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PHILANTHROPY ALLIANCE

Science Philanthropy Indicators Report

Science Philanthropy: Leading the Way Forward for Basic Research

2023

The Science Philanthropy Alliance is pleased to present its inaugural *Science Philanthropy Indicators Report*. Using National Science Foundation (NSF) data, this report examines basic research funding in the United States through a philanthropic lens, with a focus on the higher education and nonprofit research sectors. It builds on the commitments and analyses in our 2022 Strategic Plan and complements reports from others that provide quantitative information about science and engineering broadly.[1]

This report illustrates that in the higher education and nonprofit sectors, philanthropy today fuels the U.S. basic research enterprise at a level approaching that of the federal government. This situation reflects a change over time and demonstrates an increasing level of engagement and interest by foundations, philanthropists, and universities in advancing scientific discovery.

Philanthropy is important as a flexible funding source for curiosity-driven and use-inspired basic science, especially as national and global priorities require increased spending for applied research and development. All these contributions to science and technology are important for securing our future. While most funding is directed to the life sciences, philanthropy can be particularly impactful in supporting less funded areas, such as the social sciences and ocean and climate sciences. Partnerships and innovative funding models are enabling new approaches for science philanthropies.

For those in the philanthropy sector, this report provides data-driven insights regarding the significant role that philanthropy plays in supporting basic research. For those in other sectors, it demonstrates the value of engaging with philanthropy as a key contributor in the research enterprise. Future reports will explore new directions, such as global science funding.

We thank all who contributed their time and effort to this report so that it disseminates critical information and highlights the importance of investing in scientific discovery.

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President, Science Philanthropy Alliance

FINDINGS AT A GLANCE

I	**Basic Research: A Small Slice of a Large Pie**	Basic research is approximately 15% ($118B in 2021) of U.S. Research & Development (R&D) spending. Applied research is approximately 18% ($144B in 2021).
II	**Philanthropy: A Major Funder for Basic Research**	Federal funding has declined as a relative source of support for basic research at U.S. universities and nonprofit research institutes, from more than 75% in the 1960s to approximately 50% in 2021. Philanthropic funding for basic research via higher education and nonprofit support has increased from less than 20% of the total in the 1960s to an estimated nearly 40% or $24.7B in 2021.
III	**Safeguarding and Advancing Basic Research**	Federal support for basic research at U.S. universities and nonprofit research institutes has not increased over the last 15 years when adjusted for inflation, while federal support for applied research increased by over 70% from 2006 to 2021. Philanthropic support increased by approximately 40% for basic and 100% for applied research from 2006 to 2021.
IV	**Biomedical and Health Sciences Still Primary Beneficiaries of Funding**	Biological, biomedical, and health sciences accounted for two-thirds of science R&D spending at universities and over 80% of science R&D spending at nonprofit research institutes in 2021. Philanthropy especially favors biological, biomedical, and health sciences, with over 70% of nonprofit funding for science R&D at universities consistently devoted to these fields.
V	**Exploring Other Research Fields**	Philanthropy can drive research in smaller fields. In the social sciences, for example, higher education and nonprofit funding supported over half of university R&D spending in 2021. Philanthropy can transform less funded fields such as ocean and marine sciences, which account for less than 2% of science R&D spending at universities across all sources.
VI	**New Models of Philanthropy and Partnership**	Partnerships and new models of philanthropy offer mechanisms for increased impact and effectiveness. Philanthropies are working together to advance equity in science, evaluate basic research, and promote open science.

Introduction

The Science Philanthropy Alliance is composed of nearly 40 philanthropic organizations devoted to advancing scientific discovery. Some of these have been active for decades; for example, the Research Corporation for Science Advancement (RCSA) was established in 1912 to address "some of the great questions in the history of science" and has since supported over 18,000 scientists, including at least 42 Nobel Laureates. The Alliance's inception by six founding members in 2013 is a testament to philanthropy's ongoing commitment to discovery science.

Today, science philanthropy is experiencing a "growth spurt" (Córdova, 2022) and is particularly impactful in supporting curiosity-driven and use-inspired basic research. Philanthropy is synergistic with other funding sources and can make flexible, high-risk, and long-term bets on ideas too unproven or interdisciplinary for other funding streams. Yet, philanthropy's role as a key sector of the research enterprise is often underrecognized. This analysis of NSF data through a philanthropic lens seeks to illuminate the vital role of science philanthropy, with the goal of facilitating more funding for discovery science and highlighting opportunities for impact.

