

CONNECTION



NEW ENGLAND'S JOURNAL
OF HIGHER EDUCATION AND ECONOMIC DEVELOPMENT
VOLUME III, NUMBER 1

SPRING 1988

- Inside:
- The Legacy of Claiborne Pell
 - Women in Development

SPECIAL FOCUS: BIOMEDICAL R&D

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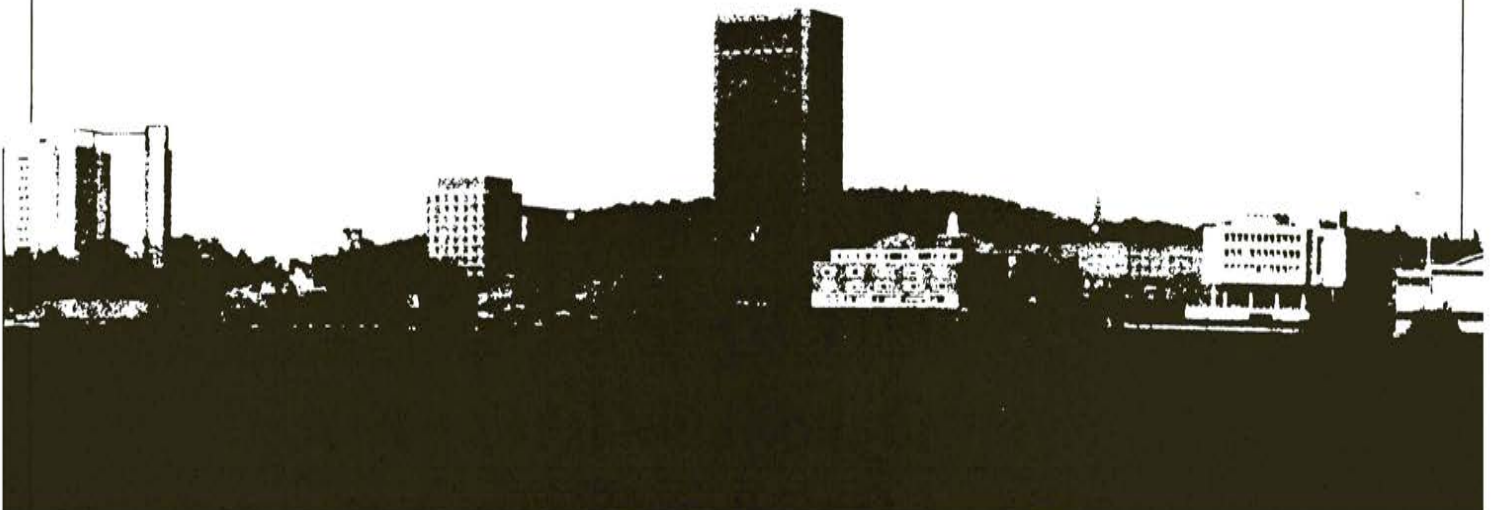
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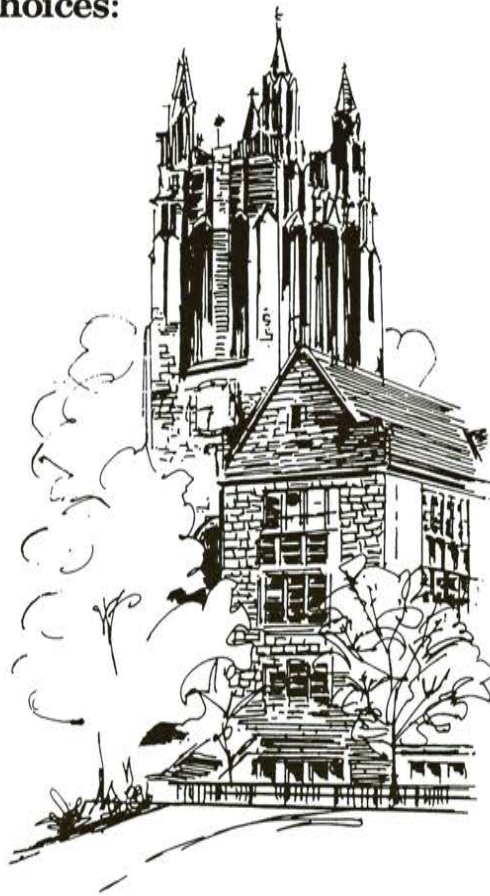
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is the purpose of the Board to advance and
develop programs that encourage higher
educational opportunities and improve
efficiency in the use of resources among New
England's public and independent colleges and
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EDITOR'S MEMO

In this issue, *Connection* reviews the results of an intensive two-year investigation of our region's academic medical centers, the biomedical research they have generated and the concentration of biotechnology firms emerging throughout New England. The study was undertaken by the Commission on Academic Medical Centers and the Economy of New England, appointed by NEBHE President John C. Hoy in 1985. The commission examined the impact of academic medical centers on the region's economy, the promise biomedical research and its successful commercial transfer hold and how to overcome the obstacles to realizing that promise.

Comprised of more than forty individuals of diverse backgrounds and professions, and chaired by James M. Howell, senior vice president and chief economist at the Bank of Boston, the commission makes a number of recommendations to regional leaders of government, business, education and medicine. The commission's recommendations are basically two fold: The strength of biomedical research in the region's medical schools, teaching hospitals and universities must be protected; and obstacles to new job creation in medical-related industries must be removed. Taking both these steps will insure that New England remains economically competitive, as biomedicine and related industries continue to mature.

The results of the commission's work are reviewed in detail by JoAnn Moody, NEBHE biomedical R&D project director and assistant vice president and legal counsel. Statements from commission members and leaders of academe, industry and government add perspective to the commission's findings. Among those commenting on the work of the commission and biomedical research and development in general are Dr. Robert Buchanan, general director of Massachusetts General Hospital; Sen. Edward M. Kennedy; and Dr. Robert McColcum, dean of Dartmouth Medical School.

Related articles include features by U.S. Rep. James M. Jeffords, R-Vt., who addresses academic research as it relates to the growth of the biomedical "revolution;" Peter E. Schwartz of General Scanning, Inc., who discusses the importance of biomedical equipment manufacturing; and Stewart N. Smith, Henry Luce Professor of Agriculture and Society at Tufts University, who examines the potential agricultural applications of biotech.

Departing from our special focus on biomedical research and development, we explore a diverse range of topics. Jennifer W. Canizares takes a look at the career paths, present positions and observations of five influential New England women in institutional development. The rapid advancement of talented development professionals was evidenced just before press time in the appointment of Inge Reichenbach, interviewed for this article, as director of development at Cornell University. Reichenbach leaves Wesleyan University June 1 for Cornell, where she will supervise a 100-person staff responsible for raising more than \$140 million annually.

In "Washington and Beyond," *Connection* correspondent Michael J. Bennett assesses the legacy of Rhode Island Sen. Claiborne Pell, whose most recent undertaking is sponsorship of the National Education Savings Trust Act. This legislation would enable families to save up to \$2,000 a year per child, tax-free, for college.

Our cover photo, courtesy of Damon Biotech of Newton, Mass., depicts gel electrophoresis, a process used for the preparation of recombinant genes for introduction into mammalian cells. These cells are custom-engineered to aid in the development of new human pharmaceuticals that augment our natural defenses to disease.

As always, your reactions to the material presented in *Connection* are welcome. □

Charlotte Stratton is managing editor of *Connection*.

CLASSES OF 2009



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**WICHE BEGINS
WESTERN UNDER-
GRADUATE EXCHANGE**

Nine western states have initiated a venture comparable to the New England Board of Higher Education's Regional Student Program. The new program will make a wide range of undergraduate programs available to non-residents at reduced cost, through the Western Interstate Commission for Higher Education. Starting next fall, the program will enable students to study selected programs of out-of-state institutions at in-state tuition, plus 50 percent. Fifty-three two- and four-year public institutions in Alaska, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Utah and Wyoming will participate in the exchange. Eighty-three two- and four-year public campuses participate in the RSP in the six New England states.

**MAINE MARITIME
PURCHASES YACHT
DESIGN COMPANY**

The Maine Maritime Academy has assumed ownership of the Yacht Design Institute in Blue Hills. Academy President Kenneth M. Curtis sees the purchase of YDI as "an opportunity for Maine Maritime to expand its service to the multi-billion-dollar recreational boating industry, which has considerable value to coastal Maine." Graduates of YDI find employment with small-craft designers and boat builders in the United States and Canada.

**BUSINESS/EDUCATION
PARTNERSHIPS
EXAMINED
IN NEW BOOK**

The Industrial Consortium Strategy, a new "how-to" manual available through the New Hampshire College and University Council, illustrates how small businesses can satisfy their education and training needs, even in isolated rural areas. The book recaps a recent statewide project in which groups of small companies were asked to join forces with colleges and universities to deliver training programs to joint groups of employees, cost-effectively and often at the workplace. For more information contact Eric Brown, NHCUC, 2321 Elm Street, Manchester, NH 03104. Phone: (603)669-3432.

**UMASS RESEARCH
PRODUCES BIO-
DEGRADABLE PLASTIC**

UMass-Amherst professor of biochemistry R. Clinton Fuller and polymer science professor Robert Lenz have developed a biodegradable bacteria-based plastic. Unlike plastics presently made with oil, the new product could eliminate litter from plastic containers and packaging. A few more years of research, according to the professors, should solve remaining technical problems with the plastic and permit its cost-competitive production. The research is sponsored by the National Science Foundation, the U.S. Office of Naval Research and a joint UMass/industry grant.

**NSSFNS SESSIONS
HELD IN BOSTON
AND NEW HAVEN**

The National Scholarship Service and Fund for Negro Students held its annual student-college interview sessions in Boston and New Haven in late March. Cosponsored by NEBHE, the Higher Education Information Center in Boston and the New Haven Public Schools, the sessions drew nearly 80 colleges and universities and more than 1,500 minority high school students to the Park Plaza Hotel in New Haven and the Sheraton Boston Hotel. The sessions are designed to provide high school students with the opportunity to meet college and university representatives, to discuss admissions, financial aid and career options.

**RECORD NUMBERS OF
MINORITY, FEMALE
APPLICANTS AT MIT**

A record number of women and minority students have applied for admission to the Massachusetts Institute of Technology this year, according to Michael H. Behnke, MIT's admissions director. The trend indicates a 50-percent increase in underrepresented minority applicants over two years, and a 6-percent increase over last year. Behnke says that the trend reflects strengthened recruitment efforts at MIT. The number of women applicants also sets a new record of 1,631, compared to last year's 1,614.

**WHEATON COLLEGE
ON SCHEDULE TO
ADMIT MEN FOR FALL**

Wheaton College will break its 153-year tradition of single-sex education and admit men to its first coeducational class in the fall of 1988. Wheaton College trustees took the controversial vote for coeducation in May 1987, following four months of discussion between college administration, faculty, alumnae, students and their parents. Gail Berson Weaver, executive director of admissions and student aid, greeted the news with enthusiasm, stating: "Applications were up 35 percent, with young men comprising 18 percent of the applicant pool. We look forward to welcoming our first coeducational class to campus in September."

UCONN HEALTH CENTER GETS SECOND ENDOWED CHAIR

The Connecticut Board of Governors for Higher Education recently approved a \$1-million endowed chair in human genetics at the University of Connecticut Health Center. Creation of the chair is intended to focus research in inherited genetic disorders within the School of Medicine's Department of Pediatrics. The State of Connecticut is providing \$500,000 for the chair, to be matched by Physicians Health Services, a health-maintenance organization based in Trumbull, Conn.

NEW ENGLAND WOULD GAIN FROM U.S.-CANADA AGREEMENT

If the U.S. Congress and the Canadian Parliament approve the U.S.-Canada Free Trade Agreement signed by President Reagan and Prime Minister Mulroney last fall, regional computer industries, banks and insurance companies will benefit. The results of a study, conducted for the New England Council by the Northeast-Midwest Institute and reported in the *Boston Business Journal*, reveals that the New England computer industry would benefit almost immediately because the current 3.9-percent duties on computer exports would be eliminated. New England's service industries would also benefit, since the agreement obliges both countries to treat services equally. On the negative side, the telecommunications, automotive and textile industries would not fare as well from the agreement.

CLARK WILL ESTABLISH GLOBAL STUDIES CENTER

Clark University has received a \$75,000 grant from the Massachusetts Board of Regents for Higher Education to establish a Teachers Center for Global Studies. Through the center, global issues will be translated into classroom instructional units for the benefit of central Massachusetts high schools. Several hundred junior- and senior high-school teachers will make use of the center during the first year. Other Massachusetts universities receiving funding include UMass-Amherst, Tufts University, Wellesley College, Framingham State College and the University of Lowell.

DARTMOUTH/AIT STUDENT EXCHANGE

Soon graduate students at Dartmouth's Thayer School of Engineering will have the opportunity to attend the Bangkok-based Asia Institute of Technology. Dartmouth is the first American institution to establish a student exchange program with the 30-year-old international institute, often called the "MIT of Asia." Daniel R. Lynch, director of graduate programs at the Thayer School, says that by spending a term at AIT, "students will see that engineering challenges are very different in different parts of the world." Almost all of AIT's 650 students are Asian, while instruction is in English.

UNH RESEARCHERS DEVELOP NETWORKING SOFTWARE

Computer scientists at the University of New Hampshire have developed networking software that will help a major manufacturer of parallel computers maintain its competitive edge. In return, the Oregon-based manufacturer, NCUBE, Inc. will provide the university's computer department with significant hardware discounts, royalties from the sale of the software and a fee for continued refinement of the software package. Parallel computing involves linking several small but powerful processors so they can solve complex problems at high speed. Designed by UNH computer scientist Charles Grasso, the software gives NCUBE machines the networking capability that has become an industry standard.

FOUR NEW ENGLAND SCHOOLS AMONG TOP 50 AWARDED D.Ed.

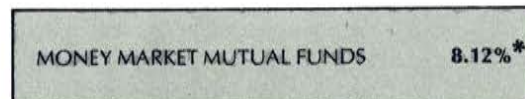
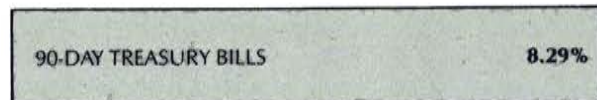
Four New England universities are among the top 50 U.S. institutions in the number of doctoral degrees in education conferred in 1986. According to a U.S. Center for Education Statistics survey, the University of Massachusetts, Harvard University, Boston University and the University of Connecticut ranked 10th, 27th, 32nd and 46th, respectively. Together they awarded 7 percent of the 4,427 doctoral degrees in education conferred by the top 50 institutions. More than 80 percent of the New England degrees were awarded by Massachusetts institutions.

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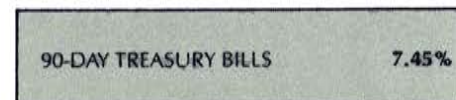
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WOMEN IN DEVELOPMENT:

New Professionalism Brings Competitiveness and Results

JENNIFER W. CANIZARES

In the past 10 years, the time-honored job of soliciting donations and raising funds for non-profit institutions has been transformed. It has been taken over by a group of energetic and sophisticated professionals who are demonstrating that the charitable dollar is alive in America if properly pursued. Although philanthropy is affected by an unpredictable stock market and the rate of inflation, more and more Americans are giving generously.

Non-profit organizations throughout New England, from the largest university to the smallest museum, have learned that a highly professional and informed approach to seeking charitable donations can yield large benefits. Demand for capable and resourceful people to conduct these sophisticated funding efforts is growing, and there are excellent career opportunities that did not exist a decade ago.

To understand the new directions in development, and to discover who is in the profession, the New England Board of Higher Education has spoken with five of the region's most prominent and successful women in this field. While they have varied backgrounds and training, each projects a sense of excitement, purpose and dedication. We asked them about changes in the profession, opportunities for women and the outlook for giving in light of today's economy and tax code. Prospects for continued growth in the fund-raising profession are promising, particularly for women.

Roads to success

As vice president for resources at Wheaton College, **Ann W. Caldwell** is one of six officers of the college, supervising external relations through alumni affairs, communications and community relations, as



Mary Kay Eliot, *director of development*, Simmons College

Prospects for continued growth in the fund-raising profession are promising, particularly for women.

well as development. **Mary Kay Eliot** has been director of development at Simmons College for more than two years. Both these successful women have a strong background in communications. With English undergraduate degrees, they began their careers writing in an academic environment. Eliot was instrumental in founding the College of the Atlantic, a small college of human ecology in Bar Harbor, Maine, where she taught creative writing and worked in public relations and development. She wrote in her role as a development officer for Harvard University, later

becoming the director of fund raising for the Unitarian Universalist Association in Boston.

Ann Caldwell also wrote for Harvard, as editor of the alumni magazine of the Graduate School of Education. She later prepared the presentation of a major fund-raising campaign at Phillips Andover Academy, which she views as an invaluable learning experience that committed her to the development field.

Both women agree that their writing skills were significant in achieving success. They also argue that the best way to learn the job is through participation in a major capital campaign. Eliot believes that the field is wide open to capable and motivated people with two solid years of experience.

Inge Reichenbach has been director of development at Wesleyan University for a year and a half. She shares with **Deirdre Ling**, vice chancellor for university relations and development at UMass/Amherst, a strong background in university administration. Reichenbach began her career in Cornell University's development office. She was born and educated in Germany, and had never heard of "development" before joining Cornell's staff. At Wesleyan, Reichenbach conducted a major reorganization of her 29-person staff. She maintains that development can be learned on the job, if one is bright, sensitive and a very hard worker.

Ling supervises a staff of 102 in development, alumni affairs, communications, public affairs and university relations. UMass/Amherst, like many other public institutions, began serious development efforts only about five years ago. With the support of a new chancellor and an enthusiastic board of trustees, Ling was able to move into her present



Inge Reichenbach, *director of development, Wesleyan University*

position after a long stint in university admissions. This is her first position in development, and she admits that it is difficult to move into a high position outside one's area of experience. Ling holds a PhD in English, and, like Reichen-

bach, who studied literature and linguistics, corroborates the value of writing skills. Ling and Reichenbach also attest to the fact that strong organizational and managerial skills, preferably gained in an academic setting, are essential to reaching a high level of responsibility.

The successful development officer is energetic, entrepreneurial, a self-starter and a self-supervisor.

Barbara Snelling stands as a model of encouragement to women who have delayed starting their professional careers. Although she was in her mid-forties before holding a salaried job, this fact belies a volunteer career of such impressive proportions that the University of Vermont offered her a position as their vice president of development and external relations. Snelling had gained a wide reputation from her volunteering involvement, had excellent organizational experience,

and was committed to higher education.

Today, as president of Snelling, Kolb & Kuhnle, Inc., Snelling is a nationally recognized consultant on institutional advancement for non-profit clients in the United States and Europe. She shares with all the women we interviewed a strong commitment and clear enthusiasm for her work.

Development demands a type of person rather than specific training. Development professionals are no longer falling into the job by chance, however, and development offices actively recruit young graduates who will consider a career in development. Almost all the women we spoke with were looking for professional staff, preferably with several years' experience. We asked them what qualifications were important.

Education: The field of development is compatible with a variety of intellectual and personal backgrounds. Specific academic training is not important, though Caldwell argues that a strong liberal arts background is a plus. As the field becomes increasingly competitive, higher degrees offer an edge, at least within an academic setting. Ling

FOR A SMALL COLLEGE, A FUNDRAISING METHOD THAT WORKS

Professionalism has brought spectacular results to the Pine Manor College 75th Anniversary Campaign, which has exceeded its \$6-million goal and nearly quadrupled the college's endowment funds. Vice President for Institutional Resources Beth Steffian led the campaign, which was initiated in the spring of 1985.

Steffian describes her office as a fairly typical small-college development shop with a relatively recent fundraising history, dating from the early 1960s. As Steffian explains, Helen Temple Cook, founding president of the college, believed that "it wasn't polite" to ask for money.

"And so she didn't," Steffian continues, "so that when she left Pine Manor back in the 1950s, we had no endowment and no annual fund." Today, as Steffian agrees, it is not only polite but necessary to ask for support.

At the outset of the fund-raising drive, Pine Manor's development committee and trustees set about contacting



Beth Steffian, *vice president for institutional resources, Pine Manor College*

the closest friends of the college with the help of staff and volunteers. Efforts during the last third of the campaign were shared with a professional telemarketing firm, Anderson, Cole and Dollhopf.

Telemarketing is a relatively new concept in fundraising in which contact with potential donors is made through carefully targeted phone calls followed-up by letter.

"It's a method of reaching a large number of people when you don't have a large body of volunteers," Steffian explains. "It's a wonderful concept, and more and more colleges are using it. It really brings forth first-time gifts, gifts from new donors and from those that we've been otherwise unable to contact because we don't have the volunteer staff."

Steffian feels that the fund-raising field will continue to grow, and that the profession is very hospitable to women. While some argue that salaries are dropping with the "feminization" of the profession, Steffian disagrees.

"I think we'll begin to see more and more women moving into positions that command higher salaries," she says. "The sky's the limit."



Barbara W. Snelling, *president*,
Snelling, Kolb, & Kuhnle

Historical analysis, according to Snelling, shows that people have never given because of tax deductibility.

feels that her PhD has been of value, particularly in relationships with university faculty. In hiring for her department, she finds that a candidate with graduate training is often a person "who believes in the academic mission and can readily represent the university."

Personal skills: Development is big business. The successful officer is energetic, entrepreneurial, a self-starter and a self-supervisor. There are erratic hours, extensive travel and many competing pressures. It is not a job for those who need predictability, structure and quick results. Sophisticated programs are carried out by large staffs, and the officer has to feel comfortable in the role of team player.

All of the women we interviewed feel strongly that a development professional must be good with people. "You have to be able to thrust yourself into the external environment," Ling explains. One must meet with strangers, speak publicly and be able to pursue human relationships with warmth and interest.

Communication: Essential to fund raising are good written and oral communication skills. A significant

part of the job is the ability to persuade. People give money to an institution because they care about it and believe in it, but also, as Reichenbach explains: "People give to people." Although donors are giving to an institution, they almost always become interested and involved through an individual. The successful development officer must believe in her institution, know its merits and weaknesses, and make that belief infectious. A development leader must motivate and energize a staff, a board of trustees, invaluable volunteers, skeptical donors, inundated corporate officers and overburdened foundations.

Integrity: Speaking from experience about persuading, Snelling insists that integrity is the essential ingredient. Not only is it important in a personal sense, but, as she points out: "You cannot stretch the truth about the institution" and be convincing. This form of integrity takes common sense as well as fundamental ethical standards. Snelling has a wide reputation for candor and directness.

"How do you feel about money?" Eliot poses this question to everyone she interviews for a job. Money is a subject laden with complex and conflicting feelings. Eliot says: "It is absolutely important to be relaxed about money. You need to be able to challenge people with the question, 'Is your gift to the college equal to your commitment to the institution?.' You cannot ask that question convincingly if you feel that it is presumptuous."

Anyone seeking to lead in resource development must appreciate and "believe in the role that voluntary support plays in our society...and in the value and pleasure of volunteer activity," insists Caldwell. This is a subtle but significant point. Many contemporary women are disdainful of volunteer work as being symbolic of historic female roles. Fund raising depends heavily upon volunteers, often alumni, who must be motivated and inspired by the development officer. "It is impossible to inspire others without really respecting the job of a volunteer," insists Caldwell.

The demand for professionals has created a very mobile job market, which poses heavy burdens on in-

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stitutions. The current job turnover rate is about two years, as people move out or to better positions. This is not only disruptive, but severely limits an individual's commitment to an institution and their ability to nurture relationships with donors. Eliot believes that institutions must find better financial and professional incentives to keep people, while Reichenbach points out that frequent changes limit promotion. In the space of two years, few people are able to determine the dynamics of a campus, let alone the depth of its external constituencies.

"Many people are trying it out and not putting in the time it takes to get to the top," Reichenbach states. "If someone wants a higher position, they should stick around."



Ann W. Caldwell, vice president for resources, Wheaton College

Opportunities for women

Snelling recounts with humor that 14 years ago, an officer from a foundation told her, "I've never met a woman development officer before—at least you'll be remembered."

Today, there is expanding opportunity for women in the field of resource development. According to the 1986 *Brakeley Compensation Report* on the compensation of chief development officers in higher education, 36 percent of middle-management positions are held by women. As Snelling points out, the many opportunities for bright and

EDUCATIONAL ATTAINMENT: has the gender gap closed?

Higher-education attainment among women nearly doubled between 1970 and 1985. While in 1970 only 25 percent of women aged 25 to 34 had any college experience, by 1985 that figure had risen to 45 percent.

The "gender gap" in higher-education attainment appears to be closing. As of 1985, women were tied with men in the proportion having one to three years of college: 22 percent for both men and women aged 25 to 34. They are also catching up with men in the share that complete four or more years of higher education (22.5 vs. 25 percent).

But a decline in higher education attainment among men may be making those statistics look more respectable than they actually are. Among men aged 25 to 29, the number with college degrees peaked at 25 percent in 1975, then dropped to 24 percent in 1980 and, further, to 23 percent in 1985.

Source: U.S. Dept. of Census

able women reflect society's high demand for good people. "There is real accountability," she maintains, "and there is little discrimination where there are ways to prove you are good. If you are good, you get results and can clearly demonstrate your competence."

As in many other professions, the difference between salaries for men and women development officers is significant. *The Brakeley Report* concludes that women earn 81.2 cents for every dollar earned by men. A June 1986 report in *Currents*, journal of the Council for the Advancement and Support of Education, states that just being male adds an average of \$3,686, or 12 percent, to a development salary. This gap is, however, just half of what it was four years ago. *The Brakeley Report* also points out that the differences

are exacerbated by the fact that women have not, on average, been in the profession as long as men, and that they "serve institutions with smaller budgets, smaller enrollments and smaller endowments. They supervise smaller staffs and manage programs that raise less money than the male CDOs (chief development officers)."

There is disagreement over the appropriate response to these statistics. Some argue that the profession is losing dollar value as it becomes "feminized." Salaries for other white collar professionals in U.S. industry rose nearly 14 percent faster than those of advancement officers, according to the *Currents* article. The argument can also be made that it is the responsibility of each institution to assure that its men and women are paid on an equal basis. Caldwell cautions that the problem cannot be presented as if it were the fault of women that salaries are not comparable. There is no question that development shares many of the problems of other professions that are experiencing changes in gender dominance.

The emergence of black alumni associations testifies to the distinct needs of minority graduates.

Minorities are very poorly represented in the development profession. Caldwell maintains that this is probably a vestige of the "old-boy network" approach to fund raising that used to be the norm and still lingers. She argues for the profession to take a conscious look at itself. The emergence of many black alumni associations testifies to the distinct needs of minority graduates. Ling actively recruits minorities for her staff, and sees great potential for them in the field.

