Brown University: Economic Impact on Rhode Island

December 7, 2009

Appleseed

Brown's Role in Rhode Island's Economy:
By the Numbers

- Brown is the sixth-largest private employer in Rhode Island, employing 4,455 people in the spring of 2009.

- Brown bought more than $65 million on purchases of goods and services from Rhode Island firms in fiscal year 2009, directly supporting about 690 full-time-equivalent jobs at these companies.

- Brown spent more than $67 million on construction in 2009, including $35 million with Rhode Island-based contractors, directly generating nearly 270 full-time-equivalent jobs in construction and related industries.

- Since 2005, the number of Brown alumni living in Providence has grown by 23 percent.

- Factoring in direct University jobs, employment by Brown's suppliers and contractors, spending by students and visitors and the "multiplier effect," ***Brown directly and indirectly accounted for nearly 8,200 Rhode Island jobs in 2009, and $660 million in statewide economic output.***

- Brown paid $16.5 million to state and local governments in 2009 for income tax withholding, property taxes, payments in lieu of taxes and fees.

- Brown spent $139 million on research in fiscal year 2009, making the University Rhode Island's leading center of scientific research and development. Almost all of Brown's research is funded by federal agencies or other out-of-state sources.

- During the next four years, Brown is planning to invest $227 million dollars in new or renovated facilities for research, teaching and student activities. These investments will help build not only Brown's future, but that of the city and the state.

A leading Rhode Island employer – and job generator

Brown University is a leading source of employment opportunities for Rhode Island residents – as a major employer in its own right, through its spending on goods, services and construction, and through spending by Brown students and visitors to the University.

In the spring of 2009, Brown employed 4,455 people (excluding students), 83 percent of whom worked full-time. During fiscal year 2009, wage and salary payments to Brown employees totaled $252.6 million.

In 2009, Brown University was the sixth-largest private employer in Rhode Island. Brown is, moreover, a growth enterprise; between 2005 and 2009, regular employment at Brown grew by 18.6 percent – a gain of nearly 700 jobs. During the same period, payroll employment in Rhode Island declined by 4.8 percent – and in Providence, employment declined by 3.3 percent.

Brown provides a broad range of employment opportunities for people with varying skills and levels of education – from full professors, PhD researchers and professional administrative staff to facilities management staff, clerical workers and lab technicians, security guards and food service workers. The University provides competitive salaries and wages, and extensive health, retirement, educational and other benefits.

In 2009, 31 percent of Brown's regular employees – approximately 1,400 people – lived in Providence. More than half (51 percent) lived in other Rhode Island communities; and 17 percent lived outside the state – the majority of them in southeastern Massachusetts.

The impact of purchasing and construction

Brown University spent nearly $270 million in fiscal year 2009 on purchases of goods and services and on construction, of which $101 million was paid to Rhode Island vendors and contractors.

Brown's spending on goods, services and construction generates business for Rhode Island companies and jobs for Rhode Island residents. Overall, Appleseed estimates that University spending on goods, services and construction directly supported about 950 full-time equivalent jobs with Rhode Island companies in fiscal year 2009 – 720 in Providence and another 230 at companies elsewhere in the state.

Table 1: Brown University spending by location of vendor, FY 2009

Brown's Spending by Location of Vendor, FY 2009	TOTAL	Percent Paid to Rhode Island Companies	Dollars Paid to Rhode Island Companies
Goods & services	$202,547,000	32%	$65,630,000
Construction	$67,451,000	53 %	$35,469,000
TOTAL	**$269,998,000**	**37%**	**$101,017,000**

In fiscal year 2009, Brown spent $202 million on purchases of goods and services (other than construction). Purchases from Rhode Island companies totaled $65.6 million – 32 percent of all University spending on supplies and services. Businesses based in Providence accounted for about 71 percent of all in-state purchasing.

Rhode Island businesses from which the University buys goods and services include such large firms as Gilbane Inc., Dimeo Construction, Shawmut Design & Construction, Blue Cross Blue Shield of Rhode Island, and EW Burman as well as smaller firms and institutions like Trinity Rep, Shanix, Atomic Catering, and Durkee & Brown Architects.

University purchases of goods and services directly support jobs in these and other Rhode Island companies. Appleseed estimates that the $65.6 million Brown spent on in-state purchases of goods and services in fiscal year 2009 generated 690 full-time-equivalent jobs throughout the state.

Some of the jobs supported by Brown's purchasing are minority- and women-owned businesses. The University estimates that about $4.1 million in spending during FY 2009 was with minority- and women-owned businesses.

Brown spent $67.5 million in fiscal year 2009 on construction and renovation of University facilities, of which $35.5 million was paid to Rhode Island-based contractors. Appleseed estimates that in 2009 University construction directly generated nearly 270 full-time-equivalent jobs with Rhode Island contractors in construction and related industries.

As Table 2 shows, Brown's combined spending on purchasing and construction directly created nearly 1,000 FTE jobs in Rhode Island in fiscal year 2009 – nearly 700 of them in Providence.

Table 2: Direct jobs created from purchasing and construction, fiscal year 2009

	Providence	Rest of Rhode Island	Total
Purchasing	489 FTE	200 FTE	689 FTE
Construction	208 FTE	59 FTE	267 FTE
TOTAL	697 FTE	259 FTE	956 FTE

Brown's spending on construction includes a number of projects that have recently opened or will be complete in the next couple of years, including the $12 million Rhode Island Hall renovation, the $7.4 Lyman Hall renovation, and major maintenance projects (including residence hall renovations, utility upgrades and energy conservation initiatives) that will total more than $34 million.

Over the next three years, the University plans to invest nearly $220 million in construction and major maintenance projects. Based on FY 2009 construction activity, we project that about $116 million will go to Rhode Island-based contractors. We

estimate that this spending will directly create approximately 870 person-years of employment in construction and related industries in Rhode Island – an average of 290 full-time-equivalent jobs each year for three years.

Indirect and Induced Effects

Brown's impact on the Rhode Island economy goes beyond the direct impact of its spending on payroll, purchasing and construction; it also includes "indirect and induced" or "multiplier" effects. Rhode Island companies from which the University buys goods and services use some of the money they earn from Brown to buy goods and services from *other* local businesses; and those businesses in turn buy some of what they need from still other Rhode Island companies. Similarly, Brown's employees (and the employees of its Rhode Island-based suppliers) spend part of their take-home pay locally – for housing, utilities, food, child care, entertainment and other routine household needs.