NSF Data Through a Philanthropic Lens

Since 1953, the NSF National Center for Science and Engineering Statistics (NCSES) has reported trends in funding for basic research, applied research, and development from multiple sectors (federal, higher education, nonprofit, business, and state and local government). The National Patterns of R&D Resources data update released in January 2023 contains preliminary data for 2020 and estimates for 2021 (NCSES NSF 23-321, 2023). In this report, we refer to higher education and nonprofit R&D performers as universities and nonprofit research institutes, respectively. We combine spending from higher education institutional funds and nonprofit organizations as an estimate of legacy and current philanthropy (Murray, 2013; Kastner, 2018)[2]. Legacy philanthropy refers to institutional funds derived from past philanthropic giving to universities and nonprofit research institutes, often in an endowment (Conn, 2021; Conn et al., 2023). Current philanthropy refers to nonprofit funding, typically from foundations.

Caveat: Our estimates may undercount philanthropic contributions by excluding gifts from individuals designated for research, which are combined with other funds in the source data[3]. Individual giving to R&D is a third or more of the contributions from foundations[4] (Shaker & Borden, 2020). Conversely, our estimates may overcount the contributions of legacy philanthropy. An analysis of interviews with institution representatives benchmarked 25% as the average contribution of legacy philanthropy to institutional funds supporting R&D (Conn et al., 2023). More robust data collection is needed to better characterize institutional funds and individual giving to improve estimates of philanthropy's contribution to R&D.

I. Basic Research: A Small Slice of a Large Pie

Investment in basic research is the seed for future discovery and innovation. It can lead to new technologies that have profound impacts on humanity, often in unexpected ways. Examples include mapping the human genome and the development of COVID-19 mRNA vaccines, MRIs, lasers, X-rays, semiconductors, GPS, mobile phones, and Artificial Intelligence (AI). These advances all rest on decades of basic research in physical and life sciences[5].

Despite its critical role as a driver of the R&D ecosystem, basic research receives the smallest share of investment ($118B, 15% in 2021), followed by applied research ($144B, 18%) (Figure 1). The combined share of funding devoted to basic and applied research falls far short of funding spent on development ($530B, 67%). The business sector drives applied research and development as both a funder and a performer and is the second largest performer of basic research following higher education. Additionally, the share of basic research funded by business grew by 11% from 2010 to 2020 (Anderson et al, 2023).

Total R&D Expenditures in the U.S. (1953–2021)

Source: NSF National Patterns 2021 data update (NCSES NSF 23-321, 2023)

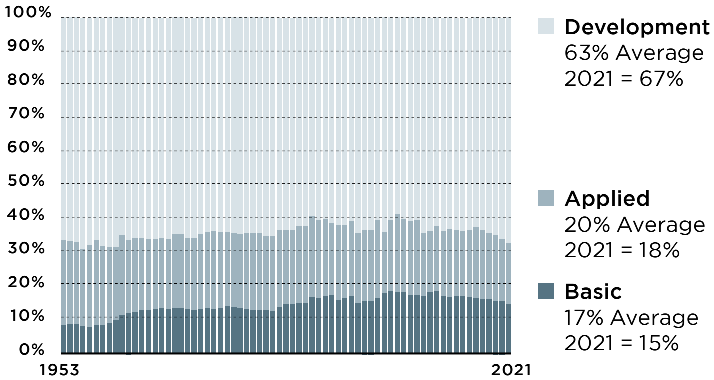


Figure 1. Basic research represents approximately 15% of R&D spending. Data shown are for all sectors that perform R&D, from all funding sources. R&D activities are divided into basic research (dark gray), applied research (mid gray), and development (light gray). Expenditures are shown as a percentage of the total from 1953 to 2021.

Basic Research, Applied Research, and Development

The Science Philanthropy Alliance focuses on "discovery science," which includes curiosity-driven and use-inspired basic research and some technology development. This report uses NSF definitions, adapted from the Higher Education Research and Development (HERD) Survey (NCSES NSF 23-304, 2022):

Basic Research:
focused on the "underlying foundations" of our world, with no particular application in mind

