BROWN

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June 28, 2022

Dear Members of the Brown Community,

How can we better prepare for and respond to future pandemics? What are the drivers of economic inequality and the policy solutions to address them? How can we unlock the mysteries around Alzheimer's disease for early detection and more individualized treatment? These are just some of society's pressing issues, and Brown stands ready to develop solutions to these and other challenges.

In alignment with Brown's strategic plan, *Building on Distinction,* this *Operational Plan for Growing the Research Enterprise* outlines a strategy to take Brown's scholarship to the next level – positioning the University to enhance its impact, visibility, and reputation during these challenging times. For the first time in Brown's history, we have developed a plan that builds on the existing strengths of our research enterprise to positively impact people both locally and throughout the globe.

The goals of this plan are ambitious but achievable. The strategy for doubling research calls for targeted investments in space, faculty, staff, and students, as well as reducing existing barriers to research by improving and streamlining support structures.

Brown has already seen dynamic growth and made substantial progress in research activity over the last several years as part of the *Building on Distinction* strategic plan, and we want to build on that momentum. Research touches every area of the University and growing our scholarly activities will benefit the entire Brown community.

The following plan provides a framework for what Brown can achieve over the next five to seven years and a clear path for getting there. It illustrates how growing our research also supports our efforts to promote diversity and inclusion at the University, strengthens our educational programs, and enhances Brown's impact and hence reputation in the world.

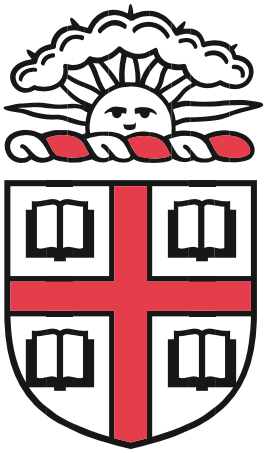
The current draft of this plan is being circulated for feedback from the members of the Brown community. University leadership will offer several forums to collect and hear feedback from the community over the summer and early fall. President Paxson will distribute a revised and final version that incorporates feedback with the Brown community and external stakeholders during the Fall 2022 semester.

Creating and translating knowledge is fundamental to our mission as a university, and that mission has never mattered more than it does during our current moment.

We look forward to your feedback.

Sincerely,

Richard M. Locke
Provost
Schreiber Family Professor of Political Science and International and Public Affairs
Brown University



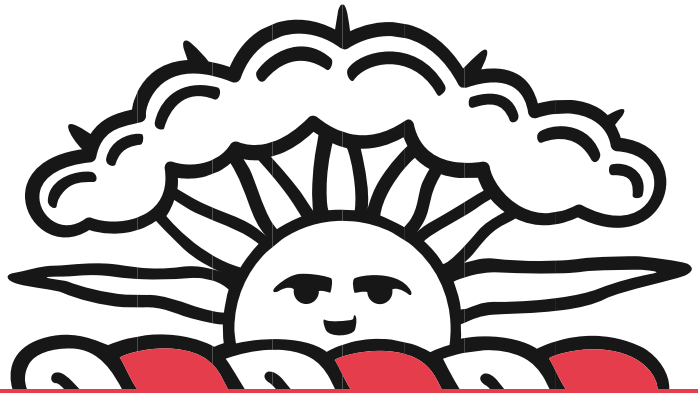
BROWN

Operational Plan for Growing the Research Enterprise

Realizing the Goals of *Building on Distinction: A New Plan for Brown*

June 28, 2022

DRAFT



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Introduction

Brown University is a major research university with a long and well-established reputation as a leader in innovative undergraduate education. We aspire to be among the very best at what we do, and Brown's reputation is inextricably linked to the strength of its research enterprise.

Growing the University's research enterprise will help us further our mission and reputation because research reinforces innovation in our classrooms, attracts world-class faculty and top students to our campus, stimulates innovation and economic development in our state, and benefits society through the creation and dissemination of knowledge. Our faculty are pathbreaking scholars whose work expands knowledge at the leading edge of their disciplines. Our graduate programs train the next generation of scholars who will push these frontiers even further. Our undergraduates participate as active partners in research as part of their intellectual formation. Our world-class staff support the entire research enterprise through subject matter expertise and specialized skillsets. Research is a distinguishing feature of Brown University.

Research conducted at Brown improves the health, wellbeing, capabilities, and human possibilities of people across the globe and in our local community. Faculty experts advise government institutions, elected officials, business leaders, and non-governmental organizations while also catalyzing innovation in the commercial and nonprofit sectors. Brown's distinctive institutional character stimulates our researchers to think differently about the most significant issues facing our society and to develop novel approaches that might not emerge elsewhere.

For all these reasons, we propose to redouble our efforts to grow research at Brown and further our position as a leading research university by building even more intensively on its distinctive culture and strengths. What follows here is an outline that will guide this effort, which will open a new phase in our strategic plan, *Building on Distinction*.

Building on Distinction

> *Brown is both a major research university and an educational institution based upon collegiate values. We believe that education and research reinforce each other and that the best academic programs bring innovative teaching and rigorous research together.*
>
> - "The Brown Difference," *Building on Distinction*

Building on Distinction, which has guided the University's growth and development for nearly a decade, is divided into four areas:

- **Integrative Scholarship.** Building on Brown's distinctive strength in research and education that integrates knowledge from diverse disciplines through investments in nine thematic areas.
- **Educational Leadership.** Sustaining Brown's position as a leader in undergraduate, graduate, and medical education through innovative approaches to teaching and learning.
- **Academic Excellence.** Strengthening Brown's community of faculty, staff, and students by supporting scholarship and partnerships, cultivating diversity, and enhancing access.

- **Campus Development.** Reinvigorating Brown's physical campus both on College Hill and off, strengthening our ties to our city and state, and creating a robust virtual campus.

Since the launch of *Building on Distinction*, Brown has increased the breadth and quality of its scholarship and research in ways that have involved a larger number of students in the discovery and creation of knowledge. This expansion of Brown as a research university was made possible by the success of the $3 billion *BrownTogether* campaign, which has supported the essential building blocks of research, including:

- Endowed professorships;
- Seed funding for research innovation;
- Improvements in research infrastructure including laboratories and libraries;
- Funding for staff researchers and administrators supporting research; and
- Student support through fellowships and internships.

Brown is now well positioned to take its research mission and its corresponding impact on our students and the wider world to the next level. This document lays out how Brown proposes to expand further the core research goals set forth in *Building on Distinction* by:

- Supporting existing research across campus and increasing the number and kinds of researchers at all levels;
- Investing in core research infrastructure that benefits scholarly activities across the University;
- Identifying an initial list of capital projects under consideration in support of research growth across disciplines; and
- Highlighting examples of future research initiatives that build upon existing strengths and fall under the nine integrative themes from *Building on Distinction*.

Many of the goals outlined in this plan are already underway, and nearly all are included as priorities in the $1 billion extension of the *BrownTogether* campaign. As Brown has demonstrated consistently in recent years, a clear understanding of our distinctive strengths combined with sustained adherence to the core principles derived from our institutional values enable us to reach the very highest levels of excellence.

A STRONG FOUNDATION FOR GROWTH

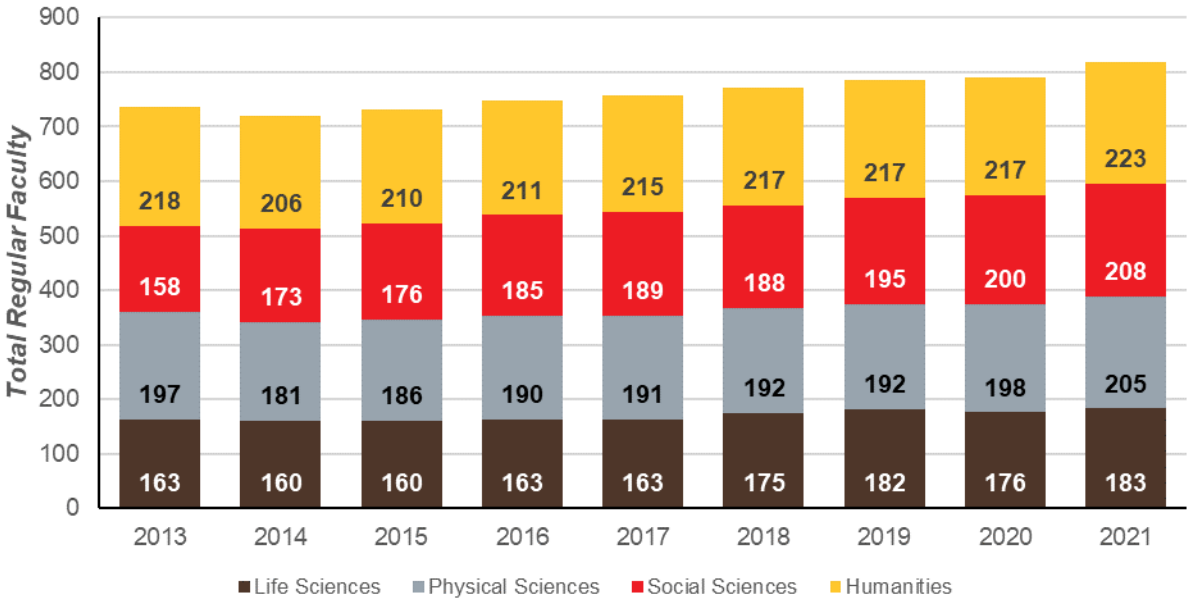
The investments Brown has made in recent years have created a period of unprecedented dynamism in research activity. Indeed, Brown's research enterprise has grown significantly faster than those of our peers since the launch of *Building on Distinction* in 2014 as evidenced by:

- Growth in our faculty and Ph.D. student body;
- Increased research productivity across our faculty; and
- Growth in external funding for our research programs.

Faculty and Graduate Students

The University has significantly diversified and increased the number of faculty and graduate students since 2013 (the year before the strategic plan was launched). As shown in Figure 1, Brown has added significantly more faculty across the disciplines – with 11% growth through the spring of 2021. The humanities continue to have the largest share of faculty across the University, and the social sciences saw the largest growth in faculty both in absolute and relative terms.[1] It is notable that over the past few years, the University diversified the faculty as well, increasing the percentage of regular faculty from historically underrepresented groups from 8% to over 16% since the 2014-2015 academic year.

Figure 1: Regular Faculty Growth by Academic Division

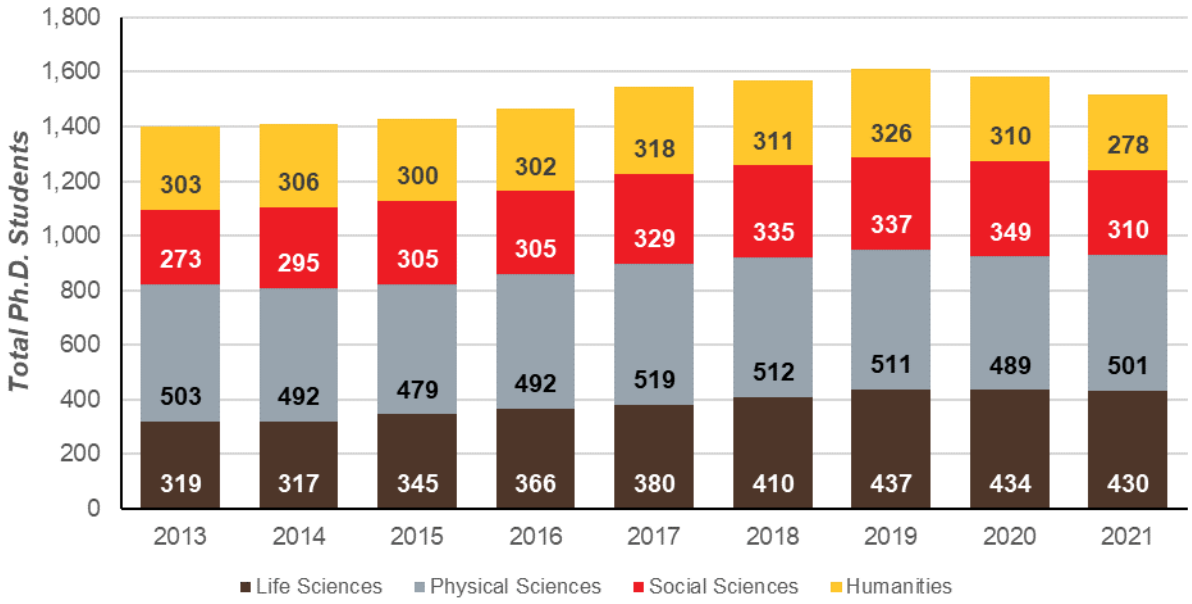


The University saw similarly impressive growth in graduate student enrollment since 2013. As shown in Figure 2, Brown added over 210 Ph.D. students – a growth of 15% – through the spring of 2020. Due to the COVID-19 pandemic, the University – and most peer institutions – saw a slight dip in Ph.D. enrollment over the past two years, but there are still over 120 more Ph.D. students than there were

[1] Data from the Office of Institutional Research factbook.

before *Building on Distinction* launched.[2] More impressive, though, is the fact that the University significantly grew the proportion of Ph.D. students from historically underrepresented groups – increasing from 9% in 2013 to 16% in 2021.

Figure 2: Ph.D. Enrollment Growth by Academic Division



Measuring Research Productivity

Scholarly impact and research productivity are measured differently across the variety of disciplines embraced at Brown. Some disciplines measure productivity and impact through the publication of books and articles, others focus on citations or grant funding from government agencies, and still others emphasize well-received public exhibitions and performances.

Across all relevant metrics, Brown faculty have dramatically increased their scholarly impact and productivity since the launch of *Building on Distinction*. These increases are evident both on a per-faculty basis and in the aggregate across all faculty. For example, between 2013 and 2020:[3]

- **Articles.** The total number of articles by Brown faculty increased by 30% and the number of articles per faculty member increased by over 15%.
- **Citations.** The total number of citations of work by Brown faculty increased by 60% and the number of citations per individual faculty member increased by more than 40%.
- **Honorific Awards.** The total number of honorific awards received by Brown faculty in recognition of their research and scholarship increased by 45% and the number of awards per faculty member increased by nearly 30%.

[2] Data from the Office of Institutional Research factbook.

[3] Data from *Academic Analytics*, based on data from active Brown faculty in 2013 and 2020.

- **Conference Proceedings.** The total number of conference proceedings for which Brown faculty contributed scholarship increased by nearly 35% and the number of proceedings per faculty member increased by nearly 20%.

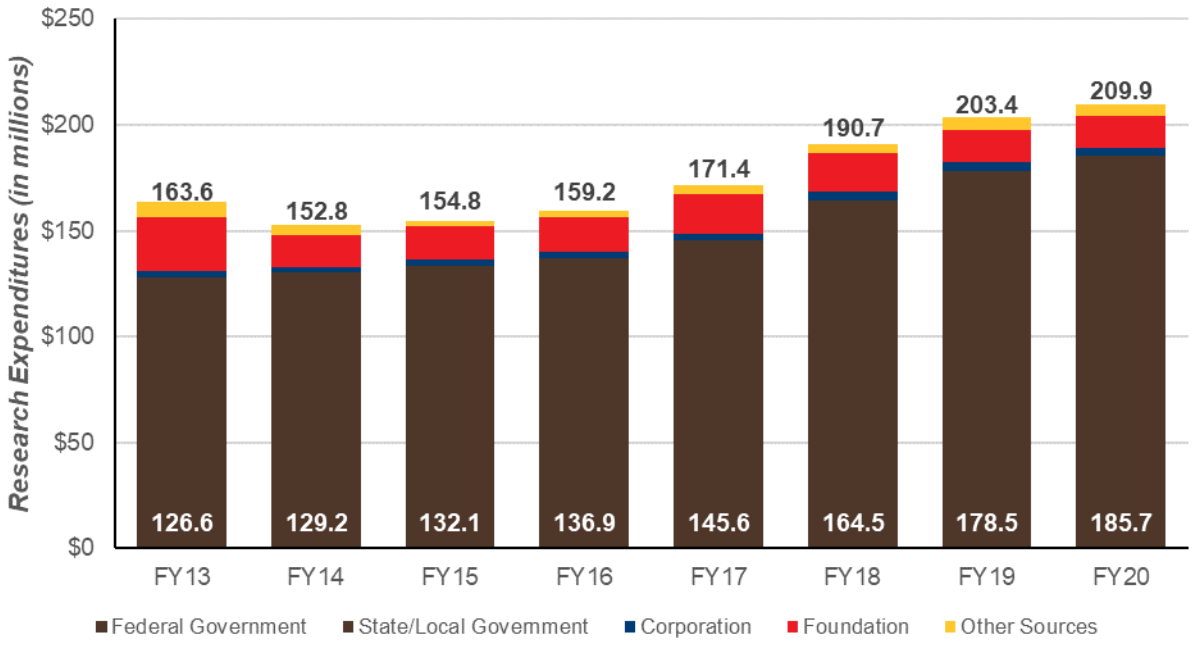
- **Books.** The number of books published by Brown faculty members remained relatively flat, but Brown rose to be in the top five of our Ivy plus peers in terms of books published per faculty member.

The growth in research productivity has been possible by the hard work of our faculty and their research teams, as facilitated by the University's investments across campus.