As Table 3 shows, the indirect and induced effects generated by Brown's direct spending on payroll, purchasing and construction in fiscal year 2009 totaled nearly $212 million in statewide economic output, and approximately 1,694 FTE jobs.

Thus, the direct, indirect and induced effects of the spending on payroll, purchasing and construction – and the spending by university employees and in-state suppliers that university spending made possible – generated about 7,100 full-time-equivalent jobs throughout Rhode Island in FY 2009, and $565 million in statewide economic output.

Table 3: State-wide impact of purchasing, construction and payroll spending

	Direct University spending		***Indirect and induced impact of spending by vendors, contractors and employees***		
	Payroll	*Purchasing / construction*	*Impact of employee spending*	*Impact of vendor and contractor spending*	***Total impact***
Rhode Island	$252.6 million 4455 jobs	$101.1 million 956 FTE	$150.8 million 1222 FTE	$60.9 million 472 FTE	**$565.4 million** **7105 FTE**

The impact of student and visitor spending

Brown University also contributes to the economies of Rhode Island and Providence by attracting students and visitors from around the country and the world. Spending by students and visitors supports employment in a variety of local industries; including housing, restaurants, hotels, retailing and entertainment.

Student spending

Brown enrolled 8,318 undergraduate, graduate and medical students in the 2008-09 academic year, and 869 students during the summer. Based on data provided by the University, we estimate that students living in a dormitory or Brown-owned apartment spend an average of about $2,900 on miscellaneous personal expenses; and students living off-campus, about $9,360. To calculate the impact of summer students, we assumed that summer students would spend a quarter of the amounts spent during the academic year.

Based on the assumptions outlined above, Appleseed estimates that in fiscal year 2009, spending by Brown students totaled about $47.3 million.

Table 4: Student spending

Student Spending	Students	Student Costs	Total
On-Campus Academic Year	4,890	$ 2,902	$ 14,190,780
Off-Campus Academic Year	3,428	$ 9,362	$ 32,092,936
On-Campus Summer	684	$ 726	$ 496,506
Off-Campus Summer	185	$ 2,716	$ 501,378
TOTAL			$ 47,281,601

As with spending by the University itself, money spent by Brown students generates economic activity and jobs in Rhode Island, both directly and indirectly. Appleseed estimates that student spending of $47.3 million in fiscal year 2009 directly supported 615 full-time equivalent jobs; and through the multiplier effect, another $22 million in economic output and 170 FTE jobs.

Visitor spending

Like the University and its students, visitors to Brown spend money while they are in Providence that generates economic activity and jobs in Rhode Island. Based on data and estimates provided by Brown University, we can estimate that there were approximately 120,000 visitors to the Brown campus during fiscal year 2009. This includes prospective students and their parents, relatives and friends who attended commencement ceremonies, participants in academic meetings and conferences and visitors attending athletic and performing arts events.

The impact of these groups varies. By definition, all of those for whom University departments book hotel rooms are out-of-town overnight visitors. And with many students coming to Brown from outside Rhode Island, it is reasonable to assume that a great majority of prospective students who visit the campus, commencement guests, reunion alumni and participants in parents' weekends are similarly from out of town.

Assuming that they stay an average of two days in Providence, we estimate that local spending by out-of-town visitors totaled approximately $15.2 million in fiscal year 2009. This spending directly supported 218 FTE jobs in Rhode Island; and an additional 64 FTE jobs and $8.4 million in economic output through the multiplier effect.

Payments to State and Local Governments

Payments to State and Local Governments

Despite its status as a nonprofit institution, Brown – like any other major enterprise – generates revenue for state and local governments, in a variety of ways. Overall, Brown directly contributes $16.5 million to the state and city treasuries.

- In FY 2008, Brown withheld $10.4 million in income taxes from the salaries and wages of its employees. In addition, the University paid about $441,000 in unemployment insurance taxes.
- At the local level, the University paid about $3.4 million in real property taxes on property used for purposes not considered tax-exempt, and in payments in lieu of taxes (PILOT).
- As a user of state and city services the University paid $2.3 million for water, sewer and other services.

Table 5: Payments of taxes and fees to state and local government

Tax or fee		Amount
Taxes and PILOTs		
State income taxes withheld	$	10,412,000
Unemployment insurance taxes	$	441,000
Real property taxes	$	2,200,000
PILOTs	$	1,150,000
Fees for services		
Narragansett Bay Commission	$	1,300,000
City of Providence Water Supply	$	885,000
Other City and State fees	$	115,000
TOTAL	**$**	**16,503,000**

Putting It All Together: Brown as a Job Generator

When the number of Brown employees is combined with the number of jobs supported by Brown's spending on supplies, services, and construction; the number of jobs generated by the spending of students, employees, and visitors, Appleseed estimates that in fiscal year 2009, Brown directly and indirectly accounted for nearly 8,200 jobs throughout Rhode Island – 1.7 percent of all wage and salary employment statewide.

Table 6 summarizes Brown's impact on the state of Rhode Island in fiscal year 2009.

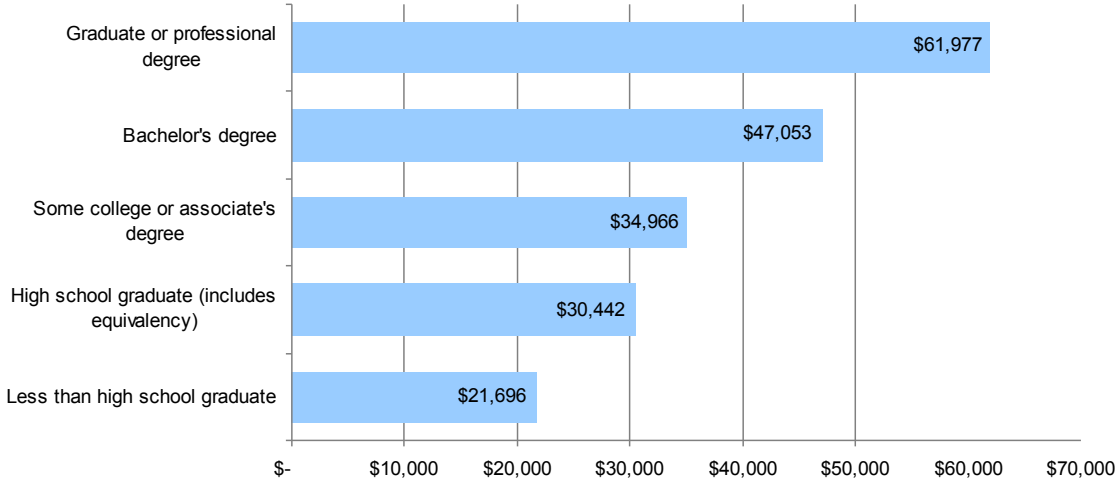
Table 6: Brown's impact as an enterprise on Rhode Island, fiscal year 2009

