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Public Attitudes

Science and Technology: Public Attitudes, Knowledge, and Interest

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Executive Summary

Key takeaways:

- Most Americans continue to have positive attitudes about the benefits of science. For example, nearly three-quarters of Americans in 2018 saw more benefits than harms from science, and more than 90% of Americans agreed that science and technology (S&T) will offer more opportunities for the next generation. These positive attitudes have remained stable for several decades.
- Americans have supported federally funded basic research (84% in 2018) for several decades, and in 2018, approximately half (43%) thought federal spending was too low.
- Despite the public support for the scientific community and the benefits of science, about half (49%) of the U.S. public is concerned that S&T may be making “life change too fast.” This share has been generally stable over the last decade but was relatively lower in earlier decades.
- The U.S. public has become more concerned about the potential danger of several S&T issues, including environmental issues and technological issues, such as nuclear energy and genetic modification.
- Americans increasingly rely on the Internet, rather than newspaper and television, for S&T news and information.
- Americans with higher levels of education consistently report the most positive attitudes about science and scientists and have the most interest in S&T.

This thematic report presents indicators about people’s attitudes toward issues related to S&T, awareness of basic S&T facts, and how people interact with science. As in past editions of *Science and Engineering Indicators*, this 2020 thematic report shows that most Americans hold positive beliefs about the benefits of S&T, have relatively high confidence in the scientific community compared with other groups, and believe that scientists are seeking to improve society. Most Americans also see value in federal funding of scientific research, and an increasing percentage of Americans indicate that current spending on science, health, and other issues is too low. These positive perceptions are, however, accompanied by some concern that S&T may be making “life change too fast.” Compared with previous years, there are also relatively high levels of concern about specific environmental issues, such as water pollution and climate change, and technologies, such as genetically engineered food and nuclear energy.

Americans report high levels of interest in new medical discoveries and the environment. However, interest in both topics has declined over time. Americans report relatively moderate but stable levels of interest in other S&T issues, such as new scientific discoveries and new inventions and technologies. Americans’ use of the Internet for science and general news has grown steadily over most of the last 20 years, and the Internet has become the most widely used source. Reliance on television and traditional newspapers has dropped in the same period for science and general news. Zoos and aquariums continue to be the most popular types of informal science institutions, with the share of Americans visiting these venues remaining fairly stable.

Education is the most important demographic variable associated with positive views about science. Highly educated Americans—whether measured by highest year of education completed, number of science and mathematics courses taken, or knowledge of basic scientific facts—are more likely to report the most optimistic views about science and positive views about scientists. More highly educated people typically report the most concerns about environmental threats. Women and younger respondents are also more concerned about the environment. International data exhibit similar trends. They suggest that, in most cases, Americans remain relatively positive about S&T when compared with people in other countries, with the exception of Chinese citizens, who are often equally or somewhat more positive.

Introduction

This report provides a portrait of public attitudes and understanding of science and technology (S&T) in the United States. The primary data for the report come from the General Social Survey (GSS), a long-standing, face-to-face national survey sponsored by the National Science Foundation (NSF) with comprehensive sociological and attitudinal trend data.¹ The **Technical Appendix** provides more information on the GSS and the other data sources used in this report. All differences or patterns specifically reported in the text are statistically significant. Other public sources, including Pew Research Center and Gallup, are also noted when appropriate, as well as data from other countries. Question wording and order, as well as other factors, such as survey mode and sampling frame, generally vary across sources; comparisons across surveys should, therefore, be done with caution.

The report focuses on overall patterns in S&T attitudes and interest in science. It emphasizes over-time comparisons and comparisons between related questions. It also discusses variations by respondents' demographic characteristics. Race is not included in the analysis because the GSS does not include an adequate number of responses from any single nonwhite group to allow for valid comparisons (see, however, Allum et al. [2018]; Plutzer [2013]). Detailed data on the demographic characteristics of respondents are included in the report's supplemental tables and the **Technical Appendix**.

This report contains four main sections. The first presents Americans' overall views about science, including the degree to which Americans see promise in S&T, whether they report reservations about S&T, and what views they hold about scientists and federal funding of scientific research. The second section addresses public attitudes about specific S&T issues, such as various environmental issues, including climate change, genetically modified food, and nuclear energy. The third section examines understanding of S&T-related facts and processes. The final section explores the American public's interest in and source of S&T-related news and public involvement in S&T-related activities, such as visits to science or technology museums.

Although the survey questions examined throughout the report focus on views about science or technology, rather than engineering, limited available evidence suggests that most Americans may not substantially distinguish between these subjects when it comes to public opinion. Specifically, the 2014 edition of *Science and Engineering Indicators* included an analysis of an experiment in which half of the respondents were asked their perceptions about scientists and half were asked about engineers (National Science Board [NSB] 2014). The results showed few substantive differences between the two groups of respondents. Further, many of the specific technological issues discussed in the report (e.g., genetic modification, nuclear energy) could be understood as engineering focused. Engineering, in this regard, can be understood as a key driver of technology. Nevertheless, readers should be cautious in extrapolating views about science or technology to views about engineering.

Public Attitudes about S&T in General

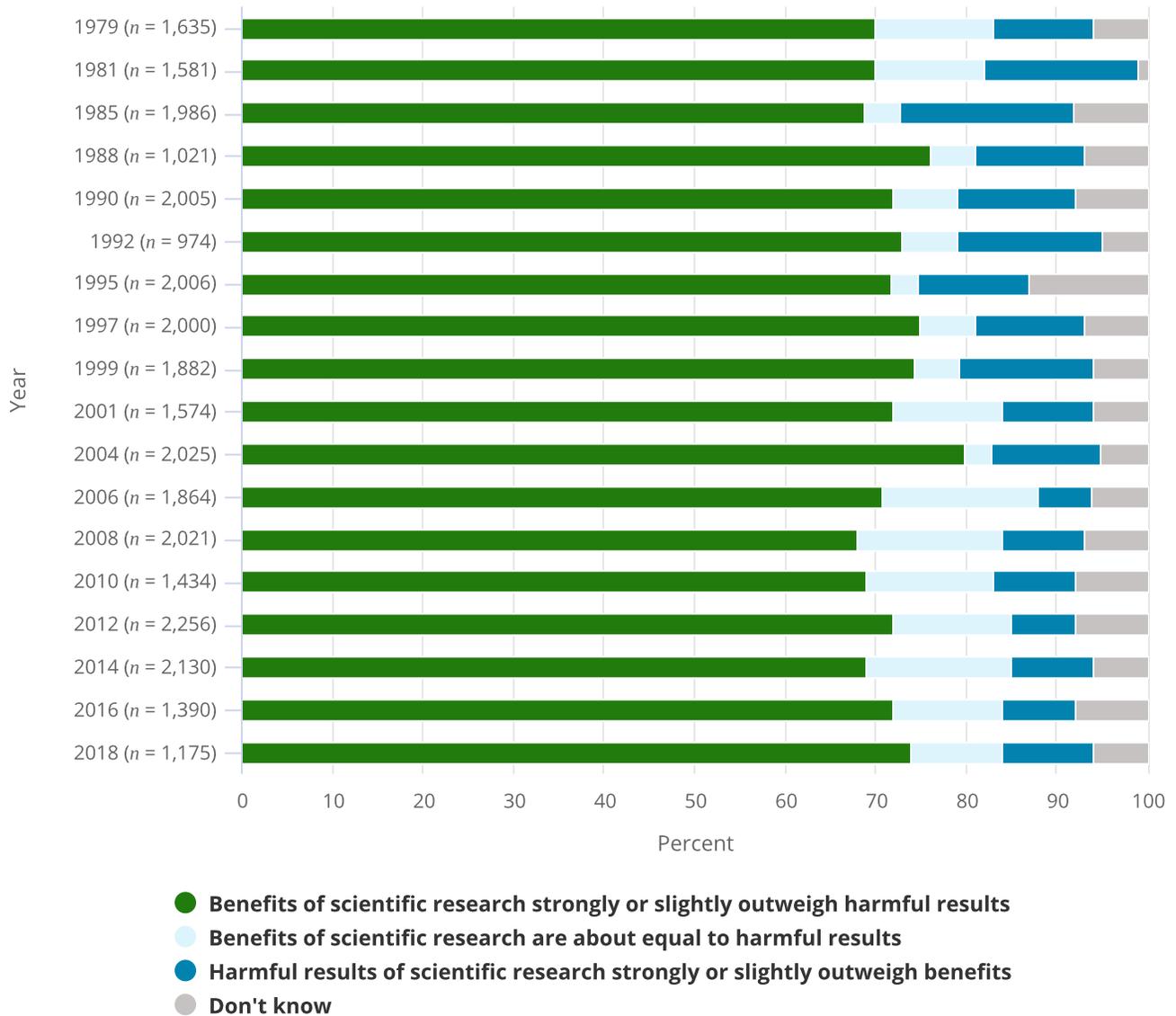
Public perceptions of science and scientists can influence willingness to fund S&T through public investment (Besley 2018; Miller, Pardo, and Niwa 1997; Muñoz, Moreno, and Luján 2012), as well as young people's willingness to enter S&T training programs and choose S&T jobs (Besley 2015; Losh 2012). Committing resources—including money to fund science research and time to pursue S&T training—means trusting that such commitments will pay off over the long term for individuals, families, and society. General views about S&T may also be associated with opinions about specific technologies and research programs that could enhance lives or pose new risks (NSB 2018). This section summarizes whether Americans see promise in S&T and/or hold reservations about S&T, their confidence in the scientific community's leadership and perceptions of scientists, and their views about federal funding of scientific research.