Applied Research:
knowledge creation directed towards practical outcomes

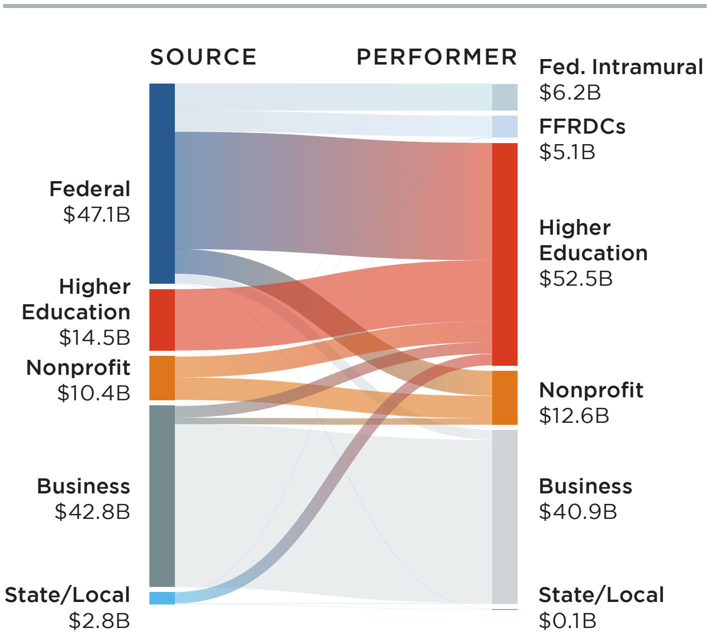
Development:
applying knowledge from research to new or improved products or processes

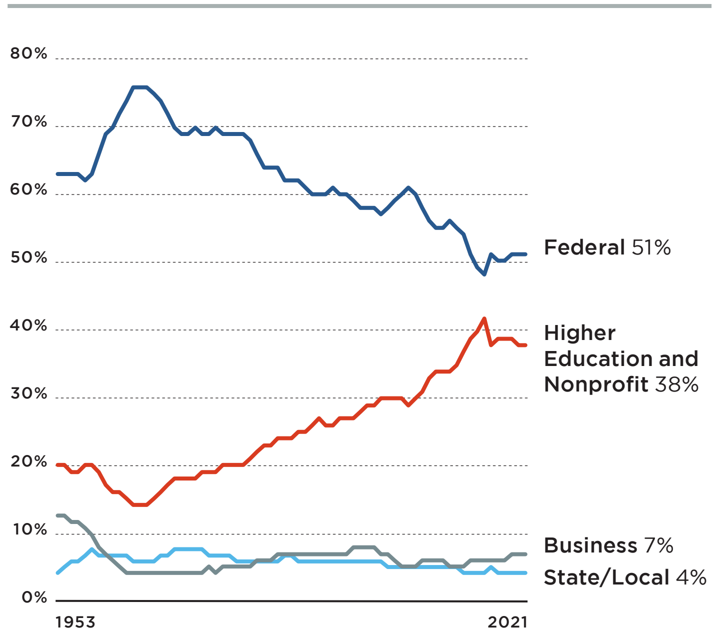
II. Philanthropy: A Major Funder for Basic Research

Philanthropic support for basic and applied research at universities and nonprofit research institutes is an important growing sector[6]. Philanthropy is particularly well-suited to supporting basic research given its adaptability to novel fields of work and variable time frames. These attributes are less feasible for the federal government, which is the main funder of academic research[7]. The flow of basic research support between funders and performers (Figure 2; left panel) provides insight into the contribution of philanthropy at universities and nonprofit research institutes.

Funds for Basic Research: Sources and Percentages

Source: NSF National Patterns 2021 data update (NCSES NSF 23-321, 2023)





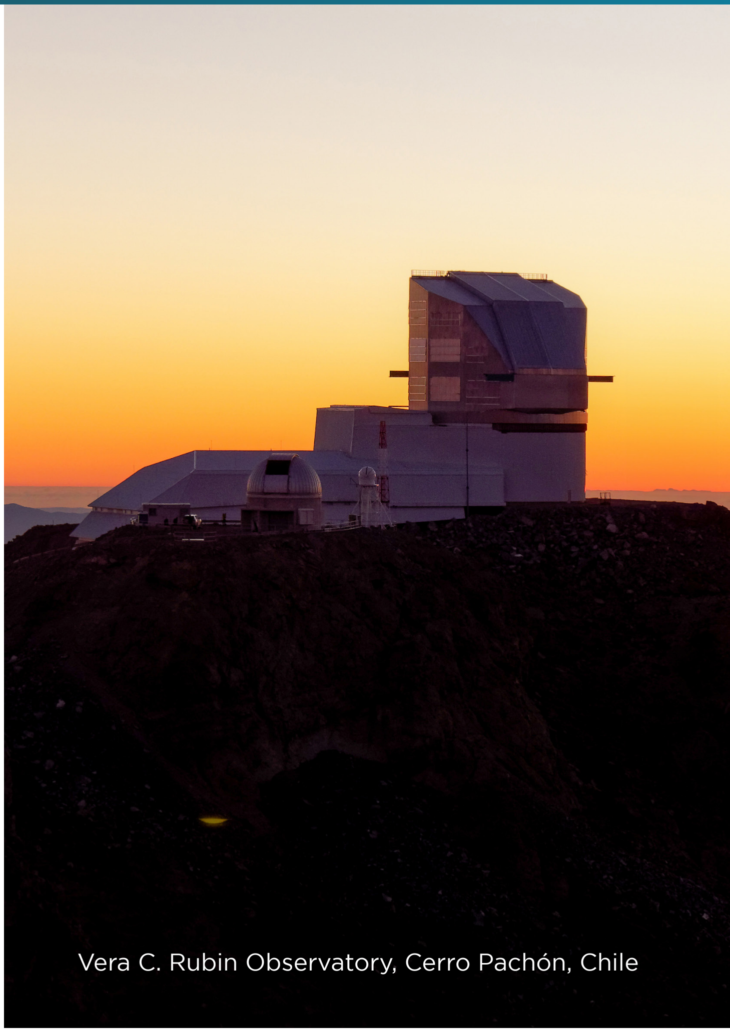
Note: Totals may not match due to rounding.