Competition for the dollar

The women with whom we spoke were generally very positive about the outlook for academic fund raising. However, in the short term, a variety of problems beset institutions dependent on charitable contributions. These include a competitive job market and competition among institutions.

ACE SETS "NEW AGENDA" for women in higher education

Early this year, the American Council on Education's Commission on Women in Higher Education and Office of Women in Higher Education released a report addressing the future of women in academe: "The New Agenda of Women for Higher Education." The report is intended as a guide to help college and university presidents, faculty and administrators accommodate the needs of women and assure their full and equal participation in higher education.

The commission asked higher education experts around the nation the following question: "If an institution were to commit itself fully to meeting the educational needs of women, what would it do?" Recommendations based on their responses included the following:

- Seek a commitment from institutional leadership to understanding and addressing the concerns of women students, faculty, staff and administrators
- Correct inequities in the hiring, promotion, tenure and salary of women faculty, administrators and staff
- Make a permanent commitment to women's studies in the curriculum
- Review policies for effect on majority women and minority women and men
- Give specific attention to sexual harassment
- Prepare an annual status report on women
- Make leadership development for women a priority
 - Form a campus Commission on Women
 - Appoint a person responsible for women's advocacy on campus

The report comprises the last chapter of a book, *Educating the Majority: Women Challenge Tradition in Higher Education*, to be published this summer by Macmillan.

The realization that professionalism can and does make a difference in dollars raised has resulted in a heightened sophistication among even the smallest non-profit organizations. There are more pleas for every available dollar. Grant requests to corporations and foundations have skyrocketed, and consulting firms like Snelling, Kolb and Kunle are numerous and growing. Choosing the right firm for an institution is also a competitive decision for a college or university.

The job of fund raising used to be a much more casual affair in most academic institutions, having centered on an annual fund drive. This approach has changed dramatically. The total number of charitable dollars given each year continues to increase, up 9.4 percent from 1985 to 1986. The expanding population between 35 and 64 gives the most during their earning years. Most important, the professionalism of the gift-seeking process has gained the attention of a much broader audience. Eliot reports that since development was put in professional hands at Simmons in 1975, the number of donors has tripled.

Professionalism is producing quality. Effective printed material, carefully crafted pleas and focused appeals are expanding the pool of donors. But donors are obviously becoming more selective as they are inundated with requests. As Reichenbach puts it, a major motivation for giving is: "I have the means and I can make a difference to the institution." The burden is on the development officer to make vividly clear just how the donor will make a difference at a specific institution.

The quality and quantity of information gathered on each donor has gone up with computerized storage. Effective use of information about personal interests, past commitments and present inclinations can make the difference in making the donor perceive how much his or her dollar will count.

Giving in an unstable economy

All our interviewees were concerned about the strength of charitable giving in view of the uncertain state of the economy. With the bull market of 1986, charitable giving in the United States reached its highest



Deirdre Ling, vice chancellor for university relations and development, University of Massachusetts at Amherst

level in 17 years, at 2.06 percent of personal income. People were feeling comfortable and giving generously. But times have changed.

Deirdre Ling defines the pattern. "When the economic climate is uncertain, middle-income people tend to hold back. When the economic picture is really bleak, people who still have resources will give even more, because they recognize the greater need." In the present climate, unpredictability makes everyone a bit more conservative.

The decline in the stock market has already been reflected in a reduction in the giving of stocks, and a substantial reduction is anticipated in the area of large gifts. Usually, annual giving comes out of the donor's income, whereas larger gifts arise from investments. As investments are threatened, some giving is certain to be restrained. Up to 98 percent of a major capital campaign dollar can come from only 2 percent of all donors.

On the other hand, Harvard economist Lawrence B. Lindsey has analyzed giving patterns since 1960 and finds that charitable donations have steadily risen, even in years of rapid inflation and stock market decline. Many institutions are encouraging their larger benefactors to consider long term gifts and other

forms of planned giving to reduce the impact of fluctuations over the short term. Clearly, all forms of giving are dependent on a general sense of economic well-being.

Most of the women we spoke with do not anticipate major changes in charitable giving because of the recent changes in the tax code. Everyone witnessed strong year-end giving at the end of 1987, but giving that year also benefitted from lower tax rates and an increase in after-tax personal income.

Reichenbach feels strongly that it is a great mistake for development officers to undervalue the motivation of donors by overestimating the importance of tax deductions. Historical analysis, according to Snelling, shows that people have never given because of tax deductibility. Deductibility is "a sweetener, not a motivator," in her words, and donors will always give primarily because they care.

Reichenbach points to the first tax reform effort under the Reagan administration, which reduced the top bracket from 75 percent to 50 percent. A feared reduction in giving did not materialize; in fact, the reverse was true, since people found they were better able to give.

Changing donor patterns

Not everyone realizes how large a percentage of the money given to

higher education comes from individuals. In 1985-86, alumni gave 25.0 percent of all funds donated to higher education, and non-alumni gave another 25.8 percent. Only 8.1 percent came from business, 16 percent from foundations, 1.4 percent from religious organizations and 6.4 percent from all others.

The business statistic is the most significant, down from 24.9 percent in 1984-85. Patterns of corporate giving are rapidly changing. Eliot is concerned that the number of corporations has actually decreased with mergers, reducing the actual number of corporate charitable entities. Corporate pretax income in 1985 was \$22.5 billion less than in 1984, prompting many to reduce charitable giving. In a survey, nearly half of the firms that gave more than \$10 million in 1985 said they were cutting contributions for 1986 by 2 percent to 78 percent.

Corporations have become more systematic in handling donations, operating like foundations with specific criteria and formal application procedures. Many firms are very restrictive about the uses of funds, often insisting on a demonstrable return for their money, such as graduates in a relevant discipline or research in an area of specific corporate interest.

While private institutions have a long history of fund raising, public institutions have only recently expanded their quest for support. As

Ling reports, public appreciation of the needs of a public institution is poor. As development director at a public land-grant university, she experiences some difficulty in convincing people that the state does not foot the entire bill. Many foundations refuse to support any public institution.

The need for increased donor support is significantly influenced by public policy. Reichenbach is concerned about the status of financial aid. Federal student aid has dropped significantly at Wesleyan over the past few years, and in order to continue a policy of admissions regardless of student financial need, more and more scholarship money must be raised by the development office. These dollars are therefore not available for other pressing institutional needs.

Living with uncertainties means developing new strategies. Snelling advises her clients to increase their efforts to let people know that there are many creative ways to give. As new forms of planned giving are adopted by a wider population, additional dollars will become available. Meanwhile, colleges and universities are reaching out to an ever-broader portion of charitable America. □

Jennifer W. Canizares is a freelance writer and communications consultant from Newton Centre, Mass.

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A NEW RESOURCE CENTER FOR EDUCATORS

The University of Massachusetts at Boston has established a new resource for educators in New England. In early February, University Chancellor Robert Corrigan and Professor Edmund Beard, director of the John W. McCormack Institute of Public Affairs, announced the formation of the New England Resource Center for Higher Education.

New England has long been rich in educational institutions and specialized academic programs. But the center's new director, Zelda F. Gamson, argues that unlike other regions, New England has never had a campus-based program serving as a central resource for higher education. As a unit within the McCormack Institute, the Resource Center will strengthen the ties among college and university faculty and administrators, policy makers, industry and labor officials and members of the media.

Gamson is collaborating closely with Professors Ernest A. Lynton and Sandra E. Elman, two senior associates at the McCormack Institute who concentrate on educational issues. The center will devote its attention to critical policy issues facing higher education in New England in the 1980s and 1990s.

Targeted issues

The overriding purpose of the Resource Center, according to Gamson, is to "create connections and collaborations" within New England's academic community. This will take place through seminars, conferences, workshops and publications that will address major concerns of faculty, administrators and policy makers in New England. The center will focus on a specific theme each year, the first of which will be the academic workplace. Most of the center's activities over the next two years will explore the policy implications of such questions as: What is the labor market for



Zelda F. Gamson, *director*,
New England Resource Center
for Higher Education

Zelda Gamson brings with her a strong combination of academic and organizational experience.

faculty, administrators and other education professionals? Who will replace the large numbers of faculty who will be retiring in the 1990s? Why are our best minority students not entering college?

Questions about the preparation and continuing education of faculty members and administrators will also be addressed in center activities; for example: How can higher education more effectively prepare faculty members and administrators for their jobs? This will be an increasingly serious policy issue as higher education becomes a more complex industry, its students more diverse and its contributions of greater value to society.

Also central are quality of life issues, such as: How can colleges and universities deal with low faculty morale and burnout? How can college and university professionals overcome feeling overworked and underappreciated? What policies and practices create a work environment that is both productive and sane?

An activist director

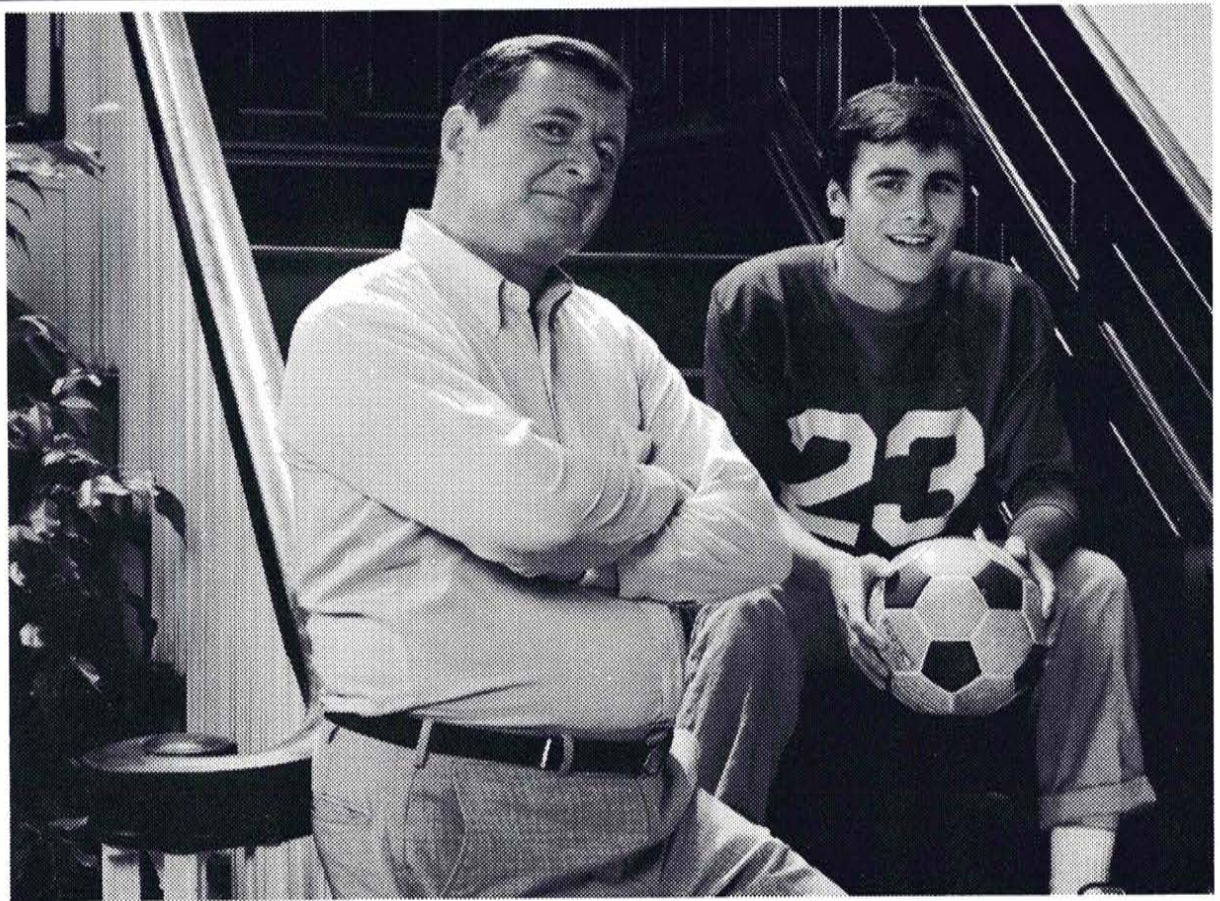
Zelda Gamson brings to the center a strong combination of academic and organizational experience. For many years she was a professor in the University of Michigan's Center for the Study of Higher Education. Her publications have addressed such issues as the university workplace, minority access and undergraduate education. She has also served as a member of national committees, such as the Study Group on the Conditions of Excellence in American Higher Education, which issued the report "Involvement in Learning."

Gamson believes that "an effective way to produce collaboration is to bring together active, articulate individuals with common problems." With this in mind, the center will organize a series of think tanks composed of leading senior administrators, faculty members and student affairs professionals representing a broad cross-section of New England's public and independent institutions. Participants will be asked to define policy issues in their domain, prepare position papers and participate in workshops and conferences. "Being in a think tank," Gamson notes, "is an honor and a commitment. We will select people very carefully."

In addition to think tanks, the center will offer a series of short workshops on specific issues, plus a yearly conference. As Gamson says, "We are creating a place where people can get together in neutral territory and talk to each other about controversial subjects.

"The impact of the Resource Center," she continues, "will be visible in the position papers, workshops and conferences we do. In the end, however, our real contribution will be felt when there is more cooperation within and among colleges and universities and between higher education and policy-makers. If that means a better education for our students, what could be better? That's our bottom line."

For further information, write to Professor Zelda Gamson, Director, New England Resource Center for Higher Education, John W. McCormack Institute of Public Affairs, University of Massachusetts at Boston, Boston, Mass. Telephone: (617) 929-7275. □



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New Presidents for Salem State, Connecticut College, New England Council

An expert in Latin-American studies with more than eight years' experience in higher education administration has been appointed as the 11th president of Massachusetts' Salem State College. **Rolando Bonachea**, currently president of Duquesne University in Pittsburgh, Pa., succeeds James T. Amsler, who will retire in August.

The appointment of Bonachea, after a unanimous vote by the Salem State College Board of Trustees, closed a year-long nationwide search that included the review of more than 100 applications. Board Chairman L. Lee Harrington said his colleagues were "impressed by Dr. Bonachea's strong background and excellent academic credentials." In addition, Bonachea was well-received by Salem State faculty, administrators and students during a campus visit.

Bonachea came to this country as a 17-year-old Cuban refugee "with 25 cents and three words of English," according to Harrington. He received a bachelor's degree in political science from the University of New Mexico and a PhD in history from Georgetown University, where he also completed a graduate program in Latin American studies. Bonachea has written and edited numerous scholarly works on Central America, the Caribbean and U.S. policy in those regions. An eloquent speaker, Bonachea has been a guest lecturer at many colleges and universities, government agencies and professional conferences.

Bonachea became acting president of Duquesne University in September 1987, having previously



Claire L. Gaudiani

served there as vice president of academic affairs. A tenured professor of history at Duquesne, Bonachea has been both a lecturer and research fellow at Georgetown University. From 1980 to 1985 he was dean of the College of Arts and Sciences at St. Louis University in Missouri.

Salem State's new president is a native of Cuba and an expert in Latin-American studies.

Claire L. Gaudiani, a 1966 graduate of Connecticut College, will assume the presidency of her alma mater on July 1. She is currently acting associate director of the Joseph H. Lauder Institute of Management and International Studies at the University of Pennsylvania. In her role as director, Gaudiani works closely with humanities, social sciences and management faculty in overseeing the institute's graduate programs in language and culture. She also originated and directs the Institute's Title VI National Resource Center in International Studies for Management, the first such center in the nation.

Gaudiani has written extensively on management in higher education and international business. Her expertise has led her to testify several times before congressional committees in support of the National Endowment for the Humanities and before the Senate on U.S. competitiveness in a global economy. While at the institute, Gaudiani undertook a lengthy visit to the People's Republic of China, where she met with 28 presidents of Chinese corporations.

Gaudiani is a consultant to non-profits including the Rockefeller and Ford Foundations, as well as a senior fellow in romance languages at the University of Pennsylvania. She is also a scholar of 17th-century French literature and has written articles and books on the subject.

Praising his replacement, Oakes Ames, president of Connecticut College since 1974, said: "Her qualifications as a scholar and administrator are of the very highest order." In accepting her appointment, Gaudiani called liberal arts colleges "America's best-kept educational secret," and stated that she plans to work at increasing Connecticut College's national exposure and reaffirming its commitment to providing high-quality liberal learning.

The Boston-based New England Council has had a new president since April 1: **J. Bonnie Newman**, the first woman to lead the council in its 60-year history. Previously, Newman was president of the Business and Industry Association of New Hampshire.

J. Bonnie Newman is the first woman president of the New England Council.

Speaking of Newman's appointment, Council Chairman George Macomber commented: "Bonnie has considerable experience in the private and public sectors and knows the economic needs and opportunities of the region." Newman



Rolando Bonachea

says she looks forward to "working with council members and others to insure New England's competitive position in national and international markets."

Newman is familiar with regional higher education, having served as dean of students at the University of New Hampshire from 1972 to 1978. She also has extensive experience at the national level. Newman served as assistant U.S. secre-

tary of commerce for economic development from 1983 to 1985; as associate director of presidential personnel at the White House from 1982 to 1984; and as chief of staff for U.S. Rep. Judd Gregg, R-N.H., in 1981. Newman is a member of the President's Export Council, which advises the president on U.S. trade policy; and a member of the Defense Advisory Committee on Women in the Services, which reports to the U.S. Secretary of Defense.



J. Bonnie Newman

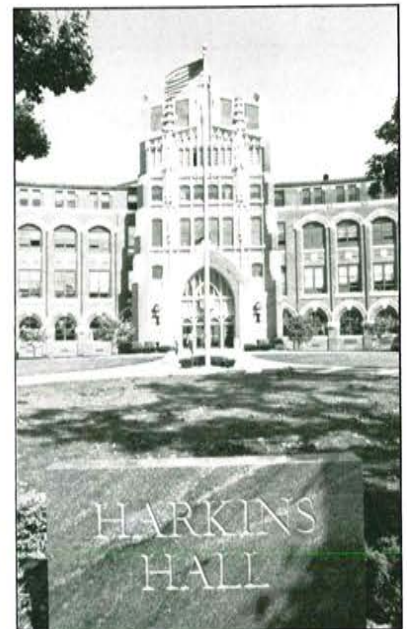
A native of Lawrence, Mass., Newman earned a bachelor's degree from St. Joseph's College in Maine in 1967 and a master's degree from Pennsylvania State University in 1969.

The New England Council—America's oldest regional business association—is dedicated to improving the region's economic vitality and quality of life. Its members include manufacturers, professional and financial services, wholesale and retail distributors, utilities, health care facilities and educational institutions. In recent years, the council has worked closely with the New England Board of Higher Education on education issues. □

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LEGACY OF A LONG- DISTANCE RUNNER

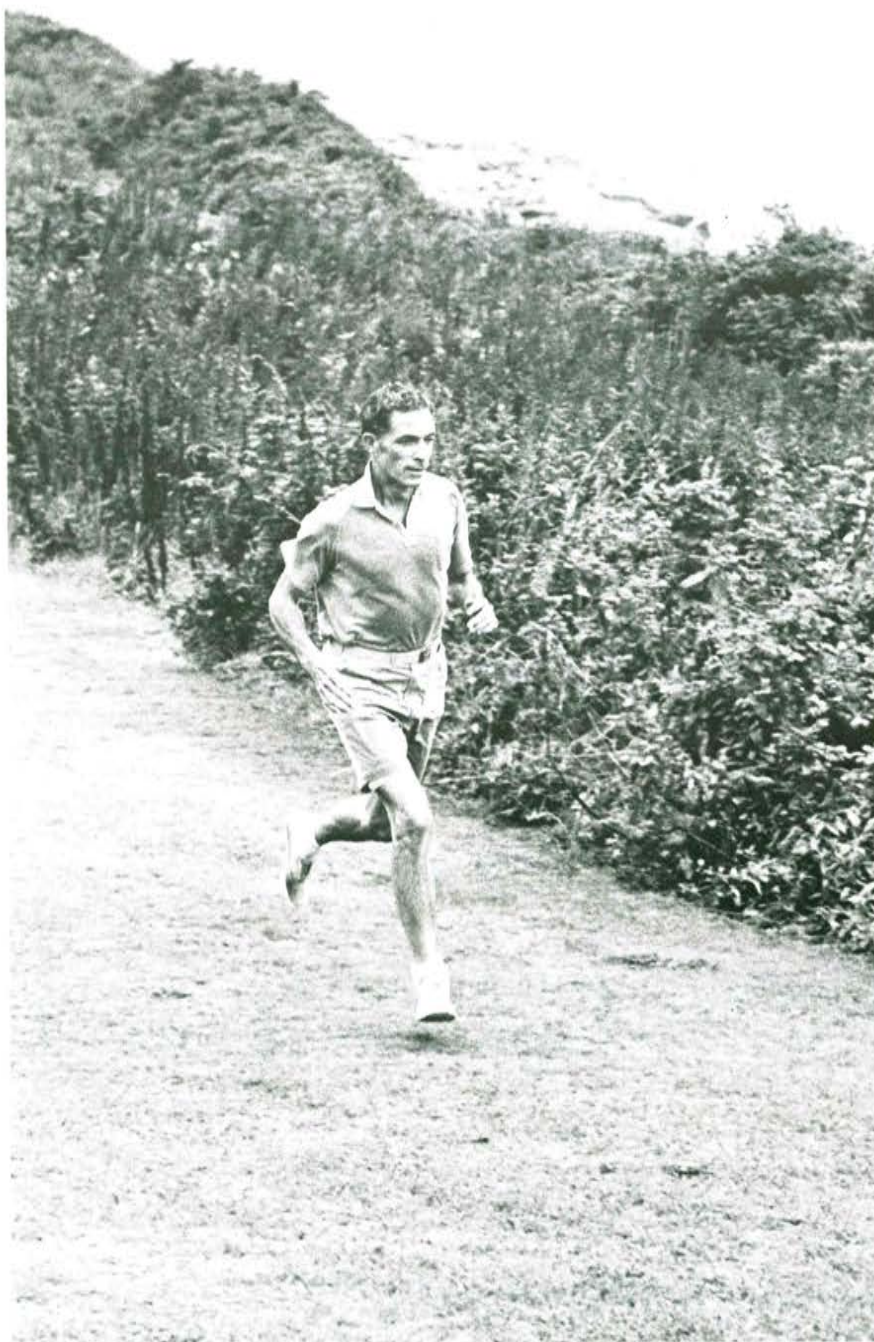
MICHAEL J. BENNETT

If the mark of a first-class mind is the ability to accept, relish—and resolve—seemingly contradictory ideas and values, Sen. Claiborne Pell, D-R.I., may well be the number one intellect in the U.S. Senate.

His greatest accomplishment in the Senate, perhaps, was the passage of Basic Educational Opportunity Grants, named "Pell grants" in his honor by Congress in 1981. Yet he has been as zealous as Secretary of Education William Bennett in taking action against the "intolerable" (Pell's word) situation created by \$1.6 billion in annual defaults on Guaranteed Student Loans. "If they were an education program, defaults would be the third largest in the Department of Education," Pell told a recent meeting of the National Association of Independent Colleges and Universities.

As chairman of the Subcommittee on Education, Arts and Humanities, Pell is the prime sponsor of a bill, the National Education Savings Trust Act, that would enable families to save up to \$2,000-a-year per child, tax free, for college.

NEST funds would operate much like Individual Retirement Accounts or Social Security. Similar plans have been introduced or considered in 40 states, including Rhode Island, but are limited in their application to the state limits. A federal program, as Pell said in his remarks to the Senate in introducing the bill, "could provide complete portability to every post-secondary provision in the country"—a matter of more than passing concern in New England, the one section of the United States dominated by private institutions of higher education.



SENATOR CLAIBORNE PELL (D-R.I.) running along Newport's Cliff Walk, near his home.

"Whether a child were to choose to attend an Ivy League college," Pell said, "a state university, a community college or a trade or technical school, the same educational benefits would apply. Tax advantages would be equitably applied to all citizens."

The proposal might also go some way towards resolving what Pell often refers to as the "access vs. choice" problem posed by traditional grant and loan programs. These programs, at least, afford children from middle-class families "access" to higher education. But they do not permit a "choice" unhampered by financial considerations, which, in turn, can dictate career choices based on the need to pay back debts, rather than pursue a vocation.

Letting others have his way

Pell, for many years a long distance runner who regularly comes in second or third in races with 700 or more contenders, has become one of the three or four major movers and shakers in the Senate. His style seems incongruously old-fashioned in a political environment based almost exclusively on media hype and polling as the principal means of establishing leadership qualities. Pell has dedicated himself to the long-term cultivation of ideas—real ideas, not the phantasms that come out of television ads.

"I have a seven-word definition of my job and my life: 'Translate ideas into events and help people,'" the senator says. Pell has done just that, quietly, unobtrusively and effectively in his more than a quarter-century in the Senate. He has identified issues, proposed solutions, and then waited tenaciously—always a gentleman, but just as much a tough and determined leader—for the moment, and the other politicians, to come to him.

He calls it "letting others have my way." A classic example of this was the NEST legislation, which the Republicans had apparently staked out as their own exclusive surefire vote-getter. "The Republicans seemed to have homed in on the education issue," Dennis Doyle, an

education specialist at Hudson Institute, was quoted as saying in a major *Wall Street Journal* article ("Education Emerges as Hot Political Issue and GOP Seizes It," Sept. 11, 1987).

"They've done some creative thinking," Doyle said, "and some of the ideas are genuinely interesting." Roy Pfauch, a Republican political consultant, commented: "Education is a family and community issue and central to the Republican effort to win the heart of the middle-class voter."

**The National
Education Savings
Trust Act,
sponsored by Pell,
would enable
families to save up
to \$2,000-a-year
per child, tax free,
for college.**

But a bill incorporating all those Republican concepts, NEST, had already been introduced by Pell in the Senate more than a month before, on July 30, co-sponsored by Sen. Edward M. "Ted" Kennedy, D-Mass., and Sen. Robert Stafford, R-Vt. Yet no member of the Senate, on the surface, would appear as unlikely to understand and "appeal to the heart of the average middle-class American voter" than Pell. He is reputedly the second richest man in the Senate; Kennedy is usually accorded first place. But Pell's money is old, very old. He is as close to a hereditary aristocrat as America can produce, born into a family that, in his own words, "has been here forever."

A study in contradictions

Pell's first government job was peeling potatoes for the Navy as a ships' cook. His master's degree from Columbia was paid for by the G.I. Bill of Rights, although his bachelor's degree, cum laude, came from Princeton, in the 1930s when "Old Nassau" was still the most socially exclusive school in the country.