		Output	Jobs (FTEs)
Brown payroll			
Direct (RI)	$	252,617,000	4,455
Indirect/induced	$	150,800,000	1,222
SUBTOTAL	**$**	**403,417,000**	**5,677**
Brown purchasing			
Direct (RI)	$	65,630,000	689
Indirect/induced	$	40,827,000	316
SUBTOTAL	**$**	**106,457,000**	**1,005**
Brown construction			
Direct (RI)	$	35,469,000	267
Indirect/induced	$	20,145,000	156
SUBTOTAL	**$**	**55,614,000**	**423**
Student spending			
Direct (RI)	$	47,281,000	615
Indirect/induced	$	22,000,000	170
SUBTOTAL	**$**	**69,281,000**	**785**
Visitor spending			
Direct (RI)	$	15,200,000	218
Indirect/induced	$	8,358,000	64
SUBTOTAL	**$**	**23,558,000**	**282**
GRAND TOTAL	**$**	**658,327,000**	**8,172**

Developing Rhode Island's human capital

Economists have long recognized that that there is a strong correlation between a city's or state's "human capital" – the accumulated knowledge, skills and experience of its people – and its potential for economic growth and development. At the individual level, of course, the impact of education on earnings is widely recognized. In 2007, as Figure 1 shows, the median income of Providence residents who had four-year college degrees was nearly $17,000 greater than the median income of those who had only a high school diploma.

Figure 1: Median earnings by educational attainment, Rhode Island, 2007



The benefits of higher education, however, are not limited to those who earn degrees. In a paper published by the New York Federal Reserve Bank, Jaison Abel and Todd Gabe found that "a one percentage point increase in the proportion of residents with a college degree is associated with a 2.3 percent increase in metropolitan-area GDP per capita." Summarizing the results of previous studies, Abel and Gabe cite two explanations for the powerful link between human capital and economic growth.

> *First, human capital increases individual-level productivity and idea generation. Second, the concentration of human capital within a region facilitates knowledge spillovers, which further enhance productivity and fuel innovation. Indeed, Glaeser suggests that human capital is a key predictor of urban success because "high skilled people in high skilled industries may come up with more new ideas." In addition, a region's stock of human capital has been shown to lead to more rapid reinvention and increases in the long-term economic vitality of cities.*[1]

[1] Jaison Abel and Todd Gabe, "Human Capital and Economic Activity in Urban America," Federal Reserve Bank of New York, staff report no. 332, July 2008, pp. 1-2.

Abel and Gabe's work echoes that of other economists who had found similar spillover effects. Even non-college educated workers benefit from this effect; other research has shown that a 1 percentage-point increase in the percentage of workers with college degrees is associated with a 1.6 percent increase in the earnings of workers who only have high school diplomas. [2]

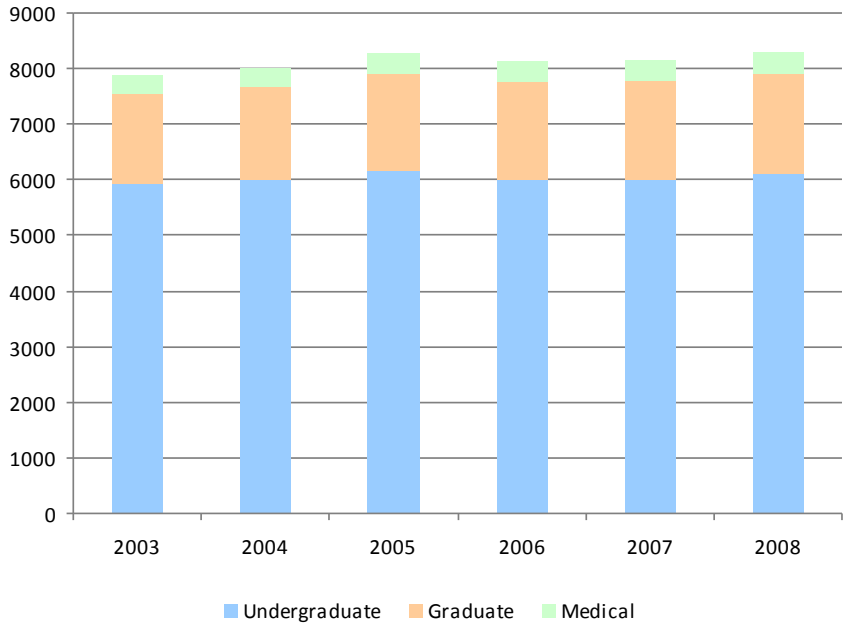
Brown students and alumni

- During the fall of 2008, 8,318 students were enrolled at Brown, including 6,095 undergraduates, 1,814 graduate students and 409 medical students.

- About 18 percent of all Brown students cited Rhode Island as their permanent address – including 1,089 (13 percent of total enrollment) who were residents of Providence.

- Between 2003 and 2008, enrollment at Brown increased by about 440 students. Graduate enrollment grew especially rapidly. Enrollment in the Graduate School grew by about 11 percent between 2003 and 2008; enrollment in the Medical School grew by nearly 20 percent during the same period. The University's enrollment growth is summarized in Figure 2 below.

Figure 2: Fall Enrollment, 2003-2008



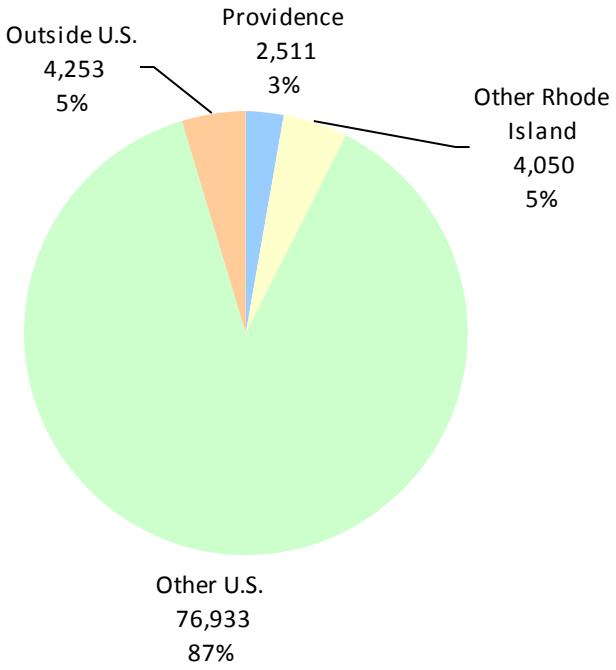
[2] Enrico Moretti, "Social Returns to Human Capital," NBER Reporter: Research Summary, Spring 2005.