Figure 2. Philanthropic funds are a significant and increasing source of support for basic research. The left panel shows 2021 estimates for the flow of funds from the major funding sources to basic research performers. The right panel shows the share of basic research support that universities and nonprofit research institutes received over time from each funding source. The increasing red line shows the estimated philanthropic contribution to universities and nonprofit research institutes and represents a mix of current and legacy philanthropy.

Basic Research is Largely Basic Science

Data captured by NCSES surveys includes funding for science and engineering, and also business, humanities, and law[8]. Within the higher education sector, science fields received 78% of support from all sources, with 16% going to engineering and 6% to non-science and engineering areas in FY 2021 (NCSES NSF 23-304, 2022, Table 13). Within nonprofit organizations, 89% of FY 2021 R&D expenditures were in science fields, compared to 7% in engineering and 4% in humanities and other (NCSES NSF 24-304, 2023, Table 5).

The combination of higher education and nonprofit sources represents an estimate of current and legacy philanthropy (see "NSF Data through a Philanthropic Lens" on page 3; Murray, 2013; Kastner, 2018; Conn, 2021). Both types of philanthropy contribute to advancing science and technology. Current philanthropy includes directed-use grants designated for specific projects. Legacy philanthropy refers to endowed or expendable gifts to universities and nonprofit research institutes; investment income from such gifts supports a variety of research activities, such as startup funds, faculty salaries, and graduate students and postdoctoral fellows.



Vera C. Rubin Observatory, Cerro Pachón, Chile

The combination of higher education and nonprofit sources is an increasingly large fraction of the total support for basic research, doubling from less than 20% to nearly 40% over the last seven decades (Figure 2; right panel). In 2021, this estimated philanthropic contribution was $24.7B, or 38% of the total[9] (note caveat described on page 3).

Higher education institutional funds supported $14.5B or 22% of total basic research spending at universities and nonprofit research institutes in 2021. Nonprofit funding for basic research at universities ($4.9B) and nonprofit research institutes ($5.3B) is an estimated $10.2B or 16% of the total in 2021[10]. In contrast, federal support has declined as a relative source of support for basic research at these institutions, from over 75% in the 1960s to about 50% in recent years ($33.5B, or 51% in 2021).

Alliance Members' Shared Commitment to Discovery Science

Alliance members share a commitment to supporting discovery research, which can include both curiosity-driven and use-inspired basic research as well as technology development. Some members like the Simons Foundation devote the majority of their funding to basic science, while other philanthropies, like the Moore Foundation, have a portfolio that includes non-science activities. For more information, visit our members page.

Philanthropic investment has been a steadily increasing source of support for basic research, as federal dollars declined and then rebounded following the 2008 recession[11] (Figure 3). Over the last 15 years, federally funded basic research spending at university and nonprofit research institutes increased by only 1% when adjusted for inflation. In contrast, federally funded applied research spending grew by 72% over the same period. Meanwhile, the cost of fundamental research has grown as more researchers enter the research ranks (NSB-2023-26, 2023) and work at finer scales and faster speeds with specialized instrumentation.