Pell's ancestors fought on both sides in the Revolutionary War. Six of his forbears, including his father, served in Congress, and one became vice president under James Polk. Pell first ran for the Senate in 1960, defeating former Rhode Island governor Dennis Roberts and J. Howard McGrath, U.S. Attorney General under Harry Truman.

Rhode Island is the most ethnic, blue-collar and Catholic state in the union. "The Catholics of Rhode Island, all 64 percent of them, have 'the misfortune to be represented by two lax Episcopalians,'" Pell said in a conversation with Nelson Aldrich for *New England Monthly*. "A pity, really," Pell continued, "that their faith isn't better represented. Yet in my last campaign they gave me 75 percent of the vote. As long as you don't do something to choke off their economic well-being they will let you vote your principles. You must compromise on the objective sometimes, but not on the principles."

Pell pointed to a tiny figure on top of the great white dome of the state Capitol looming over Providence. "It's the statue of the Independent Man," he said.

Defying the "bosses"

Pell comes by his independence through family inheritance and state heritage. His father, Herbert Pell, a Democratic congressman from Manhattan, chairman of the Democratic State Committee in New York and minister to both Portugal and Hungary, was a great friend of Franklin Delano Roosevelt. The elder Pell once said: "I believe that honest capitalism is the best system for the United States, but I am being slowly convinced by the leaders of business

that honest capitalism is a myth."

Both arrogant corruption and distinguished public service have been hallmarks of Rhode Island since it was established by Roger Williams in the 17th century as a refuge for dissenters from the Massachusetts theocracy. It was the last of the original 13 colonies to ratify the Constitution, but only after it was threatened with commercial sanctions that threatened its "triangle trade" in rum, sugar cane and slaves.

It was the last state to give the vote to free white men in the 19th century, and then only after it was challenged by "Dorr's Rebellion" in the 1840s, when two separate state governments claimed sovereignty. By the turn of the century, when political machines absolutely controlled and corrupted Congress, state legislatures, and cities, Rhode Island Sen. Nelson Aldrich (great grandfather of his namesake, mentioned above) was known as "the

political boss of the United States," according to Lincoln Steffens, the best known "muckraking" journalist of the era. "Rhode Island was a state for sale, and cheap," Steffens wrote in his *Autobiography*.

However, in the 1930s, Gov. Theodore Green, another wealthy Democrat, pushed through reform legislation substantial enough to warrant the title of a "bloodless revolution." Green went on to the Senate, becoming chairman of the Foreign Relations Committee. But he never broke the power of the professional politicians who controlled the town and city committees of both the Republican and Democratic parties—and whose permission had to be sought by aspiring office seekers just to appear in their communities.

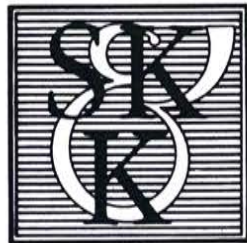
That was the way matters stood when the 40-year-old Pell, who had served as a "striped-pants" Foreign Service officer after World War II, decided to enter the primary battle

for Green's seat. Pell had never run for political office before and was matched, in Roberts and McGrath, with the most seasoned and successful politicians in the state.

Yet in a campaign using some tactics that had been successfully employed by John F. Kennedy in his first senatorial campaign eight years before, Pell won. Criss-crossing the tiny state in a van emblazoned with the words, "Pell: A Forward-Looking Democrat," Pell defied the "bosses," emerging as the first insurgent to beat the Democratic Party's endorsed candidate. In the general election, he won with the biggest plurality in the state's history. Pell has been reelected four times since then, three times without serious opposition. His one real challenge came in 1972 when he faced now-Sen. Chafee, a popular former governor and U.S. Secretary of the Navy.

"Many Washington observers deprecate Pell's political skills," the

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Gallaudet University	Rutgers Preparatory School	Wilderness Society

authoritative *Almanac of American Politics* has observed. "He is more civil than aggressive," the *Almanac* noted, "and seldom takes the lead in opposing administration policy. He leaves it up to other Democrats to be more partisan."

Pell has dedicated himself to the long-term cultivation of ideas.

More substance than style

Yet in a capitol that takes as its first principle the assumption that appearance is reality, Pell has perhaps "originated more forward-thinking legislation than has anyone else in the Senate," Aldrich observed in the *New England Monthly* article. The issues have been as diverse as rail transportation, Vietnamese refugees and support for the arts and humanities.

Pell is now the sixth-ranking member of the Senate, and chairman of the Foreign Relations Committee, which his distinguished predecessor Green dominated for so many years. He was the principal Senate sponsor for the 1965 law that established the National Endowment for the Arts and the National Endowment for the Humanities, and the Senate author of the National Sea Grant College and Program Act of 1966.

He originated the idea and spurred the negotiation of a treaty prohibiting emplacement of weapons of mass destruction on the seabed. He also fathered the Environmental Modification Treaty, which prohibits the use of environmental modification methods affecting weather, as weapons of war, for instance.

His other legislative accomplishments include the High Speed Ground Transportation Law, which made Metro-rail service possible in the Northeast Corridor. He was the initial sponsor of laws to curb drunk driving, to create a career service for Foreign Service Information Officers and a National Police Memorial, as well as other bills designed to prevent abuse of the elderly and provide education for the handicapped.

But undoubtedly, his greatest impact will be felt on the lives of hundreds of thousands of young men and women whose education and future will have been made possible first by Pell grants and now by the NEST proposal. His philosophical attitude towards education, expressed most recently in a speech before the National Association of Independent Colleges and Universities, has remained consistent over the years: "When I conceived the grant program in the early 1970s, my sole intention was to enable a talented and determined student to achieve a college education. That student might not be able to afford Harvard or Yale, but at least he or she would have the chance to get a college education."

A completely free "choice" is still not available for many college students, but the NEST program could bring far more than "access" to higher education.

"This is in line with my overall belief," Pell said, "that we should be moving to the point where we are guaranteeing the availability of 16 years of education to every student who has the talent, the desire and the drive. In my mind it is imperative that we reach this goal. At the dawn of the 20th century, state after state recognized the need for this nation to move from six to eight

years of formal education to 12. That move was accomplished so that a young person, through education, would be more adequately prepared for the workplace.

"But if you think of the changes that have occurred in this century and the demands that have increasingly been placed upon education during that period, it becomes clear—at least in my mind—that we are long overdue in moving from 12 to 16 years of formal education."

Pell's style seems old-fashioned in a political environment based on media hype and polling.

When that day comes, as well it may, in the 21st century, Pell may still be there in the Senate, a long-distance runner with miles to go before he sleeps. His predecessor and friend Sen. Green didn't retire until he was 93. Pell is 69. That gives him another 24 years to go—until 2014. □

Michael J. Bennett, Washington correspondent for *Connection*, covered Pell's 1960 Senate campaign for *The Providence Journal*. He didn't think Pell had a chance.

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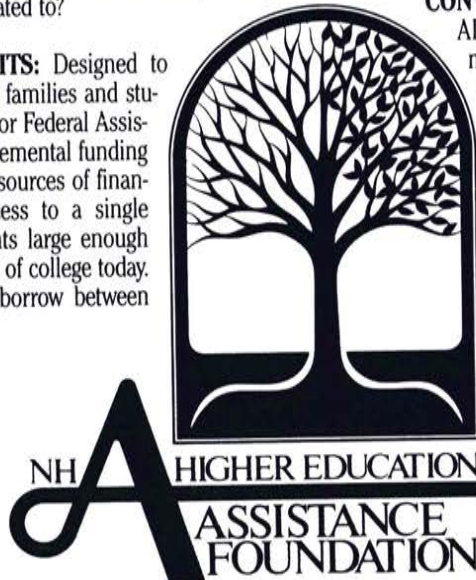
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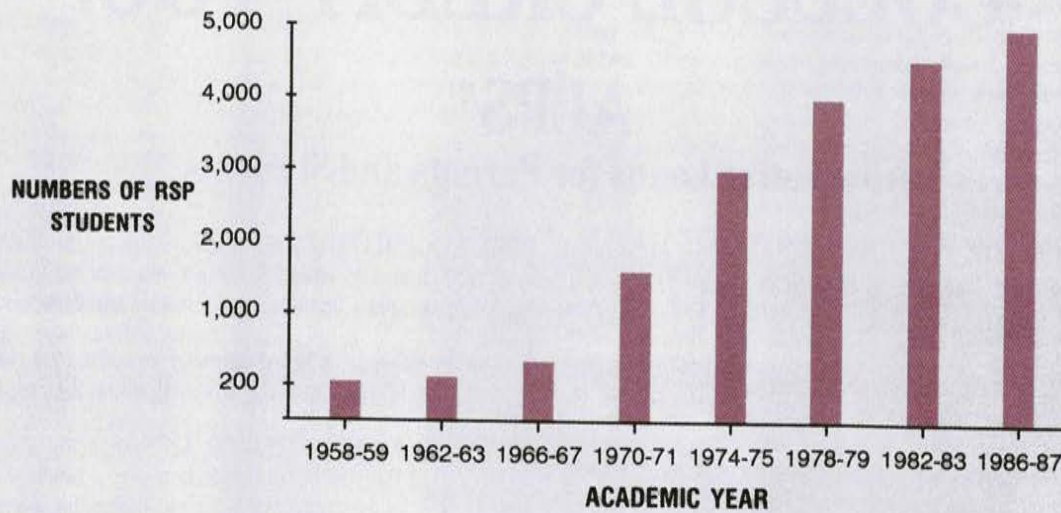
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GROWTH OF RSP ENROLLMENT OVER 30 YEARS



RSP Marks 30 Years of Interstate Cooperation

The 1988-89 academic year marks the 30th anniversary of the New England Regional Student Program. Created by the New England Board of Higher Education, the RSP enables New England residents to attend out-of-state public colleges and universities in the region at reduced tuition rates, to study certain degree programs not offered by their home state's public institutions.

Since its inception, the RSP has helped more than 68,000 New England residents gain greater access to post-secondary education and achieve their higher education goals in specialized fields of study. The program has been a model for similar efforts of the Southern Regional Education Board in Atlanta and the Western Interstate Commission for Higher Education in Denver.

A modest level of cooperation within the public higher education

community began nearly four decades ago, well before the formal creation of the RSP. For example, the University of Connecticut accepted New England residents at in-state tuition rates for such degree programs as pharmacy and physical therapy as early as 1948. Similar opportunities were available at the state universities in Maine, New Hampshire and Rhode Island.

RSP presently offers more than 1,100 degree programs at 85 public institutions, with new degree programs being added each year.

In 1955, the priority of expanding interstate cooperation was formalized by ratification of the New England Higher Education Compact by the U.S. Congress. The compact

emphasized the need for expanded regional education opportunities, and established the New England Board of Higher Education as the mechanism to foster this cooperation. Given this mandate, NEBHE initiated discussions that led to the creation of the RSP in 1957. Since that time the New England states have saved millions of dollars in capital costs by avoiding the establishment of high-cost, duplicative degree programs, permitting further investment in already existing programs.

Survey profiled RSP students

The 25th anniversary survey of regional students conducted in 1982 evaluated RSP students' perceptions of the effectiveness of the program. The survey revealed that the RSP has a significant impact on participating students, many of whom would have altered their educational goals and plans if the program had not existed. Regional students rely heavily on the financial assistance that the program provides; many come from middle-class families that are often ineligible for certain forms of aid. The survey also found that regional students are loyal to the region and continue to contribute to the New England economy upon graduation.

According to the 1982 survey, RSP students are above-average academically and have high academic aspirations. They score well above the national average on standardized tests, have superior final grade point averages, and plan to obtain graduate degrees.

RSP students are above-average academically and have high academic aspirations.

The RSP has experienced a steadily increasing level of participation since the mid-1960s, and presently

offers more than 1,100 degree programs at 85 public institutions with new degree programs being added each year. In 1986-87, over 5,100 students saved an estimated average of \$1,943 in tuition costs; total estimated RSP savings to students and their families reached nearly 10 million dollars.

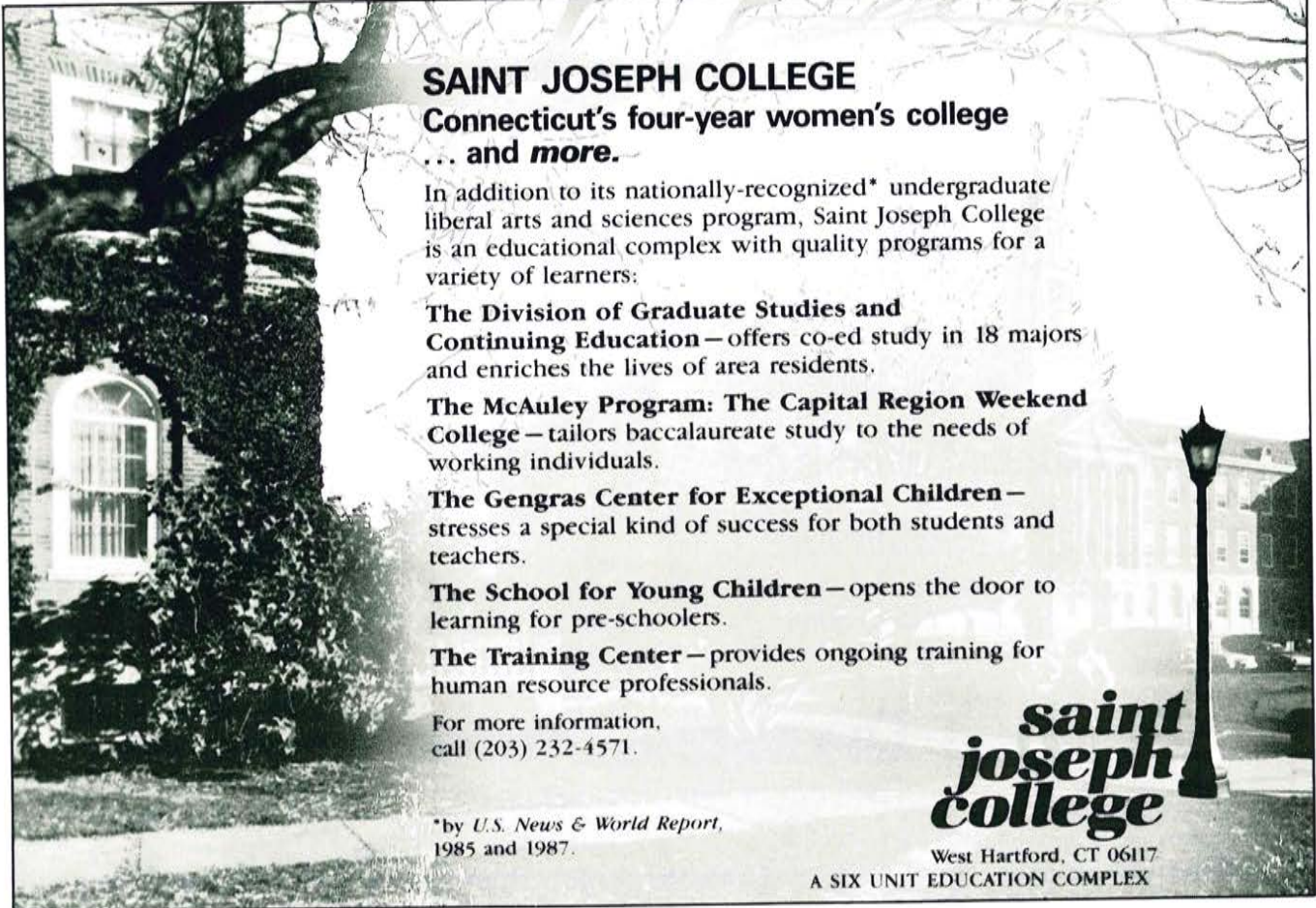
"Over the past four years, RSP enrollment has averaged 5,000 students annually," says Eugene A. Savage, vice chancellor of university system relations for the University System of New Hampshire and chairman of the RSP Advisory Council. "This figure is testimony to the tremendous need that the Regional Student Program fills in New England," he adds.

The wise use of New England's higher education resources has been supported vigorously by the New England Board of Higher Education since its creation. The RSP theme, "Your Education is New En-

gland's Future," underscores the link between sharing these resources and the benefits to students, their families, their home states and the region as a whole. The several thousand RSP students now studying throughout the region

In 1986-87, over 5,100 students saved an estimated average of \$1,943 in tuition costs.

will soon become part of the workforce, and with the skills and benefits of their education, they will be vital contributors to the regional economy. □



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JOHN C. HOY

Since 1985, New England state governments have increasingly struggled with the double-edged sword of health-care cost containment and the provision of adequate health care coverage for our citizens. Massachusetts' "universal" health-care bill is the nation's most prominent example. In addition, health education and preventive medicine, brought to the forefront by mounting fear of the AIDS epidemic, have aroused intense public debate and concern. Drug rehabilitation, infant mortality and health care for the elderly, the homeless and the poor have received acute public scrutiny. These issues will remain with us through the balance of this century, each controversial and carrying with it high costs.

One of the great ironies of New England's continuing preoccupation with health issues is the seeming lack of regional public policy attention directed at the future of biomedical research and development. The concentration of biomedical research in New England is preeminent by national and international standards. The resulting galaxy of cutting-edge biotechnology enterprises in the region demands wide public understanding as well as strategic support for R&D by state government.

In creating the Commission on Academic Health Centers and the Economy of New England, the New England Board of Higher Education believed it was essential that a highly qualified and diverse group of leaders examine the future of bio-

medical research and its implications for the regional economy. When I appointed the commission members in 1985, I requested their insight with respect to a three-point charge:

- To assess the collective scale and competitive strength of New England's nine academic health centers and associated teaching hospitals, with particular emphasis on R&D capacity.

- To analyze New England's future biomedical leadership role within the context of anticipated change and the advent of emerging technologies, new processes and health diagnostic systems.

- To recommend steps to enhance the future economic contributions of academic science, with particular attention to the future of the medical centers and the emerging biomedical/biotechnical enterprises of the region.

The commission's report, like others NEBHE has sponsored during the past decade, reveals heightened evidence that quality education from elementary school through college in the fields of science and mathematics is the bedrock of academic medicine. Excellent preparation is essential for those students who will pursue graduate degrees in medicine and related fields, including biochemistry, molecular biology, biophysics and bioengineering.

New England's world-renowned medical schools, major teaching hospitals and graduate universities collectively form what one member of the commission has called "a unique national treasure." Biotechnology development has become internationally competitive, and the global impact of biomedical discoveries on behalf of all peoples increases daily. The region's higher education resources represent the seedbed of our biotechnology and biomedical industries, making it possible for New England to assume a world leadership role.

From 1981 to 1986, federal awards to New England nonprofit organizations for biomedical research increased 100 percent, to \$660 million, accounting for 15 percent of all U.S. funds granted by the National Institutes of Health. In comparison, NIH awards to all other states rose 65 percent during this period.

Put another way, New England receives \$51.46 per person from NIH—2.85 times more than the national average of \$18.04 per person. Despite the region's lead in competing for federal R&D awards, New England state governments' share of higher education R&D is the lowest among all regions of the United States at 2.3 percent, a mere 27 percent of the average 8.4 percent provided by all states. And while the region's state investment in R&D is low, support for biomedical research is even more modest.

If successful biomedical technology transfer offers, as the commission persuasively argues, the promise of creating a major new replacement industry in New England—one that will generate quality jobs, spin off additional economic activity and increase public revenues—the current level of state investment in R&D is dangerously inadequate. Meanwhile, future discoveries in medical diagnostics and the vast potential of biomedical technology sit in the waiting room, impatiently aware of the compelling current opportunities.

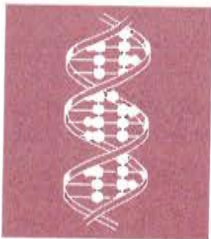
Balancing short- and long-term issues in the health sciences is imperative, while the present imbalance favors immediate results and neglects investment in long-term solutions. The commission urges that New England prudently prescribe balanced investment in the future of biomedicine. Their findings should be read with care. □

John C. Hoy is president of NEBHE and publisher of *Connection*.

BIOMEDICAL RESEARCH AND TECHNOLOGY:

NEBHE Commission Reports Prognosis for the Future

JOANN MOODY



Concluding a two-year examination of how academic medical centers impact the region's economy, the New England Board of Higher Education's Commission on Academic Medical Centers and the Economy of New England has determined that prompt steps must be taken to protect the strength of biomedical research in the region's medical schools, teaching hospitals and universities. In addition, barriers blocking the creation of new jobs by medical-related firms must be removed. The commission's report, which focuses on biomedical research and its commercial development in New England, is designed to spur regional leaders of government, business, education and medicine to constructive action.

Public and economic benefits of biomedical research

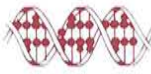
The commission's report identifies New England's academic medical centers (defined as medical schools and their major affiliated teaching hospitals) as generators of the pioneering research and medical innovations that lead to new technologies and industries.

The region's nine medical schools (at Boston University, Harvard, Tufts, Dartmouth, Yale, Brown, the universities of Vermont and Connecticut and the University of Massachusetts at Worcester) and their 46 major affiliated teaching hospitals are world-renowned for their excellence in patient care. Clients from around the world make pilgrimages to New England to secure medical consultation and intervention. Likewise, students from around the world seek basic professional training in New England's medical schools and advanced clinical experience as residents in the teaching hospitals.

Besides providing patient care and medical education, faculty at academic medical centers engage in biomedical research. Because this research almost always involves human subjects or was prompted by patient care problems, it is applied rather than theoretical in nature. New England academic medical centers have, for example, pioneered the use of chemotherapy and hyperthermia to treat cancer, created artificial skin for victims of trauma and burns and have discovered ways to lower cholesterol through drug therapy and changes in diet and exercise.

**At right:
laboratory
technician uses
genetic
engineering
techniques.**





COMMISSION CHAIRMAN JAMES M. HOWELL

As chairman of the NEBHE Commission on Academic Medical Centers and the Economy of New England, James M. Howell, PhD, senior vice president and chief economist at the Bank of Boston, has brought his considerable expertise and energy to the study of the future of biomedical development during 30 months of inquiry. Howell is committed to assuring that the commission's soon-to-be-released analysis and recommendations are widely understood by policy-makers in the region and nation, as well as by the public at large. He believes that action by the education, corporate, government and medical sectors is required for the effective completion of the commission's work.

From the outset, Howell has realized that the commission's most important function is to reveal how the preeminence of New England's biomedical research establishment can lead to the job creation, income and taxes generated by successful biomedical development and biotechnology transfer. Howell believes that the commercialization of biomedical innovation and invention generated by New England medical schools, major teaching hospitals and universities is a precious national resource of international significance.

A native of Texas, Howell is widely known as New England's leading corporate economist, whose work in the area of New England's economy and the dynamics of regional economic development has gained national recognition. He chaired an earlier NEBHE study focusing on the role of higher education in regional economic recovery. The resulting report, *A Threat to Excellence*, published in 1982, spurred state reform in secondary and higher education, and contributed to increasing public awareness of the necessity of continued investment in higher education.

Many engineers and researchers at the Massachusetts Institute of Technology (where applied research is stressed) have been drawn to collaborations with Boston-area medical faculty. Joint projects have successfully produced the "Boston arm" (an artificial limb controlled by electrical signals generated by the remaining muscles in an amputee's upper arm); computer-based monitors of patients' vital signs; and a multitude of other innovations.

Although MIT does not have a medical school, one third of its on-campus research is health-related. Resources at MIT include the Clinical Research Center (with a 12-bed hospital and outpatient services); the Center for Cancer Research; and the Biotechnology Process Engineering Center (focusing on biopharmaceutical and other biotech manufacturing processes). MIT is also affiliated with the Whitehead Institute for Biomedical Research and with the Harvard-MIT Division of Health Sciences and Technology, which awards a joint M.D./PhD degree. Several MIT faculty hold joint appointments at Boston teaching hospitals. For these reasons, MIT was included in the commission's study.

**On a per-capita basis, New England
garners more NIH funding than any
other region of the United States.**

NIH funding in New England

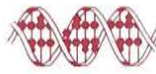
The critical mass of biomedical research conducted in New England contributes a superlative economic advantage to the region and the nation. Biomedical research, in medical schools, major teaching hospitals, institutes and university life-science departments attracted \$661 million in federal support from the National Institutes of Health in 1986. On a per-capita basis, New England garners more NIH funding than any other region of the United States and Boston-area funding surpasses that of all other metropolitan areas nationally. (See "Support for Health-Related R&D is Crucial to New England's Biotech Industry," by Judith A. Beachler, elsewhere in this issue.)

NIH funding, largely deployed in the war against cancer, has underwritten recent advances in genetic and cell engineering. Microbiological manipulation has already produced effective diagnostic and therapeutic aids, using recombinant DNA and monoclonal antibody technologies. Many biopharmaceuticals and diagnostic aids are presently undergoing clinical testing prior to public use.

Threats to biomedical research

The commission has determined that the region's biomedical research infrastructure is threatened on several sides.

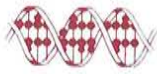
- *The purchasing power of research grants has been relentlessly eroded. The cost of performing biomedical*



THE COMMISSION The members of the NEBHE study commission represent the diversity of those concerned with the future of biomedicine in New England. They include medical-school deans and teaching-hospital administrators; executive officers of large and small businesses; faculty researchers; and those who determine higher-education policy. State legislators have met with the commission, as have technology-transfer experts, venture capitalists and medical economists. To secure background information, commission members and project staff conducted interviews with medical researchers, CEOs, entrepreneurs and economic development and other government officials throughout New England. A total of 16 commission meetings, seminars and site visits, in addition to more than 100 consultations by commission staff, were held during the past two years in developing the report.

COMMISSION ON ACADEMIC MEDICAL CENTERS AND THE ECONOMY OF NEW ENGLAND

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- Wogan, Gerald N., PhD, Chairman, Department of Applied Biological Sciences, Massachusetts Institute of Technology, Cambridge, Mass.
- Wood, Robert, PhD, Henry Luce Professor of Democratic Institutions, Wesleyan University, Middletown, Conn.; Former Secretary, U.S. Department of Housing and Urban Development
- Wurtman, Richard J., M.D., Director, MIT Clinical Research Center, and Professor of Neuro-Endocrine Regulation, Department of Applied Biological Sciences, Massachusetts Institute of Technology, Cambridge, Mass.



New England's academic medical centers are national treasures. The NEBHE Commission Report sets forth ways to preserve and strengthen them in a time of financial stress. Partnerships with the private sector should be especially explored, in order to commercialize a greater number of innovations and findings stemming from biomedical research.

I believe this report and the months of study behind it will be used as a model by the rest of the country. Biomedical research and development can be an invaluable tool in sharpening America's competitiveness in a world market.