Research Expenditures

As shown in Figure 3, Brown's federally sponsored research expenditures increased by 41% over the last five years – the highest growth among our peer institutions by a wide margin.[4] And Brown outperforms some of our peers in terms of research activity or grant funding per faculty member, particularly in the humanities and social sciences.

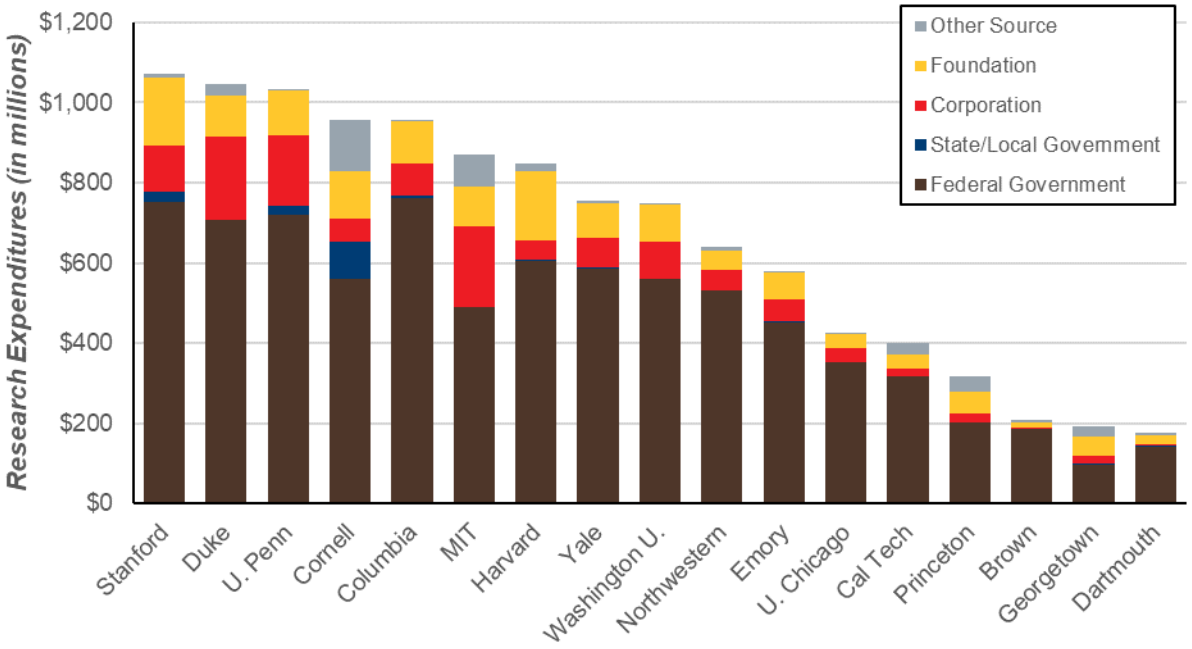
Figure 3: Total Annual Research Expenditures at Brown University by Funding Source



It is true that Brown remains significantly smaller than its peers in absolute research expenditures and activity. Moreover, Brown is well below some peers in research per faculty member in some of the life and physical sciences. In 2019-20, Brown ranked 74th out of 655 institutions nationwide in federal research expenditures. This is considerably behind other private institutions that made up roughly half of the top 50. Figure 4 illustrates the total research expenditures at Brown and 16 peer institutions.[5]

[4] Data from the National Science Foundation, *Higher Education Research and Development Survey* (HERD).
[5] Data from the National Science Foundation, *Higher Education Research and Development Survey* (HERD).

Figure 4: Total Research Expenditures by Institution (FY20)



Some differences in research volume reflect particular institutional configurations. Many of our peers have directly affiliated health systems which funnel research funding through their respective universities, whereas research conducted by Brown clinical faculty at our associated health systems is not included in our research expenditures. Other institutions are affiliated with national laboratories with millions of dollars in guaranteed annual funding. And many of our peer institutions have a wide array of graduate and professional schools that fund expanded research portfolios.

However, it remains the case that as we compete for the very best faculty, staff, and students in this peer landscape, accelerating growth of Brown's research enterprise is critical for elevating the University's reputation and visibility, and strengthening our distinctive approach to undergraduate education. Although our faculty, research staff, and students already perform cutting-edge research that makes a difference in addressing issues of importance to society now and in the future, Brown is currently too small in some fields and in our central administrative structures to achieve our full potential. Ensuring that Brown's research enterprise does not remain below scale and can continue to attract the very best faculty, staff, and students requires strategic focus and clearly articulated goals.

THE GOAL

> Research at Brown will double over the next five to seven years.

Only one or two institutions of higher education have been able to achieve such significant research growth in recent years. But Brown has demonstrated that it can achieve its ambitious goals with focused planning, prioritization, and processes that engage stakeholders throughout the community.

This does not mean that we expect every faculty member, staff member, and student to double their productivity. As previously shown, we know that members of our community have already increased their research significantly over the past few years. Growing research at Brown will require targeted investments in faculty, students, staff, and space, as well as resources to support research across the campus. Doubling Brown's research activity will require a significant commitment by the University.

We know that we are limited in research space on College Hill and in the Jewelry District. We know that our faculty, staff, and students are already working incredibly hard on their existing research, teaching, and service commitments. Accordingly, our plan seeks to maximize the effectiveness of new investments with an accompanying reduction of barriers to research and streamlining of our support processes.

Defining the Goal

Research takes many forms and varies in structure and methods across disciplines. The research enterprise touches nearly every facet of the University, involving not only scholars in laboratories, libraries, archives, field sites, clinical settings, data centers, and many other spaces, but also the students, staff experts, and technicians who work closely with researchers as well as essential administrative support personnel. Growing research will provide a broad array of benefits to the entire Brown community.

Doubling research is an overall goal. Not every area of research will increase twofold, and some will grow faster. Furthermore, not every discipline or support function has the same needs. To be successful, it is essential that we adopt a tailored and targeted approach and measure our progress with clearly defined metrics, including:

- **Individuals Involved in Research.** Doubling will require hiring more faculty and postdoctoral researchers, enrolling more graduate students in key areas, and increasing the number of undergraduates engaged in research. In addition, more staff support will be needed for critical research functions. This growth in people must be targeted and appropriate by discipline. Academic departments have different needs, and we must ensure that we grow sustainably.

- **Research Outputs.** Different fields and different departments across the arts, humanities, social sciences, life sciences, and physical sciences have their own established methods for capturing and recognizing research activity. The University will collect data from a variety of sources to track research growth across the campus, including the publication of articles and books, citations, and external awards.

- **External Research Funding.** The federal government plays an important role in funding research at institutions of higher education through the National Institutes of Health (NIH), National Science Foundation (NSF), and Departments of Energy, Defense, and Commerce. While increased federal funding will play a significant role in growth, we must also expand support from private foundations and corporations.

- **Internal Research Funding.** The University offers internal research funding awards and grants, including the Seed Awards and Salomon Awards administered by the Vice President for Research, start-up funding for new faculty, and research support funds offered by individual academic units. This seed funding yields a high return on investment. For example, to date, the Seed grants have yielded a return of 13:1 in external awards. We plan to double the total internal funding available for research across the University and track the ROI and impact of different funding mechanisms.

Why Growth Matters

As previously described, growing the research enterprise is important to ensure Brown can achieve its mission and maximize the University's impact on society. But there are also important operational and academic benefits to growth.

- **Scale.** The University's current research enterprise is below scale. There are many fixed costs to effectively engage in research – like large pieces of laboratory equipment, library collections, and expert staff to support researchers – and the small size of the University's current research portfolio, particularly in relation to peer institutions, means that certain investments are often reduced, delayed, or even deferred. The University needs to achieve a larger scale across the research enterprise to enable the critical investments needed to keep the University on the cutting edge and further increase the impact of our scholarship.

- **Academic Excellence.** In some academic disciplines, there is a correlation between the number of faculty and students and the reputation of those programs. Sometimes, there is a minimum number of people required to achieve excellence in scholarship and teaching. By adding researchers and increasing investment, Brown will be able to continue advancing academic excellence across all programs.

- **Diversity and Inclusion.** Growth means more opportunities to diversify the University's scholarly community. These opportunities will allow the University to continue its progress toward achieving the goals of the 2016 *Pathways to Diversity and Inclusion: An Action Plan for Brown University* by increasing the number of faculty, staff, and graduate students from historically underrepresented groups.

- **Teaching and Learning.** Growing research means additional resources and innovation to support the University's teaching mission as well. Hiring additional faculty and postdoctoral researchers and enrolling more graduate students will naturally increase the number of instructors available to teach and mentor our undergraduate students. More scholarship on campus also means that instructors can leverage the knowledge they create to further innovate in their coursework and teaching.

- **Local Impact.** Finally, a broader research enterprise – with additional faculty, graduate students, and postdoctoral researchers – will allow for an expanded impact on the local community through startups emerging from research and innovation on Brown's campus, the growth of the knowledge economy and biomedical sector in the Jewelry District, and engagement between Brown's subject matter experts with local policymakers and organizations.

How to Grow Research: Guiding Principles

Clear and transparent principles that reflect the University's history, distinctive strengths, and values will guide our proposed investments. The following three principles will guide every investment in Brown's research enterprise over the coming five to seven years:

- **Strategic Alignment.** Investments and activities must be in line with the University's strategic plan *Building on Distinction*, and signature initiatives must align with one or more of the nine integrative scholarship themes.

- **Teaching and Learning.** Research growth must support and uplift Brown's educational mission by ensuring students are engaged and by growing the number of faculty on campus who teach students in addition to performing research.

- **Diversity and Inclusion.** Growing research activities and personnel must align with the DIAP and ensure additional hiring, enrollment, and investments are targeted in ways that help achieve our goals for diversity and inclusion.

To ensure that additional investments will have the greatest effect, resource decisions across the University will be informed by careful needs assessment and benchmarking.

Funding the Growth of Research

Doubling research will require significant investments by the University – likely over $700 million dollars in capital investments in addition to several hundred million dollars in annual expenses. These are necessary investments, which will be funded by a variety of external and internal sources:

- **External Grants.** The University generates over $200 million each year in external funding, largely from federal funders, and the University will ideally more than double that funding over the coming five to seven years.

- **Indirect Cost Recovery.** With an increase in grant funding and expected increases in the costs of facilities and administrative support, the University will generate significantly more funds through indirect cost recovery – which is calculated as a percentage of direct grant revenue.

- ***BrownTogether* Campaign.** The three-year, $1 billion extension of the highly successful *BrownTogether* campaign will provide philanthropic funding to support research growth initiatives. We anticipate that further funding after the campaign extension will continue to support Brown's research growth in the years to come.

- **University Funds.** We recognize that the University will need to allocate significant operating budget to support research growth. This funding will come from a combination of sources, including the University's endowment, existing gift funds, and additional funding made possible through efforts like the *Program in Innovation and Financial Sustainability*.

Research Integration with the Affiliated Health Systems

Brown leadership is currently engaged in efforts to integrate the research activities of Brown's clinical medical faculty – who are employed by our affiliated health system partners, **Lifespan** and **Care New England**, and specialty practice plans under **Brown Physicians, Inc.** – into the University's research enterprise. If successful, this integration will help expand the University's research infrastructure, reach, and impact – and bring in an additional $100 million in grant-funded research activities to Brown, which would represent a 50% increase in federal research funding.

THE STRATEGY

The strategy for doubling research balances investments in research support and infrastructure that benefits scholars and students **across the entire University** with targeted investments in signature high-growth academic initiatives that align with Brown's strengths and academic priorities:

- **Research Infrastructure.** Growing our research enterprise across disciplines will require significant investments in people (faculty, students, and staff), in research spaces, and in support structures and systems across campus. The subsequent sections of this plan highlight initiatives to expand and improve research support and infrastructure across the University. These proposed investments represent an initial list based on discussions among the senior academic deans, leaders of various academic departments, institutes and schools, and the University leadership. Additional projects will be added over the coming five to seven years based on additional information, expressed needs, and available funding.

- **Signature Research Initiatives.** Through a process described below, we have identified a series of areas for high-growth research that would further existing areas of strength at Brown and fall under the nine integrative themes in *Building on Distinction* (outlined in Figure 5). Examples of these innovative signature initiatives from an array of disciplines are highlighted later in this plan. These examples are not meant to be the final or exhaustive list of all research initiatives in which the University will invest over the coming five to seven years. New areas of research will emerge in the coming years while others may not take off.

Figure 5: Nine Integrative Themes from *Building on Distinction*

1. CULTIVATING CREATIVE EXPRESSION
2. UNDERSTANDING THE HUMAN BRAIN
3. SUSTAINING LIFE ON EARTH
4. CREATING PEACEFUL, JUST, AND PROSPEROUS SOCIETIES
5. EXPLORING HUMAN EXPERIENCE
6. USING SCIENCE AND TECHNOLOGY TO IMPROVE LIVES
7. ADVANCING COMPUTATIONAL AND DATA SCIENCES
8. DECIPHERING DISEASE
9. IMPROVING POPULATION HEALTH

Research Infrastructure: People

The University typically employs around 800 regular faculty across the humanities, life sciences, social sciences, and physical sciences, plus an additional 700 research, adjunct, and visiting faculty. The University also employs nearly 300 postdoctoral researchers across all disciplines and a similar number of staff members directly supporting research. Roughly 1,500 Ph.D. students are enrolled in various graduate programs at Brown.

Doubling Brown's research enterprise will require significantly more people to write grant proposals, perform research, and produce scholarship. This means increases in:

- Tenure-track and research faculty;
- Graduate students, specifically Ph.D. students;
- Postdoctoral researchers;
- Staff researchers and administrators; and
- Undergraduate research assistants.

Growth in people will not be uniform across these different categories of researchers. The growth in tenure-track faculty will be relatively small and limited to key areas of research. Instead, most of the growth in people engaged in research will come from graduate students, postdoctoral researchers, and research faculty who are supported by external research grants. An increase in undergraduate research assistantships will also be supported by a combination of external grants and philanthropic gifts. Numbers of people in these categories will scale up as research grows.

Growth will also not be uniform across disciplines. While we know that some units – like the **School of Engineering** – will likely need to expand graduate student enrollment, other disciplines – like those in the life sciences – may need to grow their postdoctoral researchers more than their Ph.D. students. We similarly heard from some humanities faculty that additional undergraduate research assistantships would be most helpful in terms of increasing their scholarly activity.

Academic departments have different needs and we must ensure that we grow the number of people engaged in research ethically and sustainably. This means that employees hired and students recruited must have clear pathways for career development to meet their professional goals and that the University must be able to fund growth responsibly.

Although much of the growth in people will be financed by external grants, the growth in people will place some demands on philanthropy and core University support. Fundraising for endowed chairs will continue to be a top University priority. Additionally, in the initial stages of executing the plan, we will need to dedicate philanthropic funds and some central funds to hire the people who will prepare grants and jump-start research in new areas. (Some of this funding would be included in faculty start-up packages.) In addition, the growth in graduate students, postdoctoral scholars, and research staff will need to be factored into our capital plans and student support services. Financially responsible growth in people will be supported by careful multi-year budgeting and planning efforts that are currently being refined.

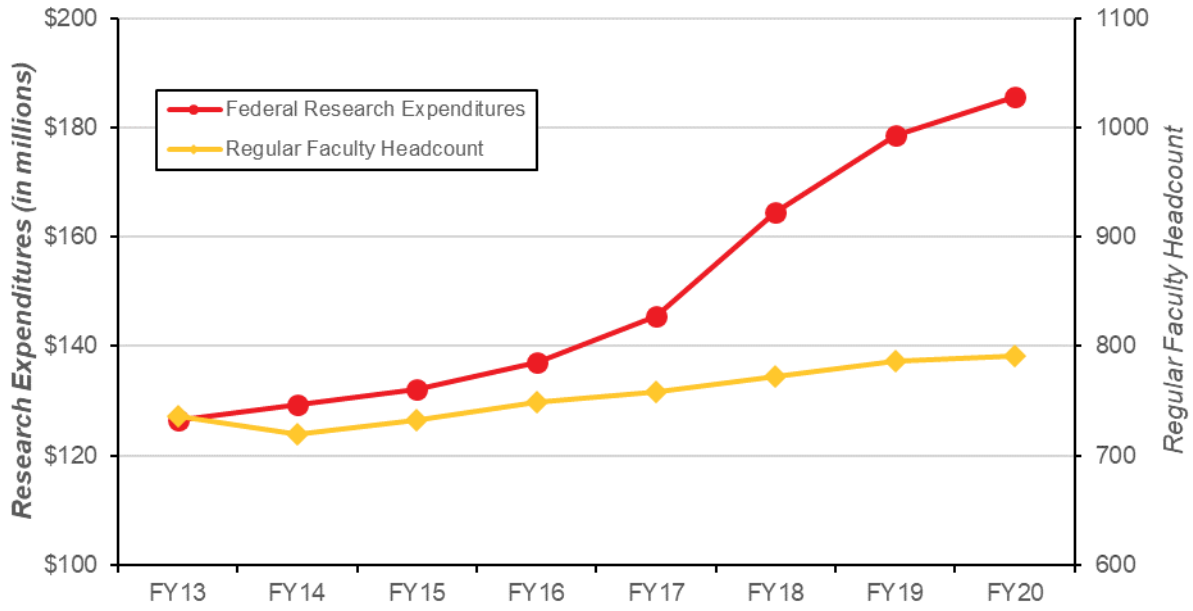
FACULTY

The University has been steadily growing its faculty across most disciplines to support the world-class education and research for which Brown is known, and has been investing in support for faculty to conduct research. While we anticipate additional growth of regular faculty, it will be targeted based on discipline and philanthropic support. Research faculty funded by external grants will likely grow more significantly over the next five to seven years.