Perceived Promise of and Reservations about S&T

Overall, most Americans remain strong believers in the benefits of S&T; however, a considerable number also see potential harms. In 2018, nearly three-quarters of respondents (74%) saw more benefits than harms from science; this share has ranged between 68% and 79% since 1979 (Figure 7-1; Table S7-1 and Table S7-2). By comparison, 10% in 2018 said science creates more harms than benefits, and 10% said that the benefits and harms are about equal (Table S7-2).

FIGURE 7-1

Public assessment of benefits and harms of scientific research: 1979–2018

**Note(s)**

Responses are to the following: *People have frequently noted that scientific research has produced benefits and harmful results. Would you say that, on balance, the benefits of scientific research have outweighed the harmful results, or have the harmful results of scientific research been greater than its benefits?* In this figure, "Benefits...outweigh harmful results" and "Harmful results...outweigh benefits" each combine responses of "strongly outweigh" and "slightly outweigh." Percentages may not add to 100% because of rounding. Data in this figure may differ slightly from data in *Science and Engineering Indicators 2018* because of the rounding procedure used. See Table S7-1 and Table S7-2.

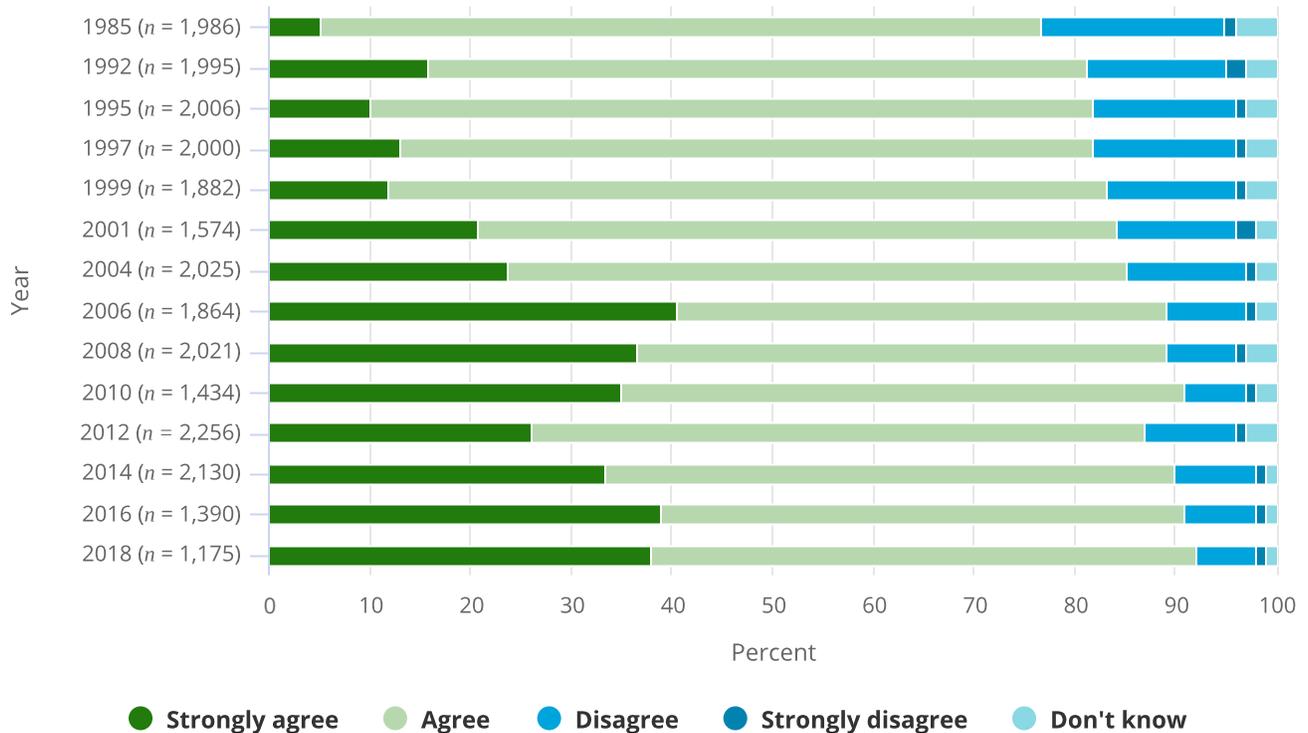
Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1979–2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2006–18).

It is also informative to ask about perceived benefits and harms separately (Binder et al. 2012). Regarding specific benefits, in 2018, almost all Americans (92%) agreed with the following statement: “Because of science and technology, there will be more opportunities for the next generation” (Figure 7-2; Table S7-3 and Table S7-4). This share of agreement included 38% of those who “strongly agreed” with the statement and 54% who “agreed.”² U.S. public agreement (consisting of those who “strongly agree” and those who “agree”) that S&T provides more opportunities increased from 77% in 1985 to 90% in 2006 and has hovered around that level over the last decade.

FIGURE 7-2

Public assessment of whether science and technology result in more opportunities for the next generation: 1985–2018

**Note(s)**

Responses are to the following: *Because of science and technology, there will be more opportunities for the next generation.* Percentages may not add to 100% because of rounding. See Table S7-3 and Table S7-4.

Source(s)

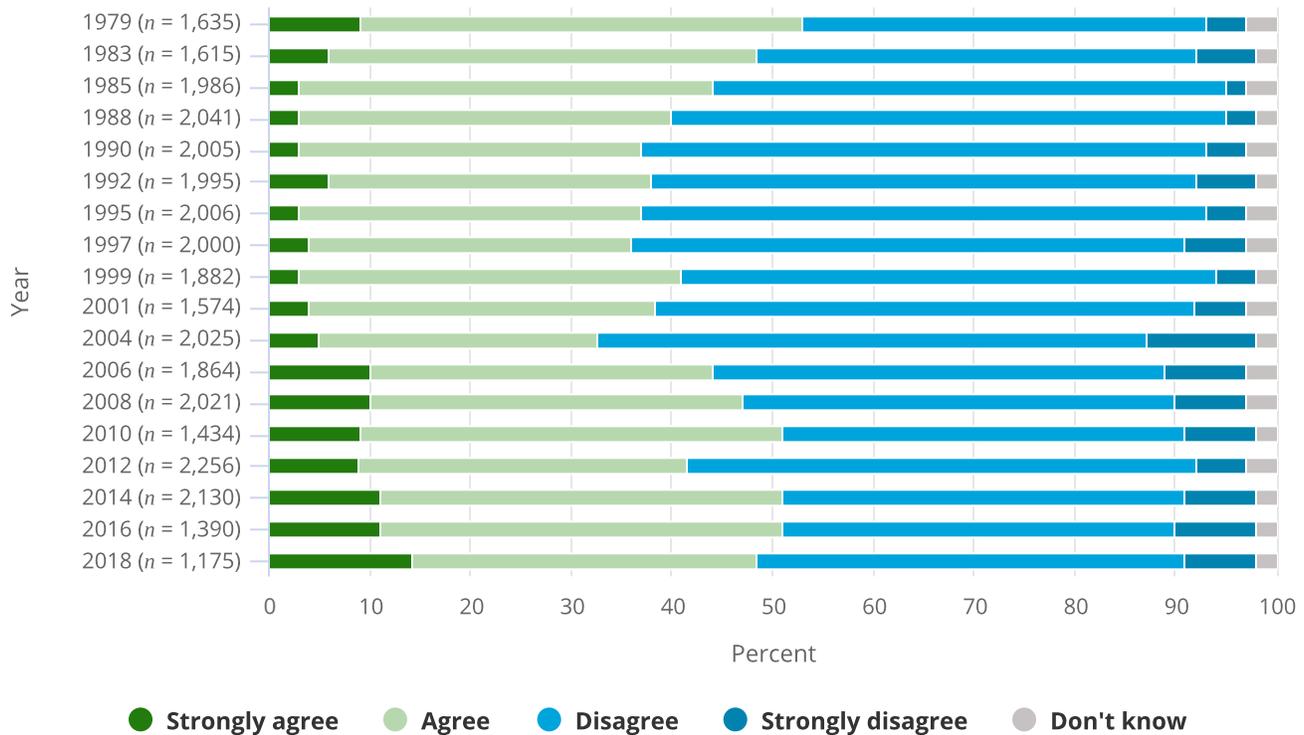
National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1985–2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2006–18).

Science and Engineering Indicators

Despite these near-universal positive perceptions, nearly half of Americans (49%, consisting of 14% who “strongly agree” and 34% who “agree”) agreed in 2018 that “science makes our way of life change too fast” (Figure 7-3; Table S7-5 and Table S7-6). This share has been generally stable over the last decade but was relatively lower in the mid-1980s, 1990s, and early 2000s.

FIGURE 7-3

Public assessment of whether science makes life change too fast: 1979–2018

**Note(s)**

Responses are to the following: *Science makes our way of life change too fast*. Percentages may not add to 100% because of rounding. See Table S7-5 and Table S7-6.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1979–2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2006–18).