CHARLES BAKER
Professor of Finance
Northeastern University
Boston, Mass.

(Former Undersecretary,
 U.S. Dept. of Health and Human Services)

BIOTECH COMPANIES ARE BREWING CURES

Biotech companies in Greater Boston, like those across the region, appear to be "brewing a cure" for everything from cancer and AIDS to the common cold. Consider the following examples:

- The Genetics Institute is developing a drug (tissue-type plasminogen activator, TPA) shown to dissolve blood clots that cause heart attacks.

- Biogen recently received FDA approval for its alpha interferon, shown effective against a rare form of leukemia in human clinical trials. Biogen is a leader in the development of gamma interferon, a promising treatment for rheumatoid arthritis and certain kinds of cancer.

- Genzyme is the leading independent supplier of the key active components—enzymes and substrates—used by manufacturers of clinical diagnostic kits for diabetes, coronary artery and pancreatic diseases.

- Damon Biotech, anticipating a major market for anti-cancer uses of monoclonal antibodies, is shifting into large-scale synthetic manufacture of antibodies using fermentation vats and procedures.



The first step in developing a good biomedical research project at an academic medical center is to be able to ask the right questions, to have the right problem to work on. More often than not, what identifies the right problem is a patient presenting the medical staff with something intriguing, different and challenging. The patient starts a series of questions being asked. Ultimately, these questions translate into research programs and hopefully, in time, often through some very circuitous route, the loop is closed back—perhaps not to the same patient, but to similar patients who benefit from an advance in medical treatment.

J. ROBERT BUCHANAN, M.D.
General Director
Massachusetts General Hospital

Biomedical Report Now Available

*Announcing the Report of the NEBHE Commission
 on Academic Medical Centers and the Economy of New England*

Will biomedical products and services succeed computers as New England's next technology-driven growth industry? How can biomedical research and the business ventures and jobs it creates be preserved? The Report of the Commission on Academic Medical Centers and the Economy of New England focuses attention on New England's unique capacity to strengthen biomedical research and its commercial development. The report may be ordered from NEBHE for \$5 per copy.

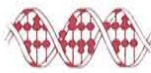
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research has increased because of inflation and because of the intricate technology and equipment needed to answer the increasingly complex questions biomedical research seeks to solve. According to one expert, a dollar awarded by NIH in 1986 is worth only 31 cents of a 1977 grant dollar.

- *Research funding is decreasing because of changes in patient-care reimbursement under the federal Medicare program.* A portion of Medicare reimbursement covers research projects and graduate medical education, or clinical residencies, at teaching hospitals. Recently, cutbacks in Medicare have been achieved by basing payment on a single national rate, depending on the patient's diagnosis. Within the next five years, the consequences of Medicare's Diagnostic Rating Groups will be severely felt by researchers at many academic medical centers in New England.

NIH funding, largely deployed in the war against cancer, has underwritten recent advances in genetic and cell engineering.

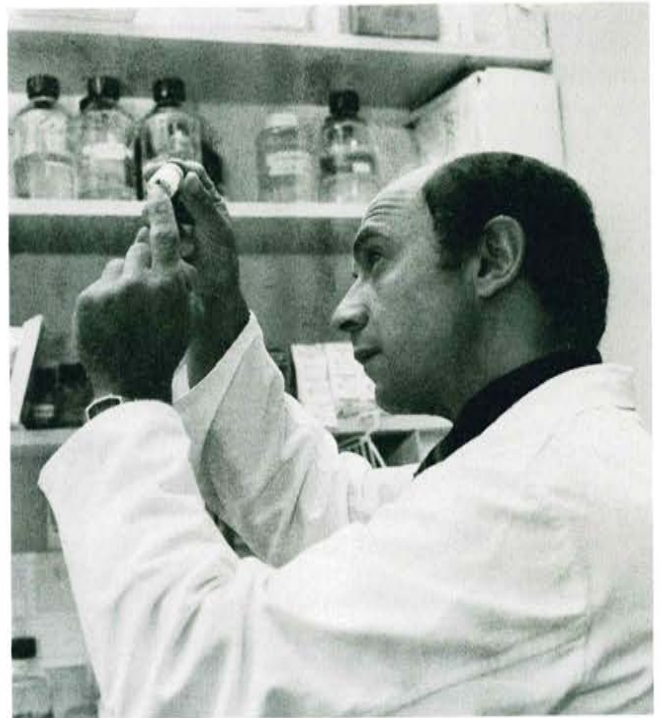
- *The diminishing competency of American students in mathematics and science, who score the lowest of any industrialized nation in these subjects, is perceived as a serious threat.* The shrinking pool of young people who have the ability to pursue sophisticated research careers is transforming the United States into a technically underdeveloped nation. By contrast, Japan has doubled its science and engineering graduates in the past 20 years, producing as many engineers annually as the United States with only half the United States' population.

- *Existing financial assistance for graduate students and postdoctoral biomedical researchers is inadequate.* In 1986, NIH committed only 4.9 percent of its budget to the training of biomedical scientists, whereas in 1971 the portion was 11.5 percent. There is a similar decline in the proportion of the National Science Foundation budget dedicated to training young people. This inattention to the competency and training of the next generation of researchers is bound to undermine New England's strong biomedical research enterprise.

Recommendations to strengthen research

The commission has made several recommendations to strengthen New England's biomedical research infrastructure. The recommendations call for concerted action by academe, business, foundations and state government.

- *While the federal government must not abdicate its responsibility for funding basic biomedical research, the commission believes that academic medical centers and universities can take measures to augment their own research budgets.* These might include: securing greater sponsorship by businesses of research projects and human clinical trials for drugs; improving academic med-



At Biogen Inc., Cambridge, Mass., a medical researcher examines a vial of Immuneron[®] recombinant gamma interferon, a potential treatment for rheumatoid arthritis and certain cancers.

A SAMPLING OF MEDICAL-RELATED FIRMS

With the collaboration and advice of medical and university researchers, firms in New England are involved in commercially developing an array of devices, instruments, pharmaceuticals and microorganisms that will advance human health care, from prevention of disease and disorders to diagnosis and treatment.

Ventrex Labs in Portland, Maine is now selling a five-minute diagnostic test (based on monoclonal antibodies) to detect strep throat; Bristol-Myers recently opened a new drug research center (employing 2,000) in Wallingford, Conn.; the newly formed Medarex, a joint venture of Dartmouth Medical School and the New Jersey firm Essex Chemical Co., is locating in Hanover, N.H. and plans to market certain monoclonal antibodies that bind to harmful cells; West Greenwich, R.I. is welcoming a new biopharmaceutical firm, WelGen Manufacturing, Inc. (a joint venture of the Boston-based Genetics Institute and Britain's Burroughs Wellcome Corp.); Bio-Tek Instruments of Winooski, Vt. (founded in 1968 by a UVM medical professor) makes equipment that tests, calibrates, and measures medical products.



ical centers' technology licensing programs so that a greater number of faculty inventions and innovations reap dividends for the research institutions; and investing in the business enterprises and inventions of faculty.

- *Charitable foundations should increase their support of biomedical research projects.*

- *Established medical equipment, supply and instrumentation companies as well as the larger of the region's young biotech companies should subsidize more graduate and postdoctoral fellowships.*

- *To encourage contributions of state-of-the-art research equipment and computers, each New England state should consider offering tax incentives for such donations by companies and individuals.*

- *Schools, colleges, universities and businesses must intensify their efforts to ensure math and science literacy and to enlarge the number of women and minority students in these areas. To interest leading math and science students in teaching careers, the Massachusetts High Technology Council provides summer employment in high-tech companies for qualified teachers. Together with NEBHE and other organizations, the council is also proposing a state grant program that will match every company-sponsored PhD-level fellowship in science and engineering.*

Biomedical research nourishes economic development

Biomedical industries, broadly defined to include traditional pharmaceuticals, medical instruments and equipment as well as biotech medical products, are viewed by the commission as having special importance as a source of regional economic growth. The discoveries of New England's biomedical researchers have spurred the creation of dozens of medical-related firms here in the region.

Of New England's approximately 85 "embryonic" and "adolescent" biotech firms, 50 are located in the Boston area. In Boston proper, at least six new biotech firms have hatched since the fall. As noted in a recent study conducted by the Arthur Young High-Technology Group, "Biotech 88: Into the Marketplace," the techniques of biological manipulation being perfected by small biotech companies may transform the worldwide pharmaceutical industry.

Biotech firms have begun to generate a variety of related technology-based enterprises and support/support companies. This multiplier effect was the hallmark of the computer industry and promises to enhance the economic benefits of biotech.

A replacement industry: biomedical products and services

Looking ahead into the 1990s, several experts maintain that the region's existing high-tech companies, especially the manufacturing sector of the computer and electronic-components industries, are moving into the later phases of development and will no longer generate jobs at the rate the region has enjoyed for the past decade. Moreover, federal defense spending has leveled off and will probably be a less important force. The commission members believe that biomedicine is the front-runner among candidates for a technology-driven replacement industry in which New England has a competitive edge.

Barriers to biomedical job creation

Particularly disturbing to the commission are several obstacles blocking the development, production and manufacturing of medical-related products in New England.

- *In-house technology transfer efforts could be improved.* At universities and academic medical institutions, snags frequently slow down or even prevent the transfer of faculty inventions from academe to the private sector. Interviews with other leaders in the private sector support this view.

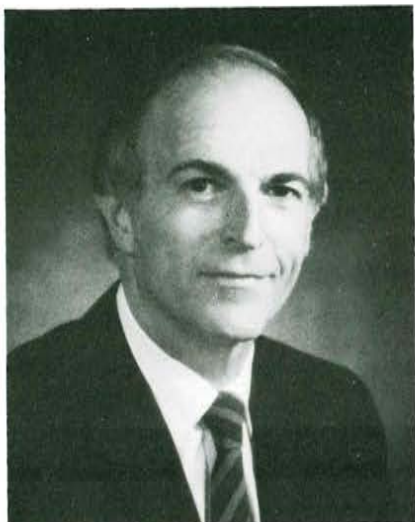
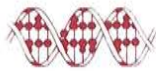
Oftentimes, in-house staff are excessively occupied with the legal aspects of technology patents and licenses. Too little support and encouragement are given to faculty as they try to assess the public and commercial uses of their work. The result is that some faculty back off from technology transfer because the legal and business challenges seem too complex and time-consuming.

- *The New England states do very little to promote the successful development, production and manufacture of medical-related products within the region.* Benign neglect seems to explain New England's minuscule contribution of overall state funds to R&D expenditures at the universities. Only 2.3 percent of total expenditures in the region are devoted to R&D, in contrast to the 1986



The commission report underscores the inadequate financial support available for training biomedical graduate students and postdoctoral researchers. The severe problem of limited financial support at the graduate level is increasingly apparent to me, both as commissioner of higher education and as chair of the Brown University Corp. Committee on Graduate Education. One of the main factors in attracting the best graduate students in the nation to New England is the extent to which full financial support can be given over the course of a PhD or postdoctoral program, to insure that students devote their full attention to study and research and not be forced to prolong their programs because of the need to generate outside income.

ELEANOR M. McMAHON, D.Ed.
Commissioner
of Higher Education
Rhode Island



There are few institutions more vital to New England and its emerging biotechnology industry than its academic medical centers. The report by the Commission on Academic Medical Centers and the Economy of New England presents concise and valuable insights into the characteristics and critical needs of their emerging partnership. NEBHE's report should help to raise the level of understanding of the major role these institutions play in the overall economic health and vitality of the New England states.

In looking to the future, our biotechnology industry, supported and nurtured by the academic medical centers of the region, represents a cornerstone of growth for our economy. However, major problems now confront both the corporations and the centers. If these issues are not resolved in a timely manner, the result may be the ultimate loss to New England of the primary results of innovation—namely jobs and products—with the largest benefits moving to other regions of the United States, and indeed to the other countries of the world.

DAVID KOSOWSKY, Sc.D.
Chairman and CEO
Damon Corp.
Needham Heights, Mass.



The Massachusetts Biotechnology Research Park came together in an unprecedented way. The city of Worcester passed an ordinance that was "biotechnology-friendly"; the University of Massachusetts Medical Center donated 75 acres of land; and the federal and state governments joined together to provide the essential underpinnings. Such cooperation is noteworthy in Massachusetts or any other state. It happened because a small number of people had the vision and the determination to persevere in the face of many critics who said: "Biotechnology has peaked; it has been oversold; it is much too risky."

The naysayers were wrong. The third building in the park will be ready for occupancy by July 1, 1988. Some of the most outstanding faculty members of the University of Massachusetts Medical School have a symbiotic relationship with the excellent biotechnology firms in the park. The expertise of biomedical research is being applied to practical problems that will improve the health of society, the economy of the region, and the scientific strength of the university.

JAMES BARRY HANSHAW, M.D.
Dean and Provost
University of Massachusetts
Medical Center, Worcester

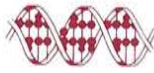


Most commission members were surprised to find layers upon layers of collaboration among biomedical researchers at various institutions in New England. We also found that MIT engineers and faculty have been engaged for years in joint projects and problem-solving with the medical community.

Given this traditional mode of operation, I believe it is easier for medical and biotech companies to enter the circle of discovery and problem-solving and sponsor joint R&D projects with academic and medical institutions.

While Biogen has working relationships with researchers at MGH and other Boston academic health centers, it is important to understand that we, and other biotech companies, have relationships with many of the academic medical centers throughout New England. These institutions are critical to the successful development of biotech products and processes.

MARK B. SKALETSKY
Chairman
Enzytech, Inc.
Cambridge, Mass.;
Former President and Chief
Operating Officer, Biogen, Inc.



Biochemical industries seem likely to be among those corporations that will provide the next impetus to growth for the region. As was the case for computers in the early 1970s, biochemical industries have long had a presence in New England, but recent technological advances have greatly expanded their growth horizons.

New England, with its existing industry base, unique cluster of research institutions and high educational level, should be well-positioned to take advantage of the new opportunities.

LYNN E. BROWNE
Vice President and Economist
Federal Reserve Bank of Boston

We are witnessing the infancy of a technological revolution. In the next 20 years we will experience an explosion of biotechnology as its influence radiates into many industrial sectors.

The NEBHE commission report is right on target when it calls for universities, medical schools and teaching hospitals to improve their technology transfer efforts. Faculty researchers require help in thinking through the real-life benefits of their work and in linking up with the private sector. It is the entrepreneurs and businesses that actively translate ideas into beneficial products and processes.

What often obstructs technology transfer is excessive devotion to legal technicalities. Recently my company backed away from licensing a faculty invention from the University of Washington because of the thick stack of legal documents and red-tape delays generated by the university's technology licensing office.

I see improvement in technology transfer at the University of Vermont. The outstanding researchers there are making it a world-class institution. It is becoming easier to talk with them about the applications of their work.

New England is blessed with many fine medical institutions, creating a fertile climate for entrepreneurs. Fortunately a medical company, in my opinion, can be small and still be viable. I expect to see many more biomedical firms spring up throughout New England.

ERIC PERRON
General Manager
Bio-Tek Instruments, Inc.
Winooski, Vt.

national average of 8.4 percent. By sponsoring more applied research projects between large and small technology-based companies and academic medical centers, the New England states could accelerate commercialization of outstanding inventions as well as ensure the solving of some production and manufacturing problems and the improvement of some existing medical product lines.

The discoveries of New England's biomedical researchers have spurred the creation of dozens of medical-related firms.

The commission has noted that some New England leaders may be caught in a self-fulfilling prophecy: namely, that the region's strength is in research rather than product development and manufacture. Some believe that the region makes its unique contribution through brainpower and ideas and that it is inevitable that others will enjoy the jobs and taxes generated by the actual manufacture of inventions flowing from the "intellectual center." This mind-set is literally and figuratively counterproductive.

- *There appears to be a shortage of bioprocess engineers who can direct the commercial scale-up production of microorganisms.* Specialists with both chemical engineering and biology backgrounds who work with fermentation, purification, separation and other systems are in short supply. (See Ellin Anderson's article, "New England's Biomedical Industry Demands Skilled Graduates," elsewhere in this issue.) Here the United States is at a comparative disadvantage because West Germany and Japan have an adequate supply of bioprocess engineers and technicians. There also seems to be an acute need for technicians with lower levels of skill.

- *Of greater magnitude is another problem facing "adolescent" biotech companies in this region: the difficulty of constructing production and manufacturing facilities.* Because New England does not already possess pharmaceutical production and manufacturing facilities as do New York and New Jersey, biotech companies must build these capabilities from scratch. West Germany, the Netherlands and Scotland are moving quickly to offer tax breaks, low-interest or no-interest government loans and other assistance in building facilities so that young New England and other U.S. biotech firms will settle there, creating jobs and providing training. An even greater competitor is Japan, whose large chemical and pharmaceutical corporations already possess the facilities and know-how to dominate in biotech manufacturing. At the present time, New England does very little to meet this challenge and retain the economic benefits that can flow from the maturation of this industry.

Removing the barriers

As recommended by the commission, improving technology transfer from academia to the private sec-

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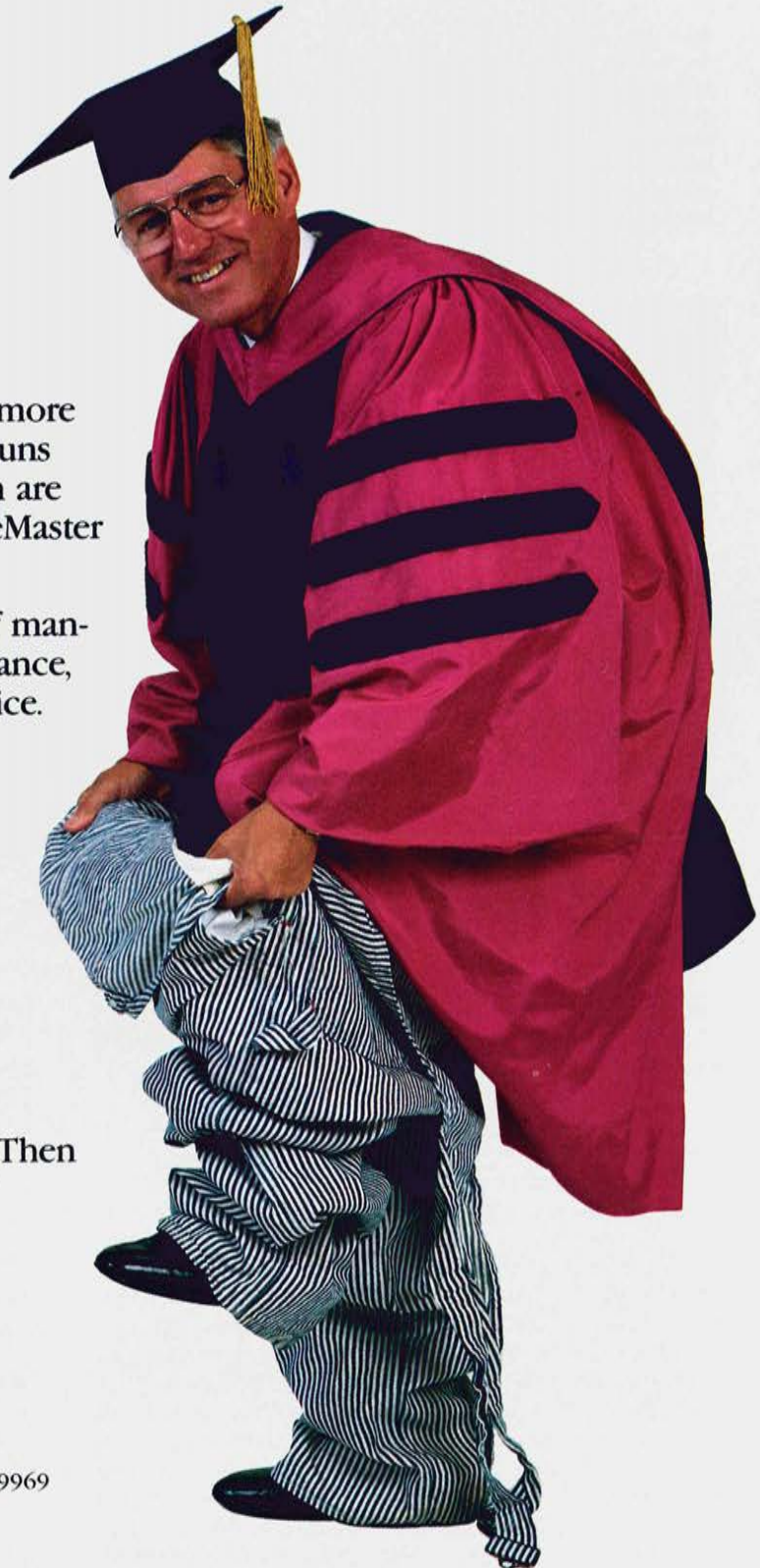
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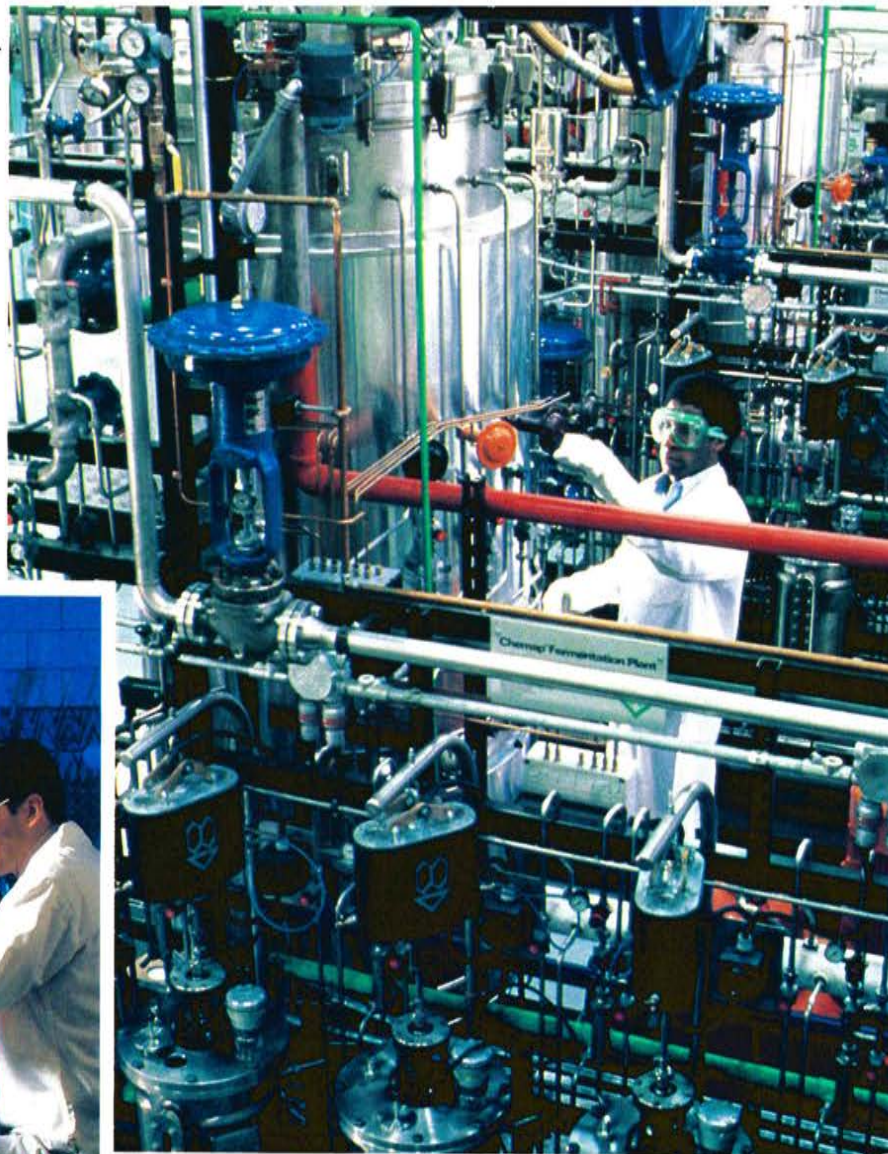
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At right:
two 1,500-liter fermenters
producing amounts of a biotech
product for clinical trials and initial
marketing.

Below:
Dr. Henry W. Founds, of Ventrex
Laboratories, Inc., Portland, Maine,
inspects cells grown in HL™, a
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medium used by the biotechnology
industry for the growth of
hybridomas.



tor will ensure that a greater number of faculty inventions and innovations are available for commercialization and public use.

Each New England state should establish its own Small Business Innovation Research program.

- *Licensing offices at campuses and academic medical centers need technically-trained and business-oriented professionals who can fully grasp the significance of faculty researchers' work and aggressively explore commercial possibilities.* Although legal protections and documents are a necessity, they should not be allowed to preoccupy the licensing staff. As a case in point, in 1986 Neils Reimers, head of Stanford University's Technology Licensing Office, was brought in to reorganize and restaff the MIT Technology Licensing Office. The Office's legal orientation was replaced with a technical and marketing orientation. Today the new MIT office licenses as many faculty inventions in two

months as the old one did in a year.

- *Each New England state should establish its own Small Business Innovation Research program.* This supplemental state program could provide matching grants to in-state companies that receive Phase I grants under the federal SBIR program and are preparing to compete for Phase II money. The federal program—created in 1982 and currently funded at \$400 million annually—requires federal agencies (including NIH and NSF) spending \$100 million or more a year for outside research to set aside 1.25 percent for small business innovation. These contracts, awarded on a competitive basis, are designed to stimulate the growth of small science and technology-based companies. Medical companies have typically sought research assistance from universities and academic medical centers during Phases I and II.

Unfortunately, Phase I of the federal grant provides no more than \$50,000 for six months of feasibility-related research. This first stage prepares the way for applying for Phase II federal funding of up to \$500,000 to develop prototype products. The universal complaint

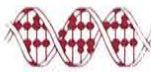


photo credit: Patty Lord

A graduate student examines recombinant bacteria in a biology laboratory for work connected with the Biotechnology Engineering Center at Tufts.

is that Phase I funding is inadequate; only New York state provides a full match of Phase I funds. The commission recommends that all New England states do so.

- *Each New England state should initiate a biomedical development grant program to foster collaboration between academic medical centers and large and small medical-related firms.* In those states where modest but important programs are already in place (the Massachusetts Centers of Excellence Biotech Project; the Connecticut Cooperative High Technology R&D Grant Program; the Rhode Island Partnership for Science and Technology), the commission suggests that modifications be made and additional funding be provided.