Regular Faculty

Brown grew its federal research expenditures by 47% between 2013 and 2020. Over that same timeframe, the University grew its regular faculty by 7%.[6] Figure 6 illustrates the difference between these two metrics.[7]

Figure 6: Growth of Federal Research Expenditures and Regular Faculty at Brown University



The University has also tied incremental growth of tenure-track faculty to specific strategic priorities outlined in *Building on Distinction* and supported by newly established endowed professorships raised during the *BrownTogether* campaign. This is how we plan to continue to grow our faculty over the next five to seven years.

Faculty Time

We know that the most precious resource for faculty – particularly in terms of conducting research – is time. The University has invested significantly over the past few years to free up additional time for faculty to generate new knowledge and scholarship. In particular, the University recently transitioned all tenure-track faculty who had taught four courses per year to a three-course teaching load. This

[6] This growth is different than previously reported in the Introduction due to differences in reporting years.

[7] Data from the *Higher Education Research & Development Survey* and the Office of Institutional Research factbook.

represented a significant investment by the University, which has continued to provide exceptional undergraduate and graduate curricula and a low faculty-to-student ratio. It has also made Brown a national leader and innovator in the humanities and qualitative social science fields.

In the coming year, the University will review the sabbatical policy for faculty, including the frequency and compensation levels offered to faculty for sabbaticals. Given the importance of sabbatical time for dedicated focus on research and scholarship, Brown leadership will review the current policy and report back to the faculty on the findings of this review.

The University also recognizes the importance of internal funding to help faculty leverage their time by supporting graduate and undergraduate students, postdoctoral researchers, and staff positions. The Research Infrastructure: Administrative & Support Services section of this document outlines additional investments for internal research funding.

Research Faculty

One of the primary populations that we anticipate growing over the coming years is research faculty. These positions are largely funded and supported through external grants, with an expectation that over time they develop their own research portfolios and begin building their own research teams.

The University currently employs roughly 100 research faculty members, with nearly 70% dedicated to the **School of Public Health** and the **Division of Biology and Medicine**. We anticipate growing the number of research faculty commensurate with the growth of our research enterprise. We also recognize that doing so will require some investment in ensuring the broader population of research faculty feel supported and have a clear career trajectory at the University.

STAFF

The University employs more than 3,100 staff across campus. There are twice as many staff as there are Ph.D. students and 50% more staff than faculty. While many staff are engaged in supporting Brown's educational programs, a large number of administrative staff members support the research enterprise as well – ranging from human resources and IT professionals to librarians and custodians.

The Research Infrastructure: Administrative & Support Services section of this document highlights several administrative and support functions in the University, such as research administration and the University Library, which will need to grow and scale to accommodate the larger research enterprise. However, Brown will need to scale and hire additional administrative staff members broadly across campus – from the academic departments, centers, and institutes to the central administrative units – over the next five to seven years.

In addition to administrative support staff, staff positions that directly engage in research are increasingly common at universities across the country, particularly in larger laboratory settings in the life and physical sciences. These staff are almost always funded by external grants and often require relevant experience with research at the undergraduate and graduate levels. There are two types of staff research positions: staff who support research programs and staff who actively conduct research.

Research Support Staff

Brown currently employs over 300 staff involved in supporting and managing research programs led by faculty members.[8] Their titles range from Research Assistant and Research Associate to Laboratory Manager and Laboratory Coordinator. Most of these positions do not require a Ph.D. but do require relevant work and research experience. We anticipate that there will need to be significant growth in these positions, commensurate with the growth of our research enterprise.

Staff Researchers

Many peer institutions have established positions classified as Staff Researchers, Staff Scientists, or Research Scientists for individuals who have already received their Ph.D. and often completed a postdoctoral fellowship. These positions are embedded in laboratory teams, most often in the life sciences, and are often on fixed-term appointments that align with grant funding. These researchers have higher qualifications than research support staff and may be supervised by research faculty or regular faculty.

Brown has historically not embraced these types of positions. Only a handful of Staff Scientists are currently employed by the University.[9] The need for these positions has been highlighted by faculty and academic leadership, particularly in the life sciences. To support our growth goals, the University will establish consistent policies for hiring and promoting Staff Researchers in the future.

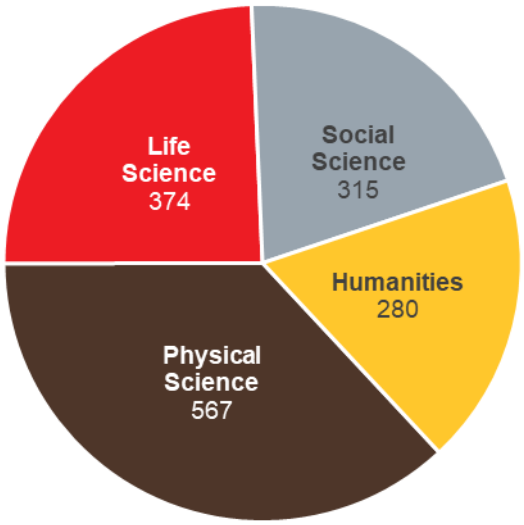
[8] Data from the Office of Institutional Research factbook.

[9] Data from *Workday* as of March 2022.

PH.D. STUDENTS

Brown has historically had one of the smallest populations of graduate students among our peer group. Figure 7 illustrates the breakdown of Ph.D. students by academic division during the Spring 2022 semester. The physical sciences have the most Ph.D. students and the largest programs on average, with the largest – Computer Science – enrolling around 100 total students.[10]

Figure 7: Enrolled Ph.D. Students at Brown University by Academic Division (2022)



Though enrollment statistics are difficult to compare across institutions, we know that Brown is significantly under scale in terms of Ph.D. students. One means of illustrating that point is to compare the ratio of Ph.D. students to undergraduate students. Table 1 illustrates that both in absolute and proportional terms, Brown is significantly smaller than its peers in terms of Ph.D. student enrollment.[11] While many peers have professional and graduate schools that enroll Ph.D. students – the vast majority are enrolled in programs similar to those offered by Brown.

Table 1: Ph.D. and Undergraduate Enrollment at Brown and Select Peers (2021)

Institution	Ph.D. Enrollment	Undergrad Enrollment	Ratio
MIT	4,004	4,638	0.86
Harvard	4,251	6,644	0.64
Stanford	4,720	7,645	0.62
Princeton	2,753	5,240	0.53
Duke	3,481	6,979	0.5
Yale	2,895	6,494	0.45
Chicago	3,224	7,559	0.43
Columbia	3,554	8,448	0.42
Northwestern	3,394	8,330	0.41
Penn	3,445	10,106	0.34
Cornell	3,442	15,451	0.22
Brown	1,519	7,125	0.21
Dartmouth	686	4,556	0.15

[10] Data from *Banner* in February 2022.

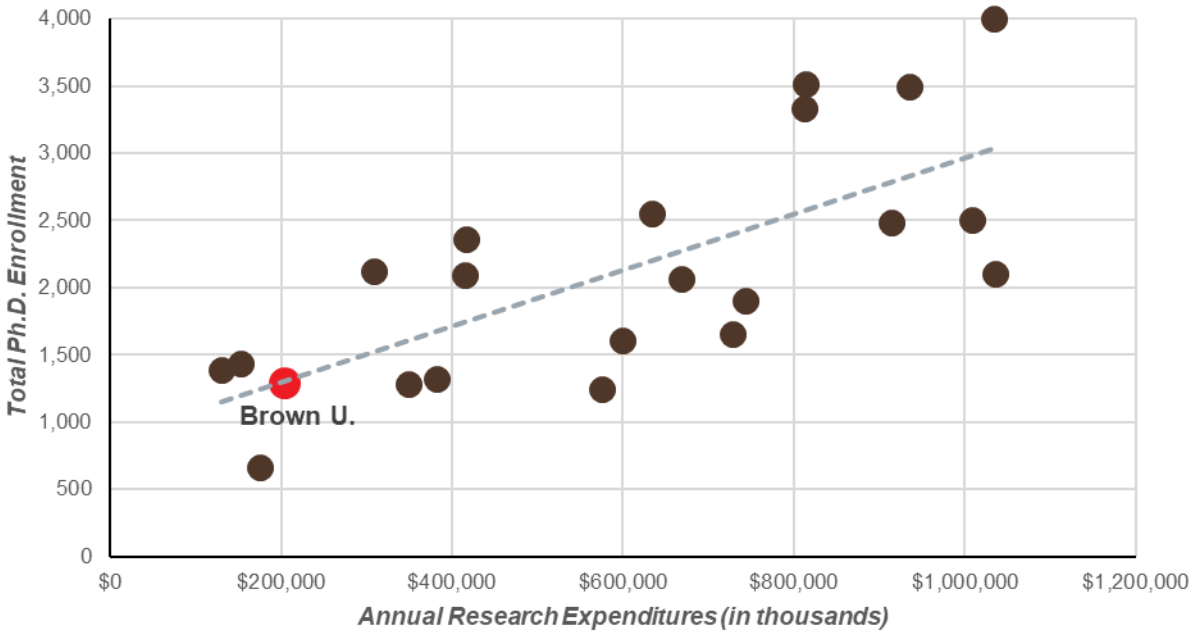
[11] Data from institutional websites as of the 2021 Fall Semester.

Analysis and Projections

We know that growth of graduate student enrollment must be tied not only to our research goals, but also to the desired career opportunities of our graduate students following the completion of their training. For example, there are several disciplines in the humanities where additional growth would be challenging given the difficult academic job market for graduates of those programs and the fact that our graduate students in the humanities aspire principally to academic positions – to a significantly higher degree than their peers in the life, physical, and social sciences. We also assume that most of the incremental growth in Ph.D. enrollment will be largely funded through external grants, with the exception of the students' first or second years of training, when the University provides fellowship funding. We therefore assume that much, though not all, of the growth in Ph.D. enrollment will be focused in the life, physical, and social sciences. However, the University will continue to invest in research and development opportunities for Ph.D. students in the humanities through increased research/travel funds, interdisciplinary collaborations through the Open Graduate Education program, and improved access to support and resources from the University Library.

By comparing total research expenditures at Brown and 15 peer institutions against Ph.D. student enrollment in the life, physical, and social sciences, we actually see that Brown is roughly where we would expect it to be given the size of our current research enterprise. Figure 8 illustrates the relationship between these two metrics based on self-reported data collected by the National Science Foundation.[12]

Figure 8: Relationship between Ph.D. Enrollment and Research Expenditures in the Life, Physical, and Social Sciences (FY20)



By analyzing these data using a simple regression analysis, we can estimate that the University would need to enroll more Ph.D. students to support the doubling of our total research expenditures. This

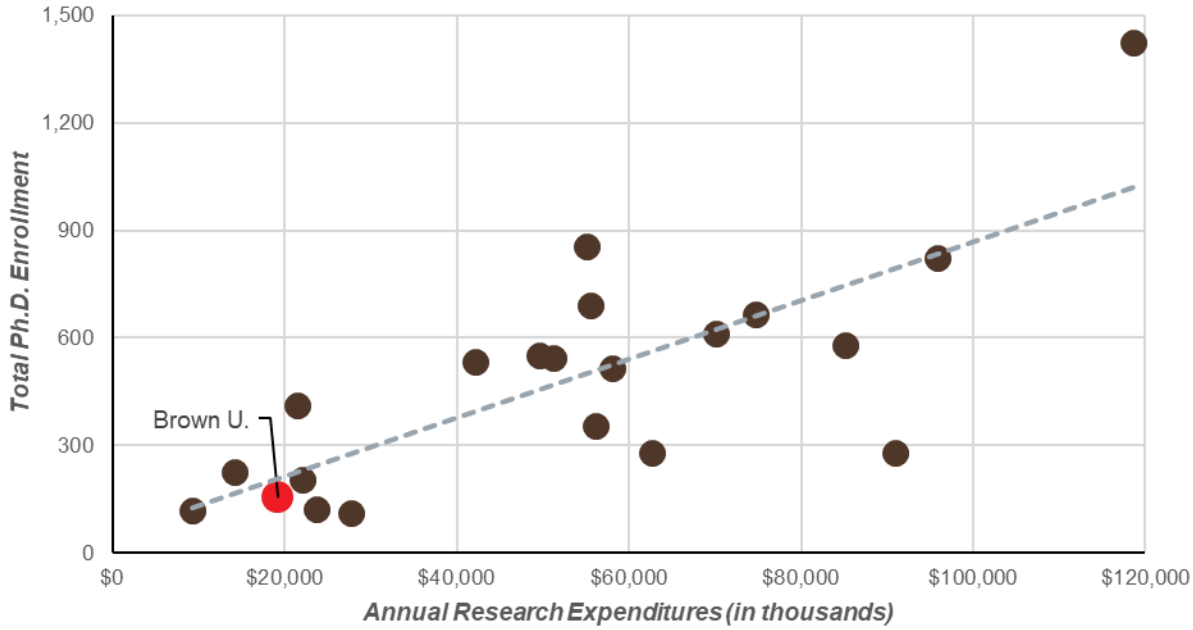
[12] Data from the 2020 *Higher Education Research & Development Survey* and the *Survey of Graduate Students & Postdoctorates in Science and Engineering*.

analysis is directional at best, but helps to illustrate the magnitude of enrollment growth the University may need to pursue.

Discipline-Specific Growth

Certainly, there are differences across the disciplines – even in the current state. For example, despite having the largest doctoral program at Brown, the **Department of Computer Science** has the lowest Ph.D. student-to-faculty ratio among its peer institutions – 3-to-1 compared to 4-to-1 on average.[13] Brown's **School of Engineering** has roughly 150 Ph.D. students but is well under the expected number of students given its current research portfolio. Analyses of NSF data suggest that the **School of Engineering** could enroll another 50 Ph.D. students given its current research portfolio and would need to grow to 350 total Ph.D. students if it were to double its research expenditures. (See Figure 9.)

Figure 9: Relationship between Ph.D. Enrollment and Research Expenditures in Engineering (FY20)



Growth Needs

To support such a large expansion of Ph.D. students, the University will need to increase the amount of funding available for doctoral fellowships and adjust the process through which Ph.D. support is allocated across departments to allow for greater flexibility. We anticipate that additional recommendations will be offered by the forthcoming report from the **Task Force on Doctoral Education**.

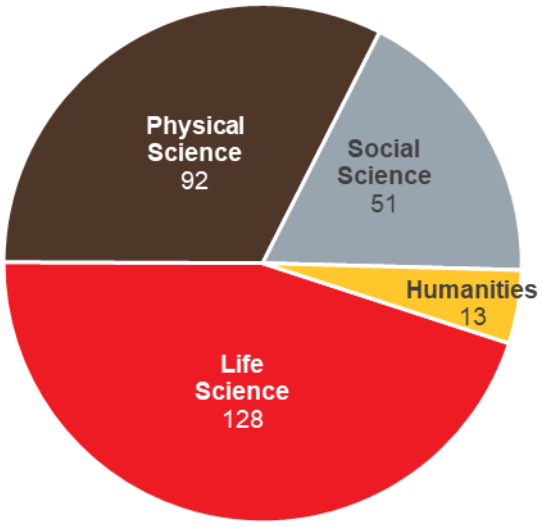
[13] Benchmarking data from Ivy League Computer Science departments, Fall 2021 semester.

POSTDOCTORAL RESEARCHERS

Postdoctoral researchers are often recent graduates of Ph.D. programs who serve on limited-term appointments supporting individual faculty members while building their own research portfolios. These appointments are important to the postdocs, since they provide opportunities to further develop their research skills and scholarship before taking jobs as faculty members or staff researchers. Postdocs are central to the research enterprise of all universities, but Brown has historically had a very small population of postdocs.