- In fiscal year 2009, Brown provided $1.5 million from institutional sources in need-based scholarships for Providence residents, and another $2.8 million in scholarships to students who reside elsewhere in Rhode Island.

- More than 6,500 alumni of Brown University reside in Rhode Island (about 8 percent of all alumni), including more than 2,500 who live in the City of Providence. The distribution of Brown alumni by current residence is shown in Figure 3.

- Since 2005, the number of Brown alumni living in Providence has grown by 23 percent.

Figure 3: Brown alumni as of the summer of 2009, by place of residence



Preparing students for tomorrow's economy

Brown offers a wide range of programs that help both undergraduate and graduate students acquire the knowledge, skills and ways of thinking they will need to succeed in tomorrow's economy – and that are needed for the rebuilding of Rhode Island's economy as well. We cite here just a few examples.

- Brown's Biomedical Engineering program engages students in using the tools and methods of engineering to address some of the most critical problems in health care, the life sciences and biomedical technology – areas that are critical to the future growth of the state's economy. The program offers both

undergraduate and graduate degrees, and has since the 1990's been one of the most popular areas of concentration for Brown engineering students.

- In the fall of 2008, Brown and the Rhode Island School of Design began to offer a five-year dual undergraduate degree program, in which students obtain an AB from Brown and a BFA from RISD. The program has space for 15 students each year.

- Brown's ***Public Health Program*** – the only program of its kind in Rhode Island – prepares students to address some of the most critical health issues facing communities throughout Rhode Island and the U.S., and around the world. The program offers undergraduate concentrations in community health and biostatistics, master's degrees in public health and biostatistics; and doctoral programs in epidemiology, biostatistics and health services research.

- The ***C.V. Starr Program in Commerce, Organizations, and Entrepreneurship*** (COE) is an undergraduate program that spans the departments of economics and sociology and the Division of Engineering. COE offers concentrations in business economics, organizational studies, and entrepreneurship and technology management. Students in the last of these three tracks must complete a sequence of courses in one of several technology areas – such as biotechnology, nanotechnology, information technology or energy – and courses in entrepreneurship. In their senior year, teams of students are also required to conceive and develop a business plan for a new technology-based business venture. Starting in the fall of 2009, the program also offers seniors the option of developing a plan for a new social venture.

  Since its founding in 2005, COE has become one of the most popular programs at Brown, currently enrolling about 170 juniors and seniors.

- Brown's ***Entrepreneurship Program*** (EP) – which despite its name is actually a student-run club, rather than a formal part of the curriculum – was founded in 1998. The centerpiece of the program is its annual business plan competition, which helps students develop plans for new ventures, and awards cash prizes totaling $50,000 to the most promising entries. In the past decade, more than 200 teams of Brown students have participated in the contest. EP also sponsors lectures and panel discussions with successful entrepreneurs, arranges mentorships, and provides access to a network of more than 900 entrepreneurs.

- The ***Program in Innovation Management and Entrepreneurship*** (PRIME) is a master's degree program for science and engineering students who want to learn how to apply their technical skills in the development of new products, processes and companies. Coursework emphasizes business fundamentals like finance, forecasting, and operations as well as technology management and development.

  As part of the two-semester program, students have an opportunity to develop a technology business idea into a fully-formed business plan. The PRIME program began in 2006 and now enrolls about 10 students each year.

- Starting in 2005, Brown University and the Marine Biological Laboratory in Woods Hole began a joint doctoral program in biological and environmental sciences. There are currently 20 students in the program.

- In 2009 Brown and Instituto Empresa (IE), one of Europe's leading business schools, launched a new ***international executive MBA program***. The program combines on- campus courses in Providence and in Madrid with an on-line component.

Developing Rhode Island's physician workforce

- As the only medical school in the state of Rhode Island, Brown is a leading educator of the state's future physician workforce. Based on data obtained from the Rhode Island Department of Health, about 7 percent of the state's 5,047 licensed physicians earned their medical degree from the Alpert Medical School as of the summer of 2009.

- The Alpert Medical School also oversees graduate medical education – the training of residents and fellows – at its affiliated teaching hospitals. In the fall of 2008, 774 residents and fellows were enrolled in the Graduate Medical Education program and assigned to affiliated Rhode Island hospitals.

- Brown University also contributes to the continuing education of medical professionals in Rhode Island. In 2008, the University offered 42 continuing medical education programs. About 84 percent of the 2,954 attendees of the programs were Rhode Island residents.

Continuing education at Brown

In addition to its full-time undergraduate and graduate programs, Brown offers southeastern New England residents a variety of opportunities for continuing education.

- The ***Brown Continuing Studies*** program allows adult learners to enroll in a wide range of courses across the University. In 2009, 650 Providence-area residents enrolled in approximately 100 courses at Brown.

- During the fall of 2008, Brown enrolled 16 high school biology teachers from Rhode Island schools in **Project ARISE**. The NIH-funded program helps to develop the teachers' ability to integrate bioinformatics, neuroscience and physiology into their classrooms.

- A two-year **certificate program in infant and child mental health** trains licensed professionals in the developmental and behavioral dimensions of children up to age 5. The certificate is aimed at masters and doctoral level health practitioners from nursing, psychology, pediatrics and other disciplines. The

program is sponsored by the Center for the Study of Children at Risk, the Alpert Medical School, Women & Infants Hospital, and the Brown University Office of Continuing Education.

Rhode Island's leading research institution

University research has long been an important contributor to the growth of the U.S. economy; and it remains one of America's greatest sources of competitive advantage.

> *Since the Industrial Revolution, the growth of economies throughout the world has been driven largely by the pursuit of scientific understanding, the application of engineering solutions, and continual technological innovation. Today, much of everyday life in the United States and other industrialized nations….is the product of investments in research…*[3]

Brown's research enterprise contributes to the vitality of Rhode Island's economy in several ways.