It may be possible for the New England states to enter into partnership so that a firm in one state can collaborate with medical or campus researchers in a neighboring state who possess the requisite expertise to help solve a problem. Through reciprocity legislation, each state could reserve one third of its biomedical development grant dollars for use by home-based firms that seek assistance somewhere else in the region. For example, given MIT's prominence in medical-related fields, it would seem beneficial to the region as a whole to tap this reservoir of talent. Throughout the region there are world-class researchers, engineers and clinicians in various specialties who could contribute to the

improvement and creation of new medical-related products.

- *New England universities should facilitate their engineering and life-science students' work abroad.* Bioprocess engineering has remained strong in Western Europe and Japan. As is well-known, a proportionately large wave of foreign graduate students and industrial scientists are welcomed to New England institutions of higher learning. It is time that American students and scientists seek to enrich their expertise through study outside the United States.

Biotech firms have begun to generate a variety of related technology-based enterprises and support/supply companies.

- *NEBHE should undertake a survey of medical-related companies in the region (perhaps with the assistance of the Massachusetts Bay State Skills Corp.) to determine more reliably their entry-level-to-postdoctoral labor needs.*

- *State higher education boards should survey and then publicize campus offerings that address the demand for labor by medical-related firms.* With the results of both

(continued on page 43)





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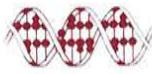


photo credit: Patty Lord

A technician looks at a gel electrophoresis pattern used to separate and identify proteins as part of a project making rare antigens for diagnostic products.

The Biotechnology Center of Excellence program encourages and supports innovative biotech-related research and commercial applications in the state. It is a program of the Massachusetts Centers of Excellence Corp., a quasi-public agency chaired by the Secretary of Economic Affairs and founded two years ago.

During the most recent grant competitions, we have focused on diagnostics and therapeutic drugs; agricultural and animal health; toxic waste degradation and treatment. Over a dozen grants for collaborative projects mounted by academic/research institutions and industrial firms have been awarded. One major grant to the Massachusetts Biotechnology Research Institute, a consortium of academic institutions in the Worcester area with headquarters at the Massachusetts Biotechnology Research Park, has led to the creation of Commonwealth BioVentures Inc., a "super incubator" that has raised over \$5 million in its first private offering. BioVentures has in turn begun to invest in selected biotech start-up firms in the Commonwealth and to provide critically important management assistance. Business space is provided by the

Massachusetts Biotechnology Research Park in Worcester.

The Biotech Center of Excellence program also promotes information exchange. BCE has collaborated with the Massachusetts Biotechnology Council (the state's biotech trade association) to organize a round table on federal regulation coordination, a U.S. Department of Commerce briefing on biotech export opportunities and a promotional campaign focusing on Massachusetts' exceptional resources in biotech.

A pioneering public health symposium series examining biotech's contributions to the detection and treatment of infectious diseases, heart disease and cancer is now being developed.

As more companies enter or prepare to enter manufacturing stages, the Biotech Center is committed to assisting them.

FERNANDO QUEZADA
Project Director
Massachusetts Biotech Center
of Excellence
Boston, Mass.



At left: research scientist at Genzyme Corporation, Boston, Mass., modifies hyaluronic acid, an important surgical lubricant.

Below: a student operates a fermenter—a piece of equipment that allows mammalian cells and microbes to be cultivated in a laboratory.

photo credit: Patty Lord

(continued from page 39)

surveys in hand, it should be possible to make specific recommendations to New England higher education about the demand for certain skills.

- *Regarding the adoption of municipal regulations governing biotech research and manufacturing, the commission urges an educational campaign on the subject for municipal leaders.* This effort could be coordinated by the states, New England's municipal leagues, the U.S. Conference of Mayors or the National League of Cities.

Biomedical firms can provide a competitive edge in the world market.

- *The New England Governors Conference should consider state incentives to ensure that the region captures the subsequent product development of the biotech industry.* Low-cost loans to be used in constructing production facilities might be offered, as well as accelerated depreciation on such facilities. Allowing research-oriented companies (such as biopharmaceuticals facing long-term animal and human clinical trials) to carry forward operating losses to 15 years seems reasonable

and would be in conformance with the federal tax rule. Presently, only Maine, Rhode Island and Vermont have the 15-year carry-forward, although the Massachusetts legislature is now considering its adoption.

- *New England's U.S. senators and representatives should play a leading role in ensuring that national tax and other policies encourage the successful development of the biotech industry.* The R&D Tax Credit might be made permanent, or R&D Limited Partnerships could again be encouraged. It is fortunate that several members of New England's Congressional delegation have already recognized not only the importance of medical research and medical-related industries to the region's economy, but also the fierce competition we face from abroad.

The NEBHE commission's recommendations are designed to strengthen biomedical research: the well-spring of new insights, which increases the world's knowledge, nourishes the practice of medicine and produces the flow of innovations that are vital to established and yet-to-be-formed companies. □

JoAnn Moody is biomedical R&D project director and assistant vice president and legal counsel for NEBHE.

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ACADEMIC RESEARCH:

Key to the Biotechnology Revolution

JAMES M. JEFFORDS



Translating American ingenuity into marketable products is without doubt the key to improving our competitiveness in the world marketplace. We invented the transistors, the semiconductors and the other electronic components that pioneered the electronics revolution. Yet our industry was unable to compete with the Japanese in perfecting and commercializing these technologies. As a result, Americans took their 1981 tax cuts and bought VCRs that were made in Japan, not America.

How our nation meets the challenge of biotechnology—in basic research, development and commercialization—will dictate to a great extent how well we fare in the global marketplace of the future.

As in the electronics revolution, the United States already has the early lead. American researchers in academic labs pioneered gene splicing and have developed methods of applying it in a number of fields.

Two particularly promising fields for biotech are medicine and agriculture. Biologists are developing methods of synthesizing drugs in the laboratory, making them more effective and dramatically reducing production costs. New diagnostic tools for AIDS and other diseases are also being developed.

In the field of agriculture, crop yields will be increased through advances in genetics, while livestock farmers will have a host of new vaccines, diagnostic tools and growth hormones available to boost production.

My hope is that America will learn some important lessons from the high-tech revolution.

Taking the lead

These technologies are coming, and we must be prepared to take full advantage of the long-term potential they offer. The Japanese already know this. Japan's Ministry of International Trade and Industry has created an impressive and powerful consortium of corporations and educational institutions to develop and commercialize biotech. Taking the lead in biotech, in fact, is one of Japan's national economic goals.

American universities, medical schools and teaching



Marty LaVor © 1986

hospitals have already taken a leading role in sponsoring the basic research that has led to fundamental breakthroughs in biotech. This must continue, with additional emphasis on translating those breakthroughs into commercial technologies that will benefit society and strengthen the American economy.

Our academic medical centers have proven time and again that nobody in the world can touch our basic research capabilities. As the national leader in this arena, New England is particularly well-poised to assume an international role in the development of biotech industries.

That kind of lead, of course, is not possible unless academia has the facilities and the resources to pursue basic research. To ensure that they do, I insisted that support for academic research and development be

included in the omnibus trade bill now pending before Congress.

New biotech center at UVM

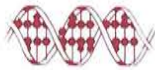
The University of Vermont will break ground this year on the state-of-the-art George D. Aiken Center for Microbiology and Agricultural Sciences. This joint federal/state project will be one of a handful of top biotech research centers worldwide, attracting top talent to the region and serving as a potential magnet for private firms looking to market spinoff technologies. Research universities in each New England state are also in an excellent position to lead biotech efforts.

My hope is that America will learn some important lessons from the high-tech revolution. We must benefit from some of our mistakes, strengthen those areas where we are weak and work hard to ensure that the American economy will be the main beneficiary of the coming biotech revolution.

Academic research centers need to continue their dominant worldwide role in basic research. In addition, they can play a more vigorous role in translating basic research into commercial products.

Japan has already chosen worldwide leadership in biotech as a national priority. We can and must work to ensure that Japan is not alone in achieving that goal. □

Rep. James M. Jeffords is a Republican congressman from Vermont.



New England's leadership in biotechnology is a direct result of its extraordinary concentration of capable people in the sciences and business. I know of no other area in the United States with quite the concentration of "people resources" needed to advance our industry. It should also be mentioned that the United States' preeminence in biotechnology, as emphasized by the commission, is something that we will have to aggressively support in the coming years as other industrialized nations begin to develop capabilities in this new field.

GABRIEL SCHMERGEL
President and Chief Executive Officer
Genetics Institute, Cambridge, Mass.
(Past President, Industrial Biotechnology Association)



The biotechnology industry in New England and especially in Massachusetts holds great promise both for its contributions to advancing medical care and to mounting another high-tech wave of economic benefits for our region.

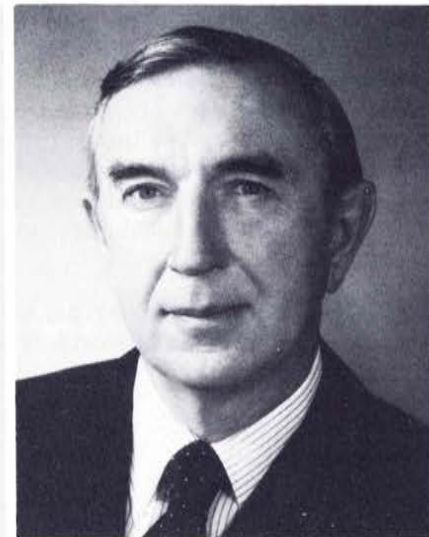
I was gratified by the insight provided by the NEBHE commission and their unanimous endorsement of my sponsorship of the drug-export bill that became law in late 1986. Prior to passage of S.1848, biotech companies could not export biopharmaceuticals that had not been approved by the U.S. Food and Drug Administration even though the recipient countries had tested and found the drugs to be safe and effective. This archaic rule hit small biotech firms particularly hard and was forcing some of them to begin plans for building production facilities abroad in order to reach the world market. With the passage of S.1848, production and manufacturing are now more likely to stay at home.

U.S. SEN. EDWARD M. KENNEDY,
D-Mass.

New England has benefitted time and again from the symbiotic relationships among academic institutions, the financial community and entrepreneurs. Economic exploitation of information technology is our most recent success; biotechnology can be the next, if we recognize that this symbiosis is a basic New England resource, and actively nurture it.

The smaller of New England's fine liberal arts colleges are an unrecognized source of outstanding scientific talent for our great research universities and academic health centers. These colleges produce more than their share of science graduates. Small liberal arts colleges are also leaders in developing students' research skills and creating the interdisciplinary programs our biotechnology industry will need for the future.

The report of the Commission on Academic Medical Centers and the Economy of New England places appropriate emphasis on the economic and industrial potential of biotechnology's medical applications. But we must remember that the promise of biotechnology goes well beyond the medical field. In fact, applications to be used in creating safer or more efficient industrial processes, or exotic electronic devices, may turn out to be more robust in realization and even more startling in their economic implications.

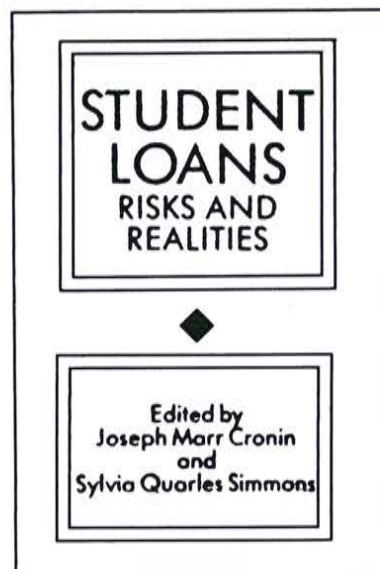


JOHN F. MAGEE
Chairman and CEO
Arthur D. Little, Inc.
Cambridge, Mass.

Student Loans

Risks and Realities

Joseph M. Cronin
and
Sylvia Q. Simmons,
Editors

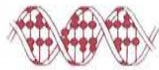


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Support for Health-Related R&D is Crucial to New England's Biotech Industry

JUDITH A. BEACHLER

TABLE 1
NIH FUNDING TO THE NEW ENGLAND STATES:
1971 TO 1986

	Total Awards in All Categories (in thousands of dollars)				1971-1986 15-yr. % gain
	1971	1976	1981	1986	
MASS.	\$ 113,054	\$ 173,491	\$ 291,229	\$ 473,137	318.5
CONN.	24,423	43,835	79,143	121,763	398.6
R.I.	4,060	5,212	12,314	21,352	425.9
VT.	3,660	6,817	9,492	18,935	417.3
N.H.	12,413	5,114	8,406	16,219	30.7
MAINE	2,635	3,918	5,704	9,495	260.3
N.E.	160,245	238,387	406,288	660,901	312.4
U.S.	1,408,920	1,815,372	2,859,733	4,400,434	212.3

Immediately following World War II, the United States focused national policy on the importance of research and development in sustaining a prosperous economy. Subsequently, an effort second to that of no other nation was launched to support basic research.

Of the \$12,123 million in total support for basic research in the nation in 1984 (the most recent year for which data is presently available) approximately 65 percent came from the federal government. The National Institutes of Health is the nation's major investor in basic research, as well as in more specific health-related research and development. Almost 63 percent of the NIH budget supported basic research in 1984; the \$2,667 million appropriated by NIH for basic research represented 22 percent of all basic research dollars appropriated by all sectors: industry; major federal government agencies; state government; and private nonprofit organizations.

Health-related R&D

Of the total R&D dollars from all sources (including both basic and applied research) expended in the United States in 1985, approximately 12 percent (\$13.1 billion) went to health-related R&D, while the remainder supported defense,

agriculture, space and aeronautics, energy, business and manufacturing, environmental and various other R&D endeavors.

With only 5.3 percent of the total U.S. population, New England's 15 percent share of all NIH dollar awards is significant.

Of the \$6.8 billion appropriated for health-related R&D by the federal government in 1985, almost 71 percent was NIH funding. Moreover, NIH's effort alone is almost as large as that of any other single source (see Figure 1).

New England's share of NIH funds

Given that New England has only 5.3 percent of the total U.S. popu-

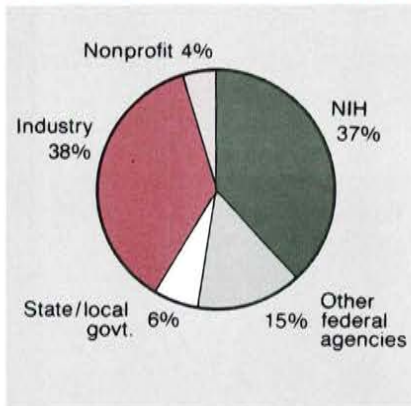
lation, the region's 15 percent share of all NIH dollar awards is significant. Moreover, the region's portion has increased substantially over the last 15 years (see Figure 2). Though NIH funding within the nation and in New England has grown steadily over this time period, there is cause for concern about the dwindling impact of basic research funds, as will be discussed later.

In 1986, New England received more dollars *per capita* than any other U.S. region in all but one category: R&D total grants; institutional training grants; individual training grants and fellowships; and overall total dollar awards. Only in terms of R&D contracts does New England rank second to the South Atlantic states in per capita awards. Further, per capita dollars in those categories in which New England ranks number one are more than double those awarded to any other region. Relative to all other regions in the nation, basic medical research funding clearly has had a substantial economic impact in New England.

Whereas total NIH funds awarded nationally have increased by more than 212 percent, awards to the New England states have increased by more than 312 percent over the past 15 years. In 1971, approximately \$160.2 million were awarded here. By 1986, the region's share had increased to \$660.9 million (see Table 1).



FIGURE 1
Support for Health-Related R&D
in the United States by Source: 1985



Bay State captures lion's share of funding

As might be expected, a large portion of New England's NIH resources is awarded to the universities, medical schools, teaching hospitals, businesses and nonprofit institutions of Massachusetts. In 1986, almost 72 percent of the total was awarded to organizations in Massachusetts, while Connecticut captured 18 percent, Rhode Island 3.2 percent, Vermont 2.9 percent, New Hampshire 2.5 percent and Maine 1.4 percent.

Several New England universities, medical schools and their affiliated hospitals as well as nonprofit institutes are among the top 100 nationally in terms of dollar awards from NIH. Among the top 100 domestic institutions (all organizations within the United States that are awarded funds), 15 percent are in New England and receive 11.6 percent of all dollar awards. Yale University, Harvard University, MIT, Massachusetts General Hospital and Brigham and Women's Hospital hold the national rank of third, fifth, 21st, 28th and 30th, respectively.

Of the top 100 higher education institutions receiving NIH funds, 11 percent are in New England and account for 11.5 percent of the funds awarded to all universities nationally. Yale, Harvard and MIT rank third, fifth and 21st, respectively.

Among the 124 medical schools across the nation that receive NIH funding, 7.3 percent are in New England. Yale, Harvard and Boston University are ranked third, 12th and 27th, respectively, among all medical schools.

Yale's rankings in all of the above categories is indicative of the fact that funding awarded to Yale-New Haven Hospital is incorporated in Yale Medical School's award. Conversely, Harvard's rankings in all of the above categories do not take into account the many researchers employed by its several affiliated hospitals, which also secure NIH funds. A number of these researchers are also members of the medical school faculty. A review of awards to independent hospitals shows that faculty members of Harvard and its teaching hospitals are significantly involved in health-related research using NIH funding.

Among the top 100 independent hospitals funded by NIH, 20 percent are located in New England and six of the nation's top seven are in Massachusetts. Of these six, all but one are affiliated with Harvard

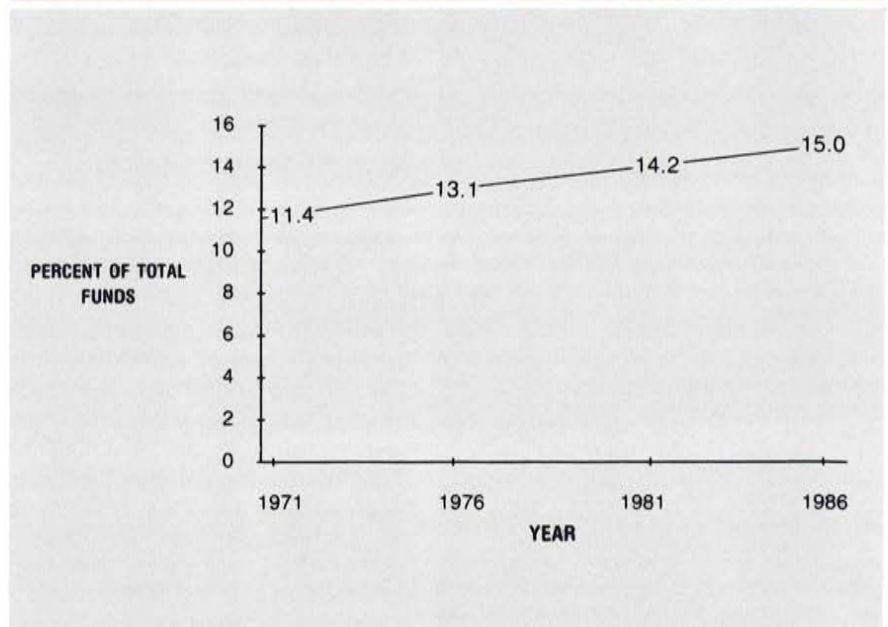
Medical School. Likewise, of the 20 New England teaching hospitals ranked among the top 100 nationally, 40 percent are affiliated with Harvard Medical School, 15 percent with Tufts, 10 percent with Boston University and 20 percent with Brown University. Massachusetts General Hospital, Brigham and Women's Hospital, the Dana Farber Cancer Center and Beth Israel Hospital hold national rankings of first, second, third, fourth, sixth and seventh, respectively, in NIH funding awards to independent hospitals. Additionally, 10 New England hospitals are among the top 50 independent hospitals in NIH awards.

Future concerns

Basic medical research is indeed important to the future of the biomedical technology industry, and New England institutions play a critical role in this national research endeavor through their 15 percent share of NIH funds.

Nationally, in 1986 NIH funding had increased by approximately 4.2 percent over 1985. Although funding awarded to the New England

FIGURE 2
New England's Share of Total NIH Funding: 1971 to 1986



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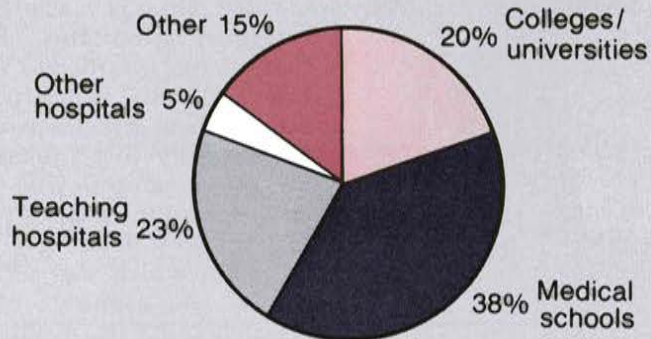
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FIGURE 3
NIH Awards to New England: 1986



region as well as to the nation as a whole has steadily increased in terms of current dollars over the past 15 years, its purchasing power has not kept pace. A biomedical research and development price index established by the U.S. Commerce Department's Bureau of Economic Analysis suggests that because of inflation, a dollar awarded by NIH in fiscal 1986 was equivalent to slightly more (52 cents) than a FY 1977 dollar.

Academic medical centers receive the majority of the NIH funds that are awarded to the New England region.

Moreover, as Federico Welsch of the Harvard-MIT Division of Health, Sciences and Technology recently pointed out to the NIH director's advisory committee, the cost of carrying out scientific research has increased not only because of inflation, but also because of the increasing complexity of the questions asked and the intricacy of the technology and equipment needed to answer them. This suggests that on average, a more realistic deflator to bring 1986 figures in

line with 1977 figures would be approximately 66 percent higher than the deflator used in the biomedical research and development price index, setting a 1986 dollar's value at 31 cents rather than 52 cents in relation to a 1977 dollar. Though NIH research funds and New England's share of those funds have increased over time, their value certainly has not.

In an international context, our major economic competitors have challenged and surpassed us in domestic R&D funding. Twenty-five years ago we held a leadership position in national expenditures for R&D. In 1962 national expenditures for R&D as a percentage of gross national product was 2.7 in the U.S., 1.5 in Japan and 1.3 in West Germany. By 1982, comparable figures were 2.6, 2.5 and 2.6 percent, respectively. Further, estimated *nondefense R&D expenditures* as a percent of GNP leave the United States well below both Japan and West Germany. Whereas Japan and West Germany spent 2.5 and 2.9 percent of their GNP on non-defense R&D in 1982, the United States spent only 1.9 percent.

More recently, a Council on Research and Technology (CORETECH) study suggests that even though the total amount spent



on basic research has indeed increased on an annual basis, as a percentage of total federal R&D funds basic research spending dropped in each of the three years following 1984. Federal support specifically allocated to universities for basic research has also declined as a proportion of federal R&D spending.

In an international context, our major economic competitors have challenged and surpassed us in domestic R&D funding.

If such trends continue, the nation's commitment to basic research and health-related R&D—the long-term seedbed of new industrial products and processes, innovative capacity and productivity gain—could be undermined. Since the region plays a vitally important role in basic medical research, New England leaders should be greatly concerned about these recent changes.

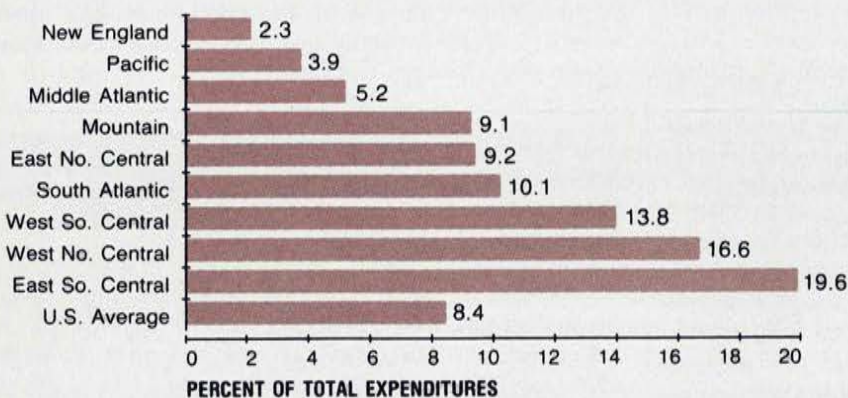
Yet, at the state level, the New England region funds university-based R&D at lower levels than any other region of the United States (see Figure 4). Basic medical research may well be the foundation of a new biomedical industrial base in New England. It behooves us to protect the foundations of biotechnology for our own long-term regional prosperity, through state-level investment in R&D. □

Note:

Sources of data included in the tables, figures and text of this article include: the *NIH Data Book*, 1972, 1977, 1981, 1986 and 1987; *Summary of NIH FY 1986 Extramural Awards to Domestic Institutions*, 4/1/87; *Summary of NIH FY 1986 Extramural Awards to Medical Schools*, 8/19/87; *Summary of NIH FY 1986 Extramural Awards to Domestic Institutions of Higher Education*, 2/11/87; *Summary of NIH FY 1986 Extramural Awards to Independent Hospitals*, 3/19/87; *Early Release of Summary Statistics on Academic Science/Engineering Resources*, NSF, October 1987; *Science Indicators: The 1985 Report*, NSF; *National Research and Development Policies for 1988 and Beyond: The CORETECH Agenda*; and U.S. Department of Commerce, Bureau of the Census, *1987 Estimate of the Population*.

Judith A. Beachler is director of research services at NEBHE.

FIGURE 4
State/Local Government's Share of R & D Expenditures at Universities:
National—Regional Comparison, FY 1986



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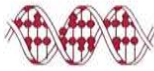
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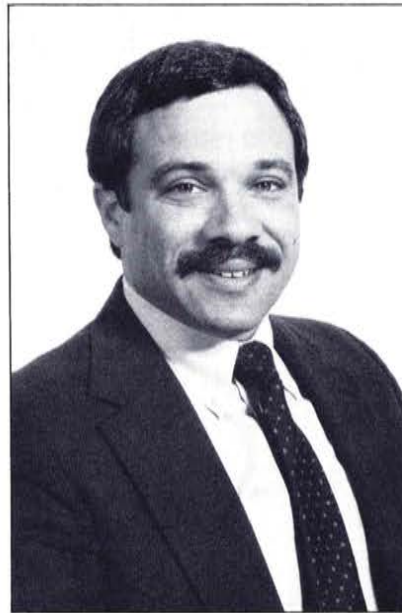
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The Future of Medical Equipment: An Opinion from a Concerned Vendor

PETER E. SCHWARTZ



Consider that more than \$1 billion in biomedical equipment—20 percent of total U.S. shipments—is sold by New England manufacturers each year. And this figure does not include the suppliers for those biomedical equipment manufacturers producing intensive care and fetal monitors, surgical and X-ray devices, defibrillators and other surgical and medical equipment. Coremetrics Medical Systems in Connecticut, Hewlett-Packard, with divisions in Andover and Waltham, Mass. and Puritan Bennett of New Hampshire are but a few of the players in New England.