During the Spring 2022 semester, Brown employed roughly 285 postdoctoral researchers. Figure 10 illustrates the breakdown between academic divisions, with nearly half in the life sciences and one-third in the physical sciences.[14]

Figure 10: Postdoctoral Researchers at Brown University by Academic Division (2022)



Analysis and Projections

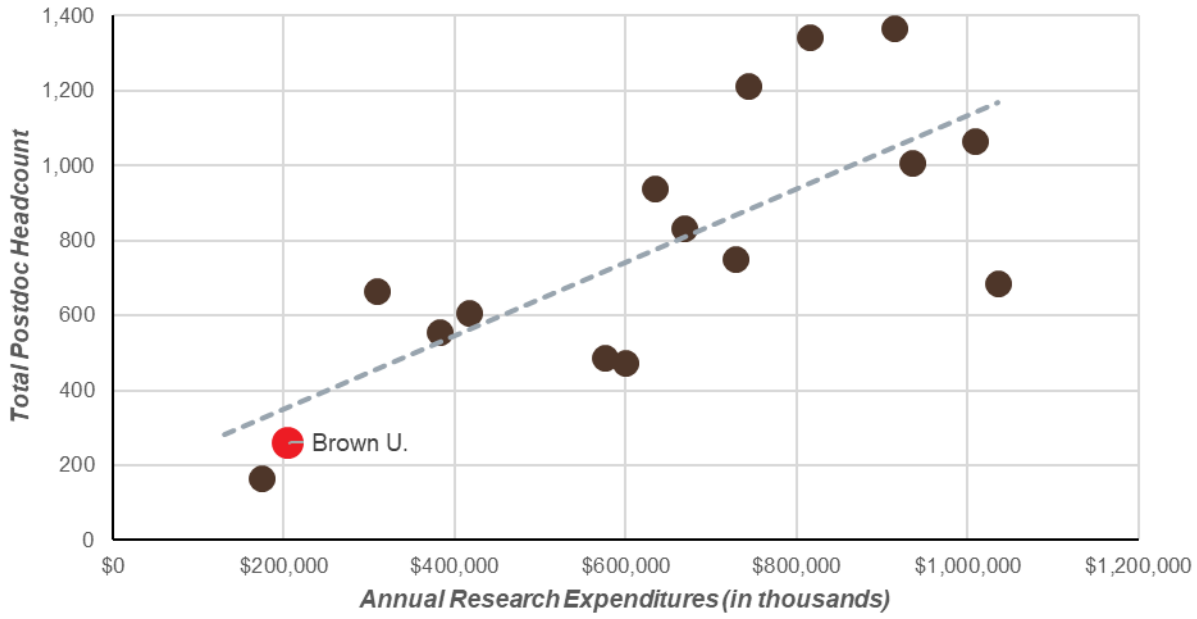
Given that most, though not all, postdoctoral researchers are supported by grant funding, there tends to be a strong correlation between research expenditures and postdocs. By comparing total research expenditures at Brown and 15 peer institutions against the number of postdoctoral researchers in the life, physical, and social sciences, we find that Brown is under scale and has roughly 30% fewer postdocs than we would expect given the size of our current research enterprise.

Figure 11 illustrates the relationship between these two metrics based on self-reported data collected by the National Science Foundation.[15] There is a strong correlation, which illustrates how necessary postdocs are in the research enterprise.

[14] Data from *Workday* as of spring 2022.

[15] Data from the 2020 *Higher Education Research & Development Survey* and the *Survey of Graduate Students & Postdoctorates in Science and Engineering*.

Figure 11: Relationship between Postdoctoral Researchers and Research Expenditures in the Life, Physical, and Social Sciences (FY20)



For illustrative purposes, we can leverage a simple regression analysis on this data to show that the number of postdoctoral researchers employed by the University is roughly 100 less than we might expect given our current research expenditures and that we may need add hundreds of postdocs over current levels if we want to double our research enterprise.

Discipline-Specific Growth

We recognize that the needs for postdoctoral researchers differ across the disciplines, and this growth will not be uniform across the University. For example, based on peer benchmarks, the **School of Engineering** should ideally aim for an average of one postdoctoral researcher for every faculty member.[16] By contrast, laboratories in the life sciences – particularly in the five biology departments in the **Division of Biology and Medicine** – have a much higher need for postdoctoral researchers. Some estimates based on peer benchmarking show that individual Principal Investigators might need an average of three postdocs to support their research. Brown is currently around one-third to one-half that level.

[16] Benchmarking data from Ivy League Schools of Engineering, 2021.

UNDERGRADUATE RESEARCH ASSISTANTS

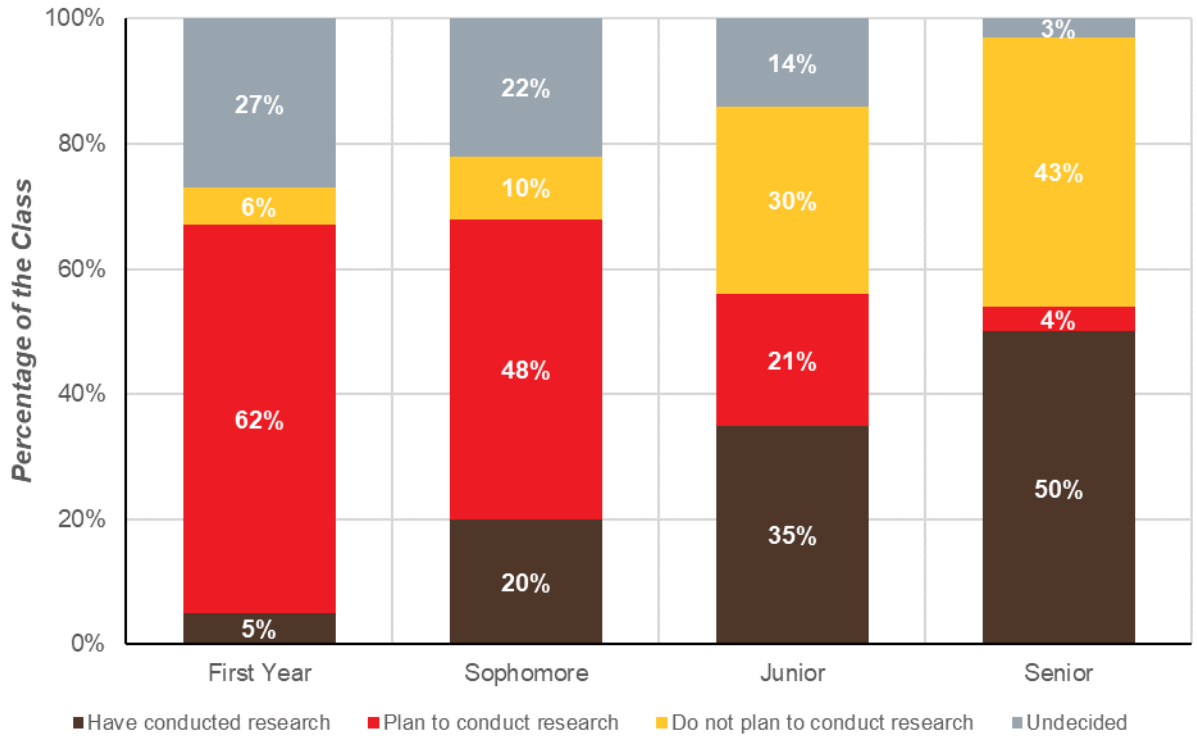
Undergraduate students at Brown have a long history of engaging in research with faculty through:

- The **Karen T. Romer Undergraduate Teaching and Research Award** program (UTRAs), which now is part of the **Summer and Semester Projects for Research, Internships and Teaching** (SPRINT) program;
- Faculty-led research grants from the federal government and other sources, including supplements to existing grants specifically geared toward creating research experiences for undergraduates; and
- Senior thesis projects that often require research experiences with faculty.

By the end of their time at Brown, 50% of undergraduate students report that they engaged in research with a faculty member, with 92% reporting that they were "Generally Satisfied" or "Very Satisfied" with the experience. In addition, 44% of students report engaging in other research experiences (not with faculty) at some point in their time at Brown.[17]

However, as shown in Figure 12, students tend to engage in research later in their time at Brown – primarily in their junior and senior years. We also see a significant drop in the number of students interested in conducting research over their time at Brown.[18]

Figure 12: Proportion of Undergraduates Involved in Research (2021)



[17] Data from the *2021 Senior Survey* conducted by the Office of Institutional Research.

[18] Data from the *2021 Enrolled Student Survey* conducted by the Office of Institutional Research.

Most students who engage in research do so during the summer rather than during the fall or spring semesters. The number of applications for UTRAs – a majority of which are geared toward research – for the 2021-2022 academic year illustrate this trend. Over 800 students applied for summer UTRAs compared to roughly 75 student applications for the fall semester and slightly under 200 for the spring semester. This academic year also represented the highest volume for fall and spring semester applications – prior to the pandemic, on average only 30 students applied for opportunities each semester. This trend is driven by the number of opportunities offered by faculty during the academic year, available funding for semester research opportunities, and awareness of these opportunities by students.

As part of this plan to double research, we aspire to meet the following goals:

- Expand the opportunities for undergraduate students to engage in research so that more students who intend to conduct research have the opportunity to do so by the time they graduate;
- More than double the number of opportunities for research in the fall and spring semesters; and
- Accelerate current trends so that more students engage in research during their first or second years at Brown.

Research Infrastructure: Space

To double its research enterprise, the University needs additional and upgraded space for research across a number of disciplines. As a result, Brown is in the midst of several building projects and space planning studies to evaluate the needs and current spaces across campus.

Brown allocates 1.3 million assignable square feet (ASF) in more than 100 buildings across College Hill and the Jewelry District for research and academic programs, with roughly 880,000 ASF of that space used for externally funded research. This is significantly smaller than many peer institutions. In 2021, the Finance Division, Department of Facilities Management, Office of the Provost, and Office of the Vice President for Research conducted a study of all research spaces which highlighted that Brown uses its research spaces very efficiently and that new research facilities are needed to accommodate even existing research projects. Table 2 illustrates the use of space across campus by academic division.[19]

Table 2: Space Allocation for Research and Educational Programs by Academic Division (2022)

Academic Division	Assignable Square Feet	Buildings[20]
Humanities[21]	342,271	40
Social Science	181,341	36
Life Science	407,142	18
Physical Science	444,804	24

While we anticipate the need to add several hundred thousand square feet of new research space, we also recognize the need to address deferred maintenance of existing research facilities. There are also opportunities to maximize existing research space through targeted reconfiguration or renovation.

Construction and renovation of research space will be the most expensive aspect of this plan, with tentative "all-in" estimates ranging from $700 million to $800 million. The University will fund these capital projects over the coming decade through a combination of debt, fundraising and, possibly, partnerships with other institutions. Ongoing operating and maintenance costs would add between $7 million and $9 million per year to the operating budget, though most of these costs will eventually be funded through indirect cost recovery from grants.

All capital projects will follow the University's usual capital planning processes, will be evaluated against the previously identified guiding principles for growing Brown's research enterprise, and must align with the University's long-term priorities and plans. Although we have a bold agenda for research, it is essential to protect the long-run financial health of the University. The University will also leverage design principles that maximize the flexibility of space, including shared/communal facilities and modular construction to allow efficient reconfiguration.

The following sections outline the initial list of known capital projects and needs related to research. Please note that this is not a comprehensive list of all capital projects. More projects will likely be added over the coming five to seven years based on evolving priorities and available funding. Each project will have a financing plan that specifies philanthropy goals that must be met before construction can proceed.

[19] Data from the *Planon* database maintained by Facilities Management.

[20] Some buildings are used by more than one academic unit or division.

[21] Includes the Lindemann Performing Arts Center, which will be opened in the fall of 2022.

LIFE SCIENCES

The life sciences include some of the most space-intensive research programs across the University:

- The five biology departments and affiliated research centers in the **Division of Biology and Medicine**;
- Four departments and more than a dozen research centers and institutes in the **School of Public Health**; and
- The interdisciplinary **Carney Institute for Brain Science** and the **Department of Cognitive, Linguistic, and Psychological Sciences** (CLPS).

The University has invested in targeted renovations and infrastructure for the life sciences over the past decade, including a floor-by-floor renovation of the Biomedical Center at 171 Meeting Street, renovations of 164 Angell Street for the Carney Institute and the Metcalf Research Building for CLPS, and the extensive renovation of the Medical Education Building at 222 Richmond Street in the Jewelry District.

Despite these investments, the main research facilities for the life sciences are currently at or near maximum capacity, and many need significant investments for renovation and deferred maintenance. These include, but are not limited to, the Biomedical Center, Grimshaw-Gudewicz, Sidney Frank Hall for Life Sciences, Laboratories for Molecular Medicine (70 Ship Street), and 121 South Main Street (School of Public Health).

We are currently investigating the possibility of leasing flexible laboratory space in the Jewelry District to reduce immediate space constraints and are actively planning for relatively large construction and renovations, which are outlined in Table 3. Once new facilities are constructed, we will be able to shift some researchers from the existing research facilities and renovate those facilities accordingly.

Table 3: Capital Projects for the Life Sciences Currently Under Consideration

Facility	Status	Description
Integrated Life Sciences Building (ILSB)	Planning for new construction in the Jewelry District	A large interdisciplinary facility adjacent to other Brown properties in the Jewelry District that would include a combination of wet and dry lab space plus an animal care facility and core facilities and would offer space for researchers from the Division of Biology and Medicine; the Carney Institute for Brain Science; and the Institute for Biology, Engineering, and Medicine.
School of Public Health Building	Planning study underway	A planning study is underway to review options to meet the unique needs of the School of Public Health. The ideal solution would allow the consolidation of the school into one building or several adjacent buildings and accommodate the school's significant growth and anticipated future growth.
Carney Institute for Brain Science Building	Planning for new construction on College Hill	Space on College Hill can provide a dedicated home for the Carney Institute in close proximity to researchers in Neuroscience and other biology departments. This would include significant wet lab space in addition to core facilities and shared equipment.
Biomedical Center + Grimshaw-Gudewicz	Awaiting plans for renovation following the ILSB construction	This aging complex has been the historic home for many of the biological sciences departments and once housed the Warren Alpert Medical School. Several areas of the complex are in dire need of renovation, including the 60-year-old vivarium and some of the research laboratories, but they likely cannot be renovated until space is available in the ILSB or elsewhere.

PHYSICAL SCIENCES

Most of the six physical science departments and the **School of Engineering** are at or near capacity in their current space, despite relatively recent investments in:

- The construction of the Engineering Research Center (ERC) and the extended home for the **Division of Applied Math** at 170 Hope Street; and
- The renovations of the Barus Building for the **Center for Theoretical Physics** and the Geo-Chem Building for the **Department of Chemistry** and the **Department of Earth, Environmental, and Planetary Sciences**.

Many of the lab spaces in the physical sciences are in need of renovation and upgrade, and certain buildings – most notably Barus & Holley and the Center for Information Technology (CIT) – need comprehensive plans for renovation and reconfiguration. The **School of Engineering** and some of the physical science departments will benefit from the new ILSB that is planned for the Jewelry District as there will be space for the new **Institute for Biology, Engineering, and Medicine** (I-BEAM) in the building, but there are still additional needs for space on College Hill.

Table 4: Capital Projects for the Physical Sciences Currently Under Consideration

Facility	Status	Description
Lincoln Field Building (DEEPS)	Renovation underway	The Department of Earth, Environmental, and Planetary Sciences is currently housed across three buildings on campus. This renovation will address much-needed building renewal, accommodate additional growth in the department, and ensure faculty have access to adequate equipment and computational labs.
Physical Sciences Departments	Space study to be started soon	The School of Engineering and most of the physical science departments are near the limits of their existing research space on campus. This study will evaluate the state and usage of existing facilities and identify potential options for renovation and/or construction of new facilities to address needs across the departments.
Barus & Holley	Infrastructure renovations underway	The University has been investing in necessary maintenance and upgrades for Barus & Holley over the past few years and has several additional projects on the horizon. The ultimate plan for the space will be determined by the aforementioned space study for the Physical Sciences and School of Engineering.
Department of Computer Science	Space study underway	The Department of Computer Science is near capacity in the 35-year-old Thomas J. Watson Sr. Center for Information Technology (CIT) due to growth in faculty and graduate students over the years. The ultimate plan for the department will be determined by a space study, with a goal of identifying potential means of accommodating additional offices and research space in the CIT or elsewhere on campus.

SOCIAL SCIENCES

The eight social science departments and nearly 20 interdisciplinary institutes, centers, and programs are spread across campus in dozens of buildings and houses. The University has invested heavily in research spaces for several social science units over the past decade, including the renovation or construction of:

- 94 Waterman Street for the **Center for the Study of Slavery and Justice**;
- 96 Waterman Street for the **Center for the Study of Race and Ethnicity in America**;
- The Nicholson House to support the unification of the **Department of American Studies**, which previously was spread across several locations;
- **Sharpe House** for the **Department of History**;
- **Stephen Robert Hall** for the **Watson Institute for International and Public Affairs**; and
- **164 Angell Street** for the **Department of Education** and the **Annenberg Institute for School Reform.**

Many social science units have sufficient space for the size of their current research programs, though some of the existing buildings need renovation and two areas have maxed out their current space:

- The **Department of Economics** is spread across five buildings – Robinson Hall (50% of faculty), 70 Waterman Street (25% faculty), 8 Fones Alley (20% of faculty), Mencoff Hall (5% faculty), and Blistein House (all graduate students). This sprawl has made it increasingly difficult to maintain department interactions and community.
- The **Department of Education** and the **Annenberg Institute for School Reform** are pushing the limits of their space in 164 Angell Street, and recently converted several public meeting spaces to offices to accommodate new faculty and staff.

The University is considering either renovating existing buildings or constructing a new building for the **Department of Economics** and affiliated research programs near the **Watson Institute for International and Public Affairs** to help create a hub for some social science research programs.

Table 5: Capital Projects for the Social Sciences Currently Under Consideration

Facility	Status	Description
Department of Economics	Beginning a space study	Economics is currently spread across Robinson Hall and four nearby buildings, which makes it difficult to maintain a strong sense of community. A study is underway to determine if a new facility near the Watson Institute would be possible.
Annenberg Institute + Department or Education	Beginning a space study	Both Annenberg and Education have maxed out their current space in 164 Angell Street. A study is underway to examine potential options to move the two units together elsewhere on campus, possibly into space freed by other moves.
Haffenreffer Museum Research Center	Space study underway	The Haffenreffer Museum needs to move from its current complex in Bristol, RI, to protect and preserve the collection. A study is underway to identify a suitable location, prioritizing stewardship of the collection and access for researchers.