- Each year, Brown attracts millions of dollars in research funding from sources outside Rhode Island – most of which is spent locally.
- Research conducted at Brown expands the boundaries of knowledge in areas that are likely to be continuing sources of innovation and economic growth in the years ahead.
- Opportunities to participate in advanced research projects helps Brown students prepare for jobs in the knowledge economy.
- The "intellectual capital" created by researchers at Brown provides a foundation for the creation of new products and services, new businesses, and new jobs.

Research spending at Brown

- Brown University spent $138.8 million on research in fiscal year 2009 – about the same level of research spending as in the previous four years. About 98 percent of Brown's research funding was obtained from sources outside the state, including $98.9 million (71 percent) from the federal government, and $26 million from corporate and foundation sources. Brown's research spending in fiscal year 2009, by source of funding, is shown in Figure 4 below.

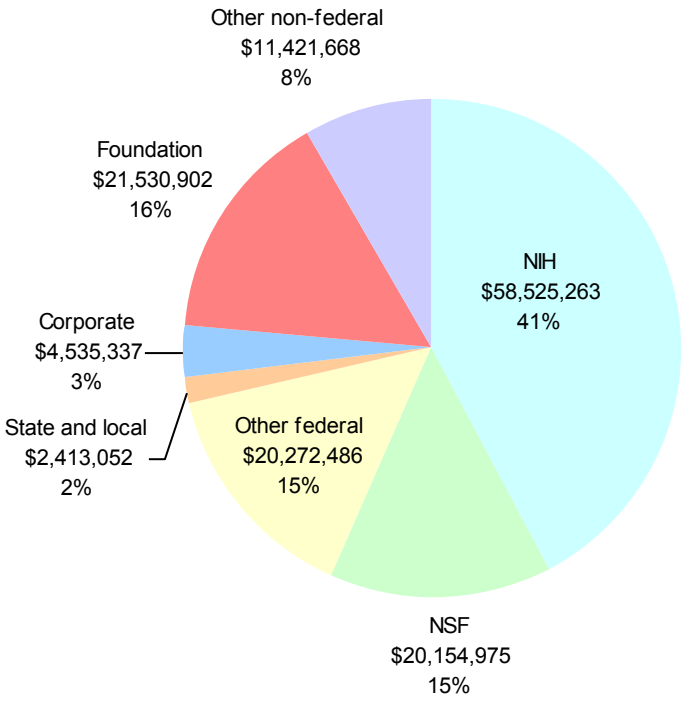
- According to data obtained from the National Science Foundation for FY 2007 (the most recent year for which comparable data is available), Brown University spent more on research than all other Rhode Island colleges and universities combined.

- As of October 2009, Brown has been awarded $31.1 million in research funding under the American Recovery and Reinvestment Act, including more than $18 million from the National Institutes of Health and $15 million from the National Science Foundation. ARRA funding will not only help relieve economic distress in the short term, but will also strengthen the state's capacity for innovation. ARRA funds, for example, are being used to upgrade the capabilities of Brown's CAVE – a facility that

[3] Committee on Prospering in the Global Economy of the 21st Century, *Rising Above the Gathering Storm,* p. 42.

allows scientists, engineers and others to use three-dimensional, high-resolution visualization as a tool for research across a wide range of disciplines – the only facility of its kind in the state.

Figure 4: Research spending, by source of funding, fiscal year 2009



Creating the knowledge that drives economic growth

Research at Brown is helping to create the knowledge that can provide a foundation for future economic growth. We cite here just a few examples.

- Based on research originally funded by the Department of Defense, researchers in neuroscience, computer science and engineering have developed the ***BrainGate Neural System*** – a system that translates brain signals from people suffering from paralysis into electronic signals, and thus enables them to control a variety of assistive devices. In early trials, paralyzed people have used BrainGate to control robotic limbs, drive wheelchairs and operate computers. Clinical trials of the system are currently under way at Massachusetts General Hospital.

- In 2009 the U.S. Department of Veterans Affairs awarded $7 million to continue for the next five years the work of the ***Center for Restorative and Regenerative Medicine*** – a partnership between Brown, the Providence VA Hospital, along with researchers from Lifespan and MIT, that is focusing on ways to restore arm and leg function in amputees.

- In 2009, NIH awarded Memorial Hospital of Rhode Island $7 million for research that will investigate ways to help patients make healthier decisions about eating, exercise and smoking. The principal investigator of the two studies is Dr. Charles Eaton, director of the Brown University ***Center for Primary Care and Prevention***, which is based at Memorial Hospital.

- In November 2009, a team of Brown researchers, working with colleagues at Dartmouth and the University of Tubingen in Germany, were awarded a $6 million NIH grant to study how a virus that causes a rare brain disease – progressive multifocal leukoencephalopathy, or PML – attaches to brain cells.

- Created in 2007, Brown's ***Institute for Molecular and Nanoscale Innovation*** is an umbrella group that supports research across multiple disciplines in three targeted areas:

    - Advanced materials research;
    - Using nanoscience and technology to develop new "soft" materials; and
    - Application of nanotechnology to problems such as improving drug delivery or the design of medical implants.

  As of 2009, more than 60 Brown faculty members were involved in some aspect of the Institute's work.

- Brown scientists have developed a new type of palladium catalyst for use in fuel cells. It is made by binding palladium nanoparticles to a carbon base. The nanoparticles are more efficient and more stable than conventional palladium catalysts.

- While compact fluorescent bulbs are energy-efficient and long-lasting, they each contain a small amount of mercury. Researchers at Brown have developed a nanoselenium cloth that acts like a mercury sponge, absorbing most of the harmful mercury vapor that would be released by a broken bulb. The University has applied for patents on the technology and is now developing a way to include the material in the bulbs' packaging material to protect against mercury leaks due to breakage in shipping and handling.