According to the Electronic Market Data Book, shipments of U.S. electromedical equipment are projected to grow at a compound annual rate of 15.4 percent between 1988 and the end of 1990. Continued technological innovation will provide the primary stimulus during this period, as will increased demand for health care services and equipment as a result of the aging of our population. The new hospital cost-containment regulations, however, are certain to have more of a restraining effect on growth of the U.S. manufacturers than on their international counterparts.

In the past few years, manufacturers of biomedical instrumentation have faced considerable financial challenges, as their multi-billion dollar domestic market adjusted to the effect of new rules within Medicare's patient-reimbursement system. The Diagnostic Rating Groups under Medicare became effective Oct. 1, 1983. Using the DRGs, Medicare pays hospitals, clinics and physicians' offices a fixed fee for each of 476 diagnoses, regardless of the length or intensity of service or the complexity of the case. This situation is analogous to an automotive mechanic or dealer being restricted by an industry-standards manual that enforces a maximum charge for the work performed—no matter how long it actually takes.

As hospitals face a growing need to contain costs, new medical equipment and instrumentation devices that are not demonstrably more cost-effective or productive will be more difficult to market. Up until the latest slide in the dollar overseas, many domestic medical facilities looked abroad for instrumentation. Imports over the past four years increased by more than 27 percent per year, while exports increased by a modest four percent.

In the short term, the present devaluation of the dollar overseas will help spur continued growth for medical equipment manufacturers.

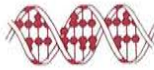
Astute firms will take advantage of this window of opportunity to develop the long-term strategies that will guide them through the next five years and beyond. These strategies will have major implications for corporate direction, methods by which products are manufactured, where they are manufactured, types of products, methods of sales, customer service, acceptable gross margins and profit. The bottom-line focus must be to consolidate systems and services, and, most importantly, to reduce cost.

As hospitals try to contain costs, new medical equipment that is not demonstrably cost effective will be difficult to market.

Major trends and catalysts

The DRG restrictions are not the only catalysts changing the biomedical market. Other major trends include the following:

- On the average, hospitals nationwide are less than 70 percent occupied and are facing increased competitive pressures from new community health plans and



outreach clinics. Many hospitals have already started to market their services and capabilities more actively to the community, something they never had to worry about before.

- Physicians are facing more pressure as well as higher expenses and insurance costs, due to the proliferation of malpractice court cases.
- Physicians are also facing competition from the wave of new recruits: More than half of all physicians in practice today began practicing within the last six years. By the year 1990, more than half the doctors in this country will be salaried. This fact clearly indicates a major transformation of the medical profession.

Where do the users of biomedical equipment stand as a result of all these changes? Technological advances will continue at an accelerated level. They will breed new devices and breakthroughs. With increased competition in the medical profession, consumers will have more of a choice, and, in time, a stabilization of costs.

For the New England biomedical equipment companies that provide technological innovations in this marketplace, the opportunities and pitfalls are clear. They must develop and manufacture more sophisticated products with greater efficiency. This will enable them to gain market share and sustain growth. Failure to achieve both objectives will most likely spell long-term regression. □

Peter E. Schwartz is director of sales and marketing for recorder products at General Scanning, Inc. of Watertown, Mass.

In Rhode Island, as elsewhere in New England, an awareness of academic medical centers as economic assets and potential developmental resources has been gradually increasing. Public and private-sector sponsorship has produced several joint R&D ventures here at Brown and more are on the drawing board. The importance of these early initiatives is magnified by their role as examples of the opportunities presented by the marriage of academia and industry. Both sectors are benefiting from this change of image: the academic medical enterprise is seen as an economic asset rather than a drain, and the for-profit sector is encouraged to support academic development rather than remain focused on short-sighted medical cost-containment efforts. The subsequent new medical spin-off firms will provide profitable opportunities for investors, jobs for the labor market and tax income for the state.

DAVID S. GREER, M.D.
Dean of Medicine, Brown University
Providence, R.I.

Just because charity begins, at home doesn't mean it should end there.

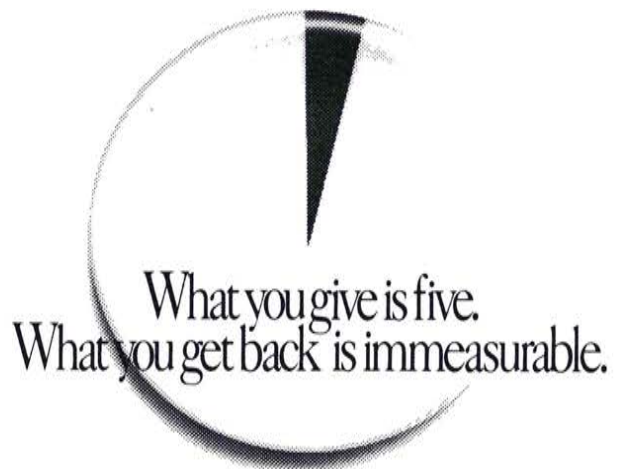
Nobody is suggesting that we should solve the problems of the world at the expense of our own families.

But, when we give less to charitable causes than we spend on frozen dinners and designer jeans, something is out of balance.

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Biotech's Promise for New England Agriculture

STEWART N. SMITH



Genetic engineering will produce more standardized and productive animals and plants. Plants will carry their own nitrogen fixation as well as pest and pesticide resistance.

Another agricultural application of biotechnology will be in food processing. Several manufacturers currently separate agricultural commodities into component parts to manufacture finished products, both food and non-food. For example, soybeans are milled into oil and meal, which are processed into lecithin, soy flour and soy protein isolate, which are then used to manufacture textured meatlike products, among other items. Biotech can greatly increase the development of similar processes in which taste, nutrients and fiber components of raw agricultural products will be separated and used as raw material for new food and chemical products. Under this scenario, more farms will become producers of biomass as raw products for further processing. Plant varieties will be engineered to maximize the particular components found to be most valuable as raw stocks. Such food manufacturing technologies will enforce the trend towards larger farms, in this case producing biomass with specialized production systems.

Public research facilities are the key to success for New England farmers' biotechnological future.

On the other hand, there will likely be an increased demand for natural food products. Farmers who are close to their markets, and that includes most of those in New England, can be very competitive in producing and marketing fresh natural products. Genetic engineering should provide local farmers with plant var-

ieties and animals more suitable to New England's environment, and production systems more benign to residential neighbors.

Stark options

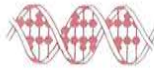
The above scenarios present New England farmers with stark options. The new biotechnologies that provide advantages to larger, more specialized farming systems will be disadvantageous to most local farmers. New England farmers work relatively small areas, often interspersed among residential neighbors.

As producers of standardized biomass for further processing, they will lose out.

However, if New England farmers adopt technologies that can give them an advantage in local markets for fresh or natural food products, they will realize a promising future. To capture that promise they must insist that the biotech research system recognize their needs. However, their volume of biotech input usage may be too small to attract much private research and development. Public research facilities, therefore, become the key to success for New England farmers' biotechnological future.

It should be noted that New England, in general, should fare well in the coming biotech revolution, since it represents one of the premiere enclaves of biotech development. To the extent that U.S. agriculture is influenced by biotech, those who hold these technologies will have considerable power over the future of American agriculture. Regardless of the impact on New England farmers, New England biotech firms, if they can retain control of their development products, should enjoy an increasing share of U.S. agricultural activity and revenues. □

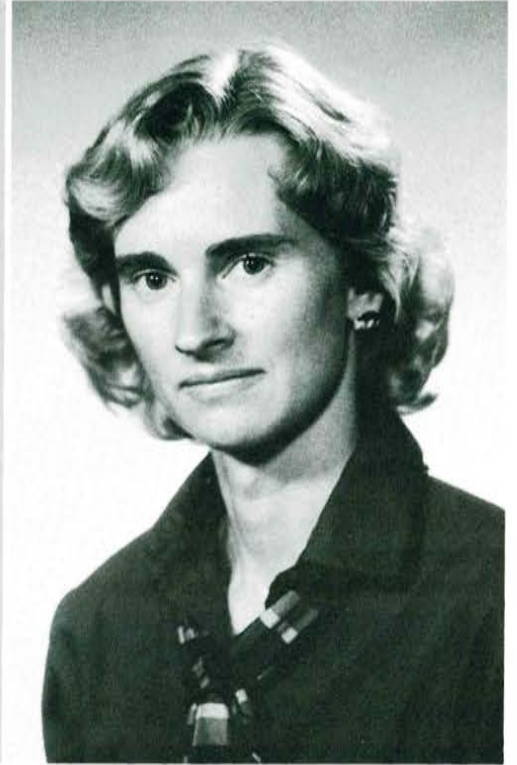
Stewart N. Smith is Henry Luce Professor in Agriculture and Society at the Tufts University School of Nutrition.



The University of Vermont's orthopaedics and rehabilitation research program includes work on the design of car seats as well as prosthetic devices for joint replacement, and has led to the creation of a spin-off company, Shelburne Laboratories. A faculty member in the department of physiology founded Bio-Tek Instruments Inc., a company that manufactures sophisticated laboratory apparatus.

To promote interdisciplinary activity on campus and expand its strength in biotechnology, in 1986 the university established a new department of microbiology. This department was formed from the departments of medical microbiology in the College of Medicine, and microbiology and agricultural biochemistry in the College of Agriculture and Life Sciences. This step capitalized upon existing research capabilities in critical areas of biotech research: recombinant DNA methodology, monoclonal antibody production and use, general molecular biology, and plant and animal tissue culture. Faculty in the new department, and their colleagues elsewhere in the university, are engaged in research in molecular genetics, genetic toxicology, nitrogen fixation, host-parasite interactions, environmental health and water resources.

PATRICIA ARMSTRONG
Director,
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What do Mike Dukakis, An Wang and Norma Foreman Glasgow have in common?

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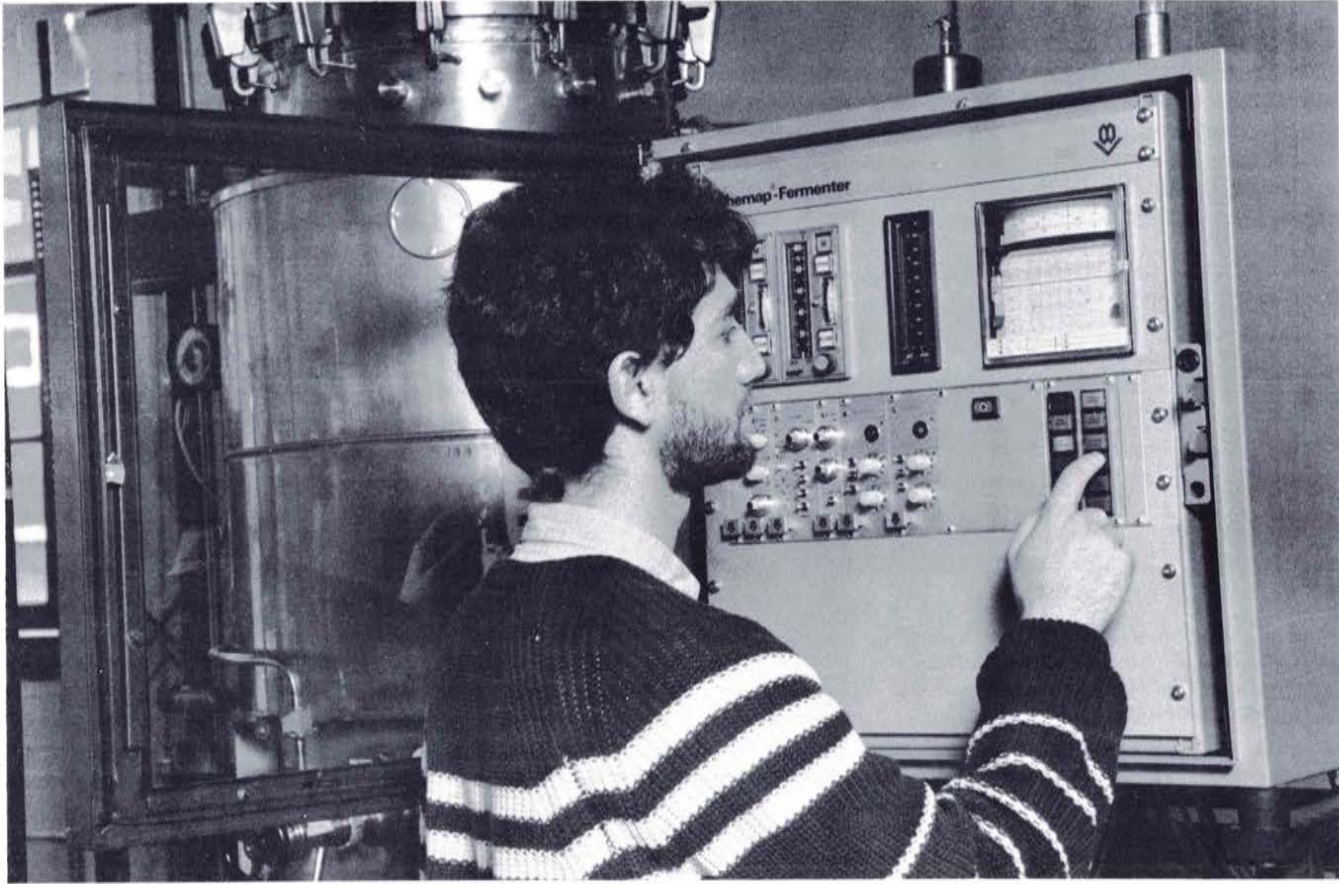
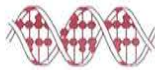
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Student working with a fermenter in the laboratory of the Biotechnology Engineering Center, Tufts University.

New England's Biomedical Industry Demands Skilled Graduates



ELLIN ANDERSON

Medical-related firms are big business in New England. There is a growing need for skilled employees among medical instrumentation and equipment companies, traditional pharmaceutical R&D firms, and biotechnology companies specializing in microbiological manipulation. Graduates of programs with expertise in biotech (most commonly, any technique that uses living organisms to make or modify products) and in biomedical engineering (in which engineering and medical knowledge are combined to make a product, such as an artificial organ or computerized wheelchair) are

therefore a valuable resource. There is a need for personnel with every level of training, from lab technicians to researchers with advanced degrees.

Many WPI graduate students specializing in biotech have jobs waiting for them before they graduate.

Gerard L. Cote, a 24-year-old doctoral candidate in biomedical engineering at the University of Connecticut at Storrs, personifies the interdisciplinary nature of biotechnology, which requires the ingenuity of an engineer and the med-

ical expertise of a doctor. Recently, Cote wrote a prize-winning research paper comparing methods of using the frequency of soundwaves to measure the velocity of bloodflow.

Much of the data Cote collects for his work comes from the University of Connecticut Health Center at Farmington. Cote's advisor, Dr. Martin Fox, an associate professor of electrical and systems engineering at Storrs, has a joint appointment with the department of radiology at the health center.

Once he has his doctorate, Cote plans to combine a teaching career with consulting for industry. His current area of study is imaging. "An X-ray image or cat scan may be stored in a computer," he says. "That type of image is readily acces-



sible to image processing on a computer because it can be digitized without losing any resolution. It's a big thing now within industry, and medical use of digital images is becoming common."

The southern tier states

According to a survey of business, higher education and government leaders conducted by the New England Board of Higher Education in 1987, biotech is expected to emerge as a vital industry in New England's three southern-tier states. This is indeed proving to be the case. Given the rate at which new biotech businesses are being created (six in Boston alone over the past six months), the efforts of New England higher education in matching industry demand with skilled graduates may not be adequate.

The **Worcester Polytechnic Institute's** department of biology and biotechnology is working to prevent a critical shortage of trained personnel for jobs that didn't even exist a few years ago. WPI's new course in bioprocess technology, the first of its kind in the country, is funded through a partnership with local industry and with the quasi-public Bay State Skills Corp. Students receive hands-on experience by running large-scale bioprocess equipment at the Norton Co. in Worcester, where they learn how microfilters are assembled and used in such techniques as cell harvesting and media sterilization.

Joseph Bagshaw directs WPI's Worcester Consortium PhD Program in Biomedical Sciences. Established in 1976, the unique program also involves Clark University, the University of Massachusetts Medical School and the Worcester Foundation for Experimental Research. Currently, there are six students in the master's and doctoral programs. Biotech and other companies actively recruit WPI students, evidence of the fact that there is "no question" about a shortage of trained people with advanced degrees, Bagshaw says.

"Our graduates have little or no trouble finding jobs," he continues. "In fact, many of them at both the B.S. and the M.S. levels have jobs

waiting for them even before they graduate. Recruiters or 'headhunters' literally call me up to ask if we have people appropriate for certain positions." Recently, personnel directors from Cambridge Bioscience and Serogen Inc. have made special visits to WPI, in the hope of getting what Bagshaw calls "an inside track on hiring."

At UConn, student demand for training has resulted in the creation of a new master's program in biotechnology.

Tufts University's interdisciplinary **Biotechnology Engineering Center** offers post-graduate courses in biotech for professionals during the afternoon and evening. The courses are designed for researchers already affiliated with biotech firms who wish to upgrade their expertise, and for established engineers and scientists wishing to acquire new skills for work with biotech

firms. The center gives industry professionals an insider's view of the field and the skills to move ahead in their careers.

Microorganisms such as monoclonal antibodies must be scaled-up, or produced in large quantities for industry, by means of biotechnology processing. At the Tufts center, courses use the principles of biology and engineering to study and solve practical problems in this area. There are courses in microbiology, biotechnology processing and a new course on the fundamental principles and practical aspects of enzymology. Participants can take the Tufts courses on a non-degree basis, or receive credit that may be used towards requirements for master's or doctoral degrees in biology, chemistry or chemical/biochemical engineering.

The **University of Connecticut** has formed an interdisciplinary Biotechnology Center. Scale-up and purification equipment has been purchased for the center with a \$250,000 grant from the Connec-



Dr. Martin Fox, a physician with a PhD in electrical engineering, uses a super computer to enhance medical images such as X-rays and ultrasounds. Fox trains bioengineers and works at both UConn's main campus and the Health Center.



ticut Board of Higher Education. This new capability will broaden the research capacity of the university's chemical engineering and biology departments, and better equip master's degree graduates to assist biotech firms in Connecticut and elsewhere. An additional \$1.7 million grant from the National Science Foundation, announced in April, will fund an analytical ultracentrifugation facility.

Also at UConn, student demand for training has resulted in the creation of a new master's program in biotechnology. The program was developed with the guidance of a 22-member industrial advisory board drawn from major New England, New York and New Jersey firms. A summer spent at UConn's Biotechnology Center or a six-month cooperative education program with industry is required. UConn also offers doctoral and master's programs in biomedical science and biological engineering.

To address the needs of industry, the National Science Foundation has set up a cross-disciplinary Biotechnology Process Engineering Center at the **Massachusetts Institute of Technology**. With a five-year, \$20-million grant from NSF, the center is conducting generic applied research involving biotechnology scale-up and manufacturing, as well as training students at all levels and providing short-term courses and lab practicums for scientists from industry.

Ed Osawa, technology coordinator for the MIT center, explains: "We have an industrial consortium comprised of about 50 companies throughout the biotechnology industry, eight or nine of which are in the New England area." One of the benefits the center provides for consortium members is a personnel exchange program in which participants may come to the center to learn about biotechnology from the ground floor up, gaining valuable laboratory experience.

Some faculty feel that MIT's controversial plan to abolish its department of applied biological science may have a negative impact on biotech research at the institute, even if most faculty are shifted to other



Judith E. Miller, associate professor of biology and biotechnology at Worcester Polytechnic Institute, confers in her laboratory with teaching assistant Francis McConville. Photo: ©1984 Michael Carroll—Photography

departments. The bioscience department brings in \$13 million annually in research grants, and has had a significant impact on the biotechnology industry, including the generation of many spin-off companies.

Boston University now has an undergraduate degree program in biomedical laboratory and clinical sciences. The program is offered through the cooperative efforts of B.U.'s School of Medicine and Metropolitan College. Endorsed by the Massachusetts Biotechnology Council, the program prepares graduates for careers in the medical technology field. Students, who may opt for a bachelor of science or associate's degree, are prepared for such positions as research technologist, assistant scientist, lab technician, medical technologist and medical lab technician. While numerous similar allied health programs are offered at colleges and universities throughout the region, B.U.'s is the first to actively involve a medical school.

The **Hartford Graduate Center**,

in conjunction with **Trinity College**, awards a master's degree in biomedical engineering. This nationally known program is directed by Joseph Bronzino, who is also Vernon Roosa Professor of Applied Science at Trinity College. The degree is awarded by the Hartford Graduate Center.

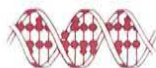
Biomedical engineering at Brown is currently confined to the development of bioartificial organs.

"We are recognized as, if not the best, one of the best programs to prepare people for the clinical engineering arena. And we are getting applications from all over the country for the full number of slots that we have," Bronzino says.

The program was created in 1969 in order to fill an area not covered by the University of Connecticut's older program in biomedical engineering, "which was not oriented towards the clinical environment," Bronzino relates. The graduate center's program provides intensive clinical engineering internships with Hartford Hospital, St. Francis Hospital Medical Center, the University of Connecticut Health Center and the Veterans Administration Hospital in New Haven.

According to Bronzino, biomedical engineering projects for the clinical environment might include any of the following: designing diagnostic devices such as automated stress tests for patients; developing ultrasonic systems for medical imaging; or creating computerized systems to assist medical staff in keeping track of patients' vital signs. Demand for graduates of this program is particularly strong among biomedical instrumentation firms.

Although the **University of Rhode Island** has no degree program in "biotech" or "biomedicine" per se, the university is keenly aware of the growing importance of this field. Activity at the university in these areas is largely confined to research, according to Richard W. Traxler, professor of food science and nutrition, professor of microbi-



ology and chairman of URI's Biotechnology Center. Administered through the College of Resource Development, the faculty consortia that make up the "center" coordinate and encourage interdisciplinary research in the agricultural, medical, marine and food sciences and related disciplines. The center provides a structure to permit interaction between the state's public and private sectors, identifying new research opportunities in biotechnology and organizing seminars for business leaders on topics in biotechnology.

Brown University has a master's program in biomedical engineering, offered jointly by the division of engineering and the division of biology and medicine. Activity in biomedical engineering at Brown is currently confined to the development of bioartificial organs, which are composed of both organic and artificial materials. Nine graduate students are currently enrolled in the program, and that number is expected to increase to 30 by 1990.

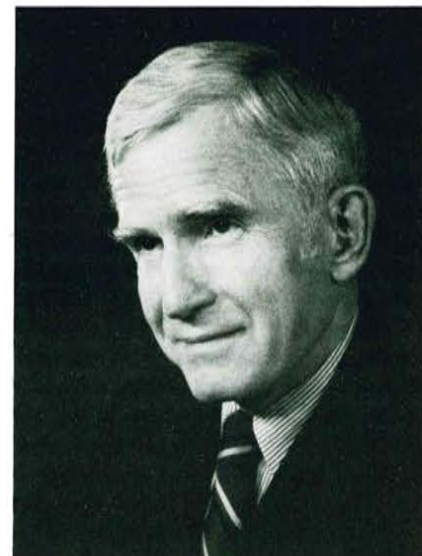
The northern tier

The Thayer School of Engineering at **Dartmouth College**, in collaboration with the Dartmouth Hitch-

cock Medical Center, offers programs in biomedical engineering at both the master's and doctoral levels. General study in applied mathematics and engineering sciences is required, followed by course work in an area of specialization and a thesis.

Close ties with the Hitchcock Center permit easy access to problems of immediate interest to medical researchers. Resources at the Thayer School include a digital systems laboratory, a bioinstrumentation laboratory, an electron microscope, computers and thermometry equipment. The resources of the Hitchcock Center are also accessible to students. A joint M.D./PhD program in biomedical engineering has been available since 1979.

The **University of Vermont** offers master's and doctoral degrees in each of the following areas: agricultural biochemistry, animal sciences, biochemistry, cell biology, microbiology and plant and soil science. "All of them have a biotechnology/applied biology bent to them," says Patricia Armstrong, director of UVM's Office of Sponsored Programs. A master's degree in biomedical engineering is also offered. (For additional information



An interesting and most effective mechanism for encouraging inter-institutional collaboration in basic medical research is the Whitaker Health Science Fund Collaborative Research programs between the Massachusetts Institute of Technology and the Harvard University, Boston University and Tufts University Schools of Medicine.

The key element of the program is that a *junior* investigator in one of the participating institutions must form an active scientific collaboration with a *senior* researcher at MIT. The junior investigator must play a major role in organizing and carrying out the research project, while the senior MIT professor supervises the research project.

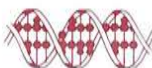
The Whitaker programs started several years ago with a modest number of collaborative projects. Now, many grants are proposed each year by the participating institutions, with a select number of them submitted to a parent committee at MIT for final approval and awarding of grants.

RICHARD H. EGDAHL, M.D.
Director, Boston University
Medical Center
Boston, Mass.



William Skea of Millipore Corp. demonstrates the use of a high-pressure liquid chromatograph to students at Worcester Polytechnic Institute.

Photo: ©1986 Michael Carroll—Photography



on biotech/biomedical research on the UVM campus and in the state of Vermont, see "Academic Research: Key to the Biotechnology Revolution" by Vermont Rep. James M. Jeffords, and commentary by Patricia Armstrong accompanying our lead article.)

Within the **University of Maine** system, several graduate-level courses with a biomedical component are offered at the Orono campus, including molecular biology, medical entomology, cell culture and advanced immunology and molecular genetics. A new wing has been added to Hitchner Hall at USM's Maine Agricultural Experiment Station to house the departments of microbiology and biochemistry, with the object of placing the departments involved with biotech under one roof.

Bruce Nicholson, chairman of USM's department of microbiology, describes the activities of two typical USM students working in biomed/biotech and the directions

their careers could take. One of his doctoral students in microbiology is working with immunological techniques. She could "assist in developing diagnostic tests for viral diseases and eventually vaccines," Nicholson says, "and would then be able to work in any of the biological/biotech companies that make immunological reagents, diagnostic reagents and vaccines, or else perform basic research in hospitals and medical schools."

A new wing has been added to USM's Agricultural Experiment Station, with the object of placing departments involved with biotech under one roof.

Another student, whose area of specialization is genetic engineering, is trying to engineer soil microorganisms to break down pes-

ticides, a problem in Maine's agricultural areas.

USM's graduate course in applied immunology was developed in response to the needs of several Portland biomedical companies. Nicholson, however, does not feel that programs should be developed "after the fact," in response to student or economic demand.

