth Sciences
- Mathematics
- Physics
- Psychology

* As of September 25, 2001

Other Events (*Topics/Dates TBA*)

- ◆ **PKAL Regional Event** — Atlanta (GA) – *Date TBA*
- ◆ **DSEA Alliance: 2001/2002 Bi-Monthly Meetings (*Topics TBA*)**
Washington (DC) – *Dates TBA*

ABOUT PKAL: HISTORY

Project Kaleidoscope (PKAL), begun in 1989 with support from the National Science Foundation, Directorate for Education and Human Resources, has sponsored 120 events since that time, events involving over 8000 individuals from colleges and universities across the country.

PKAL's initial goals were:

- ◆ to equip institutional teams for leadership in reform at the departmental and institutional level, connecting them to the ideas and people making a difference in undergraduate SME&T
- ◆ to increase national understanding of how strong undergraduate SME&T programs serve students, science, and society.

These goals continue to drive the work of PKAL, as we also seek:

- ◆ to build local, regional, national, and disciplinary networks pursuing such goals, and
- ◆ to build and sustain the leadership capacities of all taking responsibility for shaping the future of undergraduate programs in mathematics, engineering, and the various fields of science.

WITH THANKS TO PKAL LEADERS: 2000 - 2001

Project Kaleidoscope (PKAL) is a grass-roots alliance with a host of volunteers responsible for planning and implementing PKAL events and activities relating to:

- ♦ the Summer Institutes, and workshops within and beyond the Institute
- ♦ the Faculty for the 21st Century (F21) Network, including the PKAL F21 National Assemblies
- ♦ the PKAL-FIPSE Core Institution Project
- ♦ the development of PKAL publications, both print and electronic.

Through a consultancy program supported by the W.M. Keck Foundation, PKAL is building a cadre of faculty and administrators to serve as advisors to colleges and universities working toward excellence in undergraduate SME&T education. A group of architects, laboratory designers and campus planners has also made a significant contribution to the work of PKAL.

A 2001 initiative was the *Change Agents Roundtable on the Future*, an effort to ensure that the work of pioneers in reform is appropriately reflected in PKAL activities. The 2001 Roundtable, co-sponsored by Sigma Xi and hosted by the ExxonMobil Foundation, dealt with *How Can Information Technology Be Best Used to Enhance Undergraduate SME&T?* The 2002 Roundtable, hosted by Duke University, will deal with *Assessment in the Service of Student Learning*.

In 2000 - 2001, an increasingly important dimension of PKAL's efforts has focused on building networks, including:

- ♦ a network within the world of Disciplinary Societies and Educational Associations [DSEA] (hosting a DSEA bi-monthly meeting in Washington to explore and exchange ideas about building strong undergraduate SME&T programs)
- ♦ a network of Senior Associates, retired national leaders in academic and scientific circles committed to shaping the future of undergraduate SME&T.
- ♦ networks at the local and regional level that provide opportunity for frequent collaborations with colleagues
- ♦ networks that emerge from electronic conversations and sharing of ideas and materials.

We especially want to thank those who have taken a leadership role in designing and planning, or serving as an advisor for PKAL workshops and roundtables in 2000 - 2001. Their names are listed below.

Samuel A. Abrash, University of Richmond ❖
Brian Agrow, University of Colorado at Boulder
Edward F. Ahnert, ExxonMobil Foundation
Charles Allen, Drury University
Deborah Allen, University of Delaware
Shawn B. Allin, Lamar University ❖
Janet Andersen, Hope College ❖
Ramble O. Anukamah, Tuskegee University
Ramesh D. Arasasingham, University of California, Irvine ❖
P. Michele Arduengo, Promega Corporation ❖
Tracey Arndt, Hope College
David Christopher Arney, College of Saint Rose
Suzanne Baker, James Madison University ❖
Thomas Banchoff, Brown University
Debra Barbour, Zimmer Gunsul Frasca Partnership
Laura M. Barden, Western Illinois University ❖
Timothy Barker, Wheaton College
Karen W. Bauer, University of Delaware
Bernard C. Beins, American Psychological Association
J. Ellis Bell, University of Richmond
Truman T. Bell, ExxonMobil Foundation
Kirstie L. Bellman, The Aerospace Corporation
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James O. Benedict, James Madison University
Joan S. Bennett, University of Delaware
Richard Bennett, Woodrow Wilson National Fellowship Foundation
Mark A. Benvenuto, University of Detroit Mercy ❖
Alice Bergfeld, Botany Online
Mark T. Bernius, The Dow Chemical Company
Douglas A. Bernstein, University of South Florida

Keith D. Beyer, Wisconsin Lutheran College
John Bishop, University of Richmond
Daniel Blackburn, Trinity College of Connecticut
Douglas P. Blanchard, NASA Johnson Space Center
Robert H. Blodgett, Austin Community College
Pamela Blondin, Sigma Xi, The Scientific Research Society
Michael E. Boardman, Pacific University ❖
John J. Boitano, Fairfield University
Thomas M. Boyd, Colorado School of Mines ❖
Elizabeth S. Boylan, Barnard College
Thomas Brady, University of Texas at El Paso
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David F. Brakke, James Madison University
Kerry A. Brenner, National Research Council
Charles L. Brewer, Furman University
Joseph D. Bronzino, Trinity College of Connecticut
Christine Brooks Cote, Bowdoin College
James Brophy, Indiana University at Bloomington
Barbara Brothers, Youngstown State University
Miller Brown, Trinity College of Connecticut
Merle S. Bruno, Hampshire College
Tony Lambard Burgess, Biosphere 2 Center of Columbia University
Rodger W. Bybee, Biological Sciences Curriculum Study
Colleen M. Byron, Ripon College ❖
Benjamin D. Caldwell, Missouri Western State College ❖
Bruce Callen, Drury University ❖
Phil Camill, Carleton College ❖
George Campbell, Jr., The Cooper Union for the Advancement of Science & Art

Robert D. Campbell, Rock Valley College
Verna Miller Case, Davidson College
Eileen M. Cashman, Humboldt State University ❖
Anna G. Cavinato, Eastern Oregon University ❖
Phillip R. Certain, University of Wisconsin-Madison
Timothy Challans, United States Military Academy
Katayoun Chamany, Eugene Lang College of The New School University ❖
C. Clifton Chancey, Purdue University-Calumet ❖
Susan B. Chaplin, University of St. Thomas ❖
William H. Church, Trinity College of Connecticut
John Churchill, Hendrix College
Lee Ann Clements, Jacksonville University ❖
Kristan Cockerill, Biosphere 2 Center of Columbia University
Joan M. Coffin, King's College ❖
Robert S. Cole, Evergreen State College
Debra Colodner, University of Arizona
Elizabeth A. Connor, University of Massachusetts ❖
Mark Corotis, University of Colorado at Boulder
Mark Cracolice, University of Montana
Wilson Crone, Hudson Valley Community College
Mary M. Crowe, Coastal Carolina University ❖
Benjamin Cuker, Hampton University
Janel Curry, Calvin College
Daniel M. Danielson, Soderstrom Architectural Associates
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Thomas E. Dasher, Berry College
G. Doyle Daves, Rensselaer Polytechnic Institute
Glen W. Davidson, New Mexico Highlands University

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