HUMANITIES & THE ARTS

The 20 departments in the humanities and the arts occupy a wide array of spaces across campus, from the music facilities centered on Young Orchard Avenue, to the burgeoning arts district emerging on Angell Street, to dozens of smaller buildings scattered across campus. Several prominent interdisciplinary institutes and centers also have significant space for research and teaching on campus, including:

- The **Cogut Institute for the Humanities**, which will move into the newly renovated Andrews House to allow for an expansion of its programs;
- The **Pembroke Center for Teaching and Research on Women**, which will consolidate its faculty and research programs into the historic Pembroke Hall once Cogut moves;
- The **Brown Arts Institute**, which coordinates academic and artistic programming at Brown from its home in the Perry and Marty Granoff Center for the Creative Arts, the David Winton Bell Gallery, and the soon-to-be completed Lindemann Performing Arts Center; and
- The **Joukowsky Institute for Archaeology and the Ancient World**, which moved into Rhode Island Hall on the College Green in 2009.

The University has invested hundreds of millions of dollars in space for the humanities in recent years – especially in the Lindemann Performing Arts Center and Granoff Center for the Creative Arts – and we plan to continue to invest in space for research and innovation in the humanities and the arts over the next five to seven years.

Table 6: Capital Projects for the Humanities and the Arts Currently Under Consideration

Facility	Status	Description
Lindemann Performing Arts Center	Under construction on Angell Street	A new building that will support performance, teaching, and research for music, theater, and dance – along with the creation and staging of experimental, collaborative, and engaged performance work.
Andrews House (Cogut Institute for the Humanities)	Renovation approved to begin in 2022	With the opening of the new Sternlicht Commons and Brown University Health & Wellness Center, Andrews House has been vacated by University Health Services and will be renovated for the Cogut Institute with dedicated office space for faculty, fellows, postdocs, and graduate students. The new space will include collaborative spaces and exceptional facilities for events and seminars.
Churchill House (Africana Studies/Rites and Reason Theatre)	Renovation approved to begin in 2022	This project will expand and transform Churchill House into a welcoming landmark on campus that can accommodate growth in faculty, staff, and graduate students in the Department of Africana Studies. The project also significantly increases facilities for the historic Rites and Reason Theatre.
Center for Artistic Design and Production	Planning underway	To increase the visibility and quality of arts programming and research, Brown will build a state-of-the-art shop to allow Brown Arts Institute faculty and staff to make and design sets, costumes, and props for their innovative shows.

Research Infrastructure: Administrative & Support Services

In addition to expanded and improved research space and additional people engaged in research, the University will need to increase and improve research support services and resources across campus. Such support includes but is not limited to:

- **Library Resources.** Providing appropriate staffing, databases, journals, collections, and technology are foundational elements of the research enterprise, and it is essential that the University Library keep pace with Brown's growth in research excellence.
- **Internal Research Funding.** Seed funding and small grants to allow researchers – faculty, postdocs, and graduate students – to pursue professional development opportunities and initiate early-stage projects.
- **Research Administration.** Upgrade and streamline research administration processes across the University through a combination of policy changes, process improvements, investments in people and systems, and collaborations with allied health systems.
- **Computing Infrastructure.** The future of research across all disciplines will require, at least in part, significant computational capabilities and expert technical staff to support quantitative analysis of large datasets.
- **Service Centers and Cores.** Additional specialized equipment, services, and resources for research will be needed across the disciplines, such as new Research Core Facilities in the sciences – like MRI and PET machines – and common specialized services like survey development and statistical analysis.
- **Faculty Development Programs.** Training and development programs that help faculty learn how to prioritize the demands on their time, develop and submit successful grant applications, manage teams and laboratories, and keep up their technical skills.

These investments will be scaled over the next five to seven years and will be based on the principles outlined previously. It will be critical to ensure investments are targeted and coupled with close evaluations of our existing processes, policies, structures, and systems. Our goal is to make research and scholarship at Brown easier and more seamless – and while we know that the University will need to increase headcount and funding in certain support areas, we also know that we can achieve some efficiencies and improvements in the current state through changes in our current policies and systems.

LIBRARY RESOURCES

World-class research universities depend upon world-class research libraries.

Over the past decade, Brown's Library has strengthened its support for the University's growing research profile. The Library has expanded the number of staff and span of expertise to furnish the kinds of specialized information services and other forms of support that researchers require to do first-rate work. Librarians' specialized services and time are increasingly written into external funding proposals, particularly with respect to impact evaluation and data management. Roughly half of the Library's collection budget is dedicated to the acquisition of journal databases, datasets, and other resources to support STEM, and the demand for these fundamental tools of research continues to grow. The shift to more data-driven social sciences research at Brown is driving demand for expert services and new scholarly resources for these fields. The Library has also developed specialized expertise in Digital Humanities.

Continued growth in the scale of Brown's research enterprise will require an increase in the Library's capacity to deliver expert services, scholarly resources, information technology, and facilities. Investments in three core resource areas are needed to support the ambitious goal of doubling the research enterprise:

- **Research Support Expertise.** Adding staff expertise in certain areas of research support services and specific high-need disciplines;
- **Scholarly Information Resources.** Expanding access to the scholarly literature and other information tools necessary for achieving academic excellence; and
- **Research Access Systems.** Investing in additional or upgraded technology systems to improve access to scholarly materials and information sharing.

INTERNAL FUNDING

The University commits millions of dollars every year to support research. There are a number of funding programs offered to current faculty to support early-stage research projects, professional development related to research, and grant proposals. Doubling research at Brown will require investments in five key areas:

- **Start-Up Funds.** Start-up funds are offered to faculty when they begin their appointments at Brown to support them in launching their research programs. In general, the University offers very competitive start-up packages to ensure we can recruit top faculty.
- **Competitive Grants and Awards.** There are dozens of competitive grant and award programs across the University to support early-stage research projects or high-impact research that may not be easily funded through external sources. These include the Seed Awards, Salomon Awards, Zimmerman Innovation Awards in Brain Science, and Humanities Research Funds. Previous analysis indicates that seed funding has a very high return on investment, in the form of new external research awards.
- **Cost Share Funding.** Some sponsor organizations require that the home institution provide a portion of the funding required for certain research projects, and in some cases the competitiveness of a proposal depends on institutional support. Cost share is normally funded through various University sources.

These different sources of research funding are either offered centrally – through the Office of the Provost, the Office of the Vice President for Research, or the Dean of the Faculty – or locally through separate pools in the schools, departments, institutes, and centers. The local funding pools are either University funds that have been allocated to those units or endowments and gifts that are earmarked for specific research purposes.

As part of this growth plan, the University will double the amount of internal funding for competitive grants and cost-sharing programs across all disciplines to support research growth. The University will evaluate all major funding programs across disciplines to determine how much additional funding should be allocated to these programs in the future.

FACULTY DEVELOPMENT PROGRAMS

Faculty face demands on their time for teaching, research, service, and administrative matters. To help faculty advance their careers and increase their research productivity and scholarship, the University will coordinate central mentoring, training, and development programs focused on:

- Applying for external grant funding, including large center and training grants;
- Managing external grants and internal funding, including start-up funds;
- Maintaining technical skills required to stay abreast of new developments in science and technology; and
- Leading and managing teams of researchers, especially laboratory teams.

These programs will provide faculty with the skills, tools, and resources to manage the multiple demands on their time, and advance their research portfolios. These programs will also help junior faculty efficiently and effectively grow their research portfolios and gain critical skills related to management and grants administration.

RESEARCH ADMINISTRATION

Growing our research enterprise will require additional investments in research administration across the University, including:

- **Research Strategy and Development.** Stewardship and support for University research initiatives, large multidisciplinary research teams, early career faculty, complex grant proposals, prestigious awards, and internal research funding programs.
- **Pre-Award.** The development, review, and submission of grant proposals, followed by the negotiation and acceptance of award agreements.
- **Post-Award.** The management of grant funding, including ensuring compliance, managing subawards, reporting, and closing out completed awards.
- **Research Integrity.** A wide array of groups and functions, including the Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), Conflict of Interest Review Board, Stem Cell Use Committee (ESCRO), and Institutional Biosafety Committee (IBC).
- **Research Contracting.** The procurement of goods or services to support research activities in compliance with University and sponsor policies.

- **Technology Innovation.** The management of the University's patent portfolio and commercialization strategy.

Most of these processes are currently distributed across a number administrative and academic units. Many Brown researchers have expressed concerns about the efficiency and effectiveness of these processes. The University has commissioned an external review of our broader research administration functions in order to improve these functions and scale them over the coming five to seven years. This review will cover all academic and administrative units involved in research administration. All of the research administration functions will be evaluated across the following four dimensions:

- **Structures:** How staff supporting research administration are organized and structured, including reporting lines and team structure along with job titles, descriptions, and responsibilities.

- **Staffing Levels:** What levels of staffing will be required to support significant growth of the research enterprise.

- **Systems:** What technology systems used to support research administration should be upgraded or implemented to support growth of the research enterprise, and what, if any, functionality or systems are redundant, unnecessary, or inefficient.

- **Policies, Practices, and Processes:** How policies, practices, and processes should be developed and designed to optimally, ethically, and legally support significant growth in the research enterprise.

Additional research administration staff will be required both in central administrative units like the Office of the Vice President for Research and individual academic units. However, we believe that it will be possible to streamline our processes through investments in systems and adjustments in our policies and practices, so that research administration costs do not scale at the same rate as our broader research enterprise. These investments will be critical to our ability to meet the goal of doubling our research enterprise.

COMPUTING INFRASTRUCTURE

Research in all disciplines increasingly requires access to strong computational capabilities, and some of the highest needs commonly expressed by researchers across the University are for:

- High-performance computing infrastructure that can be used to analyze large datasets; and

- Support for and training on methods of computational and data analysis.

Common databases and computing infrastructure often require significant time and investment to build well, and the University runs a risk of overlapping and duplicating resources without central support. The University is also seeing a high demand for trained data scientists from a number of disciplines, but is facing an increasingly competitive job market for such specialized personnel.

The University will continue investing in computing support across disciplines through administrative support units like the **Center for Computation and Visualization** and the **Office of Information Technology** and interdisciplinary academic units like the **Data Science Initiative**.

- The **Center for Computation and Visualization** supports faculty through a team of staff data scientists and by hosting specialized hardware and complex software programs such as

Artificial Intelligence and Machine Learning libraries. The CCV will require significant investments to remain on the cutting edge of technology and to recruit and retain support staff.

- The **Office of Information Technology** currently maintains the University's high-performance computing infrastructure, and will require a significant investment to upgrade the power and cooling systems, expand the central storage capacity, and replace the campus datacenter. These investments will be required to continue meeting the University's existing research needs, and will need to be scaled with additional growth.

- The **Data Science Initiative** is developing a community of computational and data scientists across the University, including staff, faculty, and students, to provide continuing training and education, build capacity across academic units, and help retain critical data science specialists.

SERVICE CENTERS AND CORES

Service centers, such as Research Core Facilities, are shared resources that provide broad access to research instruments, equipment, technologies, and services to researchers across the University. Staff affiliated with these service centers often have advanced scientific or technical training and provide expert consultative services. As shared resources, service centers provide widespread benefits for the research enterprise by providing researchers with access to equipment and technologies that they could not support individually in their own academic units or laboratories.

Service centers are funded by charging for goods or services provided to users within the University and external to the University. All service centers are expected to recover no more than the aggregate annual costs of their operations through charges to users, and many require a subsidy from the University to help cover the costs of maintenance of the cores, procurement of additional equipment, or staff support.

Service centers are extremely beneficial for building research programs, increasing competitiveness for external grant funding, facilitating interdisciplinary collaboration, and recruiting new faculty members, postdocs, and students.

Research Core Facilities

Research Core Facilities often revolve around expensive scientific equipment and specialized technical staff. Cores must comply with federal regulations and/or policies from funding sponsors, including annual reviews and audits. The Office of the Vice President for Research, the Controller's Office, and the Division of Biology and Medicine support many of the cores across the University, but other service centers are managed by individual schools, departments, institutes, and centers.

Developing and maintaining core facilities in particular is expensive. In the last few years, the University has invested increasing levels of funding in core facilities. The current list of cores includes:

- **Cores Supporting the Biological and Life Sciences:** Bioimaging, Flow Cytometry, Genomics and DNA Sequencing, Magnetic Resonance Imaging (MRI), Media Prep, Molecular Pathology, Mouse Behavioral Phenotyping, Mouse Transgenics and Gene Targeting, Proteomics, BioBank, Structural Biology, and XROMM.

- **Cores Supporting Engineering and the Physical Sciences:** Mass Spectrometry, Environmental Chemistry Analysis, Electron Microprobe and Microscopy, High Pressure Liquid Chromatography, Nuclear Magnetic Resonance, Nano Tools, Nanofabrication, Instrument Shop, and Fluid Mechanics.

There is a need for a more systematic, ongoing structure for funding, developing, maintaining, and overseeing Research Core Facilities across the University to ensure that Brown:

- Realizes the maximum benefit from these valuable and expensive resources;
- Leverages these common resources to meet our goal of doubling the research enterprise; and
- Limits the duplication of expensive services and resources across academic units.

Over the next five to seven years, the University will increase its subsidy to support central core facilities and infrastructure, and will conduct an analysis to determine appropriate levels of ongoing support given our growth ambitions and plans to further expand the number of cores. We will also adjust our policies to ensure resource allocations are made with the highest return on investment and alignment with institutional research priorities.

Other Service Centers

Academic units across the University have established and are developing new service centers focused on expert technical and consultative services. Many of Brown's peer institutions maintain similar service centers, covering functions like:

- Statistical analysis;
- Survey development, distribution, and analysis; and
- Program evaluation and assessment.

While they do not have the same level of regulation and central oversight as cores, these service centers can still provide broad benefits across the research enterprise. The University will identify high-demand research services across disciplines and build out central capabilities over the next five to seven years.

Signature Initiatives

The second track of this research plan focuses on investments in a small number of signature initiatives, each tied to one of the integrative themes of *Building on Distinction*. This is a preliminary list of initiatives, to be further refined over the course of the summer, based on feedback from the community.

To maximize the impact of growing our research enterprise, Brown must continue to grow in ways that build on existing areas of distinction, align with the University's culture and ethos, and support broader societal priorities. *Building on Distinction* and the subsequent operational plans identified nine integrative themes that guided targeted investments in academic units and programs across campus. To achieve the goal of doubling research, the University will continue to invest in signature initiatives that align with these integrative themes and adhere to the following principles:

- **Distinctive Strengths.** Signature initiatives must build on Brown's academic strengths and have the potential to become top research programs – both at Brown and across the world – with targeted investments and resources.
- **Interdisciplinary Breadth.** Signature initiatives must engage multiple disciplines and have the potential to benefit several academic units, including faculty and students not directly affiliated with the initiatives.
- **External Support.** Signature initiatives must have the potential to attract external grants and philanthropic donations, aligning with known funding priorities from federal agencies, private foundations, corporations, and donors.

The following sections include 10 examples of signature initiatives that illustrate the kind of world-class research programs that can help propel Brown to the next level of excellence and distinctiveness. Each initiative falls under at least one of the integrative themes in *Building on Distinction* (outlined in Figure 13). Several other viable and interesting proposals for signature initiatives are mentioned in the Appendix.

Figure 13: Signature Initiatives aligned with the Integrative Themes from *Building on Distinction*

EXPLORING HUMAN EXPERIENCE

CREATING COLLABORATIVE HUMANITIES LABORATORIES

Vision	Brown will be a leader of collaborative humanities research that is important in understanding the human experience and addressing urgent societal challenges.

Collaboration in and with the humanities is a transformative methodological practice. Empowering humanities scholars to approach their research in collective contexts fosters innovative hybrid approaches and foregrounds the critical role that the humanities can play. The testing of perspectives, interrogation of narratives, and elaboration of interpretive arguments are crucial for any project that aims to understand human experience and have an impact on urgent societal challenges.

The **Cogut Institute for the Humanities** serves as a dynamic locus of activity, a collaborative "hub," for programming, cross-disciplinary research, and curricular innovation across the 20 humanities departments at Brown. Since becoming an institute in 2017, Cogut-affiliated faculty have developed signature research and teaching programs in the collaborative humanities while incubating several theme-based initiatives, from Black Visualities to Environmental Humanities.

Cogut focuses on cultivating research, scholarship, and teaching through a transformative method that ensures a multiplicity of perspectives, disciplines, and voices are represented by:

- Approaching humanities work in collective contexts;
- Catalyzing integrative research;
- Enriching professional experiences and training in the humanities; and
- Centering the critical role of the humanities to understanding human experience and impacting urgent societal challenges.

Cogut has also focused on promoting collaboration on the most challenging questions facing humanities scholars, most notably through its innovative **Doctoral Certificate in Collaborative Humanities** – the first such program in the country – which manifests Brown's Open Curriculum at the graduate level and promotes interdisciplinary study.