Trends in Basic and Applied Research Expenditures at Universities and Nonprofit Organizations, by Source (1953–2021)

Source: NSF National Patterns 2021 data update (NCSES NSF 23-321, 2023)

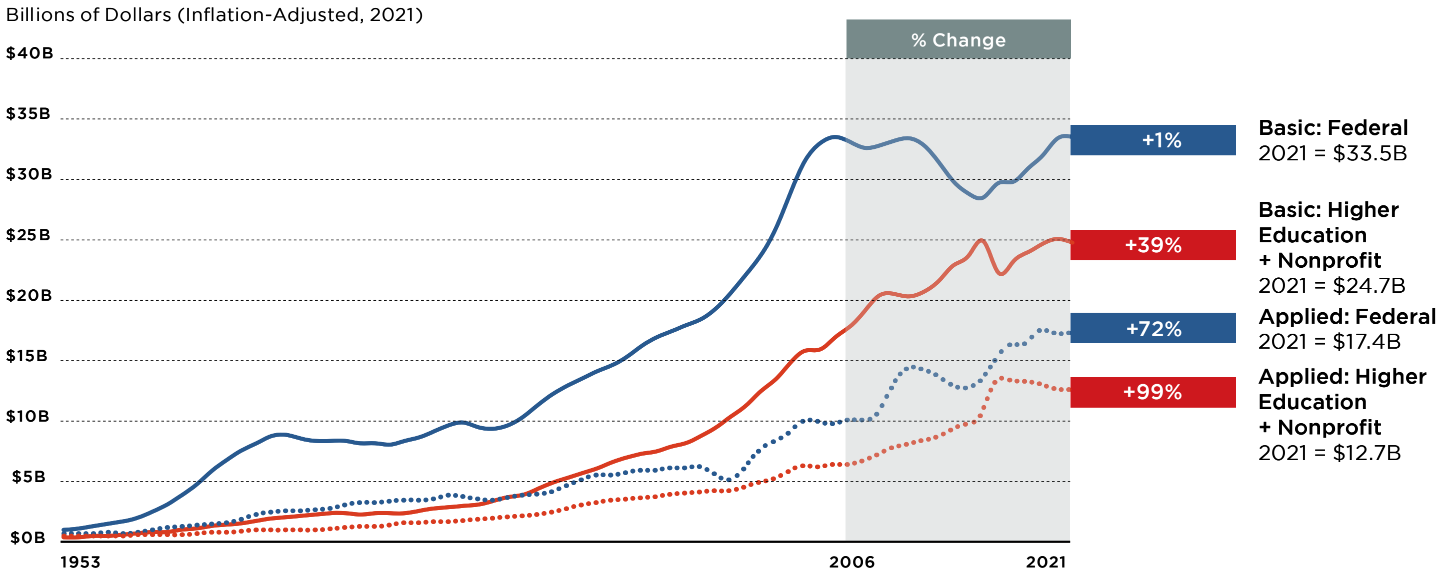


Figure 3. Federal investment in basic research has not kept pace with inflation. Blue lines show inflation-adjusted federal funding for basic (solid) and applied (dotted) research expenditures at universities and nonprofit research institutes. Red lines estimate philanthropy's contribution, combining the higher education and nonprofit funding sources. State/local and business sources are not shown. The overlay shows the change in support from 2006 to 2021.

The relative growth in applied research spending is reflected in philanthropic funding trends. While basic research spending supported by higher education and nonprofit organizations has continued to increase, the growth in applied research spending has been greater. This shift in priorities is influenced by national and global needs and may have implications for investment in research driven by curiosity and discovery. Such investment is important for unanticipated breakthroughs that turn out to have enormous, if long-term, benefits. It is also essential for enabling the next generation of scientists, engineers, entrepreneurs, and medical professionals.

The relative decline in federal support for basic research is consistent with broader trends. U.S. R&D investment has been declining steadily since 1966 (AAAS, 2022). An analysis of Organization of Economic Cooperation and Development (OECD) data found that despite leading R&D spending in 2021, U.S. public investment in R&D as a share of GDP ranked only 13th among OECD nations (Zimmerman, 2023). In 2019, the last year full OECD data were available, the U.S. ranked 10th in basic research investment as a share of GDP. Subject area diversity in the U.S. R&D portfolio has declined relative to other countries (Adams et al., 2023).

IV. Biomedical and Health Sciences Still Primary Beneficiaries of Funding

Most R&D spending within higher education (Figure 4, page 9) goes to the biological, biomedical, and health sciences[12]. In FY 2021, 67% of federal funds, 62% of higher education institutional funds, and 72% of nonprofit funds for science R&D at universities went to these fields[13]. The high level of investment from nonprofit organizations has been remarkably consistent in recent years despite changes in global priorities: it has not varied by more than 1% since 2017. Overall, two-thirds of funding for science R&D at universities is devoted to biological, biomedical, and health sciences ($46.4B); all other science fields received $23.9B.