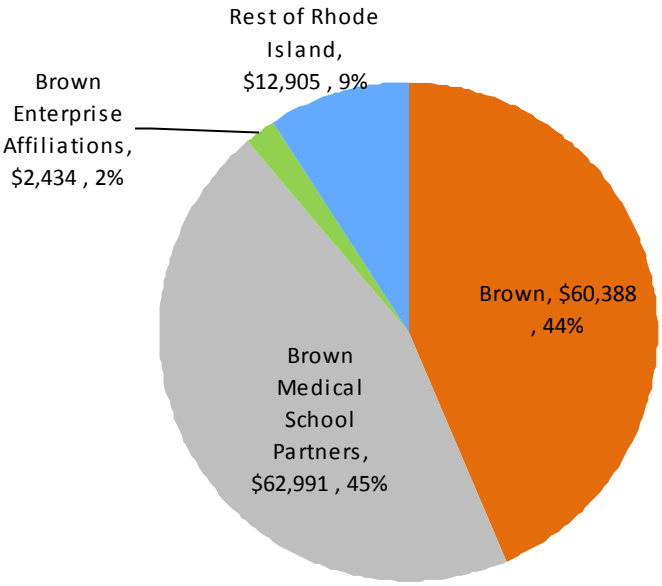
- In June of 2009, Brown University and Draper Laboratory signed a memorandum of understanding to establish a joint research center, the ***Center for Energy Research***. The Center will initially focus on four areas: carbon capture and reuse; clean energy generation; energy storage; and energy efficiency. The agreement sets a goal of conducting two joint research projects each year, supporting a graduate student as a Draper Lab fellow each year, and working to develop energy technologies to the point where they can be licensed or spun out to start-up companies.

Making Rhode Island a center of biomedical research

- Brown is the leading biomedical research institution in the state of Rhode Island. In 2008, Brown University received $60.4 million in research funding from the National Institutes of Health – about 44 percent of all NIH funding in the state.

  Hospitals and other medical institutions affiliated with the Alpert Medical School received about $63 million in NIH funding in 2008; and companies affiliated with Brown University received another $2.4 million. In total Brown and its affiliates were responsible for about $125.8 million in NIH funding in 2008 – about 91 percent of all NIH funds that went to Rhode Island institutions.

Figure 5: NIH funding for Brown and Brown-affiliated institutions vs. the rest of Rhode Island, 2008



Supporting the growth of the University's research enterprise

Brown has also been developing the infrastructure required to support the continued growth and development of its research enterprise. In 2009, Brown and IBM signed a memorandum of understanding on a project that has brought a new generation of high-performance computing to Brown and Rhode Island. The new resource provides Brown researchers with the massive computing power that is increasingly needed to support cutting-edge research in the life sciences, energy, climate studies and many other fields. The equipment is housed at Brown, and is jointly maintained by the University's faculty and staff and IBM employees; but it will also be available to Rhode Island government, university, hospital, business, and non-profit partners.

Since 2003, the Office of the Vice President for Research office at Brown University has sponsored competitive annual Research Seed Funds to help Brown researchers develop their research to a point where it can be incorporated into a proposal for outside funding. The University estimates that, on average, for every dollar in seed funding awarded, the recipients have received ten dollars in outside funding. There are some notable outliers, where the return has been much greater. For example, Robert Hurt's lab received a $60,000 seed grant to explore using nanoselenium to absorb mercury vapor, and wrote a proposal that led to an award of $2.5 million from the National Institute of Environmental Health Sciences.

Business Development and Technology Transfer

Over time, the intellectual capital that is developed through Brown's programs of education and research can be translated into new products and services, new businesses and new jobs. This can happen in several ways – through licensing of technologies first developed in University labs; through the creation of new businesses by Brown faculty, students and graduates; and through programs that encourage and support the continued growth and development of new businesses.

- In 2009, Brown reorganized and strengthened its technology transfer functions. The new ***Technology Ventures Office*** will help identify and protect the University's intellectual property; assist faculty members interested in exploring opportunities for commercialization; manage the process of commercializing new technologies through a variety of means, including licensing to existing or start-up companies; manage industrial research partnerships; and managing relationships with Brown portfolio companies.

- In the spring of 2009, Brown – in collaboration with the Rhode Island Economic Development Corporation and the Greater Providence Chamber of Commerce and the City of Providence – founded the ***Rhode Island Center for Innovation and Entrepreneurship*** (RI-CIE). The Center provides resources and expertise to the state's researchers and entrepreneurs, to help them launch and grow new companies.

  RI-CIE is housed in a building at One Davol Square in the Jewelry District, making it an important resource for that area as a growing center of knowledge- and technology-based business.

  One of RI-CIE's partners is ***BetaSpring***, a Providence-based "startup accelerator" for technology entrepreneurs. Through a competitive process, BetaSpring selects fledgling startups to participate in an intensive 12-week program that mentors startups as they build their product and gives them a chance to pitch to investors and prospective customers. RI-CIE provides space for BetaSpring teams to work with their advisors during the program.

  BetaSpring graduated seven startup companies from its first class in the summer of 2009. Four of the seven were start-ups with roots at Brown:

  - ***NuLabel Technologies*** has created an "eco-friendly" form of adhesive label that does not require a liner; the venture was started by four Brown students.
  - ***Accelereach,*** founded by Brown graduate Adam Emrich, has developed web-based software that flexibly combines e-mail, voice-mail and text messaging functions to support communications between health professionals and their patients;

- ***Leotus***, started by a team of Brown and RISD students, has developed an improved design for home air conditioners;
- ***Minds in Motion Electronics (MIME)***, also developed by Brown and RISD students, has developed tools that integrate the monitoring of brain activity into educational and entertainment games.

It is worth noting that NuLabel started as a student project in Brown's COE program; and both Leotus and MIME started as PRIME student projects. They suggest that both programs are succeeding in helping students understand, and preparing them to meet, the requirements for successful innovation and entrepreneurship.

- These members of BetaSring's first class are hoping to join others from Brown who have played leading roles in the development of new companies in Rhode Island. Table 7 lists a sampling of Rhode Island-based companies that were founded by a Brown faculty member or graduate, or that based one or more key products or processes on technology licensed from the University. Collectively, these ten businesses employ more than 250 people in Rhode Island.

Table 7: Selected Rhode Island companies started by Brown alumni, faculty and staff or based on Brown technology

Company	City	Founder/leaders/technology	Year founded	Employees
Bay Computer Assoc	Cranston	David A. Durfee, President	1981	18
Andera	Providence	Charles Kroll, President Steve Siegal, Chairman	1996	63
Nestor Inc (acquired by American Traffic Solutions in 2009)	E. Providence	Leon Cooper, Co-founder, Charles Elbaum, Co-founder	1997	55
EpiVax	Providence	Annie De Groot	1998	20
Neurotech USA	Lincoln	Encapsulated Cell Technology license	2000	44
ProThera Biologics	E. Providence	Dr. Yow-Pin Lim and Douglas C. Hixson	2001	8
NABsys	Providence	Xinsheng Sean Ling, Leon N. Cooper, Barrett Bready	2004	36
Dynadec	Providence	Pascal Van Hentenryck and optimization technology	2009	-
Tizra	Providence	David G. Durand	2005	10
Analytical Edge	Greenwich	Jeffrey Blume	2006	3

- ***Dynadec*** is a Providence-based company that was founded in 2009 by Brown University computer science professor, Pascal Van Hentenryck. The company develops a software package called Comet™ that optimizes complex decisions in scheduling, routing and workforce management. The package is based on technology developed by Dr. Van Hentenryck's optimization laboratory at Brown and licensed to the company.