Science and Engineering Indicators

Attitudes toward science may vary by level of education and income. For example, respondents with less education and lower income levels are generally less positive about S&T. The variation by demographic groups is generally small for the questions focused on the benefits of S&T, where respondents from all groups have positive views, but variation is somewhat larger for the question about pace of change, where attitudes vary more widely (Table S7-3 and Table S7-5). For example, more than 90% of Americans with the least science education and those with the most science education agreed (combining scores on “agreed” and “strongly agreed”) that science resulted in more opportunities. On the other hand, 57% of those with the least science education agreed that science makes “life change too fast” compared with 34% of those with the most science education.

Other surveys, including those in other countries, also show widespread support for, and only limited opposition to, the role of science in society, both recently and in the past (NSB 2018). For example, a recent 140-country survey about science by Gallup for the Wellcome Trust (2019), an English charity, found that about 7 in 10 people surveyed around the world think scientists’ work “benefits people like them.” The United States (83%) and the Northern European countries (80%) surveyed had some of the most positive views. People in North Africa (49%), South America (55%), and Southern Africa (55%) were among those least likely to believe that they receive benefits from scientists’ work. China’s own national survey, using a somewhat different question about benefits that is not directly comparable, found that about three-

quarters of respondents agreed that “the public’s understanding and support for science, technology, and innovation lay the foundation for accelerating the building of China into an innovative nation” and that “major S&T achievements are an important manifestation of China’s improvement in comprehensive national strength” (China Research Institute for Science Popularization [CRISP] 2018).

Perceptions of Scientists

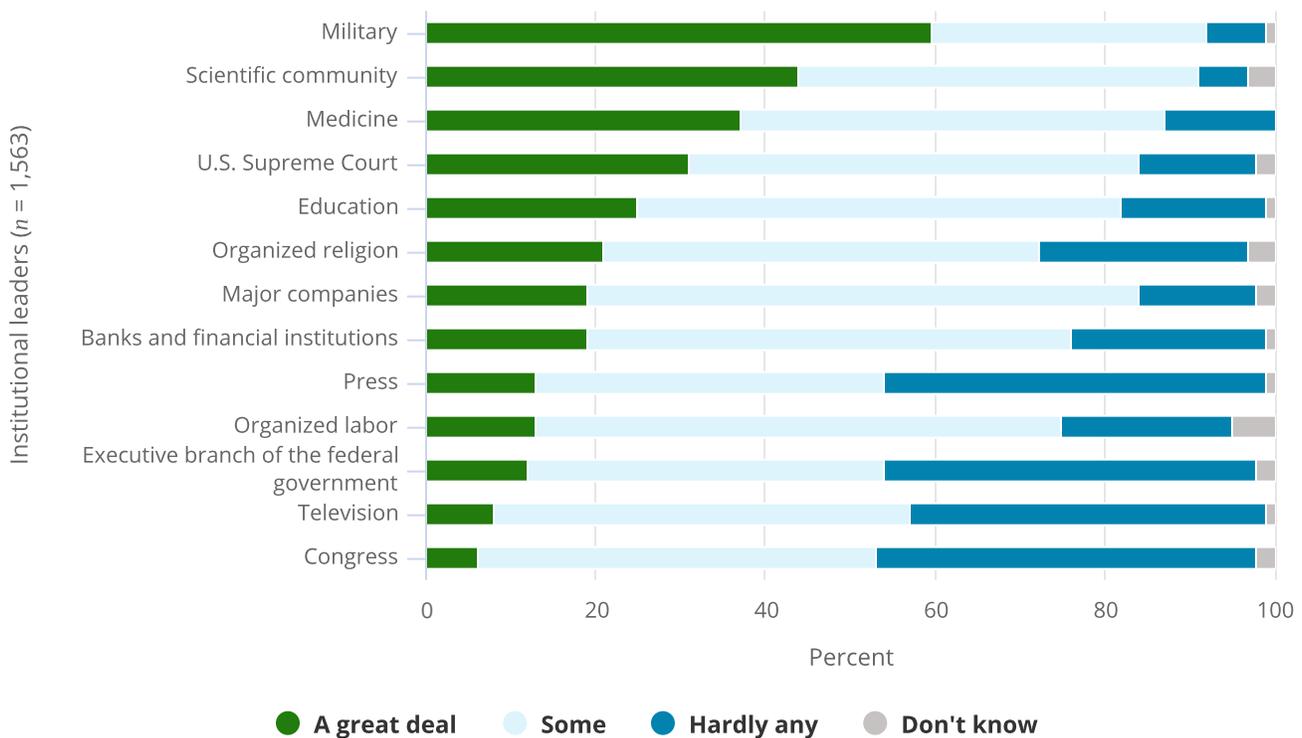
Most Americans have consistently reported holding a range of positive attitudes about scientists; however, some surveys also find specific areas where substantial groups of people hold negative or ambivalent perceptions. As with overall attitudes about science, people with more education are consistently the most likely to report positive views.

Confidence in the Scientific Community

Leaders of the scientific community have had the second strongest confidence rating among 13 types of institutions between 2012 and 2018. Leaders of the military have had the most positive rating, with substantially higher levels of confidence than any other group for nearly 20 years. In 2018, 44% of Americans had a “great deal” of confidence in the “people running” the “scientific community” (Figure 7-4; Table S7-7 and Table S7-8). A similar share (47%) said they have “some” confidence. Although those expressing a “great deal” of confidence in 2018 (44%) is near its historic high, U.S. public confidence in the scientific community has generally fluctuated within a narrow range since 1973 (37%) (Figure 7-5). The relatively stable level of confidence in the scientific community contrasts with declines in confidence for many other institutions. Pew Research Center also found that scientists rank second only to the military in a 2018 survey (Funk and Kennedy, 2019).

FIGURE 7-4

Public confidence in institutional leaders, by selected institution: 2018



Note(s)

Percentages may not add to 100% due to rounding. Responses are to the following: *As far as the people running these institutions are concerned, would you say that you have a great deal of confidence, only some confidence, or hardly any confidence at all in them?* See Table S7-7.

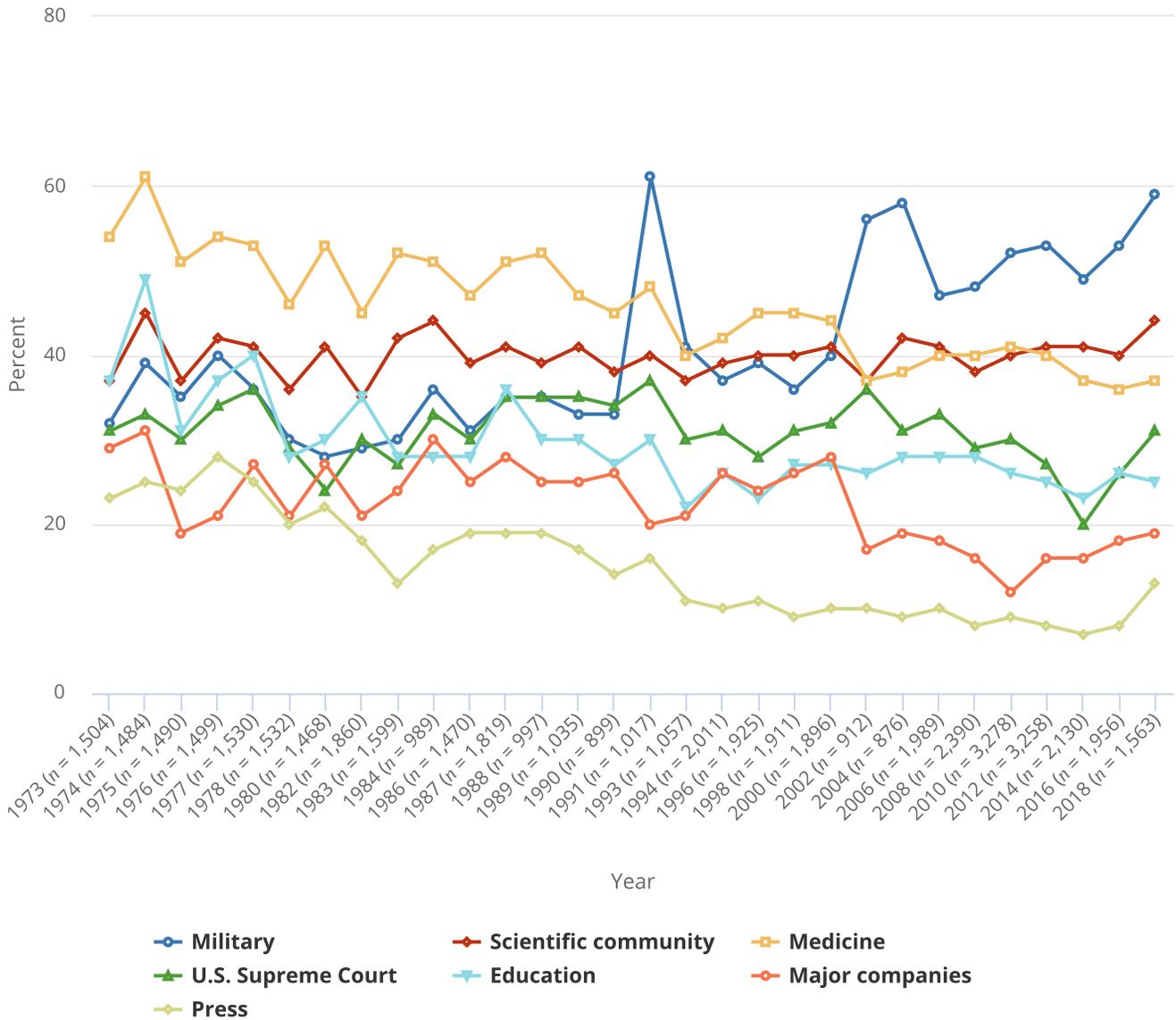
Source(s)

NORC at the University of Chicago, General Social Survey (2018).