We see similar trends in the research performed by the nonprofit sector, where 83% of science funding from all sources went to biological, biomedical, and health sciences research spending in 2021[14] (NCSES NSF 24-304, 2023). This trend is further reflected in Candid's Foundation Directory, which combines R&D with other activities such as education and healthcare. In 2022, over 28,000 grant makers provided $21.5B for health-related activities, compared to $3.0B provided by approximately 5,200 grant makers for other science and engineering activities. Despite the scale of these contributions, research still represents only a fraction of the total estimated health spending in the U.S.[15] In health, biomedical, and life sciences, there remain sizeable gaps in knowledge that philanthropy can help address.

Where Do Dollars Go?

An analysis of the FY 2021 HERD data found that nearly half (42%) of R&D spending occurred at just 30 institutions of the 910 in their census (Gibbons, 2022). An active area of effort and assessment is how to ensure a broader distribution of research performance and more equitable allocation of funds supporting research (Quider & Blazey, 2023). The first step is understanding the current landscape, as in a 2016-2021 analysis led by the Sloan Foundation that considers philanthropic investments (Gale et al., 2021), and in reports produced by NCSES[16] that discuss trends in institution support (NSB-2023-26, 2023).

Science R&D in Higher Education by Field (FY 2021)

Source: NSF/NCSES HERD FY 2021 survey (NCSES NSF 23-304, 2022)

FLOW OF FUNDS FROM SOURCE TO FIELD ($B)

FIELD	SELECTED SOURCES Federal $39.1B	Higher Education $17.1B	Nonprofit $4.7B
Biological, biomedical, and health sciences	67%	62%	**72%**
Agricultural, natural resources and conservation, other life sciences	6%	**11%**	6%
Physical sciences	**10%**	7%	5%
Geosciences, atmospheric, and ocean sciences	**6%**	4%	3%
Mathematics, statistics, and computer and information sciences	**6%**	5%	3%
Psychology and social sciences	5%	9%	**11%**
Other	1%	**3%**	1%

Note: Percentages may not total 100 due to rounding.

Figure 4. Biological, biomedical, and health sciences research receives the greatest share of funds. R&D performed at universities is categorized by scientific field and funding source. Top panel shows the flow of funds from each source (left) to scientific fields (right). Bottom panel shows the percentage of science funds that selected funding sources contribute to university R&D expenditures by field.

V. Exploring Other Research Fields

In less funded areas of research, philanthropy has an immense impact and can even be a primary research driver. For example, in the social sciences, funds provided by current and legacy philanthropy supported the majority (54%) of the $2.8B in R&D spending in 2021 (NCSES NSF 23-304, 2022). This includes the subfields of anthropology, economics, political science and government, sociology, demography, and population studies. In contrast, psychology is supported largely by federal funds (61% of the $1.3B total in 2021).

There are similar opportunities for philanthropy to move less funded sectors forward in the physical and life sciences. In June 2023, the Science Philanthropy Alliance convened a roundtable discussion focused on gaps and underfunded areas of science. Opportunities identified include zoonotic transmission, understandability of AI, quantum science, plant sciences, neuroscience, biophysics, and global climate change. The roundtable spotlighted ocean and marine science, which received less than 1% of nonprofit organizations' investment in science R&D in FY 2021, and less than 2% of the science R&D investment from the federal government and higher education institutional funds[17].

Investment is needed in all areas of science, especially as discoveries in one field can have outsized impacts on other fields. As former National Institutes of Health director Harold Varmus noted, *"scientists can wage an effective war on disease only if we--as a nation and as a scientific community--harness the energies of many disciplines, not just biology and medicine. The allies must include mathematicians, physicists, engineers and computer and behavioral scientists... Only in this way will medical research be optimally poised to continue its dazzling progress"* (Varmus, 2000).

All Areas of Climate Science Suffer From Low Philanthropic Support

A 2023 report from ClimateWorks Foundation found that philanthropic giving for climate mitigation plateaued from 2021 to 2022 and consistently receives less than 2% of overall philanthropic giving (Desanlis et al., 2023). During the Science Philanthropy Alliance's 2023 Research Institutions Meeting, multiple survey respondents highlighted basic climate science as an overlooked area. More investment is urgently needed across the spectrum from discovery research to mitigation and adaptation to global climate change[18].