THE INITIATIVE

Cogut aims to build team-based, time-bound **Collaborative Humanities Laboratories** led by Brown faculty from across the humanities and humanistic social sciences to address urgent societal challenges and complex research questions. The concept of team-based research would be fairly novel in the humanities, leveraging a model more akin to laboratory teams from the life and physical sciences where faculty lead teams of undergraduate and graduate students in researching and producing scholarship.

The truly unique aspect, which builds on Brown's well-known interdisciplinary culture, is the structure: Each lab would be led by a pair of faculty members from **different disciplines** who would be expected to team-teach and conduct research on an **integrative theme** with the support of several dedicated graduate and undergraduate research assistantships. Labs would also be responsible for developing a defined three-year research plan and report outcomes annually including:

- Peer-reviewed publications;
- Programming; and

- Other forms of research dissemination (e.g., websites, podcasts, videos, exhibits).

THE IMPACT

This innovative, team-based approach to humanities research would enhance scholarly community and research opportunities for students and faculty and support Brown researchers in addressing urgent societal challenges and complex research questions. By collaborating across disciplines, Cogut can shed light on the implications of these pressing questions, their answers, and the coming changes they reveal.

These labs and the scholarship they produce may also evolve into longer-term initiatives or centers based at Cogut or any of the participating departments, which would allow Brown to continue advancing the innovative interdisciplinary research started in the labs. For example, the **Environmental Humanities** initiative, which started initially as a research project, has evolved and grown through the collaboration of nearly 20 faculty from several departments and now aspires to become a center in its own right.

These labs would also create spillover benefits across and beyond the humanities departments – through the connections and community created between faculty and students, through a broadening of networks across campus, and as an incubator of new ideas for scholars to pursue after the completion of their three-year labs.

THE INVESTMENT

Since the collaborative humanities labs are focused on engaging scholars and students from multiple disciplines over three years, Cogut will need dedicated funds to support faculty and students over the course of these three-year projects. While the investment would necessarily change depending on the proposal, each lab would need on average:

- **Scholars.** Faculty appointments for existing Brown faculty with appropriate teaching buyouts from the relevant departments, divisions, and schools.
- **Students.** Full-year research fellowships for graduate students and research fellowships or awards for undergraduate students.
- **Space.** Collaborative work and common space available through Cogut's new home in Andrews House (formerly University Health Services).
- **Support.** Administrative and communications staff support to facilitate the development and dissemination of the integrative scholarship.

Cogut aims to start with one lab at a time, but with adequate funding, Cogut would ideally be able to support multiple labs in the future as well. There is very little federal funding for the humanities, and funding from foundations and individuals will be needed to implement these labs.

CREATING PEACEFUL, JUST, AND PROSPEROUS SOCIETIES

COMBATING INEQUALITY

Vision	Brown will develop a nationally prominent research program focused on unpacking the drivers of economic inequality and identifying policy solutions through computational and quantitative analysis.

Economic growth and the resulting distributions of income and wealth are increasingly inequitable in the United States. For example, the share of U.S. wealth held by the top 1% of the population has risen to 35%. This share has nearly doubled since 1980 and now exceeds the share of wealth held by the entire bottom 90% combined. This concentration of wealth (as well as income) has not been seen since "the roaring 20s" in the years before the Great Depression.

This growth in inequality has not only driven ever-widening gaps between households but also led to sharply reduced intergenerational mobility. Children born in 1940 had more than a 90% chance of achieving a standard of living greater than their parents, but this high rate of achieving "the American dream" had fallen to just 50% for those children born in 1980. Mobility continues to be lower for children from historically disadvantaged racial and ethnic groups. More generally, America is a land in which the circumstances of a child's birth – whether due to the location, socioeconomic status, race, ethnicity, or other aspects – significantly affect their opportunities in life.

Inequality and socioeconomic mobility are increasingly focal issues across a wide range of academic disciplines at Brown and at other major research universities in the U.S. Brown is planning to establish a **Center for the Study of Inequality** which would unite researchers from across the social sciences and leverage core empirical methods and big data analytics to understand the drivers of inequality and identify solutions through policy interventions. This Center would leverage existing strengths from across the University – especially the **Department of Economics**, the **Watson Institute for International and Public Affairs**, and the **Data Science Initiative**, plus the departments of **Education**, **Political Science**, **Computer Science**, and **Sociology**.

THE INITIATIVE

The Center would combine existing expertise in data modeling and empirical methods from across the University with an emerging trend in the structure of social science research. Large, empirical research projects now demand a wide base of expertise and support from faculty, postdoctoral researchers, staff scientists, and graduate assistants. This model of team- or lab-based research is fairly novel in the social sciences, where traditional research methods tend to be more individualized. This new model is more akin to laboratory teams from the life and physical sciences where faculty lead teams of researchers for each project. This model is necessitated by the increased scale and complexity of projects, which demand a broader range of expertise and larger commitment of effort from researchers (particularly those with experience in empirical methods). The model also requires additional research infrastructure, in the form of team-based appointments, collaborative space, and access to computing services.

Existing research projects and expertise among the Brown faculty would provide an established foundation for the Center as well, by bringing together over 30 distinguished faculty from a variety of disciplines and academic units focused on:

- Measuring inequality and upward mobility in the U.S. and other developed societies;
- Understanding the causes and consequences of inequality within areas such as education, neighborhood environments, healthcare, and the criminal justice system, as well as policy solutions within these areas that could enhance equality of opportunity; and

- Understanding how economic disparities and inequalities are tied to demographic characteristics like race, ethnicity, and gender.

The Center would also focus on developing a pipeline of diverse junior researchers in the social sciences by integrating early career and predoctoral scholars from underrepresented groups into research projects. Through fellowships and training programs, the Center would develop the next generation of empirical social scientists and help reduce racial and ethnic disparities within the social science disciplines.

THE IMPACT

Building on Brown's strength in empirical methods and the social impact ethos across campus, researchers in the Center for the Study of Inequality would help shape our understanding of the root causes of inequality and identify policy interventions to promote economic equality and equity. The primary output of the Center would come through its research releases, which will include both research papers and datasets (such as the Opportunity Atlas) to support broader research and policy efforts. The Center would additionally help advance the application of quantitative and computational tools to complex research questions related to inequality through a new approach to empirical team-based research. Finally, by emphasizing opportunities for students and junior scholars to engage in this research, Brown will be helping to develop and diversify the pipeline of future empirical social scientists.

THE INVESTMENT

Funding for research on economic inequality has been steadily increasing due to interest from several prominent foundations focused on social impact – most notably the Russell Sage Foundation, the Ford Foundation, the Mellon Foundation, and the William T. Grant Foundation. While there is some limited federal funding available (for example, from the National Science Foundation), the University will likely need to fundraise for additional support to ensure the Center can support a broad array of scholars and students across a variety of disciplines.

Given the depth of expertise in economic inequality, the University will likely rely on the more than 30 existing faculty members performing related research. Funding priorities will therefore largely focus on junior researchers, such as:

- **Students:** Full-time predoctoral research assistants, graduate students, and several undergraduate research assistants.
- **Scholars.** Postdoctoral researchers, visiting faculty members, and staff research scientists.
- **Support.** Administrative staff to support the maintenance of broad research teams, the hosting of academic research events, and the dissemination of research findings through briefings and public communications.
- **Infrastructure:** Increased access to prominent databases, computing resources, and means of research dissemination.

IMPROVING POPULATION HEALTH

PREPARING FOR AND RESPONDING TO PANDEMICS

Vision	Brown will be a global leader in multidisciplinary, evidence-based research that helps detect pandemic threats, mitigate the impact of pandemics, and ensure equitable treatment for all members of society.

COVID-19 has exposed an uncomfortable reality: We are living in an age of pandemic threats. The frequency with which new pathogens have emerged and spread to cause outbreaks has steadily increased and is now more than four times that observed before 1950. The economic, social, and health impacts of pandemics are vast and long lasting, and the current pandemic has affected behavior, economic activities, education, arts and literature, and other key aspects of our lives in ways that are not yet fully understood. Our society is facing an inflection point where we need to both continue responding to the current pandemic and plan to prevent/mitigate the impact of future outbreaks.

Brown is developing a **Pandemic Center** housed in the internationally renowned **School of Public Health** (SPH) which would examine key questions in pandemic preparedness, train people on how to effectively respond, and translate rigorous research into innovative policy. Brown has already become a national leader on pandemic-related issues. Several Brown faculty members are internationally recognized experts on COVID-19 and have been regularly asked to weigh in on international and domestic policy developments and to testify before Congress on emerging pandemic legislation and issues.

SPH is also leading a national effort to coordinate states on policies and interventions related to COVID-19 testing, vaccinations, supply chains, and school operations, and research projects to study the epidemiology and impacts of Long COVID, understand the effect of COVID-19 on opioid use disorder, and to improve tracking and reporting of COVID-19 cases. SPH faculty have also been performing critical research, such as analyzing the relationship between social factors (e.g., income, job type, geography) and mental health during the pandemic. This deep expertise will be coupled with academic strengths related to the pandemic research from across the University, including:

- Psychologists, who have been uncovering the relationship to between political partisanship and public support for pandemic control measures;
- Communications experts, who have been conducting cross-cutting research to identify and combat the online spread of COVID-19 (and other health-related) disinformation; and
- Economists, who have conducted cutting-edge research on the mitigation of COVID-19 in K-12 classrooms and the impact of the pandemic on our educational systems and students; and
- Sociologists, who have been leading national efforts to qualitatively capture the day-to-day experiences of ordinary Americans during the pandemic.

THE INITIATIVE

Through a core team of researchers, the Pandemic Center would sponsor and support independent research projects focused on generating new knowledge about pandemic threats and how to stop them by:

- Conducting analyses of pandemic-related data, policies, and practices;
- Improving disease modeling that is used to forecast threats and inform decision-making;
- Investigating lessons learned from the current pandemic and prior outbreaks; and

- Working closely with practitioners to pilot new, evidence-based approaches.

The Center would also focus on research related to disease surveillance, public health readiness, health system resilience, crisis communication, and workforce training – focused not just on handling the current pandemic but on preparing for future ones. Knowledge from fields outside of public health, such as economics, political science, international relations, ecology, and demography, is also critical to understanding the risks associated with pandemics. Further partnerships with the **Warren Alpert Medical School**, the **Watson Institute for International and Public Affairs**, the **Data Science Initiative**, and a wide array of academic departments would help the Pandemic Center become a truly unique and interdisciplinary research hub and help Brown become one of the most trusted institutions for public health worldwide.

THE IMPACT

By conducting interdisciplinary research and linking efforts from across the entire University, Brown's Pandemic Center will be unique among centers focused on preparedness in its treatment of pandemics as not just pathogens that needs to be controlled, but as complex, society-wide events with myriad health, economic and social impacts that need to be addressed. Building the Pandemic Center with an explicit charge to engage with policy makers, media, and the public on rising policy issues will also differentiate it from other academic centers that typically engage with these audiences secondarily. It will be a clearing house for the best evidence on key policy issues and synthesize that evidence for decision-makers. Faculty from the Center will collaborate with and educate journalists about translating key concepts to broaden public understanding, disseminate information using best practices in 21st-century crisis and risk communication, and develop novel approaches for public health and medical officials to combat misinformation and consistently build trust in their communities.

THE INVESTMENT

The NIH has publicly indicated in its recently released five-year strategic plan that it will invest significantly in research related to pandemics, from disease prevention to treatments and cures. Several prominent foundations, including the Rockefeller Foundation, have also committed billions of dollars for research on the current pandemic. However, many important issues are not being sufficiently addressed or funded by government or foundation partners. Governments around the world are largely focused on responding to the COVID-19 emergency – not on evaluation of performance during this pandemic or prevention of future pandemic crises. Though there was significant funding allocated for COVID-19 research at the start of the pandemic, funding from some sources is already starting to lapse, signaling the potential for waning political support to address long-term pandemic preparedness needs.

To ensure adequate support for the Pandemic Center – especially in its infancy – Brown will need to secure a baseline of philanthropy to support cutting-edge research and translation to policy action, including:

- **Scholars.** New tenure-track faculty and Professors of the Practice, in addition to a center Director who is also a tenured faculty member.
- **Space.** Shared dry lab space proximate to other Brown public health and biomedical researchers plus external partners like the Rhode Island Department of Health.
- **Support.** Administrative, scientific, and communications staff members to support research and public dissemination of research developed by the Center.

UNDERSTANDING THE HUMAN BRAIN

DETECTING AND TREATING ALZHEIMER'S DISEASE

Vision	Brown will build a world-class research program in Alzheimer's disease and related dementias that enables greater understanding of the disease and focuses on early detection/individualized treatment.

Memories define us as human beings and anchor our sense of belonging in society. Alzheimer's disease and related dementias can erase those memories and rob us of our independence. This disease is a global and urgent concern. In 2016, 43.8 million people lived with Alzheimer's disease, an increase from 20.2 million in 1990.

Brown has existing strengths in Alzheimer's disease research, from genes to cognition, and in the care of patients with dementia. Through over 60 campus-based faculty and many more hospital-based partners, Brown receives nearly $40 million in Alzheimer's disease funding per year, ranking us 20th in funding nationally. With generous philanthropic support, the University recently established the **Center for Alzheimer's Disease Research** as a joint initiative between the **Robert J. and Nancy D. Carney Institute for Brain Science** and the **Division of Biology and Medicine** that focuses on discovering and advancing understanding of the mechanisms of the disease in a reinforcing cycle informed by biological and patient-focused research and developing a pipeline of commercializable technology, novel diagnostics, and innovative therapies.

This new Center will also build on Alzheimer's disease research taking place in other academic units, most notably the **Center for Gerontology and Healthcare Research** in the **School of Public Health,** which received the largest grant in the University's history to help build the nation's capacity to conduct pragmatic clinical trials of interventions for people living with Alzheimer's disease or related dementias.

THE INITIATIVE

A new level of collaborative creativity, innovation, and knowledge-sharing will be necessary to change the current trajectory of Alzheimer's disease in our society. The Center for Alzheimer's Disease Research will build on Brown's unique culture of cross-disciplinary, cutting-edge scholarship to facilitate communication, collaboration, and the integration of knowledge across the University and in affiliated hospitals; hire key faculty; and create shared research projects across disciplines. The Center will bridge basic, clinical, and population health research through the following approaches.

- **People.** Building a critical mass of Alzheimer's disease-focused experts through strategic collaborations and key faculty recruitments in areas that will add essential capabilities, including bioinformatics and neuroimmunology.
- **Infrastructure.** Establishing the communications and operational infrastructure to bridge across research projects and expanding access to uniquely valuable human-derived data and samples by supporting the collection, integration, and maintenance of these data and samples.
- **Community.** Providing the incentives and funding to encourage collaborative research across disciplines, attract talented early-stage scientists from undergraduates through junior faculty, and build national and international collaborations that expand Brown's reach and impact.
- **Partnerships.** Developing partnerships with external industry to support the development of technologies and therapeutics; and fostering closer ties with community-based organizations and foundations to support treatment across diverse populations in our community, both here in Rhode Island and throughout the world.

THE IMPACT

The Center will lead in the early identification and treatment of those at risk for Alzheimer's disease and related dementias and the development of interventions that will be needed to prevent or ameliorate the devastating impacts. In particular, the Center will focus on answering the following research questions:

- **How does Alzheimer's disease start?** Alzheimer's disease is likely a set of related but distinct disorders precipitated by combined risk factors including lifestyle, environment, medical history and genetics. Understanding the earliest triggers for each disease subtype is essential for accurate and early diagnoses and for effective personalized treatment.

- **Where does Alzheimer's begin?** The brain is composed of multiple interconnected biological systems, and most have been implicated in Alzheimer's disease and neurodegeneration: neuronal, glial, immune, and vascular. It is essential to understand the interplay between these systems and how they interact to trigger early disease pathology.

- **When does Alzheimer's start?** Preventing or delaying the onset of Alzheimer's disease depends on early treatment, which requires an understanding of the origins and key elements that initiate disease. These factors are likely to be many-fold and different across individuals, but there is evidence that risk factors can start to accumulate in early life.

THE INVESTMENT

There is significant public and private grant funding available for research related to Alzheimer's disease and Alzheimer's-related dementia, but enabling innovative research and building unique, collaborative research teams depends on support from philanthropic donors.

- **Public Research Grants.** Alzheimer's disease-related funding from the National Institutes for Health has increased five-fold since 2015, and the NIH funding percentage is currently 10% higher than other research areas.

- **Private Research Grants.** Biotech corporations and foundations have dramatically increased investments in Alzheimer's-related research in recent years. For example, the Chan Zuckerberg Initiative has invested more than $50 million in the last few years in neurodegenerative disease research, and Bill Gates has personally committed $100 million to Alzheimer's disease research, including an Alzheimer's Disease Data Initiative.

Brown has all the elements to emerge as an international leader in Alzheimer's disease research by advancing diagnosis, prevention, and treatment. Achieving this vision requires funding to recruit and retain world experts, a research environment that enables unique collaborations from clinical to basic research, and a vibrant ecosystem of entrepreneurship. Funding priorities will therefore largely focus on:

- **Scholars.** Tenure-track professors, research/clinical faculty, and postdoctoral researchers.