Science and Engineering Indicators

FIGURE 7-5

Public confidence in institutional leaders, by selected institution: 1973–2018



Note(s)

Responses are to the following: *As far as the people running these institutions are concerned, would you say that you have a great deal of confidence, only some confidence, or hardly any confidence at all in them?* Figure shows only responses for "a great deal of confidence." See Table S7-7.

Source(s)

NORC at the University of Chicago, General Social Survey (1973–2018).

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By contrast, confidence in medicine—which might also be considered a science-related topic—has declined since the 1970s and is now relatively low compared with historical levels. Several other institutions have seen similar declines (Figure 7-5).

Men and people with more education and income tend to express higher levels of confidence in leaders of the scientific community. Education is also positively associated with confidence in medicine (Table S7-8).

A broader survey on trust by Pew Research Center shows similarly high levels of confidence in the scientific community; however, question wording varies. The Pew Research Center survey shows small increases in confidence in “scientists” and “medical scientists” between 2016 and 2019 compared with stable levels in the GSS (Funk et al. 2019).³

People in other countries also report having a relatively high level of confidence in the scientific community. For example, in China’s national survey, Chinese respondents ranked “scientists” as the third most prestigious career behind teachers and physicians (CRISP 2018). These results are similar to the 140-country Wellcome Trust (2019) survey results that suggest that the United States has trust levels similar to the European average, although less than several specific European countries (e.g., the United Kingdom, Spain). This survey also found somewhat lower trust levels in China than in Europe or the United States. U.S. respondents reported much less trust than several relatively small countries (e.g., Uzbekistan, Niger).

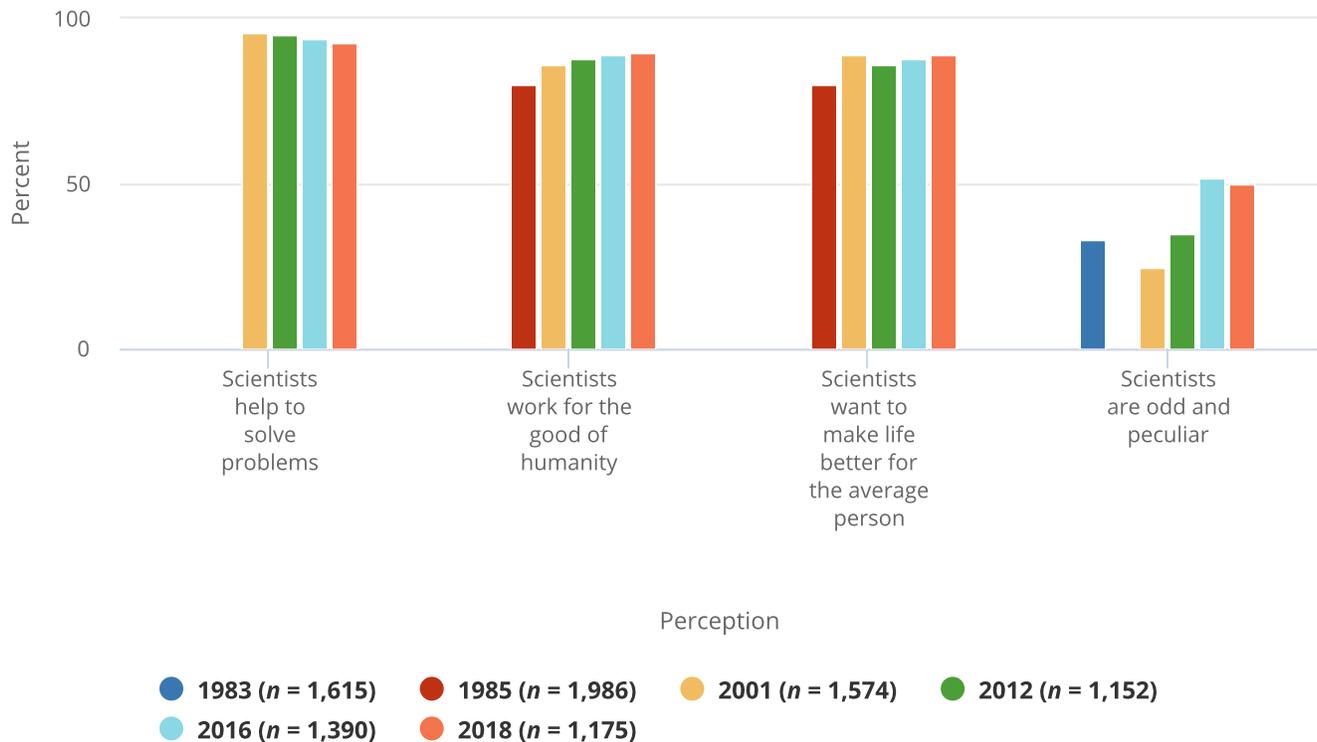
Scientists’ Perceived Trustworthiness

Beyond overall confidence, almost all Americans say that they believe scientists want to make a positive difference in the world. As in previous years, a large majority of Americans agreed with the following three statements in 2018 (Figure 7-6; Table S7-9 and Table S7-10):

- “Scientists are helping to solve challenging problems” (93% agree).
- “Scientific researchers are dedicated people who work for the good of humanity” (90% agree).
- “Most scientists want to work on things that will make life better for the average person” (89% agree).

FIGURE 7-6

Public perception of scientists: Selected years, 1983–2018

**Note(s)**

Questions were not all fielded in all years. Data represent respondents who "strongly agree" and "agree" with the following: *Scientific researchers are dedicated people who work for the good of humanity; Scientists are helping to solve challenging problems; Most scientists want to work on things that will make life better for the average person; and Scientists are apt to be odd and peculiar people.* Data in this figure may differ slightly from data in *Science and Engineering Indicators 2018* because of the rounding procedure used. See Table S7-10.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1983–2001); NORC at the University of Chicago, General Social Survey (2012–18).

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The 2018 data are very similar to the 2016 data. However, although overall agreement with these statements about scientists has been relatively high in all years in which data were collected, there has been an increase over time in the percentage of people who "strongly agree" with the statements (Table S7-10).

The high trust that Americans place in scientists contrasts with half of Americans agreeing that "scientists are apt to be odd and peculiar people" in 2018, up from 24% in 2001 (Table S7-10).⁴

A Pew Research Center study on trust (Funk et al. 2019) also investigated beliefs about specific types of scientists, such as medical, nutrition, and environmental research scientists, and science professionals (e.g., doctors, dietitians, environmental health specialists). This study also found that most Americans have "mostly positive" general views about people associated with science but gave somewhat less positive responses when asked specific questions. For example, 57% of respondents said they have "mostly positive" views about environmental research scientists, but just 40% said that they thought such scientists "do a good job" "all or most of the time." Responses about research, medical, and nutrition research scientists followed a similar pattern.

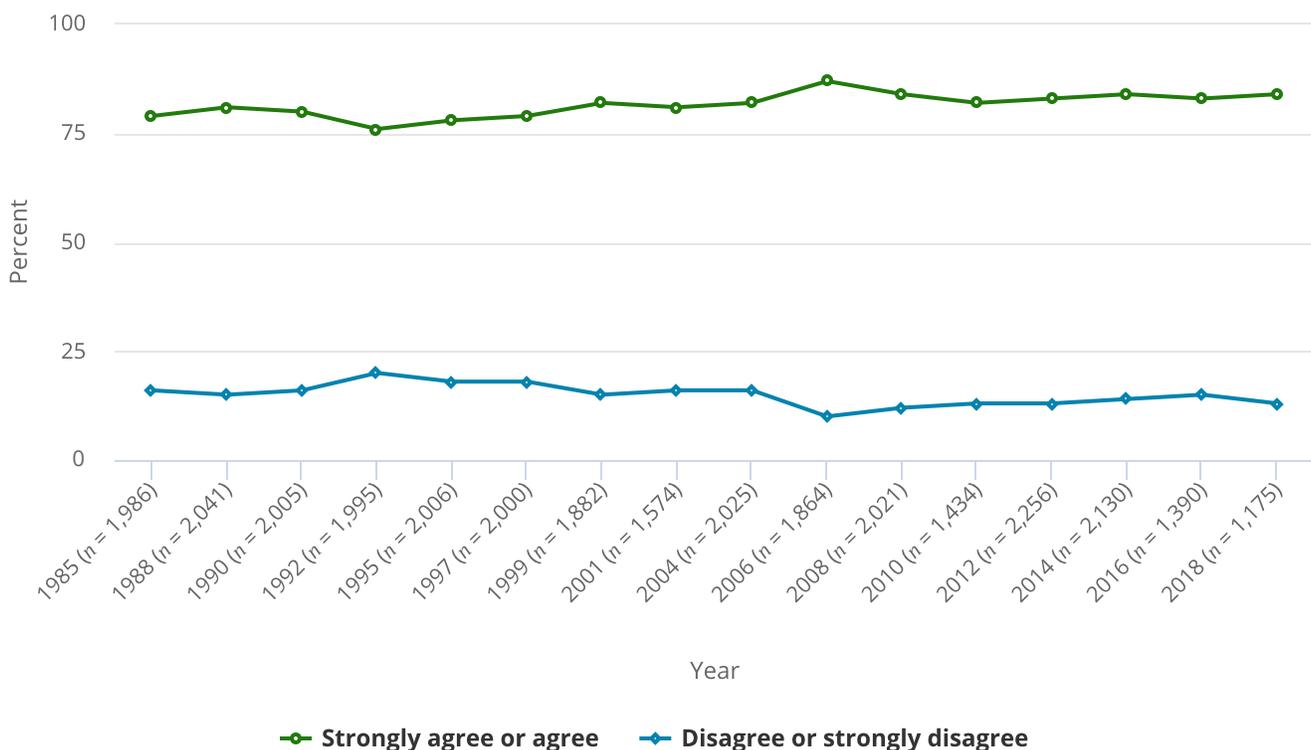
Although recent data on perceptions of scientists are rare outside the United States, data from Germany also suggest a mix of positive and negative perceptions (Wissenschaft im Dialog 2018). For example, in 2018, nearly two-thirds (64%) of Germans agreed that they trust scientists because scientists are “experts in their field”; however, about two-thirds (67%) also agreed that a reason to distrust scientists is because they “are strongly dependent on the funders of their research.” Overall, although most American respondents indicated that they thought scientists were trying to help society, less than half (40%) of Germans agreed that “scientists work for the benefit of society.”