VI. New Models of Philanthropy and Partnership

Philanthropies are increasingly pursuing collaborations with other funders. The Simons Foundation, for example, has a history of partnering with the National Science Foundation to advance fundamental biology through mathematics. RCSA partners with philanthropic and federal funders to support interdisciplinary teams of researchers through the Scialog program. The Civic Science Fellows program brings together a dozen foundations to fund fellows at the intersection of science and society. As funders seek to amplify their impact, cross-sector collaborations can help ensure that investments contribute maximally to scientific knowledge, progress, and innovation. Forums such as the Government-University-Industry Research Roundtable led by the National Academies of Science, Engineering, and Medicine provide a platform for philanthropies to explore collaborations.

Philanthropists can expand their impact by dedicating a portion of their resources to advancing scientific discovery, recognizing that progress stems from continued investment and innovative approaches to science philanthropy[19]. The Hypothesis Fund empowers a diverse network of scientists to provide seed funding to peer researchers with promising yet untested basic science ideas. Another organization exploring new approaches is the Experiment Foundation, which provides a platform for philanthropists, companies, governments, and the public to give small grants directly to scientists. Convergent Research, a member of the Schmidt Futures Network, is pioneering Focused Research Organizations to accelerate scientific research through a new type of scientific institution.

Moreover, philanthropists and foundations can be leaders in advancing equity in science (Córdova & Ginete, 2023) and evaluating the impact of basic science (Cosentino et al., 2017; Klebanov & Michelson, 2023). One such initiative with many collaborating philanthropies engaged is the STEMM Opportunity Alliance, a national effort to galvanize private and public stakeholders around scientific equity and excellence. Philanthropies are also providing important leadership in support of open science; one such collaboration is the Open Research Funders Group. Another is the Center for Open Science, which is supported by individuals, philanthropic foundations, and federal agencies to increase research openness, integrity, and reproducibility.

Concluding Remarks

Many philanthropies are coming of age in the throes of global movements, responding to international competition in areas like quantum technology and AI, displacements of researchers because of war and environmental change, and a need to include those not previously part of the STEM ecosystem. As noted in the Science Philanthropy Alliance's 2022 Strategic Plan, it is understandable for science funders to be drawn to support more translational or applied research when viewed against the many challenges that we face. Yet, we cannot lose sight of the fact that basic research is essential for enabling our responses. As Alfred P. Sloan Foundation Program Director Evan Michelson and President Adam Falk observe in their 2021 *Issues in Science and Technology Policy* article, "what research science philanthropy decides to support will shape the trajectory of discovery." Investment in both basic research and its application is essential for a vibrant future.

Philanthropy has a long and impressive history of influencing scientific innovation, and as this report demonstrates, the contributions of philanthropy to basic research are continuing to grow. New gaps and opportunities exist that must be explored for the benefit of society and our planet. As philanthropy looks inward on how to evolve its practices for greatest impact, and outward at how to respond to global challenges, it is important to recognize that philanthropy is already a key contributor to the scientific enterprise. Collaboration among philanthropies, government, academia, and business can ensure that investment in science increasingly supports and realizes the full benefit of scientific discovery.

About Us

The Science Philanthropy Alliance is committed to advancing scientific discovery through visionary philanthropy and serves as a resource for new and established philanthropists interested in supporting basic research to drive scientific innovation and progress. For more information about our membership and advisory services, contact info@sciphil.org.

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Data Notes

Figures 1-3: NSF National Patterns of R&D Resources: 2021 Data Update (NCSES NSF 23-321, 2023).

- **Figure 1:** Tables 3-5, *Research expenditures by performing sector and source of funds: 1953–2021*. Data for all performers and funding sources were combined to generate percentages.

- **Figure 2:** Left panel: Table 7, *U.S. basic research expenditures, by source of funds and performing sector: 1953–2021*. Right panel: Table 3, *U.S. basic research expenditures, by performing sector and source of funds: 1953–2021*. Percentages are calculated based on the total annual R&D investment from the reporting sources. In the right panel, higher education and nonprofit organizations were combined as a source of funds and a performing sector.

- **Figure 3:** Tables 3 *(basic)* and 4 *(applied) research expenditures by performing sector and source of funds: 1953–2021*. Values use an inflation rate adjustment of 1.189 from constant 2012 dollars. Higher education and nonprofit organizations were combined.

Figure 4: NSF/NCSES HERD FY 2021 survey (NCSES NSF 23-304, 2022), Table 13, Higher education R&D expenditures, by source of funds and R&D field: FY 2021. Several fields were combined, consistent with the categorization in the NPRA dataset (NCSES NSF 24-304, 2023). Percentages in the table are relative to total investment in science fields by source.