- Founded in 2004 ***NABSys***, is commercializing the manufacture of “nanopores” that can be used to analyze and sequence DNA at a much lower cost and greater speed than existing technologies, making it possible to use DNA analysis as a diagnostic tool. NABSys was one of five companies to receive a “$1000 Genome” award from the National Human Genome Research Institute of the National Institutes of Health. The company received $4 million in equity investment in May of 2009. The company was founded by Brown University professor Xinsheng Sean Ling.

Community service and outreach

Brown's history of active engagement with the Providence community stretches back more than three decades, to the founding of Center for Public Service in 1977. Now called the Swearer Center for Public Service (in honor of Brown's late president, Howard Swearer, who created it), it remains a focal point for the engagement of Brown students in efforts to serve and strengthen the Providence community.

- About 1,000 Brown students per year are involved in Swearer Center activities, including:

    - 700 volunteers in community programs, such as mentoring in schools;
    - 60 students on staff as paid coordinators;
    - 70 students in the academic advising program; and
    - 100 students in other programs, such as social entrepreneurship.

  About half of all students who participate in community service programs through the Swearer Center are involved in efforts to expand educational opportunities and raise achievement levels for children in Providence-area public schools.

- The **Swearer Classroom Program** is a weekly 1-on-1 mentoring program between Brown volunteers and local elementary school children, focused on improving literacy. Currently, Brown students work with two schools: D'Abate Elementary in Olneyville and Asa Messer (and its annex school) in Providence. Recently, the Swearer Center assumed the lead role in creating a 21st Century Community Learning Center at D'Abate Elementary School, managing the strategy for the institution's out-of-school programs. Student enrollment in the program increased from 5 in the fall of 2008 to 189 in spring 2009. The Rhode Island Department of Education has awarded the Swearer Center $425,000 over three years to continue to strengthen the program.

- Brown University is one of 12 partner institutions in the ***National College Advising Corps***, a Jack Kent Cooke Foundation-funded program that places recent college graduates in high school guidance offices. The Brown University program places 12 students in six urban school districts in Rhode Island where they introduce high school students to colleges, help them with essays and work through financial aid issues.

The University has since 2007 created several other programs that are designed to help strengthen public education in Providence.

- In February 2007, Brown President Ruth J. Simmons announced creation of **The Fund for the Education of the Children of Providence (FECP)**, a $10-million endowed fund supporting local public school youth. The Fund's goal is to broaden opportunities for Providence's youth, helping them realize their professional potential. FECP is focused on three core areas, i) academic learning and achievement; ii) preparation for higher education and the workforce and iii) social, artistic, and civic development.

In May 2009, the FECP announced its first grants, including, a grant of $118,000 that was used to provide graphing calculators to Providence middle and high school students.

- In 2008, Brown's Education Department launched the **Urban Education Fellows (UEF)** program. The program rewards graduates of Brown's Master of Arts in Teaching (MAT) or Urban Education Policy (UEP) programs who dedicate at least three years to teaching in Providence schools by reimbursing their graduate tuition. Nine Brown graduates participated in the program in its first year.

Social entrepreneurship

During the past few years, Brown students' engagement with Providence-area communities has increasingly been manifested in the creation of new social ventures. We cite here just a few examples.

- In 2006, Alpert School of Medicine student Rajiv Kumar founded **Shape Up RI**, a company that uses web-based social networking and team-building tools to help participants set and meet weight loss goals. Since its founding, more than 35,000 Rhode Island residents have participated in the program. The program has since spun off a nationwide company called **Shape Up the Nation**, which Mr. Kumar co-founded. The two companies employ 15 people in Providence.

- ***Eoseek*** was founded by Brown graduate, Matthew Lent, in 2006. The firm matches students with tutors, mentors and coaches for one-on-one sessions. The company is based in Providence, and many of its tutors are Brown students, but it has expanded its service to other college campuses in the northeast, including Boston University, Wellesley College, George Washington University and the University of Pennsylvania.

- In 2009, recent Brown graduates Andy Posner and Mollie West founded ***Capital Good Fund***, a microfinance non-profit focused on the Providence area. The non-profit completed its pilot loan round in the summer of 2009 with five loans to Providence-based businesses and entrepreneurs totaling $9,800 and is currently evaluating the pilot for a larger funding round in late 2009 and 2010. Capital Good Fund received seed funding from a variety of sources including the Swearer Center, the Clinton Global University Initiative, DoSomething.org, and the Rhode Island Elevator Pitch contest.

- **Generation Citizen Project (GCP)** was founded in 2008 by two Brown students, with the goal of educating youth on the political process and on local, national, and global issues. A pilot project was launched during the 08-09 academic year in six Providence High Schools, reaching more than 100 students. Thus far, the project has raised over $50,000 and is hoping to reach a wider audience through acceptance of its curriculum as part of a new district-wide social studies platform. The Swearer Center partners with the GCP, providing funding and supporting the project's efforts to implement its model in local school districts.

A sampling of social entrepreneurship ventures are shown in Table 8.

Table 8: Selected Rhode Island social entrepreneurship ventures

Venture	City	Founder/leaders	Year founded	Employees
Capital Good Fund	Providence	Andy Posner, Mollie West	2009	2
Eoseek	Providence	Matthew Lent	2006	-
Generation Citizen Project	Providence	Scott Warren, Anna Ninan	2008	-
Runa LLC	Providence	Tyler Gage, Daniel McCombie	2008	2
Shape Up RI and Shape Up the Nation	Providence	Rajiv Kumar	2006	15

Bringing artistic and cultural resources and audiences to Providence

Brown is also a cultural asset to Providence. Brown's Departments of Music, Theater Arts and Performance Studies, and Visual Arts attract students and faculty who participate in the visual and performing arts. The University brings in thousands of other students, faculty and staff who attend other cultural events and performances in the City every year.