Federal Funding of Scientific Research

In 2018, a strong majority of Americans (84%) continued to agree with this statement: “Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government” (Figure 7-7; Table S7-11 and Table S7-12). High public support for federally funded basic research, measured by those who “agree” or “strongly agree,” has remained relatively consistent since first asked about in 1985. Americans with lower educational attainment are somewhat less supportive of government funding for basic research but still largely positive. For example, in 2018, the percentage of Americans who agreed with the aforementioned statement was 78% for those with the least science and mathematics education and 95% for those with the most science and mathematics education (Table S7-11).

FIGURE 7-7

Public opinion on whether the federal government should fund basic scientific research: 1985–2018



Note(s)

Responses are to the following: *Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government. Do you strongly agree, agree, disagree, or strongly disagree?* Responses of “don’t know” are not shown. Data in this figure may differ slightly from data in *Science and Engineering Indicators 2018* because of the rounding procedure used. See Table S7-11 and Table S7-12.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1985–2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2006–18).

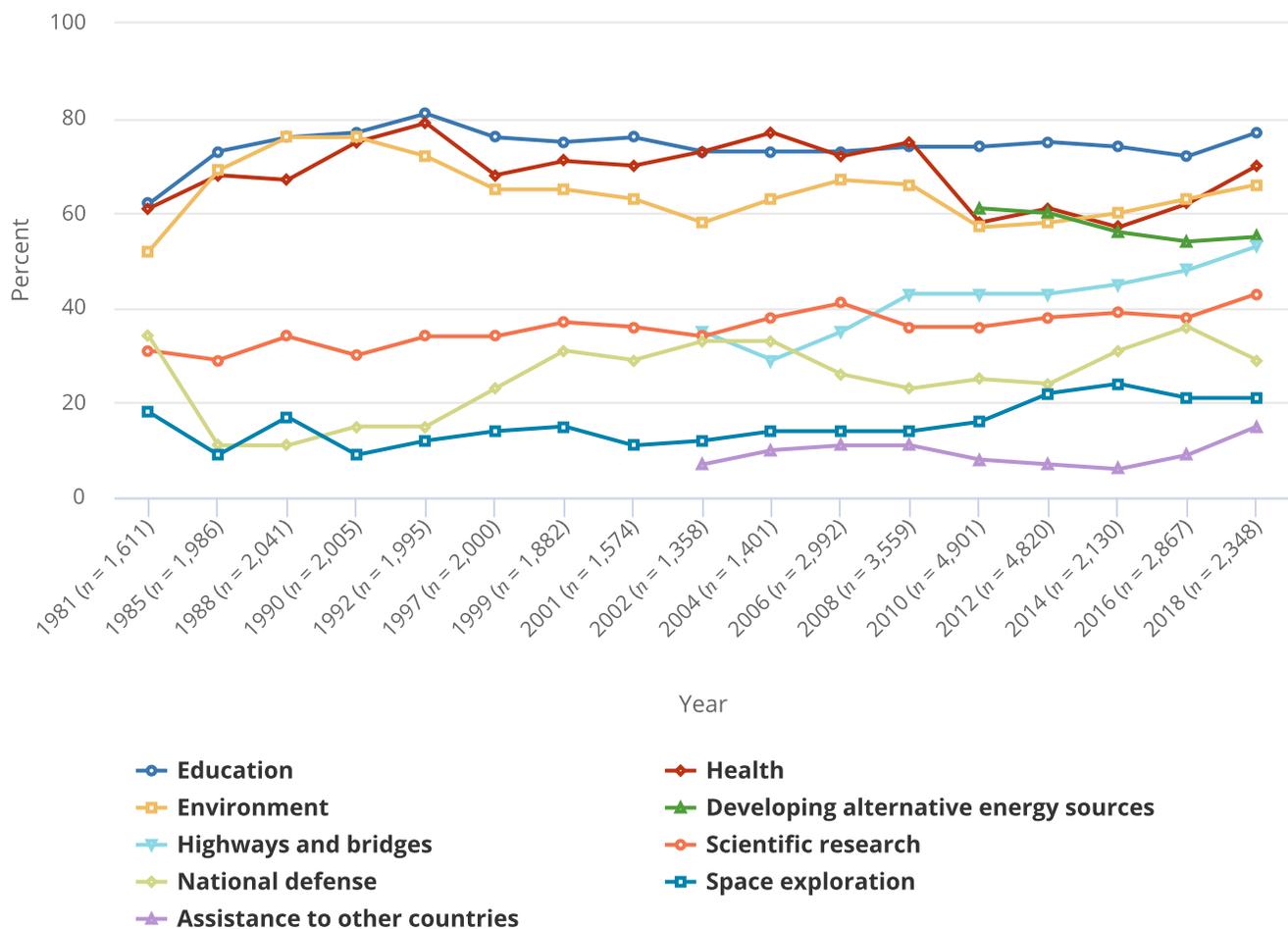
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As in past years, results are similar to those in other countries that have done such surveys (NSB 2018). In the most recent data from China, for example, 82% of 2018 survey respondents agreed with the statement that “even if it brings no immediate benefits, basic research should be supported by the government” (CRISP 2018). The share of Americans who agreed with a similar statement in the GSS in 2018 was nearly identical (Figure 7-7).

Although there is strong public support for federal funding of basic research, a separate question focused on perceptions of current spending levels found that 43% of Americans believe that “too little” is being spent in the United States to support “scientific research” (Figure 7-8). The 2018 level is as high as it has been and similar to 2006 (41%), having risen from 30% in 1990 and having largely remained in the middle to high 30% range during the 2000s and 2010s (Figure 7-9; Table S7-13). More recently, between 2010 and 2018, a rising share of Americans indicated spending was “too little” for science-related topics such as health, the environment, and space exploration.⁵ The pattern for nonscience topics varied somewhat, but overall, Americans increasingly said that multiple issues receive too little funding.

FIGURE 7-8

Public assessment that government spending is too low, by policy area: 1981–2018



Note(s)

Questions were not all fielded in all years. Responses are to the following: *We are faced with many problems in this country, none of which can be solved easily or inexpensively. I'm going to name some of these problems, and for each one, I'd like you to tell me if you think we're spending too little money on it, about the right amount, or too much.* Responses of "right amount" and "don't know" are not shown. See Table S7-13.