Footnotes

1: The National Science and Engineering Indicators (NSB-2022-1, 2022) are produced biannually by the National Science Board. The Giving USA annual report (Indiana University Lilly Family School of Philanthropy, 2023) focuses on philanthropy in general. A recent report (Conn et al., 2023) looks specifically at science philanthropy.

2: Fiona Murray's analysis provided an early estimate of philanthropic support for science and engineering at universities using similar methods to the present report. It also examined disparities in resource levels between universities and the underpinnings of modern philanthropy in the U.S. (Murray, 2013).

3: The NCSES National Patterns dataset includes gifts from individuals designated for research in an 'all other sources' designation; they cannot be accurately estimated on their own (NCSES NSF 23-321, 2023).

4: Individual gifts towards research at universities, including from alumni, represented as much as $575M in 2018, less than a third of the $1.9B in foundation giving at the same point in time (Shaker & Borden, 2020). Individuals exceeded foundation contributions to higher education overall in 2021 (Council for Advancement and Support of Higher Education, 2022).

5: Some innovation histories are shared in more depth in a 1998 policy statement (Committee for Economic Development, 1998, p. 6-10).

6: For a further discussion of the role of science philanthropy, see "Philanthropy and the Future of Science and Technology" from Evan S. Michelson, Program Director at the Alfred P. Sloan Foundation (Michelson, 2020). The unique history of science philanthropy in the U.S. is also explored in a 2021 article by physicist Robert Conn, former president of the Kavli Foundation and former board chair of the Science Philanthropy Alliance (Conn, 2021).

7: A comprehensive overview of U.S. federal R&D funding is provided by the National Academy of Sciences Committee on Criteria for Federal Support of Research and Development's report on Allocating Federal Funds for Science and Technology (National Academy of Sciences, 1995).

8: A full list of subfields for science, engineering, and non-S&E areas is provided in the Higher Education Research and Development (HERD) Survey, Table 13, *Higher education R&D expenditures, by source of funds and R&D field*: FY 2021 (NCSES NSF 23-304, 2022).

9: While this report focuses on NCSES R&D expenditure data, another approach for evaluating philanthropy's role in the research enterprise is through organizational tax returns. A 2022 study in pre-print looks at tax return data from tens of thousands of nonprofit organizations that fund science and estimates that philanthropic support for science activities at research institutions rivals government support (Shekhtman et al., 2022).

10: A notable change in data collection methods for nonprofit research institutions data occurred in FY 2016, which was the first time collected data was formalized in a survey since 1997 (NCSES NSF 24-304, 2023). This change in method may contribute to an apparent drop in nonprofit funds in 2016.

11: An NCSES Academic Research and Development report in October 2023 notes that "federal and nonfederal support for applied research and experimental development were higher in 2021 than in 2011 (Figure URD-7);" whereas, federal support for basic research at academic institutions remained below 2011 levels following inflation adjustment (NSB-2023-26, 2023).

12: The NCSES HERD Survey includes results for 910 public and private higher education institutions from FY 2021. Expenditures by field and subfield are not distinguished by R&D type (basic, applied, development) (NSF 23-304, 2022).

13: Spending on biological, biomedical, and health sciences R&D at universities in FY 2021 included $26.1B from federal funds, $10.6B from higher education, and $3.4B from nonprofits.

14: Nonprofit sector data are collected by the NCSES and the Census Bureau. The 2021 results reported on a sample of 8,050 nonprofit organizations from a population of 40,650 (NCSES NSF 24-304, 2023). Science field data is reported in Table 5.

15: A recent report by Research!America illustrates that R&D represented only 5.9% of the $4.1T in U.S. health spending in 2020 (Research!America, 2022).

16: See HERD Table 21 (NSF 23-304, 2022) and "Patterns of Academic R&D Spending" Table URD-2 from NSB-2023-26 (2023).

17: Of FY 2021 spending on ocean and marine science R&D at universities (NSF 23-304, 2022), nonprofits funded $44.8M, compared to $641M from the federal government and $209M in higher education institutional funds. The total spent on all science R&D at universities was $4.7B from nonprofits, $39.1B in federal funds, and $17.1B from higher education.

18: The Climate Finance Tracker by Vibrant Data Labs is a useful tool for exploring private support for climate mitigation and adaptation in the U.S. As one example of a gap, hundreds of prominent scientists have called for expanded ocean-based carbon dioxide removal research.

19: For further examples of innovative philanthropic funding models, see relevant articles in *The Chronicle of Philanthropy* (Stiffman, 2023) and *The Atlantic* (Thompson, 2022).

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