"One of our roles is to anticipate where fields are headed and then design our programs so that students are prepared for what they find when they finish," he says. "We know we've got to be four or five years ahead of the game." Anticipating the needs of students and of the economy, determining new directions by venturing into unexplored territory and responding to existing student and industry demand is the threefold challenge facing New England higher education. □

Ellin Anderson is associate editor of *Connection*.

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Biotechnology in Rhode Island

CRAIG DOREMUS



Boston may be the hub, but Rhode Island isn't far away from becoming an economic force in New England's emerging biotechnology industry. Brown University's medical school and major affiliated teaching hospitals is one factor. Dr. Pierre Galletti, Brown's vice president for biology and medicine, sees Rhode Island's biotech effort as complementary to Boston's. "We are trying to find our own niche," he says. He also emphasizes that the University of Rhode Island—especially its College of Pharmacy—has good potential for contributing to the growth of biotech in the state. Rhode Island is encouraging university/industry liaisons in the biotech field through its Partnership in Science and Technology. "One of our major goals is to get applied research money to Rhode Island's universities, colleges and hospitals," says Bruce Lange, director of the partnership. The state-funded partnership provides grants of at least \$200,000 for joint academic-industrial projects. It recently announced the award of four grants, including one to the Genetics Institute, Inc., of Boston, and to Providence's Miriam Hospital, for the development of a genetically engineered cell product that may be used to treat certain blood diseases. If an economically viable product is created, it will be commercially produced by WelGen in West Greenwich.

WelGen plans Rhode Island site

WelGen was formed in September 1986 as a collaboration between the Genetics Institute and Wellcome PLC, a British pharmaceutical company. After the two parent companies examined 60 sites in New England, they picked a 77-acre tract in West Greenwich adjacent to Interstate 95.

"The main consideration in picking the Rhode Island site was that it was a much bigger site and could accommodate a bigger facility in the future," says Wanderly Ribeiro, president of WelGen. The company will employ 200 to 250 people in a 130,000-square-foot drug manufacturing plant now under construction. If WelGen's products are marketed according to plan, the West Greenwich plant could be expanded to 500,000 square feet with 500 to 600 employees.

By late spring 1989, five 2,100-gallon stainless-steel bioreactors will be growing hamster ovary cells, genetically engineered to produce Tissue Plasminogen Ac-

tivator. TPA has been shown to dissolve the blood clots that cause heart attacks, the killer of one million people per year. Ribeiro estimates annual revenues from TPA in the \$50-million range.

On average it takes seven years—at a cost of \$90 million—to go from an idea to a saleable drug product.

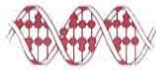
A long and costly process

"There are several potential products that WelGen can manufacture," says Ribeiro. "I say 'potential' products because they have not been approved yet." Ribeiro is referring to the long and complicated process demanded by the Food and Drug Administration before a drug is allowed on the market. On average it takes seven years—at a cost of \$90 million—to go from an idea to a saleable drug product. WelGen's TPA has not been formally approved, but they hope that the FDA license will come through before the West Greenwich plant is operational.

In addition to TPA, Ribeiro says, both parent companies are developing new cells to manufacture in WelGen's bioreactors, including alpha-interferon, a cancer treatment, and Factor VIII, a blood-clotting protein for hemophiliacs.

An old mill building on the banks of the Pawtuxet River in West Warwick is the home of Scott Laboratories, a subsidiary of Microbiological Sciences Inc. Inside the structure, the presence of surgically gowned and capped workers indicates that this establishment is part of the brave new world of biotech. Menashi Cohenford, vice president and director of research and development at Scott Labs, is involved with the development of serum-free media, the nutrients required for the growth of genetically engineered cells. According to Cohenford, serum-free media is desirable because the cow serum that is presently used is non-uniform in quality, susceptible to contamination and expensive.

Most of Microbiological Sciences' income—\$23.8 million in 1986—comes from selling microbiological testing kits to clinical laboratories. But the company hopes that the \$400,000 grant recently obtained from the National Institutes of Health will enable it to develop a variety of supplies for the biotech industry. "The market is tremendous—it will have a dramatic effect on the economic development of Rhode Island," Cohenford predicts.



The biotechnology industry is beginning to realize its commercial potential. There are several reasons to believe that biotechnology will evolve into an important industry segment for New England. The region can offer a splendid biomedical research base, promising biotech firms, a strong and dynamic venture capital community and seasoned management counsel to the new industry.

As biotechnology companies begin to commercialize their products, patents become an increasingly important topic. The incidence of patent disputes has grown, but surprisingly, when asked to evaluate the competitive importance of the ability to obtain and defend patents, respondents to a recent Arthur Young survey ranked this factor lower than many others. The finding tends to demonstrate that early-stage biotech companies and their executive officers do not focus enough on the patent issue. However, many biotech products experience long development cycles and associated high costs. Those companies that exercise commercial savvy at any early stage by carefully managing their patent filings are likely to do better than companies that speed down the scientific path without considering the protection patents can offer.

STEPHEN BUCKLEY, JR.
Audit Partner
National High Technology Group,
Arthur Young Accounting Firm
Boston, Mass.

Brown Foundation helps market ideas

William Jackson is president of the Brown University Research Foundation, which helps Brown faculty market their discoveries. The University of Rhode Island Foundation performs a similar function for Rhode Island's state university. Most of Jackson's present efforts center on the work of 15 faculty members of the Division of Biology and Medicine. "Genetic engineering is not the basis for most of the inventions that I am dealing with," he explains. "Medical technology is a better word to describe what we're licensing from Brown."

Analytical Biosystems is commercializing a method discovered by Brown professor Boris Rotman. His test allows oncologists to find the best chemotherapy to treat cancer patients by measuring a tumor sample for drug sensitivity in the laboratory. This test is particularly important because oncologists have discovered that the susceptibility of a tumor to a particular anti-cancer drug varies from patient to patient and may change during the course of the disease. The company estimates an annual market of \$300 million, six times Wel Gen's projected revenues, because its test will be used in the treatment of cancer, a disease afflicting one in four Americans during their lifetime.

Most scientists know little about marketing an invention. "It helps a lot to have someone else looking into the financial aspects," said Rotman, speaking from Analytical Biosystem's new 10,000-square-foot facility in Warwick. "I could not have developed this test if I had to worry about contacting people."

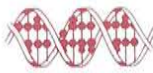
Jackson of the Brown Research Foundation did the contacting, and was able to interest Applied DNA Systems Inc., a publicly-traded New York-based venture capital firm, in funding the development of Rotman's test. Analytical Biosystems was formed as a joint enterprise between the Brown University Research Foundation and Applied DNA Systems. The company is now conducting clinical trials of Rotman's assay at six of the leading cancer centers in the country, including Massachusetts General Hospital and Rhode Island Hospital. Hopefully the test will be on the market by the end of this year.

If Rhode Island doesn't jump on the bandwagon soon it may lose both jobs and revenue to the estimated 50 Massachusetts biotech firms.

Biotech seen as risky investment

Jim Saafeld of the Fleet Financial Group in Boston is very skeptical of biotech as an investment. When asked why, he says: "In general I think it's been a market that's relied on the greater-fool theory. The greater-fool theory says that it doesn't make a bit of difference what I invest in because there's always going to be a greater fool that will take me out at a higher valuation than I paid."

Wall Street's panic selling on October 19 of last year seemed to add credence to the image of biotech as an



uncertain investment. A report by Paine Webber said that the stock of 60 prominent biotech companies dropped 44 percent on average during Black Monday, compared to a 28 percent drop in the stock prices of 400 of the nation's largest companies.

Despite biotech's image as a financial risk, most analysts agree that eventually there will be a payoff, and if Rhode Island doesn't jump on the bandwagon soon it may lose both jobs and revenue to the estimated 50 Massachusetts biotech firms. "We have many people in Rhode Island with degrees ranging from bachelor's to PhDs who have to go to Boston to seek employment," says Cohenford of Scott Labs. "Rhode Island is a growing state. If biotechnologies move into the state, a substantial portion of the people who are working in Massachusetts in the biotechnology area would immediately switch and seek employment right here." A sign outside the entrance to Scott Labs is a portent of Cohenford's prophecy: "Now Hiring, All Shifts, Apply Within."

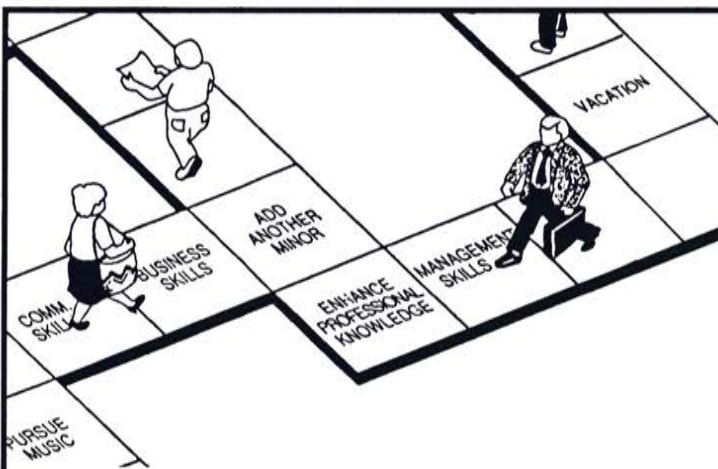
But remember that there are a number of 'ifs' clouding biotech's future in Rhode Island: if WelGen's TPA is approved by the FDA; if Cohenford's serum-free media is successful; if oncologists accept Rotman's test. □

Craig Doremus is a freelance writer from Rhode Island. (This is an adaptation of an article that originally appeared in the *Providence Business News*.)

B iotech investors had their nerves tested in 1987. A series of negative surprises, most particularly the October 19th stock market crash, have battered the stock and shifted the psychology of the group. Specifically, for the year ending Dec. 31, 1987, the Vector Biotech Index declined 12.8 percent compared with a 2 percent rise for the Standard and Poor 500 stocks.

In the current market environment, the access to capital markets for the biotech industry is limited. As we see it, cash is king and the industry can be divided into the "haves" (those companies with technology, people, products and cash) vs. the "have nots" (those that have only technology, people and products, lacking sufficient cash to support product development through a bear market).

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Yale Boosts New Haven's Medical-Related Industries

STEVE HAMM

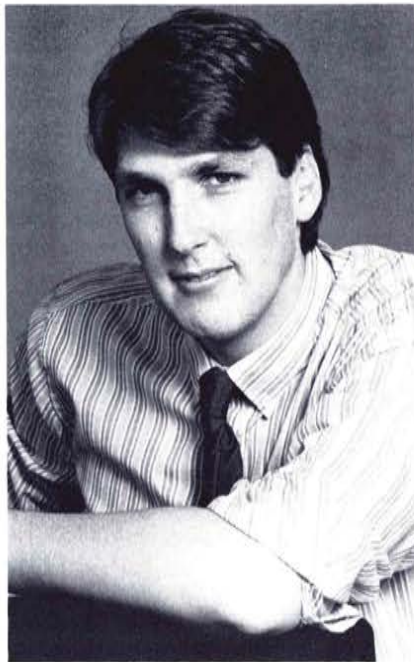
In the area around New Haven, Conn., the heavy manufacturing industries that once drove the economy are being replaced by businesses of the intellect, many of them related to health care.

The south central region of Connecticut was in the forefront of creating technology for the munitions, metal-forming and rubber industries in the first half of the century. Those technologies are now obsolete, and most of the factories are closed—either torn down or left as crumbling brick and steel hulks haunting an industrial wasteland.

While higher education and the aerospace industry are large employers now, business and civic leaders believe the growth of medical-related businesses is the best hope for sustained economic development in the coming decades.

A good foundation has already been laid. The New Haven area has two major hospitals in Yale-New Haven and the Hospital of St. Raphael. Yale University has elite biology and medical faculties and facilities. The area has two pharmaceutical research centers—Bristol-Myers and Miles Laboratories—and a germinating biotechnology industry. There is also a solid base of medical equipment manufacturers.

Another important element is Science Park, a nonprofit high-technology industrial park in New Haven founded by Yale, the city



Steve Hamm, business editor, *New Haven Register*

Yale University is the key to the future of medical-related business here

and the Olin Corp. The five-year-old park has more than 100 tenants, a substantial number of them creating products for the health-care industry.

But Yale University is the key to the future of medical-related businesses here. Traditionally, the university's science research has been theoretical rather than applied. Unlike Stanford and MIT, Yale has not embraced the world of business.

Benno C. Schmidt, president of Yale for the past two years, says he wants to change that. Recently he stated that he will set a national example for commercial and social links between a major university and the community that surrounds it. He is encouraging faculty members to interact with business people and look for commercial applications for their research inventions.

Last year Schmidt announced the establishment of a fund of up to \$50 million for investments or loans for

economic development projects in New Haven. Yale also invested \$2 million in the newly formed Connecticut Seed Ventures Fund.

Yale has already been a magnet for some medical businesses. Officials of Bristol-Myers said the proximity of Yale researchers was a key factor in their decision to locate a major drug research center in nearby Wallingford. Three Yale faculty members are involved in a joint venture, Molecular Diagnostics Inc., with the West German pharmaceutical giant Bayer AG, parent of Miles Laboratories in West Haven.

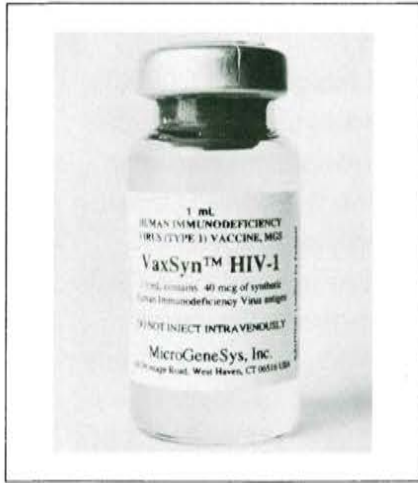
The hospitals are also attractive to pharmaceutical companies. In addition to the local companies, Pfizer Inc. in Groton and Boeringer Ingelheim in Danbury conduct drug tests at Yale-New Haven Hospital.

The Connecticut Department of Economic Development has identified pharmaceuticals and biotechnology as critical industries. In the New Haven area, two small biotechnology companies have already attracted national attention.

MicroGeneSys in West Haven has developed a trial vaccine for acquired immune deficiency syndrome, and last year became the first company to test an AIDS vaccine on humans. The fast-growing International Biotechnologies Inc. in Science Park was recently purchased by Eastman Kodak.

The New Haven area has also attracted or generated several key medical equipment manufacturers. U.S. Surgical Corp., the leading maker of surgical staples, has its main factory in New Haven. Philips Medical Systems in Shelton makes diagnostic imaging equipment. Other growing companies are Novamatrix Medical Systems in Wallingford, which makes needleless patient monitoring systems, and Corometrics Medical Systems, in the same town, which makes X-ray equipment.

Many of the elements needed to support a thriving medical industry are here. But there are also barriers to growth. Housing prices are rising rapidly. The highways are jammed



Experimental AIDS vaccine developed by MicroGeneSys, limited by Federal law to investigational use.

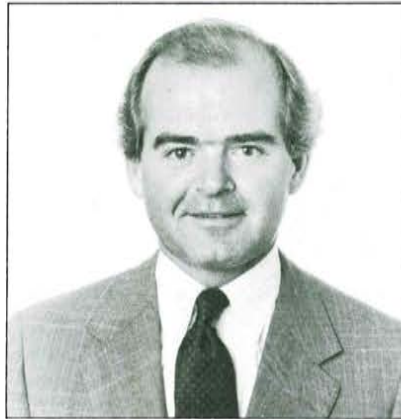
**Bristol-Myers
located a major drug
research center in nearby
Wallingford because of
the proximity of Yale
researchers.**

at rush hour. There is a shortage of low-skilled labor, with an unemployment rate of less than 4 percent. Wages are inflating.

The city administration, together with the Greater New Haven Chamber of Commerce, headed by a former Science Park vice president, are beginning to systematically identify the problems of local businesses, with the goal of devising programs that address them. Also, the city and its Downtown Council have just launched a marketing campaign designed to attract new businesses here through a combination of approaching Yale alumni, advertising and direct selling.

The critical element, according to civic leaders, is the willingness of senior officials of Yale University and the hospitals to market their institutions and their community. □

Steve Hamm is business editor of the *New Haven Register*.



The prospects for continued growth of medical-related businesses in Maine is very good in my estimation. The foundation on which this growth will occur is in place. In addition to a growing group of companies (like Ventrex Labs, AgriTech, Immucell, Immunosystems, Atlantic Antibodies, Virostat, Diamed, Binax) in the greater Portland area, Maine has several fine research laboratories, Jackson and Bigelow Laboratories, the Foundation for Blood Research, and one of the finest hospitals in the country, the Maine Medical Center. To undergird this foundation for growth, the University of Maine has begun programs to offer higher education opportunities to students interested in biomedical careers. Specifically, the university, in conjunction with the Foundation for Blood Research and the Maine Medical Center, has established a graduate-level program in applied immunology. Couple this with the quality of life that Maine offers, plus a high-quality workforce, and you will see why the growth of medical-related business here seems inevitable.

JOHN B. LINCOLN
President
Ventrex Labs, Inc.
Portland, Maine



Dartmouth Medical School entered the world of industrial biotechnology in 1987, forming MEDAREX, Inc., in collaboration with Essex Vencap, a New Jersey firm. The new company, located in Hanover, N.H., will develop and produce monoclonal (single-celled) antibodies for use in the highly specific diagnosis and treatment of autoimmune and a variety of infectious and other diseases.

The antibody product is based on more than five years of research by three Dartmouth faculty members, Edward D. Ball, Michael W. Fanger and Paul M. Guyre. Their findings indicate that selected modified monoclonal antibodies may dramatically assist treatment of a number of major diseases, such as cancer and AIDS. This technique is so promising that Essex Vencap will invest up to \$2 million in it over the next three years. Within six months, MEDAREX hopes to market several specific antibodies for use by other researchers.

The potential applications of this new antibody technology are immense. As a medical school and member of a medical center, research is one of our primary missions. We are very pleased to be a partner in this innovative development.

ROBERT W. MCCOLLUM M.D.
Dean,
Dartmouth Medical School
Hanover, N.H.

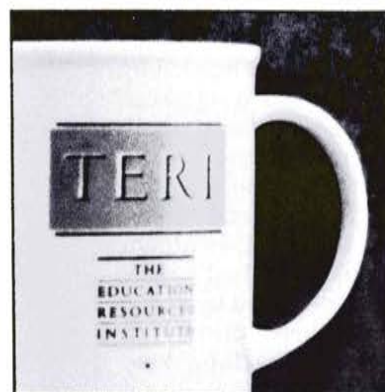
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Foreign Financing Benefits Education Loan Programs

LAWRENCE W. O'TOOLE

Foreign investment in the United States has grown dramatically over the past several years in almost all sectors of our economy. Most visible has been the investment of foreign capital in bonds and notes issued by the Treasury itself to fund federal government activities in a time of budget deficits. Also highly visible are acquisitions by foreign investors of real estate, stock in major U.S. corporations and major works of art.

One of the most dramatic though less visible developments is the high level of interest foreign investors, especially the Japanese, have had in providing very attractive terms and interest rates to support higher education financing. In addition to facility financing, some of the world's largest international banks have actively participated in the development and financing of student and parent higher education loan programs. The experience of the New England Education Loan Marketing Corp. is a prime example.

In 11 different financings totalling \$974 million for Nellie Mae's secondary market support for both federal and supplemental loan programs, 16 international banks have provided \$508 million in direct loans and letters of credit. This figure represents 52 percent of a total of \$974 million in secondary market support for the loan programs, with U.S. banks providing \$466 million, or 48 percent.

Two aspects of financings by foreign banks are important to note.

The first is the amount and scale of these financings. Over half a billion dollars have been committed by international banks to support Nellie Mae's efforts to assure access to post-secondary education in New England through its federal and supplemental loan programs. The size of these financings reflects the levels at which families are borrowing to meet ever-increasing college costs. These needs are expected to continue to grow as tuition levels increase and more New England families suffer reduced eligibility for assistance under federal student aid programs, particularly the Guaranteed Student Loan Program.

The second area of importance lies in the character of the international bank participants and the level of the financial commitment to New England higher education their investments reveal. In part, Nellie Mae's financings are reflective of the international banking

ings, providing 75 percent or \$382 million of the total \$508 million described earlier. We have been the beneficiary of such a strong lending commitment due in large measure to the history of success of higher education in New England and the related general economic success of our region. When combined with Nellie Mae's position in the national credit markets and the role it plays in higher education finance, the result has been an ability to offer flexible and low-cost financing programs for New England students and families.

In conclusion, we are clearly living in a global economy where even education loan programs in New England can benefit from utilizing international sources of financing, in much the same way that the U.S. Treasury is utilizing foreign investment to ease the domestic impact of current budget deficits. Although this is currently an effective tool, higher-education financing plans, like plans to reduce the federal

As of year-end 1986, measured by total assets, seven of the 10 largest banks in the world were Japanese, two were French and one was American.

system and the strength of various national economies and banking institutions.

When measured by total assets, seven of the 10 largest banks in the world at the end of 1986 were Japanese, two were French and one was American. Further, as *The American Banker* recently reported, of the 25 largest banks in the world, 16 were Japanese, confirmation of the growing concentration of economic wealth among Japanese banks, fueled partly by a nation of savers and partly by a booming export economy.

Japanese banks have played a major role in Nellie Mae's financ-

budget and trade deficits, must anticipate shifts in the global economy that might alter the attractiveness of foreign investment. The task of financial planners is to maximize current opportunities, in well-structured programs that can withstand shifts in the global economy and continue to provide quality services to higher education. □

Lawrence W. O'Toole is president of the New England Education Loan Marketing Corp.

FOREIGN BANKS UNDERWRITE EDUCATION LOANS

Just when college students were enrolling in their fall 1987 classes, the New England Education Loan Marketing Corp. conducted one of its most significant transactions to date involving foreign banks. This was a term loan and security agreement providing \$45 million in additional capital to fund supplemental loans outside the Guaranteed Student Loan Program.

Represented in the international consortium were the following nations: the United States (Bay Bank Boston N.A.); France (Credit du Nord); Belgium (Kredietbank, N.V.); Japan (Kyowa Bank, Ltd.; the Hachijuni Bank, Ltd.; the Yasuda Trust and Banking Co., Ltd.; and the Hokuriku Bank, Ltd.); Australia/New Zealand (the Australia and New Zealand Banking Group Ltd.); Germany (Berliner Handels-und-Frankfurter Bank); Canada (Canadian Imperial Bank of Commerce); and Singapore (the Development Bank of Singapore).

Supplemental loans funded through this transaction are guaranteed by The Education Resources Institute, through loan programs such as SHARE and EXCEL. International underwriting of New England higher education is just one example of the rapid globalization of world money markets.

A "USER-FRIENDLY" TUITION FUTURES PROGRAM:

The College and University Savings Plan of Rhode Island

ELEANOR M. McMAHON

While college tuitions continue to climb, so do the numbers of Americans who believe that a college education is critical to success in life: 65 percent in 1985 compared to 35 percent in 1978, according to a Gallup survey. Meanwhile, since 1981 the federal government has reduced grants, increased loans and enacted stiffer standards for student aid eligibility, forcing students and their families into levels of debt that negatively impact the economy. The following proposal for a Rhode Island college tuition savings plan using tax-exempt bonds is based upon recognition of the fact that in a nation of poor savers, yearly tuition increases will eventually exclude people of ordinary means from funding college educations for their children. The findings and recommendations of the Commission to Study the Feasibility of Implementing an Advanced Tuition Payment Plan for the State of Rhode Island, which was appointed in 1987, are the basis for the plan outlined here by Rhode Island Commissioner of Higher Education Eleanor M. McMahon.

Two major questions on America's public agendas that are usually dealt with as if they are unrelated are: How will today's parents of young children be able to bear the projected costs of a college education; and: How can the United States address the problem of inadequate personal savings?

If one reflects on these two problems, it becomes obvious that

one bears upon the other. The failure to save is a problem for an increasing proportion of Americans who hope to send their children to college, particularly as available tuition grants decline.

Is there a way to effectively address both problems? Tuition plans that would allow the average family to prepay at or near current tuition rates some or all of the cost of future college expenses could be the answer.

According to the National Association of College and University Business Officers, as of early 1987, 250 tuition investment plans were in existence. These prepayment plans are based on the theory that investments set on a sliding scale according to a child's age will give families a hedge against future tuition inflation. Parents can also avoid paying taxes on dividends under some of these plans. Under other plans, some institutions have devised a way to stabilize tuition for four years by using prepayments to guarantee that there will be no tuition increase.

Critics of these plans argue that unwary parents could end up with less savings or fewer options for choice of schools than if they had used conventional investments. Purchasers of certain tuition futures are exposed to the risk that their children may be unable and unwilling to attend the designated college or university. In spite of these criticisms, public and private institutions of higher education, state agencies and private sector commercial institutions offering these types of loan and payment programs continue to increase.

In a recent *Chronicle of Higher Education* article, George Sussman argued that to be successful the earnings of a college savings plan should accumulate free of federal, state and local income taxes. Further, the plan should be flexible enough to permit the application of its proceeds to any postsecondary program anywhere, without penalty; or even to another purpose if the beneficiary fails to attend college.

Unfortunately, these criteria apply to very few of the programs now in place. Many are at individual institutions and are there-

fore inflexible. Most states are either planning or have initiated plans; the latter include Florida, Illinois, Indiana, Maine, Michigan, Tennessee and Wyoming. In most of these states, however, the plan does not satisfy one of the criteria that I have cited: that the savings could be used towards any post-secondary program anywhere. Instead, they are restricted either to public institutions or to institutions within the state in question.

Proposed state-operated plans

Two representative samples of such programs include the following: The most widely publicized of

Failure to save is a problem for an increasing proportion of Americans who hope to send their children to college.

the state plans is the proposed Baccalaureate Education System Trust in Michigan. In general, the function of BEST would be to "contract, on behalf of the state, with purchasers for the advanced payment of tuition for a qualified beneficiary to attend any of the state's institutions of higher education." The plan is available for all Michigan residents. In general, BEST would provide four years of education for the participants' children, but only at the Michigan state colleges and universities where they are accepted. The success of the BEST plan depends on a favorable IRS ruling that would exempt interest

earned from federal taxation.

A somewhat more flexible plan in terms of institutional choice has been proposed in the state of New Jersey. This would allow New Jersey residents to pre-purchase a minimum of one year's tuition on behalf of a beneficiary who has not yet entered his or her junior year in high school. At the time of purchase the sponsor must choose among participating institutions, a group that includes all New Jersey public colleges and universities and some independent institutions. Without going into further detail, if the beneficiary enrolls at the designated institution the plan would cover full

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CORRECTION

The founder of America's public school system was identified as Thomas Mann rather than Horace Mann on page 27 of the winter 1988 issue of *Connection*. As a writer, Thomas Mann would have understood that one's fatal flaw can take many forms, including that of a serious editorial oversight. As an educator, Horace Mann would have understood the learning that results from such mistakes.