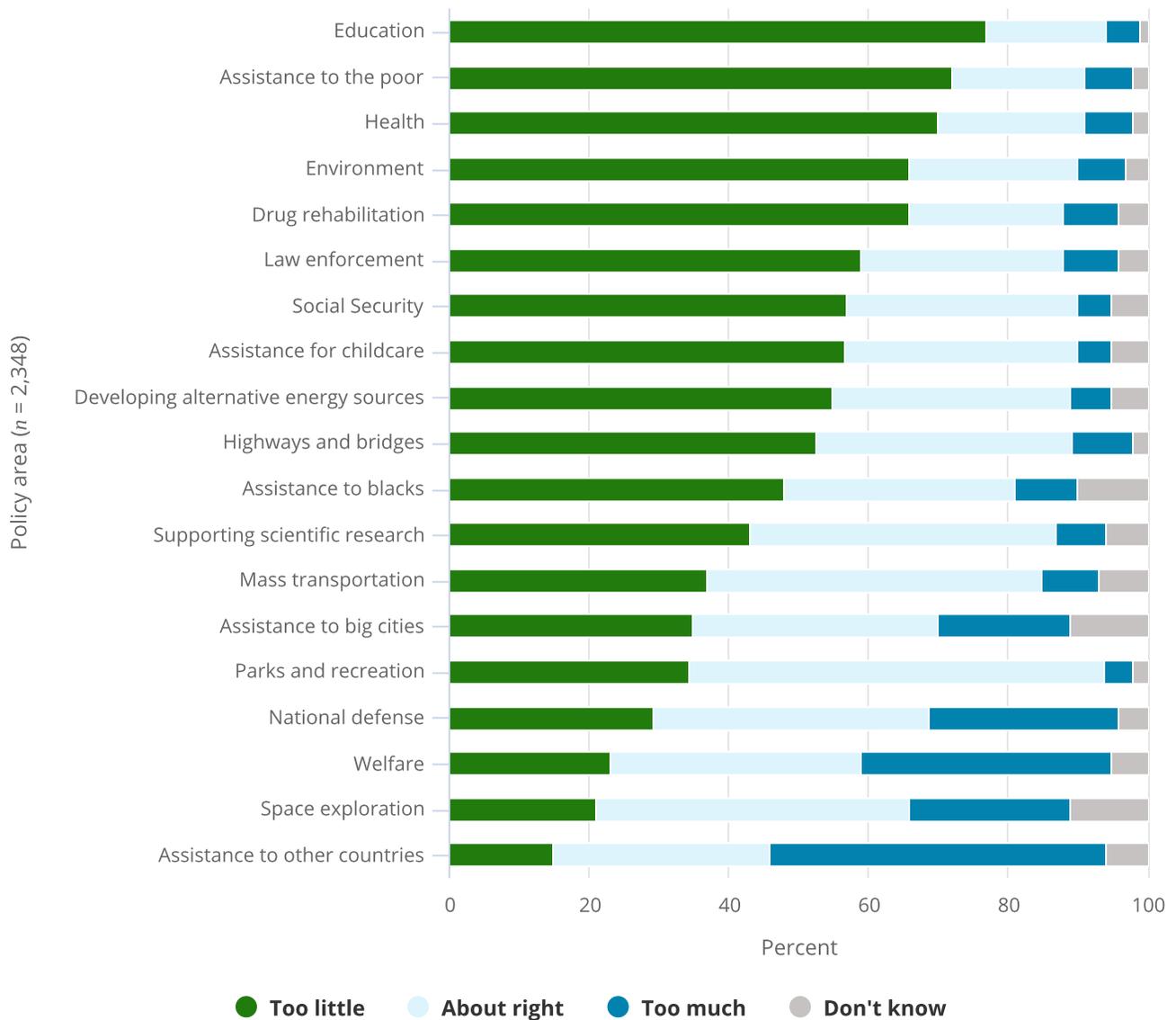
Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1981–2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2002–18).

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FIGURE 7-9

Public assessment of spending, by policy area: 2018



Note(s)

Responses are to the following: *We are faced with many problems in this country, none of which can be solved easily or inexpensively. I'm going to name some of these problems, and for each one, I'd like you to tell me if you think we're spending too little money on it, about the right amount, or too much.* Percentages may not add to 100% because of rounding. See Table S7-13.

Source(s)

NORC at the University of Chicago, General Social Survey (2018).

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Higher levels of educational attainment tended to be associated with reporting “too little” science-related funding, although this was not the case for health spending (Table S7-14 and Table S7-15). A higher percentage of women than men reported that they believe there is “too little” spending on health and the environment, whereas men tended to report perceiving “too little” spending on space exploration (Table S7-15 through Table S7-17). Relatively younger respondents were more likely to report “too little” spending on the environment. For example, although 57% of respondents in the 65 or older group said “too little” was being spent on the environment in 2018, 74% of the two youngest age groups (18–24 and 25–34) shared this view (Table S7-16).

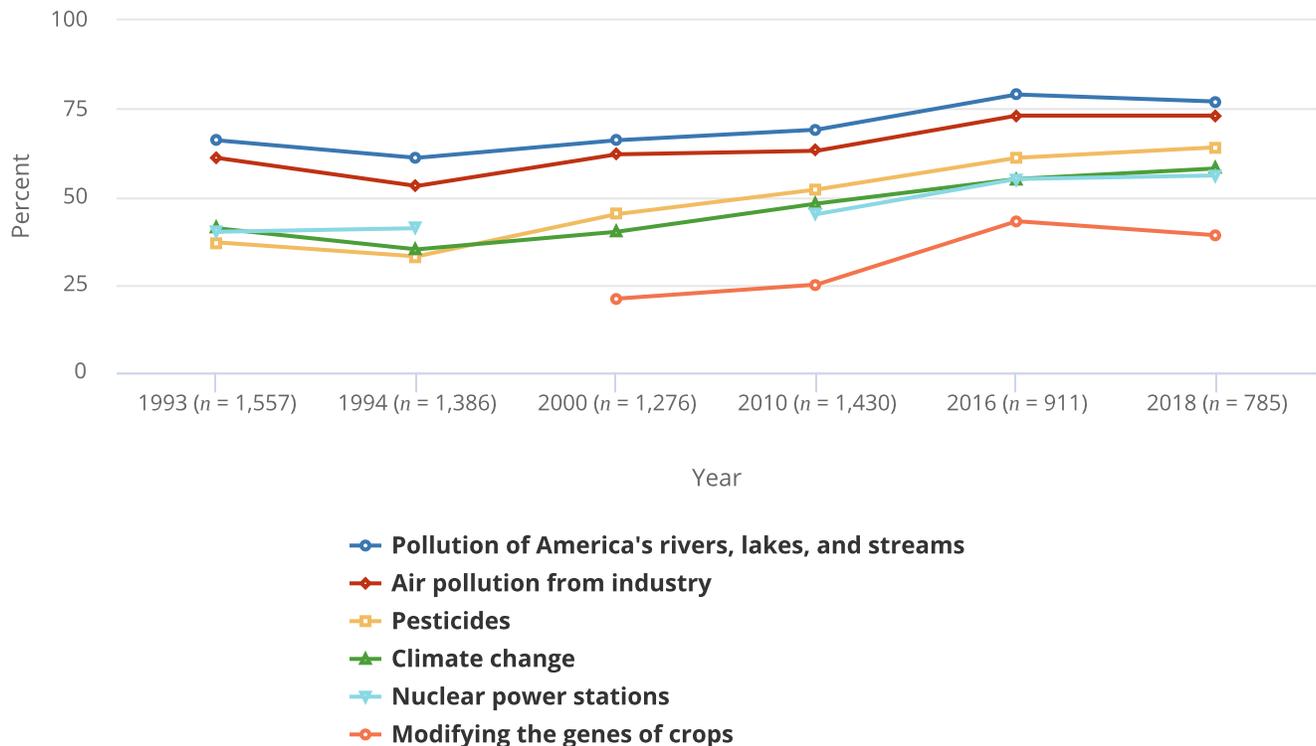
Public Attitudes about Specific S&T Issues

Views about specific S&T issues may shape individual behavior (e.g., purchasing particular products, supporting specific policies) more directly than general attitudes and knowledge (Fishbein and Ajzen 2010). Although Americans appear to have relatively stable, positive views about science in general, the available data suggest that they have become increasingly concerned about a range of environmental and technological developments in recent years.

The corresponding data from the GSS are not as comprehensive as the data provided elsewhere in this report. The questions used were initially designed as part of an international survey project and have several unusual characteristics; therefore, they should be interpreted with caution.⁶ However, the overall pattern found in the questions is largely consistent with results from other surveys where a range of questions is used to assess views about specific issues. (See the **Technical Appendix** for additional discussion.) It is important to note that perceived danger about the environment and both nuclear power stations and modifying the genes of crops move in parallel (**Figure 7-10**), suggesting that respondents' reported views are at least partly based on general levels of concern about science-related risks rather than concerns about specific issues or technologies.

FIGURE 7-10

Perceived danger of specific health and environmental issues: 1993–2018

**Note(s)**

Data are not available for all years. Data represent respondents giving a response of "extremely dangerous" or "very dangerous" to the following: *In general, do you think that pollution of America's rivers, lakes, and streams is...; In general, do you think that air pollution caused by industry is...; In general, do you think that pesticides and chemicals used in farming are...; In general, do you think that a rise in the world's temperature caused by the "greenhouse effect" is...; In general, do you think that nuclear power stations are...; and Do you think that modifying the genes of certain crops is...*

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1993–2000); NORC at the University of Chicago, General Social Survey (2010–18).

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It is also noteworthy that the issues reported here are those for which there has been a historical interest in opinion dynamics and for which there are high-quality, current data. These do not represent all potential issues. Previous editions of *Science and Engineering Indicators* have included attitudinal data on nanotechnology, the teaching of evolution in schools, and other topics.

Environment

The GSS included three general questions about environmental pollution, and the 2018 data generally suggest that concern is similar to 2016 but high relative to surveys from prior decades. The data also suggest that most Americans feel some degree of concern about a range of environmental issues. Specifically, in 2018, about three-quarters of respondents said that they believed that "pollution of America's rivers, lakes, and streams" was "extremely" or "very"

dangerous to the environment, similar to 2016 and higher than in earlier decades (Figure 7-10). The trend was similar in “air pollution caused by industry” and “pesticides and chemicals used in farming.” Women and those with a high school diploma or higher levels of educational attainment were generally more concerned about these issues (Table S7-18 through Table S7-20).

Gallup (2019b) data on similar environmental pollution questions, and on overall environmental concern, also suggest that current levels of concern are high relative to the most recent decade. However, the Gallup data suggest that concern was at its peak around 2000, a pattern that is not observed in the GSS data, which may be due to differences in the Gallup survey and the GSS, including question wording and order. It is also important to note that, in the GSS and Gallup data, levels of concern about a range of different specific environmental issues move together (i.e., if concern about one issue increases, concern about other issues also tends to increase).