- **Students.** Graduate students from a range of disciplines.

- **Space.** Dedicated space to establish a highly innovative environment for Alzheimer's disease researchers and access to cutting-edge research equipment, including cores.

- **Support.** Technical staff to support cutting-edge research, research project management and enabling the adoption of new research methods.

DECIPHERING DISEASE

TREATING AND CURING CANCER

Vision	Brown will establish the first NCI-designated cancer center in Rhode Island to understand the genetic and environmental risks of cancer that are highly prevalent in the state and to clinically treat patients.

According to the American Cancer Society (ACS), there will be 7,030 new cases of cancer in Rhode Island in 2022, with a majority of the cases from breast, prostate, lung, and skin cancer. Rhode Island has among the highest rates of bladder cancer and breast cancer in the country, and increased rates of lung, prostate, endometrial, thyroid, bile duct, and brain cancer. ACS also estimates that Rhode Island will have 2,170 deaths from cancer in 2022 – or roughly 20% of the annual deaths anticipated in the state. Cancer is the second-highest cause of death in the state, shortly after heart disease.

The National Cancer Institute (NCI) offers a designation to 71 cancer centers in the United States that meet standards of excellence and rigor in basic, clinical, and population research to prevent, diagnose, and treat cancers relevant to their communities. It is well documented that patient outcomes are better when care is provided at major cancer centers. Rhode Island is one of few states in the U.S. without an NCI-designated cancer center. The pursuit of NCI designation takes several years and is a significant step in helping the institution move into the top tier of cancer centers nationally.

An outgrowth of the Joint Program in Cancer Biology at Brown and Lifespan, the **Legorreta Cancer Center** has an unprecedented opportunity to become a world-class NCI-designated cancer center. Together with the Lifespan and Care New England health systems, Brown is poised to build a world-class cancer care program that integrates basic scientific discoveries with clinical, translational, and population research to reduce the burden of cancer in Rhode Island. Five years of developments at Brown and the affiliated health systems, including a number of high-profile recruitments, will allow the University to bring scientific discoveries and innovative clinical trials to patients in Rhode Island. The Center has special interests in cancers with higher rates in Rhode Island, as well as issues of access to care and affordability.

THE INITIATIVE

The Legorreta Cancer Center brings the full weight of Brown's research and clinical strength to bear on questions of genetic and environmental cancer risks, and seeks to accelerate progress toward new treatments and cures for patients in a personalized way. The Center already boasts 168 investigators conducting basic, clinical and population research, with over $35 million dollars in extramural funding to support cancer research and clinical trials. Programmatic integration of cancer-relevant research at Brown will highlight existing major strengths, forge new collaborations, and eventually tap into significant grant resources, while addressing the cancer burden in Rhode Island and throughout the world. The Center will significantly benefit from the existing cancer programs across the University, including:

- Core cancer research programs in Brown's **Division of Biology and Medicine** ranging from cancer biology and cancer therapeutics to genomics and precision oncology;
- Evaluations of early, cutting-edge applications of chemotherapy, biologic agents, and other cancer treatments in clinical trials through the **Brown University Oncology Group**;
- Analytical and computational research into the complex nature of genomes, disease processes, and evolutionary relationships through the **Center for Computational Molecular Biology**;
- 12 **Translational Research Disease Groups** which research specific types of cancer;

- Surgical, medical, interventional, and radiation oncologists in the **Lifespan Cancer Institute** who work together to provide state-of-the-art care to 4,000 Rhode Islanders each year;

- The **Cancer Data Registry** through Lifespan, which collects, manages, and analyzes information on patients who are diagnosed and/or treated in Rhode Island; and

- Other clinical and research partners including the **School of Public Health**, **School of Engineering**, **Care New England**, and the **Rhode Island Quality Institute**.

In addition, research laboratories, clinics, and population research programs affiliated with the Center offer outstanding training opportunities for students and a fertile environment for faculty development.

THE IMPACT

A world-class cancer center at the standards that merit NCI designation will have immeasurable benefit and impact on Brown and the affiliated health systems, as well as the Rhode Island population at large. A high-profile cancer center will attract outstanding faculty and students at all levels, and will attract patients for clinical care and participation in innovative clinical trials. With an NCI-designated cancer center, Brown will become a destination with nationally recognized standards of excellence and rigor in basic, clinical, and population research to prevent, diagnose, and treat cancers that are relevant to their communities. Rhode Island patients will get optimal care and access to innovative clinical trials without leaving the state – especially underserved communities.

THE INVESTMENT

A combination of federal funding agencies and private foundations, like the Susan G. Komen Breast Cancer Foundation, provide significant grant funding to support cancer research, and the current U.S. presidential administration recently restarted the Cancer Moonshot, which offers funding in support of the goal of halving the cancer death rate in the next 25 years. Brown will be well positioned with this Center to continue growing its portfolio of grant awards.

The initial gift by the Legorreta family has also been transformational and will enable critical early recruitments and investments in infrastructure, but additional philanthropic funds are needed in the next five years to continue recruiting top-notch personnel, expanding the infrastructure, and catalyzing research. The initial list of priorities includes:

- **Scholars.** New faculty members, including a mix of senior, mid-career, and junior faculty/researchers.

- **Internal Funding.** Available seed funds for faculty to help jumpstart research and support larger grant proposals.

- **Support.** Administrative support and technical staff to support research, grant administration, and the maintenance of laboratory facilities.

- **Equipment.** Research cores, computing, and standard resources that are required of all cancer centers, like PET and MRI machines.

- **Space.** Dedicated, state-of-the-art laboratory space for researchers, equipment, and patients.

DECIPHERING DISEASE

SEQUENCING AND UNDERSTANDING RNA

Vision	Brown will lead efforts to completely sequence RNA as part of an international consortium and create a positive impact for patients through scientific and translational discoveries in RNA biology.

Ribonucleic acid (RNA) is the regulatory code of life. Within an organism, all cells have largely the same DNA, yet different RNA content and modifications that determine cell identity and function in health and disease. Understanding RNA can lead to insights into fundamental biology, links to disease, and critically important therapeutic applications – as evidenced by the recent mRNA vaccines developed for COVID-19.

Currently, there are no technologies that can determine complete RNA sequences with all the modifications. The lack of complete RNA sequences for any organism makes it impossible to fully understand the regulation of cell functions and their dysregulation in disease, and severely hampers therapeutic interventions. To remedy this knowledge gap, a group of scientists is working with the National Institutes of Health and the National Academies of Sciences, Engineering and Medicine to obtain a complete sequence of RNA. Dubbed the "RNome Project," this effort would mimic the Human Genome Project, which was an international, multi-billion-dollar research initiative that culminated in 2003 with the first complete DNA sequence of the human genome.

Brown is planning to establish an **RNA Center** in the **Division of Biology and Medicine** focused on:

- Basic RNA discoveries and their translation to impact patient outcomes; and
- Catalyzing and jumpstarting the international RNome Project through advocacy and leadership.

RNA research is a growing area of international interest and investment, with no clear leader among academic institutions. Brown's RNA Center would build on the research of longtime Brown faculty to be a leader in this field and advance research across the full continuum – from fundamental discovery to population health outcomes.

THE INITIATIVE

Brown's RNA Center would be an interdisciplinary effort composed of basic scientists, physician-scientists, engineers, chemists, computational biologists, physicians, and public health researchers. The Center will need a critical mass and scale to perform basic and translational research, and develop novel sequencing technologies and therapeutic applications. While the University has a strong base of faculty who would support this Center, significant investments would be required to attract additional researchers, build adequate facilities, develop in-house research cores, and train a cadre of graduate students and postdoctoral researchers.

Brown currently has at least eight core faculty in the **Department of Molecular Biology, Cell Biology, and Biochemistry** and the clinical departments of the **Warren Alpert Medical School** who conduct RNA-related research, in addition to faculty with complementary expertise in the **Center for Computational Molecular Biology**, **School of Public Health**, and **Division of Applied Mathematics**. A recent study of Brown's RNA expertise highlighted the following strengths:

- A core focus in basic science research, especially in RNA binding proteins, RNA genomics/modifications, and ribosomes;

- A strong computational biology research program centered on genomics and evolutionary biology; and
- Existing partnerships and capabilities that can support translation and technical applications at Brown.

These capabilities provide the foundation to launch an exciting new RNA Center at Brown. As an outgrowth of scientific discoveries and the development of new technologies that will emerge from this new center, there will be significant opportunities for intellectual property/commercialization activities. The Center will also be committed to the training of a diverse and talented workforce of scientists who will achieve scientific and medical breakthroughs to benefit humanity. The efforts will collectively establish Brown University as the global epicenter of RNA biology.

THE IMPACT

Brown's RNA Center would create positive patient outcomes through scientific discoveries related to RNA biology and by advancing the broader field of RNA research through the international RNome Project. If approved, the RNome Project will result in billions of dollars in funding, which would further enable RNA research at Brown and across the world.

Given the disruptive potential of RNA as a therapeutic modality, research in this area can accelerate drug development, shorten timelines from bench to bedside, and address some of the most severe human diseases. This research can also expand the number of potential drug targets that were previously thought to be "undruggable" by the scientific community.

THE INVESTMENT

National funding for RNA research has increased by nearly 50% in the last six years – rising to $9 billion in 2021 – with additional funding likely to become available due to the widespread success of the COVID-19 mRNA vaccines.

It is also anticipated that there will be significant federal funding for the international RNome Project. The Human Genome Project cost over $5 billion in today's dollars and took four years to receive significant federal funding. The cost of the RNome Project is estimated at $5 billion to $10 billion, most of which would be allocated to support efforts at institutional centers like the RNA Center at Brown.

Given the scale required to achieve the goals of this Center and the early stage of international funding, Brown will need significant start-up funds from philanthropic sources to support the recruitment and retention of a large team of faculty, graduate students, and research scientists. The initial list of fundraising priorities includes:

- **Scholars.** New tenure-track faculty in addition to a center Director who would also be a tenured faculty member.
- **Students.** Biomedical graduate students, some of whom would be grant-funded and some of whom would be funded by the Center.
- **Space.** Wet and dry lab space for researchers, equipment, and core facilities such as RNA sequencing, mass spectrometry, and computational biology.

USING SCIENCE AND TECHNOLOGY TO IMPROVE LIVES

INNOVATING THROUGH BIOMEDICAL ENGINEERING

Vision	Brown will be a leader in translational research that helps people live longer, healthier lives and ensures healthcare is more equitable and effective through the integration of biology, engineering, and medicine

There has never been a better time for scholarship at the intersection of biology, medicine, and engineering. The integration of cutting-edge computation and quantitative experimental biology is central to the next generation to transformative diagnostic and therapeutic approaches. Recent advancements and innovations are already increasing the effectiveness of biomedical treatments. For example, in 2020, an artificial intelligence program called DeepMind resoundingly won a biennial competition by successfully predicting the three-dimensional structure of a protein. Quantitative biology and predictive modeling are rapidly becoming the hallmark of high-impact biomedical research. Within a few decades, researchers will be able to design biomaterials, therapeutics, and devices with as much certainty and precision as civil engineers constructing a sturdy bridge.

Additionally, the COVID-19 pandemic has revealed glaring inequities in modern healthcare. Sustained public attention and political support for biomedical research will only grow because of this catastrophic pandemic. Researchers, policymakers, and the public are increasingly motivated to make healthcare more equitable and effective through fundamental and translational research that provides novel solutions to everyone's healthcare needs.

Building on the success of the **Center for Biomedical Engineering**, Brown recently established the interdisciplinary **Institute for Biology, Engineering, and Medicine** (I-BEAM) which sits between the **Division of Biology and Medicine** and the **School of Engineering**. I-BEAM will enable scholars from across the University to collaborate on innovative translational research that produces new insights and technologies to reduce human suffering from disease and ensure equitable healthcare outcomes across communities.

THE INITIATIVE

I-BEAM will serve as a nexus of academic research at the intersection of biology, engineering, and medicine by leveraging a broad network of scholars across the University and partnerships with hospitals, clinicians, start-ups, and established corporations. With a strong focus on team-based scholarship, I-BEAM will promote cross-disciplinary research that integrates experimentation and computation to address pressing clinical needs, and take the first steps toward developing and applying experimentally informed simulations of biomolecules, cells, and organ systems by both measuring and modeling biology with quantitative precision. For example, Brown faculty are work working on research projects to:

- Apply the principles of particle aggregation to simulate the movement of cells through the spleen in order to understand organ physiology and prevent blindness from diabetes;
- Develop data-rich optical imaging and machine learning to cancer spheroids in order to predict which of the hundreds of combinations of chemotherapeutics are most toxic to a specific patient's tumors; and
- Integrate imaging of cardiac function and biological markers in a "digital twin" simulation to better understand heart disease to allow for more effective treatments and prevention of catastrophic heart failure.

Ongoing progress in this area requires collaborations that integrate biology, engineering, and medicine. This integration is a truly unique aspect of Brown's approach to biomedical engineering and one that is not easily replicated by peer institutions – particularly given Brown's historic strength in computation and modeling. I-BEAM also occupies a distinctive space as one of the few biomedical engineering programs in the country positioned between the schools of engineering and medicine. By virtue of its structure and Brown's interdisciplinary culture, I-BEAM will naturally offer a large tent for researchers, including those outside biology, engineering, and medicine. Opportunities will exist for faculty, postdoctoral researchers, graduate and medical students, residents, and undergraduates to collaborate on research projects.

THE IMPACT

Biomedical engineers in I-BEAM will integrate data-driven and computational approaches to advance human health and reduce human suffering by engineering better medicines and creating innovative technologies. By building on existing strengths and partnerships, I-BEAM will be able to maximize the impact of its research projects and be a world leader in integrating personalized data, high-content imaging, and computation to provide clinicians with powerful simulations of disease. For example:

- Research on specific organ systems or diseases with the support of academic partners – like the **Carney Institute for Brain Science**, the **Legorreta Cancer Center**, the **Cardiovascular Research Center**, and the **Hassenfeld Child Health Innovation Institute** – will lead to new disease understanding and intervention; and

- Expertise in the **Center for Digital Health** and the **School of Public Health** will lead to the development of novel device technology, integrated with the latest software, that fuses multiple data sources to provide information about health data at the population and individual level.

THE INVESTMENT

There is already significant research funding for biomedical engineering available through federal sources including the National Institute for Biomedical Imaging and Bioengineering at the NIH, plus the National Science Foundation and the Department of Defense. The current administration also recently established the Advanced Research Projects Agency for Health, or ARPA-H, as a venture to speed up biomedical and health research with $1 billion in annual grant funding

I-BEAM's approach to research and partnerships will be ideal in securing additional grant funding in the future. However, the smaller scale of biomedical engineering at the University means that Brown will need to raise funds in order to be competitive for these external grants and support the following:

- **Scholars.** New tenure-track faculty, including an endowed directorship, ranging in experience from junior- to senior-level faculty, plus several postdoctoral fellowships.

- **Students and Residents.** Support for graduate students in biomedical engineering to expand their training and research in data science and other computational areas, plus funding for medical residents to pursue bioengineering research in partnership with clinical departments.

- **Support.** Administrative support, technical staff, and seed funds to support research, grant administration, and the maintenance of laboratory facilities.

- **Space.** Dedicated, state-of-the-art laboratory space for researchers, equipment, and cores.

SUSTAINING LIFE ON EARTH

PROMOTING SUSTAINABLE ENERGY

Vision	Brown will drive technological innovations in renewable energy, sustainable fuels/materials, and energy efficiency and prepare leaders for a secure, equitable, and sustainable zero-carbon energy future.

Climate change is one of the most pressing issues facing modern society. The world must achieve and maintain net-zero carbon emissions by 2100 to avert irreversible climate change and its dire global consequences. To avert climate change and its catastrophic consequences, society needs to focus on innovating and developing three types of solutions: technology solutions, policy solutions, and societal solutions.

Brown has existing academic and research strengths in all three of those areas, but only two of them are housed and supported in existing institutes:

- The **Watson Institute for International and Public Affairs**, which researches policy solutions; and
- The **Institute at Brown for Environment and Society (IBES)**, which focuses on societal solutions.

A team of 19 Brown faculty members have proposed the establishment of an **Initiative for Sustainable Energy** (ISE) that would focus on developing technology solutions to help avert climate change. The ISE, which could evolve into an Institute as it grows, would be a highly visible, interdisciplinary research hub focused on areas of research that are the most critical for achieving and maintaining a zero-carbon energy global infrastructure over the next century. By driving innovation in sustainable energy and promoting action, the ISE would provide the critically-needed "center of gravity" to activate efforts across campus and Brown's broader community through a dedicated physical home with state-of-the-art laboratory space and a group of specialized core faculty coming from several disciplines.

THE INITIATIVE

Net-zero cannot be achieved solely by increasing the proportion of energy from renewable sources – there also has to be a reduction in the overall consumption of energy and removal of accumulated carbon in the environment from legacy emissions. Brown has a unique opportunity to leverage its existing combination of strengths in three core research areas – renewable energy, sustainable fuels/materials, and energy efficiency – to meet those goals and be a leader among our peers nationwide. These interdisciplinary research areas are all expected to grow rapidly and attract significant investments over the next decades. A well-organized, highly visible ISE would be well positioned to leverage these once-in-a-generation investments and opportunities.