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Bonds could be made available through payroll deduction, a form of saving that most people feel doesn't hurt.

tuition for the number of years purchased. If the beneficiary chooses to attend another New Jersey institution that charges lower tuition, the difference could be used to cover other college costs such as books, room and board. If the beneficiary chooses an out-of-state school, the New Jersey plan would make available to the chosen institution an amount equal to 75 percent of the tuition costs of the original institution. If the beneficiary chooses not to attend college, the investment would be refunded.

Despite a number of advantages, the deficiencies of these two representative plans and many other state plans are readily apparent: There is generally some kind of limitation on the institution that one can attend; potential coverage is frequently limited to tuition and thus does not include room and board; in some instances, if the beneficiary does not choose to attend college, the only return is the original investment; and for some plans, such as Michigan's, an IRS ruling is required on the exemption of interest earned from federal income taxes.

The Rhode Island Plan

None of these criticisms or limitations apply to the College and University Savings Plan of Rhode Island, proposed by State Treasurer Roger Begin and a legislative commission established in 1987 to review tuition payment plans. In Rhode Island:

- there is no limit as to the institutions to which it can be applied;
- there is no disadvantage to attending an out-of-state vs. an in-state institution;
- the investment yields full return even if the individual beneficiary decides not to go to college;
- the first \$25,000 in bonds purchased through this program will not be considered assets by the Rhode Island Higher Education As-

STRONG HIGHER EDUCATION RESOURCES CHARACTERIZE NEW ENGLAND'S ECONOMIC HOT SPOTS

The following 10 New England metropolitan areas were among 156 American cities and their environs listed by *Inc. Magazine* (March 1988) in its annual ranking of metropolitan economies. Rank was based on job generation, rate of significant new business start-ups and the percentage of new companies with high growth rates. Overall ranking of metropolitan areas, defined as counties or groups of counties closely related by urban community patterns, was based on the sum of the three scores. Data was provided by Cognetics, Inc., of Cambridge, Mass.

In reviewing this list, it is significant to note that each New England metropolitan area has a concentration of higher education resources, actively engaged in encouraging technology transfer, continuing professional education and community outreach programs.

NEW ENGLAND RANK (1988)	CITY	NATIONAL RANK (1988)	NATIONAL RANK (1987)
1	Manchester/ Nashua, N.H.	2	8
2	Portsmouth/ Dover, N.H.	13	20
3	Boston, Mass.	23	25
4	Portland, Maine	37	76
5	Worcester, Mass.	55	51
6	Bridgeport/ Stamford, Conn.	58	46
7	New Haven, Conn.	68	87
8	New London, Conn.	91	55
9	Hartford, Conn.	96	110
10	Providence, R.I.	103	n.a.

sistance Authority when student financial assistance is allocated;

- and because of the nature of the basic bonds, state and federal exemptions from income taxes of the interest earned are a given.

Finally, and most importantly, the plan, which shares many features with an earlier plan developed in Illinois (which in the first round floated \$90 million in bonds and found statewide demand to be \$270 million) has three exciting additional features:

First, there is no limitation or disadvantage to out-of-state use.

Secondly, as proposed, bonds could be purchased in small denominations of \$1,000 face value. By way of illustration, such a bond would cost the parent of a three-year-old child approximately \$344 in 1988 and would mature at \$1,000 in 2003 when the child reaches 18, typically the year of college entry.

Thirdly, it is hoped that these bonds could be made available through payroll deduction, a form of saving that most people feel doesn't hurt and that can easily become a habit.

One other aspect of this plan deserves comment: The students who are beneficiaries of the Rhode Island plan would graduate from college in the 21st century without the burden of debt that faces today's graduates and is a hindrance to our economy.

The College and University Savings Plan of Rhode Island is, in terms of the fundamental criteria suggested by Sussman, completely "user-friendly." Through this creative and far-sighted initiative, the Ocean State could reap both the unparalleled civic and economic advantages of a better-educated population; a statewide increase in personal savings; and college graduates who are free of debt. If ever there were a win-win situation, this is it. □

Eleanor M. McMahon is Rhode Island commissioner of higher education.

SURVEY ASSESSES IMPACT OF STUDENT LOANS

The number of students who borrowed more than \$10,000 for their college educations and are now making monthly payments of \$150 or more on those loans is rising, according to a recent survey of borrowers under the Guaranteed Student Loan Program. The survey was sponsored by the New England Education Loan Marketing Corp. and the Massachusetts Higher Education Assistance Corp.

Although the majority of those students are glad they took out a loan, a significant number are finding that repayment is a burden. Based on the New England Student Loan Survey, the GSLP appears to be successful in meeting its goal of increasing access and choice in higher education for lower- and middle-income students. However, several of the survey findings are cause for concern: Forty percent of the survey respondents believed that their college choice was limited by their concern over borrowing; thirty percent indicated loan payments are a major burden; and the percentage of minorities among the survey sample was small.

The survey was sent to 2,000 former students who are now repaying GSLs. The borrowers were asked basic questions about the effect of loan debt on their considering further education, their career choice, actual spending patterns and ability to purchase an automobile.

Other survey highlights:

- 70 percent of borrowers said loans were very or extremely important to obtaining a college education;
- about 50 percent find repayment is manageable;
- 85 percent of borrowers own automobiles, half of which are new;
- the average monthly payment on GSLs is \$105;
- the average total amount of a former student's loan debt is \$7,300.

Beneficiaries of the Rhode Island plan would graduate from college in the 21st century without the debt burden facing today's graduates.



University of Vermont

HIGHER EDUCATION BOOSTS NEW ENGLAND'S INTELLECTUAL TOURISM

JOHN D. HUNT

Tourism: a social and economic phenomenon that, until recently, has been foreign to most institutions of higher education. Yet there is a present and increasingly important relationship between the two. Higher education is both a stimulus for tourism and a source of leadership and innovation for assuring it is developed and managed to optimize its social and economic benefits.

More than recreation

To many, tourism has been narrowly defined as an activity of leisure. Also, tourism is mistakenly perceived as an activity that involves only a narrow segment of the business community: hotels, restaurants and airlines. In reality, the tourism industry consists of in-

terrelated businesses, organizations, labor and governmental agencies that provide the means of transport, goods, services, attractions, accommodations, information, facilities, programs and resources for travel. The dependency of tourism upon other facets of a community's social and economic character often goes unrecognized.

Finally, because a great deal of travel is discretionary, its economic importance has been regarded as relatively soft, highly susceptible to societal and economic forces beyond the control of those who travel or are involved in the travel industry. While the majority of travel away from home in the world is discretionary, much of it is associated with business, personal, educational and other activities which are

not. In addition, to some Americans it may be regarded as a necessary component of a quality life style.

Tourism came of age in the early 1980s. While other, more traditional industries suffered major decline and change during the recession period, travel remained relatively stable, continuing to grow modestly. It was at this time that tourism began to be recognized as a significant social and economic activity, bringing about a growing recognition of the economic benefits it can bestow upon communities, states and countries. This is particularly true of New England.

Presently, tourism is the third largest retail activity and second largest private employer in the United States. Last year, Americans and foreign visitors traveling more than

100 miles from home spent nearly \$300 billion in the United States. Expenditures for travel by such visitors in New England approached \$15 billion. But the relative economic impact of tourism in New England as compared to other regions of the United States is even greater than these figures reveal.

A better relative measure of the importance of tourism to a region is the amount spent by tourists in relation to the number of people who reside there. It is assumed that the higher the per-capita tourism receipts, the more important tourism is to the personal wealth of the residents. While none of the New England states rank among the top 10 in gross or total tourism receipts, three of its states rank among the top 10 in the nation in per capita receipts from tourism. The average per capita receipts from tourism in New England identify it as one of the most tourism-dependent regions in the nation.

Tourism is mistakenly perceived as an activity that involves only a narrow segment of the business community.

New England's education landmarks

New England's more than 260 colleges and universities are a generally unrecognized but important part of the region's attraction base or support system for tourism. Students who attend these institutions from other states and countries are not normally regarded as tourists, but they have a major economic and cultural impact upon the region, serving as the foundation for a vast network that draws others who clearly fit within the acceptable definition of "tourist." There are no solid figures on the economic impact created by parents, alumni, scholars, athletes and others, but it undoubtedly amounts to millions of dollars for the region.

In New England, higher education contributes to tourism in a very real way. Colleges and universities serve as centers of "intellectual tourism" as well as focal points for

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a vast array of cultural and sporting events, housing important museums and art collections, laboratories and demonstration projects, and meeting and convention facilities that enrich students, scholars and visitors alike. In addition, New England's institutions of higher education play a role in providing well-educated leaders and innovators through research and outreach programs to the organizations and businesses that make up the tourism industry.

Human resource development is crucial

One of the most significant challenges facing the tourism and hospitality industries is human resource development and the future supply of employees. Although industry jobs represent a broad range of skill levels, some requiring only a limited educational background, there is a growing need for well-educated managerial and professional personnel.

Many New England institutions are responding to this need. Undergraduate and graduate education in hospitality management and some aspects of tourism is available in at least 10 of New England's four-year colleges and universities. Among the most well-known programs are those at the University of Massachusetts at Amherst, the University of New Hampshire, and Johnson

and Wales College in Rhode Island. Presently, there are one or more programs either in place or on the drawing board in each New England state. Student interest in these programs is extremely high, and growing. Placement of graduates in the tourism and hospitality field is among the most successful on campuses where courses in hospitality and tourism are offered.

New England's more than 260 colleges and universities are a generally unrecognized but important tourist attraction.

The contribution made by New England's institutions of higher education extends far beyond that of undergraduate and graduate education. Research and scholarly activity at several of the region's universities is providing significant insights into developing, marketing and managing tourism. Other activities, particularly outreach and extension education, are helping the states, communities and many businesses in the region optimize the benefits of tourism. Academe is responding to tourism as an emerg-



Sculpture by Russell Jacques outside the Merrill Science Center, Amherst College.

ing social and economic phenomenon: Its role in assuring that tourism is developed and managed in conformity with the needs and desires of the residents of the region is clearly an important one.

While New England's universities and colleges serve a traditional role in education and research, they also constitute one of the region's important attractions. States which have measured levels of visitation to their "tourist attractions" consistently find that their colleges and universities are identified among those frequented by both special interest and casual visitors. Such New England landmarks are the cog that drives the tourism system, which in turn spins numerous and diverse business activities. In conclusion, the tourism industry is a growing source of jobs, and an increasingly important contributor to New England's economic, cultural, recreational and educational prosperity. □

John D. Hunt is the first Distinguished University Professor in Travel and Tourism at the University of Massachusetts at Amherst. UMass is the first university in the nation to dedicate a position of prestige to tourism.

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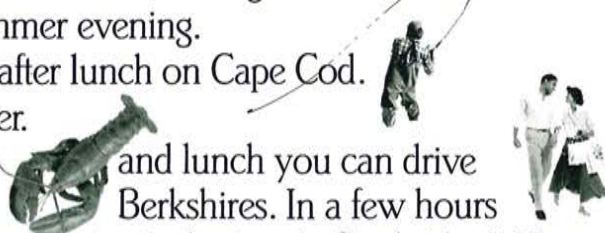
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Equine Programs Are Geared Towards Growth of Regional Horse Industry

WENDY L. DEANS

Whether we ride them or not, most of us have at one time or another been infatuated with horses, especially after reading *National Velvet* or *Black Beauty*. But most of us probably give little thought to the economic impact of horses or realize the extent of horse-related employment opportunities.

In fact, New England's horse industry is a significant one—valued well in excess of \$1 billion in annual expenditures and investments. Nationally, the horse industry is valued at \$15 billion annually; it is the fourth largest category of personal consumption expenditure on recreation; and it accounts for more periodical publications than any other special interest group. In New England there are more than 350,000 horses (one for every 30 pedestrians). Primarily kept for recreation and amateur sport, horses are also used for breeding, competition, racing and work purposes.

Employment in the horse industry ranges from riding instruction, racing and stable management to marketing equine products, breeding and health care. Preparation for such employment is provided at a number of New England colleges and universities.

Equine study degree programs are available at Post College in Connecticut, Mt. Ida College in Massachusetts, Colby-Sawyer College in New Hampshire, Johnson and Wales College in Rhode Island, the University of Connecticut, the University of Massachusetts at Amherst and the University of New Hampshire. The Universities of Maine and Vermont offer credit



Photo courtesy of Post College.

courses in horsemanship but do not have an equine studies degree program.

New England's horse industry is valued well in excess of \$1 billion in annual expenditures and investments.

Students can earn an associate degree in equine studies or equine management by spending two years at Post, Mt. Ida or Johnson and Wales College. A bachelor of science degree in equine business management is also awarded by Johnson and Wales; and a bachelor of science program in animal science with a major in equine studies is offered at UConn, UMass/Amherst and UNH. Colby-Sawyer offers a bachelor of science degree in sports science with a concentration in equine studies.

The New England land-grant universities have had a century-long romance with the Morgan horse, which is the state animal of Massachusetts and Vermont. In

Weybridge, 40 miles from the University of Vermont's main campus, UVM owns and operates a Morgan horse farm that was once the property of the U.S. government. The government raised Morgans there for the Army's cavalry units until 1951, when it turned the farm over to the State of Vermont. UVM then assumed its operation and some of the Morgans were dispersed among the Universities of Massachusetts, Connecticut, New Hampshire and Pennsylvania. Between 65 and 85 Morgans are now stabled at the UVM farm.

UVM's animal sciences department provides three courses in the care and management of horses, but does not currently offer equine studies as a degree concentration. Students having prior experience with horses can earn university credit through a summer internship at the university's farm. UVM has an exchange program with the W.H. Miner Agricultural Research Institute in New York, which provides instruction at the farm in cooperation with university faculty.

At the University of Massachusetts at Amherst, equine studies have been an option in the animal sciences degree program since the late 1970s. In 1964, instructors' courses were added and the program has since expanded to include management training. The university has had a breeding herd of Morgan horses since the early 1950s. Students can gain hands-on experience in foaling, feeding and breaking in new horses. Anthony Borton, director of equine studies, believes it is important for equine studies students to have a solid background in biology, chemistry, nutrition and math. Currently, there are about 125 students majoring in equine studies at UMass. Graduates pursue a variety of careers including stable management and riding instruction.

While the University of Connecticut began offering equine studies as a major just this past fall, UConn has been raising Morgans for more than 50 years, says Jim Dinger, coordinator of the horse program. About half the univer-

sity's 150 animal science majors are in the equine program, and most of them are women. Equine studies majors take credit courses in such areas as horse production, training and management, in addition to the general animal science and liberal-arts core. Riding instruction and experience are gained through the non-credit horse practicum program, which is open to students from any discipline.

Students in the **University of New Hampshire's** 40-year-old equine studies program may specialize in that area within the department of animal and nutritional sciences. Equine students account for about half of the 220 animal science majors, according to Nancy Deuel, UNH horse specialist and assistant professor. University-owned facilities with 40 horses are a 10-minute walk from campus. Students have the opportunity to



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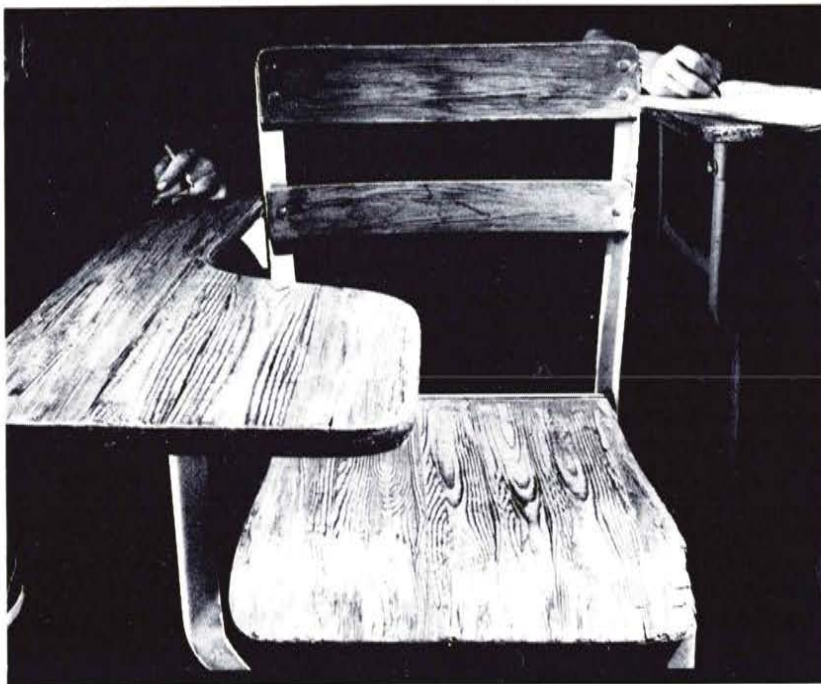
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participate in intercollegiate riding competitions and in other training events. As part of the animal science focus, students can also take part in ongoing research programs in equine reproduction and physiology.

Graduates of the program pursue such careers as stable management, horse training and horse product sales. As Deuel points out, the horse industry is a source of full- and part-time employment for many New Hampshire residents, including the 2,500 licensed employees statewide who are involved in racing.

The **University of Maine at Orono** offers two equine courses within its animal and veterinary science department: equine science and equine behavior and training. They are the only such courses offered in Maine.

Post College, an independent, four-year co-ed liberal-arts and business college in western Connecticut, has the state's only associate equine studies degree program. Post

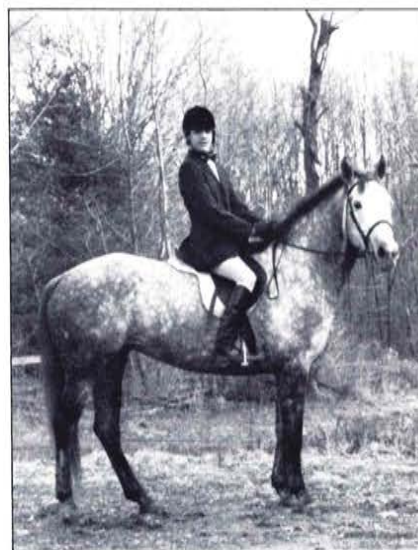


Photo courtesy of Post College.

began offering courses in horsemanship 10 years ago through its recreation department; and equine studies became a separate program in 1985. In addition to the associate's degree, students may earn a certificate in equine studies. The program primarily prepares stu-

dents to teach riding and manage horse facilities.

During the summer between the first and second years of the associate's degree program, students are required to gain employment in horse-related work. One student, for example, spent that summer writing for a horse magazine and returned there to work full-time after graduating. All students compete

At UMass Amherst, students can gain hands-on experience in foaling, feeding and breaking in new horses.

in intercollegiate horse shows regionally and nationally.

Penny Dawson, director of Post's equine program, says a curriculum has been developed for a bachelor of science degree program in equine studies with an emphasis on business management and an option to concentrate on riding. If approved, the four-year program would be added in September 1989.

The equine program at **Johnson and Wales College** in Rhode Island is grounded in business. Johnson and Wales has been offering equine degrees since 1980 and added a two-year equine business management degree during 1983-84. A fourth program, awarding a bachelor's degree in equine studies, is to be added in the fall of 1988. To prepare them for a career in equine product marketing, some students also pursue a second degree in marketing along with the bachelor of science. As Beukema points out, marketing horse products is a lucrative industry; Rhode Island alone spends \$1 million annually on equine nutritional supplements. Fifty-five students are currently enrolled in all three equine degree programs.

Colby-Sawyer College in New London, N.H., offers an equine studies option as part of its four-year program in sports science. Graduates usually take jobs in training, breeding, business manage-



"Dressage and Eventing" is one of the required courses in the Equine Studies curriculum offered at Johnson & Wales College. The college also offers a degree program in Equine Business Management.

ment and writing for equine magazines. Katherine Ballin, director of equine studies, says students may participate in intercollegiate horse competition. About 50 colleges in New England, including Colby-Sawyer, belong to the Intercollegiate Horse Show Association.

Since 1985, **Mt. Ida College** in Newton Centre, Mass. has been offering an associate degree program in equine management. The business-focused program, which includes some instruction in horse science, prepares students for employment in stable management. The college has on-campus stables housing six horses, and students are actively involved in intercollegiate horse competition. This year the college added an instructor's course for students interested in seeking state approval as licensed riding instructors.

Leslie Lonergan, director of Mt. Ida's equine program, says she has been working with the state supervisor of riding schools in Massachusetts, tailoring the instructor's course so as to best prepare students for the state's stringent licensing tests and requirements.

More than 80 colleges and universities in the United States, including those in New England described here, offer certification, majors or degrees in equine sciences. A national directory of equine schools and colleges is published annually by the Harness Horse Youth Foundation, Inc., 6320 Busch Blvd., Columbus, Ohio 43229. □

Wendy L. Deans is assistant editor of *Connection*.

Formal education is but an incident in the lifetime of an individual. Most of us who have given the subject any study have come to realize that education is a continuous process ending only when ambition comes to a halt.

—COL. R. I. REES

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Museum of Politics Soon to be a Reality

The nation's finest private collection of American political artifacts, which has belonged to the University of Hartford for 15 years, will soon be exhibited in a stunning new setting.

The nucleus of the collection was assembled over a lifetime by insurance executive J. Doyle DeWitt. He started collecting in the 1920s, when political memorabilia could be picked up for a fraction of the price it commands today.

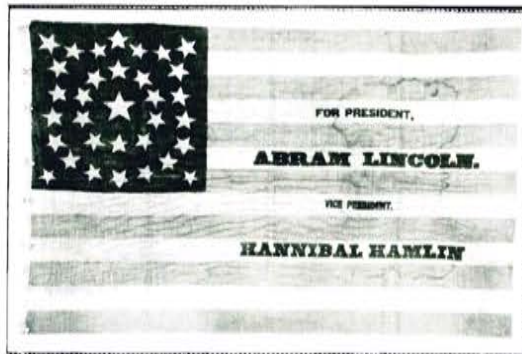
By the time of his death in 1972, he had bequeathed his collection in its entirety to the University. It numbered almost 40,000 items, some dating back to the 18th century: parade torches, banners, flags, posters, political cartoons, broadsides, song sheets, buttons, ribbons, snuffboxes, bumper stickers, flasks, tankards, photographs, paintings, china, banks, toys, books, and recordings of every president's voice, starting with Benjamin Harrison.

Some 20 years ago, DeWitt had hoped to see his collection displayed in a wing of what was then the University's new library. When the William H. Mortensen Library was built, however, there was no funding for additional space. Much to the distress of those who realized the collection's value as an educational resource, it was unable to be seen for many years.

Parts of it have been displayed over the years — at Hartford's historic Old State House, at a U.S. Information Office exhibition at the American Museum in Bath, England, at the inaugural opening exhibition of the Georges Pompidou Center in Paris, and at various museums and historical societies throughout the United States.

Thanks to a \$6.5-million federal grant appropriation in 1984, a new facility, including a wing dedicated to the collection, is about to become a reality. The funding, announced during the University's Capital Campaign, was the impetus for a \$20.8-million library addition known as University Center. The structure, designed by noted architect Tai Soo Kim, has two wings, one of which will house the Museum of American Political Life.

The collection has been under the stewardship of curator Edmund B. Sullivan, a University professor who is a nationally recognized expert on political campaigns and artifacts. Over the years, he has added substantially to the collection, and contributed to scholarship in the field with three books and scores of articles on political Americana.



A Republican presidential campaign flag from 1860.



An 1812 Bull Moose Party cotton headquarters banner.

What had been a collector's treasure trove is now, through careful husbandry, being molded into a scholarly resource. The process has been aided by grants from the National Endowment for the Humanities, the Institute of Museum Services (conservation grants for textile and paper items), and considerable corporate participation.

The exhibits are being designed by Staples & Charles, a Washington, D.C., firm which has done such prestigious exhibitions as the recent "William Wordsworth and the Age of English Romanticism" at the New York Public Library, those at the Gerald R. Ford Museum, the traveling "Renaissance of Islam: Art of the Mamluks," and the famed "We the People: Americans and their Government" exhibition at the National Museum of American History.

One of the museum's more dramatic exhibits will be a 19th century campaign parade made up of 17 life-size mannequins

carrying torchlights and waving banners. They are marching down an urban street toward a political rally and speakers' platform on the exhibit level below. The exhibit dramatically represents one of the museum's primary themes: the participatory nature of our early politics and the continuing need for this participation to preserve our legacy of freedom. A slide presentation will orient visitors to the exhibits and explain how to view this unique collection of campaign artifacts.

Thematic exhibits will be arranged to educate the public about our political history and the workings of the political process. They will also demonstrate how political artifacts traditionally viewed as ephemeral are worthy of serious study and mirror the times — in art, technology, psychology, social norms and politics.

The museum will be completed in the fall, with a grand opening celebration during Presidents' Week next February. Watch for it!

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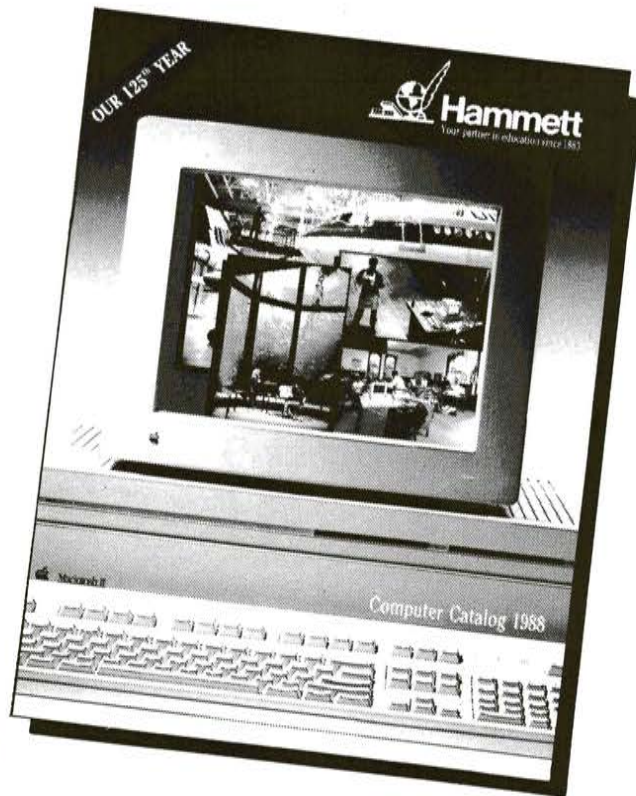
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