Climate Change

The share of GSS respondents expressing concern about the rise in the world’s temperature has increased over time. In 2018, a majority of GSS respondents (58%) indicated that a “rise in the world’s temperature caused by the greenhouse effect” is “extremely” or “very” dangerous. This is up from the 1994 low of 35% (Figure 7-10).⁷ Concern is highest among those with more education, especially science-specific education and awareness of basic scientific facts, and relatively younger respondents (Table S7-21).

Other surveys on attitudes about climate change have found similar patterns. The Yale Program on Climate Change Communication and the George Mason University Center for Climate Change Communication have jointly surveyed climate change attitudes since 2008 and have seen increases in the reported concern about climate change, as well as the belief in the scientific consensus that humans are a primary cause of current climate trends (see the **Technical Appendix** for additional information on sampling). Specifically, the November 2019 Climate Change in the American Mind survey found that 66% of Americans were “very” (30%) or “somewhat” (36%) worried about climate change, similar to an all-time high of 69% in December 2018 but higher than the low of 49% in January 2010 (Leiserowitz et al. 2019). Also, 59% said in November 2019 that they believed that “global warming is caused mostly by human activities,” up from 46% in January 2010 and March 2012. Data from Pew Research Center and Gallup also found generally rising levels of reported concerns about climate change (Gallup 2019b; Poushter and Huang 2019).⁸

The consensus among the scientific community is that climate change largely originates from human activities and represents a substantial environmental threat (Intergovernmental Panel on Climate Change 2018; Royal Society and U.S. National Academy of Sciences 2014), as well as a threat to societies and economies (National Research Council 2010).

Energy

The only energy question on the GSS focuses on perceived danger to the environment from “nuclear power stations.” In 2018, slightly more than half of Americans (56%) said nuclear power stations were “extremely” or “very” dangerous, similar to 2016 and up from 40% in 1993 (Figure 7-10). In the same year, about a third of respondents said nuclear power stations were “somewhat dangerous,” and 10% categorized nuclear power stations as “not very” or “not” dangerous. Women, those with relatively less education and awareness of basic scientific facts, and those in the 25–34 age group tended to perceive higher levels of risk from nuclear power stations (Table S7-22).

Gallup (2019a) has also asked about nuclear energy regularly for the last 20 years. In 2019, Gallup also found that about half of Americans “strongly” (17%) or “somewhat” (32%) favored the use of “nuclear energy as one of the ways to provide electricity” in the United States. Also in 2019, a similar share (47%) said they considered nuclear energy to be safe. In Gallup data, favorability of nuclear energy peaked in 2010 at 62% before the Fukushima Daiichi nuclear accident in 2011 and has been largely split since then, with about half of Americans supporting the technology and the remainder opposing the technology or reporting no opinion (Reinhart 2019). Pew Research Center data show a similar split (Funk et al. 2018).

Beyond nuclear energy, data from Pew Research Center and Gallup suggest a strong desire for renewable sources of energy and limited support for expanding the use of fossil fuels. For example, a 2018 Pew Research Center survey (Funk et al. 2018) found that most Americans favor “more solar panel farms” (92%) and “more wind turbine farms” (85%). Support for fossil fuels is more limited, with fewer Americans supporting “more offshore drilling” (42%), “more hydraulic fracturing” (38%), and “more coal mining” (35%). In 2019, Gallup (2019a) also reported strong support for more emphasis on solar (80%) and wind production (70%) and more limited support for fossil fuels.

Genetically Engineered Food

The 2018 GSS also included a question about genetically engineered food crops (sometimes known as genetically modified [GM] organisms or GM food). About 39% of respondents in 2018 indicated that they thought that “modifying the genes of certain crops” was “extremely” or “very” dangerous, down slightly from 2016 but considerably higher than the low in 2000 (21%) (Figure 7-10). A similar share (37%) said such modifications were “somewhat” dangerous, and 20% said such modifications were “not very dangerous” or “not dangerous” (Table S7-23). This issue seems to concern fewer people than nuclear energy and most environmental issues (Figure 7-10). Generally, women and those with less than a bachelor’s degree seem to be most concerned (Table S7-23).

A different survey by Pew Research Center (Funk, Kennedy, and Hefferon 2018) found higher levels of concern. Specifically, in that study, nearly half of Americans said that “genetically modified ingredients” are generally “worse for your health than foods with no genetically modified ingredients,” up from 39% in 2016. The same survey, however, reported that 71% of Americans had heard or read “a little” (58%) or “nothing at all” (13%) about the topic. Despite some Americans’ concerns about genetic engineering, in 2018, 7 in 10 Americans said that science has “had a mostly positive” effect on food in the United States, which was similar to or higher than surveys from previous years (Funk, Kennedy, and Hefferon 2018). In addition, the U.S. National Academies of Sciences, Engineering, and Medicine (NASEM) argue that there is no evidence that genetically engineered crops have caused substantial health or environmental problems since the technology emerged commercially in the 1990s (NASEM 2016a).

Public Familiarity with S&T Facts

Although this report tracks a set of questions aimed to assess knowledge of several basic scientific facts, substantial research has shown that general measures of science knowledge typically only have small—although meaningful—relationships with how people make decisions in their public and private lives (Allum et al. 2008). NASEM also recently highlighted that science literacy is largely a function of general (or foundational) literacy and that more focus should be directed toward the ability of groups to use science to make evidence-based decisions (NASEM 2016b). In this regard, it should be recognized that the science literacy of individuals is unequally distributed across social groups. This means that some groups or communities can use science when needed, whereas others cannot because they may not have access to resources such as local expertise (e.g., community members who are also scientists, engineers, or doctors).

The current GSS uses nine questions and therefore does not address the full range of scientific subjects that could be included. Further, these questions were selected several decades ago based on the likelihood that they would remain stable over time rather than as an effort to capture any specific body of scientific knowledge. Consequently, the survey data do not represent a deep or comprehensive measurement of scientific knowledge. These questions might instead be understood as a way to capture the degree to which people have paid attention to science over their life or might be expected to do so in the future (Kahan 2017). To address these types of concerns, the 2010 edition of *Indicators* included responses to an expanded list of questions about scientific ideas based on regular exams given to American students as part of the American Association for the Advancement of Science’s Project 2061. This research found that respondents who “answered the additional factual questions accurately also tended to provide correct answers to the trend factual knowledge questions included in the GSS” (NSB *Indicators 2010: Science and Technology: Public Attitudes and Understanding*). These nine items are presented as an indicator of people’s familiarity with scientific ideas or facts taught in school, as a means for evaluating trends or conducting group comparisons. Making generalizations about Americans’ overall knowledge of science should be made cautiously given that this indicator comprises a small number of questions on school-level knowledge of science.

Understanding Scientific Terms and Concepts

In 2018, Americans correctly answered an average of 62% of the nine true-or-false or multiple-choice items from the long-running factual knowledge questions (Table 7-1; Table S7-24 and Table S7-25). The 2018 average is statistically similar to averages in recent years and the historical average since 1992 (Table S7-25). In terms of specific questions (Table S7-26 and Table S7-27), the overall average stability since 1992 hides some variation within individual questions. For example, the share of correct answers to questions on radioactivity and the fact that the Earth goes around the Sun has been relatively stable except for spikes of additional correct or incorrect responses in specific years. After increasing in the early period of the survey, the share of correct answers for several questions has been relatively stable. Examples include whether antibiotics kill viruses, whether electrons are smaller than atoms, and whether lasers work by focusing sound waves. The one question where there has been a small decline in correct answers over time is whether it is the “father’s gene that decides whether the baby is a boy or a girl.” The Pew Research Center has also collected data on this topic and found similar patterns of results (Kennedy and Hefferon 2019).

TABLE 7-1

Correct answers to questions about basic facts in physical science and biological science, by country or economy: Most recent year

(Percent)

Question	United States (2018, n = 1,175) ^a	Canada (2013, n = 2,004)	China (2015, n = 70,400)	EU (2005, n = 24,896)	India (2004, n = 30,255)	Israel (2016, n = 501)	Japan (2011, n = 812 and 984) ^b	Malaysia (2014, n = 2,653)	Russia (2003, n = 2,107)	South Korea (2004, n = 1,000)	Switzerland (2016, n = 1,000)
Physical science											
Questions used to calculate the average factual knowledge measure ^c											
<i>The center of the Earth is very hot. (True)</i>	86	93	47	86	57	86	84	75	na	87	na
<i>The continents on which we live have been moving their locations for millions of years and will continue to move in the future. (True)</i>	79	91	51	87	32	86	89	62	40	87	80
<i>Does the Earth go around the Sun, or does the Sun go around the Earth? (Earth around Sun)^d</i>	72	87	na	66	70	86	na	85	na	86	na
<i>All radioactivity is man-made. (False)</i>	68	72	41	59	na	76	64	20	35	48	na
<i>Electrons are smaller than atoms. (True)</i>	46	58	22	46	30	60	28	35	44	46	39
<i>Lasers work by focusing sound waves. (False)</i>	44	53	19	47	na	67	26	30	24	31	na
Other questions											
<i>The universe began with a huge explosion. (True)^e</i>	38	68	na	na	34	64	na	na	35	67	na
Biological science											
Questions used to calculate the average factual knowledge measure ^c											
<i>It is the father's gene that decides whether the baby is a boy or a girl. (True)^f</i>	59	na	49	64	38	72	26	45	22	59	60
<i>Antibiotics kill viruses as well as bacteria. (False)^g</i>	50	53	24	46	39	53	28	16	18	30	56
Other questions											

TABLE 7-1

Correct answers to questions about basic facts in physical science and biological science, by country or economy: Most recent year

(Percent)

Question	United States (2018, n = 1,175) ^a	Canada (2013, n = 2,004)	China (2015, n = 70,400)	EU (2005, n = 24,896)	India (2004, n = 30,255)	Israel (2016, n = 501)	Japan (2011, n = 812 and 984) ^b	Malaysia (2014, n = 2,653)	Russia (2003, n = 2,107)	South Korea (2004, n = 1,000)	Switzerland (2016, n = 1,000)
<i>Human beings, as we know them today, developed from earlier species of animals.</i> (True) ^h	49	74	68	70	56	63	78	na	44	64	na

na = not applicable; data were not collected for this question in that country.