The ISE would build on existing expertise from 19 faculty who currently focus on those three research areas and over 40 affiliated faculty who support related efforts. From 2016 to 2021, the 19 core faculty members were awarded nearly $40 million in grants related to energy research. Examples of Brown's historic research programs include:

- Batteries, like next generation lithium-ion batteries that store energy, and perovskite solar photovoltaics, which are low-cost technologies that convert sunlight into electricity;
- Production processes for carbon-free fuels and sustainable materials; and

- Advanced materials for vehicles and engines, along with initiatives like Brown's Living Lab which allows researchers to pilot new energy efficient technologies for buildings.

These faculty members stretch across the University – from the **School of Engineering** and the physical sciences departments like **Chemistry**; **Physics**; and **Earth, Environmental, and Planetary Sciences** – to IBES and Watson. The unique synergy between these faculty members, combined with the other institutes at Brown with complementary missions, would make Brown a truly distinctive powerhouse for promoting sustainable energy for our global society.

THE IMPACT

The ISE would catalyze faculty from across the University to tackle the formidable scientific and technological challenges highlighted above to help achieve net-zero carbon emissions in the next century.

- **Renewable Energy.** Brown researchers would focus on groundbreaking basic and applied studies for improving electricity generation using renewable sources, such as solar or wind, and energy-storage technologies given the intermittency of renewable sources.

- **Sustainable Fuels/Materials.** Brown researchers would focus on technologies and processes to produce sustainable fuels using renewable energy and capture carbon dioxide from the environment for conversion into useful fuels, chemicals, and materials. Furthermore, researchers would focus on "green" synthesis of chemicals and manufacturing of sustainable materials for infrastructure applications such as transportation, electrification, and the built environment.

- **Energy Efficiency.** Since a whopping 68% of the annual energy generated in the U.S. is rejected or wasted, Brown researchers would focus on developing technologies to improve energy efficiency through advanced "smart," lightweight, and high-temperature materials, together with waste-heat capture technologies.

THE INVESTMENT

There are significant opportunities to support this research program from the federal government and from corporate sponsors. The current administration has reshaped federal investment priorities, with a particular focus on climate change by launching a Climate Innovation Working Group and dedicating or proposing billions of dollars in funding to develop transformational low-carbon energy technologies.

While the ISE would continue Brown's success in grant applications for sustainable energy research, the ISE would require significant infrastructure and start-up funding to bring together the 19 core faculty members and build a collaborative and cohesive community of researchers, including:

- **Scholars.** New tenure-track faculty in each of the three core research areas, plus new Professors of the Practice to support the Institute.

- **Space.** Multi-use state-of-the-art space for research laboratories, offices, and community-building.

- **Support.** Administrative and technical staff to support research, grant administration, and the maintenance of laboratory facilities.

ADVANCING COMPUTATIONAL AND DATA SCIENCES

PROMOTING ETHICAL AND SOCIALLY RESPONSIBLE DATA SCIENCE

Vision	Brown will be a premier institution for research in data science focused on improving lives in our data-driven world and using data-driven evidence to implement effective social policies.

Data science represents perhaps the most significant new area of intellectual inquiry in recent times. Increasing amounts of data are being generated through scientific research – in medicine, through the internet of things, and in academic fields that rarely used data before the current century. Meanwhile, new technologies are emerging for collecting, storing, and analyzing these data, all of which pose as many questions and challenges as opportunities and answers. The rapid increase in the quantity, quality and types of data has already created many research and educational opportunities, and yet the extent of new insights and lines of inquiries made possible by the discipline of data science is still unknown.

A new generation of scholars is creating an intellectual community centered on data science; their work transcends the scope of any single academic department. Simultaneously, researchers in many fields are discovering gaps between the data that are (often newly) available to them and their own data analysis skills. Many researchers see the potential of data science to rebalance power as well as to expose inequities in society. This landscape has led to the creation of academic units in data science or data analytics at many institutions of higher education, in a wide array of academic structures – mostly under the traditional domain disciplines like computer science or applied math/statistics.

Brown is uniquely poised to expand the current **Data Science Initiative** (DSI), established in 2016 as one of the integrative themes from *Building on Distinction*, into the University-wide **Data Science Institute** that leverages the University's strengths in quantitative STEM fields and in fields occupied with data generation and data analysis applied to societal problems: the humanities, social sciences, and life sciences. This structure will set Brown apart from peer institutions, many of which have established multiple data science units or have centralized data science under the purview of a single academic department. Brown's Institute will create a closed feedback loop between methods development and data generation/analysis and support truly innovative research in data science.

THE INITIATIVE

The Data Science Institute will transform the field of data science by fostering interdisciplinary research and training focused on improving lives in a data-driven world. The Institute will focus on tackling systemic problems such as preventing the spread of misinformation, developing effective and accessible personalized medicine, and designing technology that serves the disenfranchised as opposed to the powerful by building on Brown's academic strengths particularly in four departments that have historically been among the top of their fields nationally: **Computer Science**, **Mathematics**, **Applied Mathematics**, and **Biostatistics**.

Examples of recent cutting-edge interdisciplinary research supported by the Data Science Initiative include:

- A study led by DSI postdocs and faculty in collaboration with researchers from **Computer Science**, **Applied Math**, and the **Center for Digital Scholarship** that describes the social media phenomenon of "hashjacking" – the coopting of hashtags in polarizing ways, like the way #MyBodyMyChoice, which had been used to promote reproductive rights, was coopted during the COVID-19 pandemic to express anti-vaccination and anti-masking sentiments.

- A collaborative project between DSI, the **Center for Computational Molecular Biology**, the **Department of Ecology, Evolution, and Organismal Biology**, and the **Department of Biostatistics** that analyzed over 600,000 individuals from seven ancestries to identify shared associations for 25 biological traits.

With investments in the Institute, Brown will be uniquely poised to make a global impact across a range of academic disciplines, and as a premier research institution for understanding the ethical issues faced by data scientists and using data-driven evidence to implement effective social policies.

THE IMPACT

The Institute will motivate research and technology development across the broader Brown community focused on understanding how data science can benefit or adversely affect our society. Data science faculty at Brown are currently conducting research and studying the following questions:

- How can governments protect privacy while accurately surveilling the spread of a pandemic? (**Department of Computer Science**)
- How can we overcome biases in medical genetics study design with statistical methods in order to achieve personalized medicine for all individuals? (**Center for Computational Molecular Biology**, **Division of Biology and Medicine**, and **School of Public Health**)
- How can social media shed light on threats to democracy across the globe? (**Watson Institute for International and Public Affairs**)
- How can we detect previously missed earthquakes throughout the world and predict future seismic activity? (**Department of Earth, Environmental and Planetary Sciences**)

In addition, the Institute will use data-driven approaches and an understanding of political and social change to influence and implement policies that promote ethical and socially responsible data science.

THE INVESTMENT

Federal funding agencies have been offering significant grant funding for data science research across a variety of disciplines and specialties – such as the BIGDATA program at the National Science Foundation and the National Institute of Allergy and Infectious Disease's data science program. Additionally, research funding has been offered by the National Academies of Sciences, Engineering, and Medicine and private foundations like the Mozilla Foundation, the Ford Foundation, and the MacArthur Foundation to promote socially responsible and ethical data science. Additionally, the National Science Foundation recently established a new Directorate for Technology, Innovation, and Partnerships, which in part will offer research funding to advance ethical data science and trustworthy artificial intelligence.

While we expect additional grant funding to be available in the coming years, the Institute will require fundraising and investment to bring additional innovative and cutting-edge researchers to Brown. The initial fundraising priorities are fittingly focused primarily on people:

- **Scholars.** New tenure-track faculty, with a mix of junior and senior researchers, along with an endowed position for the faculty director and a group of postdoctoral fellows.
- **Students.** Funding for graduate student fellowships and undergraduate research assistantships.

CULTIVATING ARTISTIC EXPRESSION

REVIVING THE ARTS ECOSYSTEM THROUGH INNOVATION

Vision	Brown will be an innovator in arts research, promote artistic expression as a form of research, and advance the sustainability of impactful art-making research at Brown, across the country, and beyond.

In 2020, the National Endowment for the Arts reiterated that "the arts are integral to the social, civic, and economic wellbeing and vitality of our nation. Arts participation in childhood and youth has been linked to positive academic and social and emotional outcomes later in life." Previously, the Bureau of Economic Analysis reported that the arts contribute 4.5% of the gross domestic product for the U.S. – more than industries like construction, agriculture, and transportation. Arts and culture organizations and their audiences support local communities, attract tourists and tourist dollars to their regions, and have proven to yield large economic returns on public funding. In 2017, the combined $5 billion in direct arts funding by local, state, and federal governments yielded $27.5 billion in government revenue.

Despite the essential role artists and cultural workers play in our economy, they tend to be employed part-time, self-employed, or in multiple jobs, and often struggle to sustain income – known as the "starving artist gig economy" – and lack access to affordable health insurance, as well as mental health, financial, housing, and other social services. These situations often limit the ability of artists to innovate and perform research to further the arts and offer new lenses on critical societal issues. The COVID-19 pandemic, years of inadequate financial support, and relentless systemic racism revealed deep fissures in the arts ecosystem – dubbed an "unprecedented crisis" by UNESCO – which must be studied and remedied for the arts industry to emerge stronger, more equitable, more efficient, and more beneficial to society.

Established in 2021, the **Brown Arts Institute** (BAI) builds on Brown's reputation as a destination for arts exploration and as a hub for interdisciplinary faculty collaborations, which was supported for over two decades by the pre-existing **Creative Arts Council** and **Brown Arts Initiative**. BAI supports academic and artistic programming across Brown, together with seven affiliated departments: **Music**, **Theatre Arts and Performance Studies**, **Modern Culture and Media**, **Visual Art**, **History of Art and Architecture**, **Literary Arts**, and **Africana Studies** and its **Rites and Reason Theatre**. Through innovative research and projects, BAI aims to address this world-wide crisis in the arts, propose and test models for industry rejuvenation and change.

THE INITIATIVE

BAI will establish the signature **Artistic Innovators** program, which will gather and employ up to 40 artists, scholars, activists, and cultural leaders from across campus and beyond to focus on:

- **The Arts as Research**, particularly on the ways in which interdisciplinary artistic exploration can offer new lenses on critical societal issues by leveraging the University's innovative arts venues like the Lindemann Performing Arts Center and the Granoff Center for the Creative Arts;
- **Research in the Arts**, unearthing and analyzing the histories, trends, and impact of diverse approaches to artistic production by leveraging Brown's historic strength across the arts departments; and
- **Innovative Models for the Arts**, seeking to identify sustainable solutions to support artists and strengthen the arts industry in the future.

The program will encourage multi-year participation among the Artistic Innovators to create sustained connections with faculty, students, and other academic units across the University; further artistic programming for the community; and establish a new, more sustainable model for artistic research and production. The program will additionally:

- **Convene.** The program will serve as a convener of artists, activists, scholars, and students from campus and across the globe to cultivate creative expression, foster an interdisciplinary environment, and engage in meaningful and impactful examination of vital societal questions ranging from labor and public health to climate and freedom of expression.

- **Publish.** BAI will develop a publication to serve as the intellectual and creative home for the work of the Artistic Innovators and broader members of the Brown community. This publication would be supported by the **Digital Publication Initiative** through the **University Library** and in collaboration with members of the **RISD** community.

- **Produce.** A group of endowed **Arts Fellows** within the program will produce innovative, large-scale works at campus venues, complete with rigorous academic programming and engagement with faculty, staff, students and other scholars.

THE IMPACT

BAI's innovative and rigorous approach to arts research will encourage artistic and activist communities to meaningfully collaborate with scholars and students as they collectively find new solutions to pressing societal issues. Projects and productions resulting from these collaborations may be toured throughout the world, resulting in wide-ranging conversations and actions which reflect shared values. Artistic Innovator research, convenings, and projects will inform a wide range of innovations in the industry, including technological advances, policy changes, evolutions in leadership and pipeline models, and improvements in access to social services for artists and cultural workers.

THE INVESTMENT

Given the current state of funding for the arts, BAI will need dedicated University funds to support the Artistic Innovators program and their affiliated research/artistic projects. An initial investment would include support for:

- **Scholars.** Funding for partial and full stipends for the Artistic Innovators, along with endowed funds for full-time Arts Fellows and multi-year faculty appointments for existing Brown faculty with appropriate teaching buyouts.

- **Students.** Funding for graduate student fellowships and undergraduate research assistantships.

- **Space.** Funding and resources to fully equip the existing arts venues on campus, including the Lindemann Performing Arts Center, Granoff Center for Creative Arts, List Art Center, the forthcoming Center for Artistic Design and Production, and arts departmental facilities for performance, screenings, architectural modeling, storage, and collaboration.

- **Support.** Additional administrative, technical, and programmatic support will be needed to realize the Artistic Innovators program and support artistic space across campus.

Conclusion

Brown University has grown in significant ways since the launch of *Building on Distinction* in 2014 in terms of faculty and graduate students, in terms of scholarly work, in terms of research funding, and in terms of the diversity of our campus.

This plan represents the next phase of the University's ambitious strategic plan. Brown will double research over the next five to seven years. Much of this growth will be organic, by:

- Ensuring that our existing faculty, staff, and students have additional support, space, and resources to further their research programs; and
- Hiring and enrolling additional scholars in a range of disciplines that align with the University's research and academic priorities.

Some of the growth will also be through partnerships – like the integration of research programs run by Brown's clinical faculty in the affiliated health systems – and investment in cutting-edge signature research initiatives that align with the University's historic strengths.

Reaching Brown's aspirations to double research will be an important effort of a great many individuals, academic units, and offices across the Brown community. It will be an inclusive and collaborative process, and all of the growth and investment will be distinctively Brown.

Appendix

HOW THIS PLAN WAS DEVELOPED

Since *Building on Distinction* was approved by the Corporation of Brown University in 2013 and launched in 2014, University leadership has taken concrete steps to advance its core commitments through a series of action-oriented plans.

- In 2015, Provost Richard M. Locke led the development of the *Operational Plan for Building Brown's Excellence*, which translated the strategic plan's inspiring goals into concrete actions designed to enable the University to fulfill its mission and consolidate its role as a leader in higher education and research.
- The following year, after a community-wide process, the University launched *Pathways to Diversity and Inclusion: An Action Plan for Brown University* (commonly known as the DIAP) as a companion to the strategic plan, outlining steps for Brown to become a fully diverse and inclusive community.
- During the summer of 2018, Provost Locke worked with academic and administrative colleagues to review, reconsider and refine the original Operational Plan which resulted in the *Revised Operational Plan for Building Brown's Excellence*.

Spring 2022 Planning Process

In line with these operational plans and the University's ongoing long-term planning processes, Provost Locke convened a retreat in January 2022 with all of the senior academic deans to discuss the University's aspirations and goals for research in the years ahead. At the end of that retreat, the senior academic deans unanimously endorsed the goal of doubling our research enterprise over the next five to seven years to continue the University's progress on the commitments identified in *Building on Distinction*.

First and foremost, the deans acknowledged that research is critical to our institution and that it is complementary to our educational mission. The deans also acknowledged that to remain true to our institutional identity and culture, growth should emphasize areas where there are existing strengths and have a high potential for impact on society. By framing the goal broadly (and not relying solely on one convenient metric), the deans further acknowledged that to do justice to the breadth of scholarship at

Brown, investments should be made as well in areas of research that are not as easily measured but equally reflect values, strengths, and potential impact.

Over the winter and spring of 2022, the senior academic deans met regularly to discuss proposals for growing research and identifying potential impediments or barriers to growth. Provost Locke presented the goal and overall plan to President Paxson and several groups including:

- The **Academic Priorities Committee**, a body of elected faculty and academic leaders;
- **Chairs** of academic departments and **Directors** of major academic institutes and centers;
- The **Faculty**;
- **Administrative leadership** and **staff** from across the University; and
- The **Committee on Academic Affairs** of the **Corporation of Brown University**.

In June 2022, President Paxson distributed the current draft version of the plan to the Brown community to solicit additional feedback and recommendations.

Next Steps for this Plan

- University leadership will schedule a series of meetings and forums with faculty and staff early in the Fall 2022 semester to solicit and hear feedback on the draft Operational Plan.
- President Paxson and Provost Locke will discuss the plan with the full Corporation of Brown University during the summer months.
- Following a series of revisions based on community feedback, President Paxson will release a final Operational Plan during the Fall 2022 semester.

Additional Signature Initiatives

During the development of this draft of the Operational Plan, Provost Locke and the senior academic deans solicited and discussed several signature initiatives that are not included in this document but still illustrate the kind of world-class research programs that can help propel Brown to the next level of excellence and distinctiveness. Some of these initiatives are listed below, and several of them may be added to the final version of this Operational Plan.

- Advancing Methods of **Digital Scholarship**
- Understanding and Addressing **Systemic Racism**
- Tracking, Disseminating and Improving **Climate Information**
- Exploring and Engineering **Quantum Materials** and **Technologies**
- Developing Novel Methods/Applications for **Machine Learning** and **Artificial Intelligence**
- Preventing and Treating **Opioid Use Disorder**
- Understanding the **Biology of Aging**
- Developing and Implementing Treatments for **Infectious Diseases**