We cite below several examples of ways in which the University contributes to the cultural life of Providence:

- The ***Brown University Orchestra*** was founded in 1918. The Orchestra performs six to eight times in Providence each year. In December 2006, the Brown Orchestra became one of the first US collegiate orchestras to tour China, performing in Beijing, Shanghai, Dalian, Suzhou, Changzhou and Ningbo. All students at Brown and the Rhode Island School of Design, members of the faculty and staff of both institutions, and community members are welcome to audition.

- Brown's theater program has been entertaining campus and Providence community audiences since 1868. Most theater performances are produced in the Catherine Bryan Dill Center for the Performing Arts' three main performance spaces: Leeds Theatre, Stuart Theatre, and the Ashamu Theatre. In 2009, Brown broke ground on a new 35,000 square-foot ***Creative Arts Center*** (CAC) on Angell Street. The CAC will add a 200-seat recital hall in addition to a screening facility and smaller production spaces. The University expects to open the building in the spring of 2011.

- ***Rites & Reason***, now in its 37th year, is one of the oldest continuously producing black theatre groups in the nation. The group uses a "Research-to-Performance Method" to create new theatrical works, starting with historic documents,

artifacts, interviews, and personal experience. In addition to producing mainstage works, the group also sponsors lectures, discussion panels, and readings.

- In 2001, Brown began offering joint graduate degrees in the theater arts with ***Trinity Rep*** – among the most-respected regional theatres in the country, now in its 46th season. The program adds an M.F.A. in acting and directing and a Ph.D. in theater and performance studies. Graduate students in the program have access to the Pell Chafee Performance Center at Trinity Rep as well as Brown's libraries, and faculty and students at both institutions.

- Brown University is home to the ***Haffenreffer Museum of Anthropology*** and ***David Winton Bell Gallery***. The Haffenreffer Museum contains more than 120,000 ethnographic artifacts – primarily from the Americas, Africa and Southeast Asia. The Bell Gallery opened in 1971 and presents contemporary art in a range of media, including an annual student exhibition. Admission to both the Museum and the Gallery is free to the public.

Brown and the future of the Rhode Island economy

Brown has long been a major contributor to economic growth and development in the City of Providence and in Rhode Island, and a buffer against hard times. During the next five to ten years, however, the University could have an even greater impact on the economy of the city and the state. This is so for several reasons.

1) Investment in building and renovating research and education facilities

Over the next three years, the University plans to invest nearly $220 million in construction and major maintenance projects. We estimate that this spending will directly create approximately 870 person-years of employment in construction and related industries in Rhode Island.

More than the direct jobs created, this investment in buildings – like the Medical Education Building and the Mind Brain Behavior Building – will lay the foundation for years of growth in fields critical to the region's innovation capacity.

2) Potential for renewed growth of the university's research enterprise

While Brown's annual research spending has been relatively static for the past few years, several initiatives undertaken during the past few years could provide a foundation for significant growth during the next decade. These include:

- The University's collaboration with IBM in bringing to Brown and Rhode Island high-performance computing capabilities that will support advanced research across a wide range of disciplines;
- The collaboration between Brown and Draper Laboratory in developing a new Energy Research Center in Providence; and
- Closer collaboration with Lifespan in developing centers of excellence in medical research.

Moreover, the University is already strong in several fields where there are likely to be significant opportunities for growth, such as neuroscience, nanotechnology, environmental science, biomedical research and public health.

3) Growth in selected fields

In several areas, the next five to ten years could also see the growth of Brown's teaching enterprise. The University is currently exploring the feasibility of expanding its Engineering Division into a full-fledged School of Engineering; and similarly, expanding its Public Health Program into a School of Public Health. Over a period of several years, these changes would entail appointment of additional faculty members, expanded course offerings, increased enrollment and possibly investment in new facilities as well. They could also lead to further growth of the University's already-strong research programs in engineering and public health.

4) Greater emphasis on technology transfer and business development

Within the past year, Brown has strengthened its support for – and taken a more comprehensive approach to – translating the results of University research into new products and services, new businesses and new jobs. The reorganization of Brown's technology transfer functions under a new Technology Ventures Office – the University's partnership with the city and the state in launching the new Rhode Island Center for Innovation and Entrepreneurship – and the nurturing of student entrepreneurs through programs such COE and PRIME – should during the next five years pay off in the creation and growth of more new businesses in Rhode Island.

5) Expanding Brown's global reach

Brown has during the past several years begun to develop new partnerships with institutions around the world, such as its joint venture with Instituto Empresa in the development of an international executive MBA program. Expanding the University's global reach will clearly benefit Brown. In an era when the prosperity of cities and states will more than ever depend on their ability to do business in an increasingly globalized economy, it can benefit Providence and Rhode Island as well.

6) Keeping more Brown graduates in Providence

As noted above in Part II, the number of Brown graduates living in Providence grew by 23 percent between 2005 and 2009. Especially if this trend continues, the increased number of Brown graduates living in the city could over time have a significant impact on its economy – by expanding the city's college-educated work force, and by contributing to its entrepreneurial vitality and its already-vibrant cultural life.

7) Partnerships with the city's schools

Over time, Brown's expanded partnerships with the city's public schools – for example, through the Fund for the Children of Providence, the Urban Education Fellows program and the Swearer Center's educational equity strategy – should help to enhance the quality of public education in Providence, and expand the educational opportunities available to the city's younger residents.

8) Expanding opportunities for continuing education

Complementing the University's commitment to the city's public schools, Brown will gradually expand the range of opportunities for continuing education that it offers to adult residents of the Providence area. Expanding these programs will help Providence-area residents acquire or enhance the skills they need to succeed in an increasingly knowledge-intensive economy.

9) Developing the Jewelry District

During the next five to ten years, Brown will be a partner with the city, the state and other local institutions in the redevelopment of the Jewelry District. The University already has several facilities located in the area, including the Laboratories for Molecular Medicine at 70 Ship Street and the Rhode Island Center for Innovation and Entrepreneurship at 1 Davol Square. The University is also redeveloping an existing building at 222 Richmond Street to serve as a new Medical Education Building. With the completion of this $45 million renovation in 2011, the Alpert Medical School will be located in the Jewelry District, close to several of its affiliated hospitals.

The University owns several other properties in the Jewelry District that could in the future be developed for academic uses, such as new facilities for the proposed schools of engineering and public health – or a mix of academic and commercial uses, such as combining space for biomedical research with space for commercial biotech companies.