EU = European Union.

^a See Table S7-25 for U.S. trends.

^b Numbers for Japan are the average from two studies conducted in 2011.

^c Questions are among the nine used to calculate the average factual knowledge measure (eight appear in this table; see Table S7-26 for data on all nine questions over time).

^d The question *How long does it take for the Earth to go around the Sun?* (One year) was asked only if the respondent answered correctly that the Earth goes around the Sun.

^e An experiment in the 2012 General Social Survey showed that adding the preface "according to astronomers" increased the percentage correct from 39% to 60%.

^f In 2008, the statement was *It is the mother's gene that decides whether the baby is a boy or a girl.* (False) (Split ballot in 2008; 1,506 survey respondents were asked about "father's gene"; 515 survey respondents were asked about "mother's gene.") The China, EU, and Switzerland surveys asked about "mother's gene" instead of "father's gene." The Israel survey asked about "hereditary material from the father."

^g The Japan survey asked about "antibodies" instead of "antibiotics."

^h An experiment in the 2012 General Social Survey showed that adding the preface "according to the theory of evolution" increased the percentage correct from 48% to 72%.

Note(s)

Responses of "don't know" and refusals to respond count as incorrect and are not shown. EU data include Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom but do not include Bulgaria and Romania.

Source(s)

United States—NORC at the University of Chicago, General Social Survey (2018); Canada—Council of Canadian Academies, Expert Panel on the State of Canada's Science Culture, *Science Culture: Where Canada Stands* (2014); China—Chinese Association for Science and Technology/China Research Institute for Science Popularization, Chinese National Survey of Public Scientific Literacy (2015); EU—European Commission, Eurobarometer 224/Wave 63.1: Europeans, Science and Technology (2005); India—National Council of Applied Economic Research, National Science Survey (2004); Israel—Israeli Ministry of Science, Technology and Space, Geocartography Knowledge Group, Perceptions and Attitudes of the Israeli Public about Science, Technology and Space (2016); Japan—National Institute of Science and Technology Policy/Ministry of Education, Culture, Sports, Science and Technology, Survey of Public Attitudes Toward and Understanding of Science and Technology in Japan (2011); Malaysia—Malaysian Science and Technology Information Centre/Ministry of Science, Technology and Innovation, Survey of Public Awareness of Science, Technology and Innovation: Malaysia (2014); Russia—Gokhberg L, Shuvalova O, *Russian Public Opinion of the Knowledge Economy: Science, Innovation, Information Technology and Education as Drivers of Economic Growth and Quality of Life*, British Council, Russia (2004), Fig. 7; South Korea—Korea Science Foundation (now Korea Foundation for the Advancement of Science and Creativity), Survey of Public Attitudes Toward and Understanding of Science and Technology (2004); Switzerland—University of Zurich, Institute of Mass Communication and Media Research, Department of Science, Crisis, and Risk Communication, Science Barometer Switzerland (2016).

Evolution and the Big Bang

The GSS includes two additional true-or-false science questions that are not included in the trend data reported earlier because Americans' responses to these questions appear to reflect factors beyond familiarity with scientific facts (e.g., beliefs related to specific religious teachings). One of these questions is about evolution, and the other is about the origins of the universe. The data presented in this section show that, in some specific cases, changes to question wording can produce substantially different responses.

In 2018, nearly half of Americans (49%) correctly indicated that "human beings, as we know them today, developed from earlier species of animals," and 38% indicated that "the universe began with a big explosion" (Table S7-26). Both percentages are relatively low compared with scores on most of the other factual information questions in the survey. Some people may respond to the evolution question based on their religious beliefs rather than familiarity with scientific concepts (Maitland, Tourangeau, and Sun 2018). As such, half of 2018 GSS respondents received an evolution question that omitted reference to human evolution and instead read, "Elephants, as we know them today, developed from earlier species of animals." With the question posed in this form, 66% gave the scientifically expected response (compared with 49% when the question focused on humans, as noted earlier).⁹

Similarly, two alternate "origin of the universe" questions were also provided to random subsets of respondents in the 2018 GSS. First, simply adding the preface "according to astronomers" to the statement "the universe began with a huge explosion" resulted in about two-thirds (65%) of respondents providing the scientifically correct answer, considerably higher than the 38% who provided the correct answer without the preface. Another subset of respondents was given the statement "the universe has been expanding ever since it began" and was asked if this was true or false. Again, about two-thirds (68%) of respondents gave the correct scientifically understood response.¹⁰

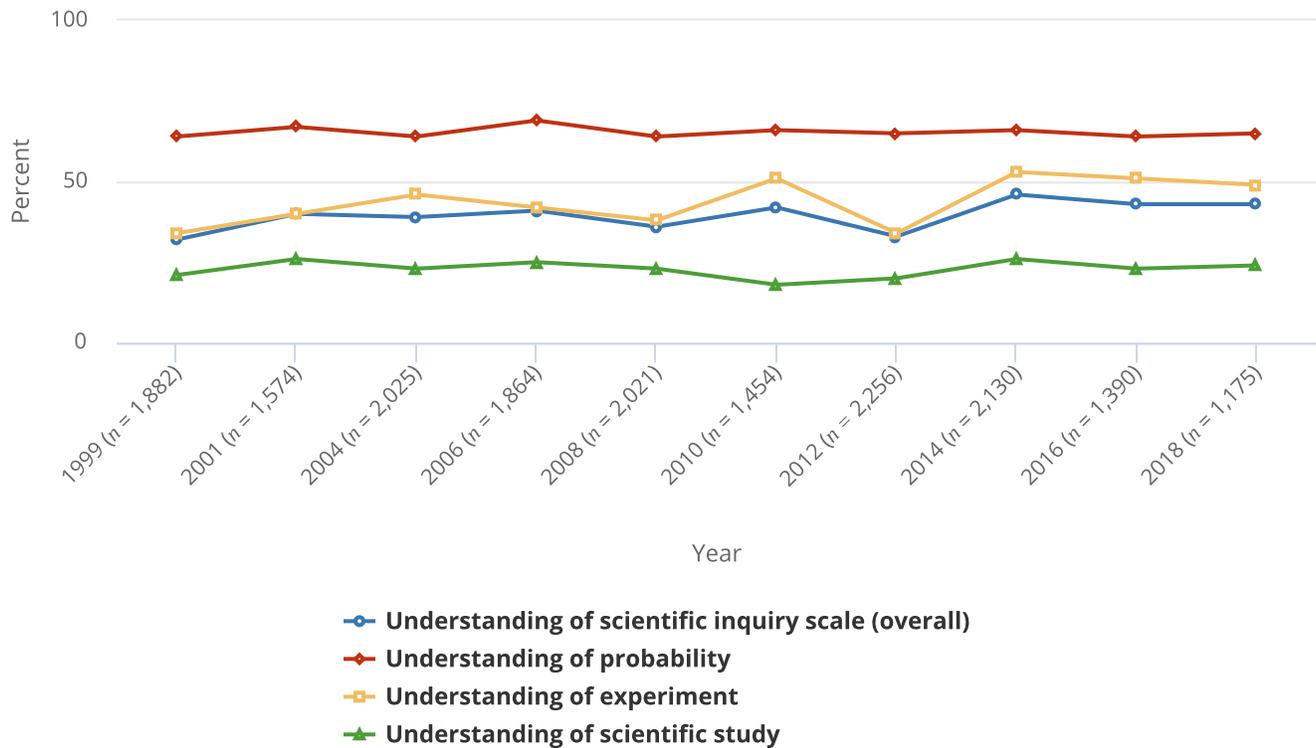
Reasoning and Understanding the Scientific Process

Another indicator of the public's understanding of science focuses on the public's understanding of how the scientific process generates and assesses evidence. Data on three scientific process elements—probability, experimental design, and the scientific method—show some previous increases in Americans' understanding of the scientific inquiry process but substantial stability in recent years.

Two probability questions are included in the GSS. Most (84%) Americans in 2018 correctly indicated that, faced with an inherited disease that affects 1 in 4 children, the fact that a couple's first child has the illness does not affect whether three future children will have the illness.¹¹ In addition, about three-quarters (74%) correctly responded that the odds of a genetic illness are equal for all of a couple's children. Overall, 65% correctly answered both probability questions. The public's understanding of probability as measured by these two questions has been stable for most of the last 20 years (Figure 7-11; Table S7-28).¹²

FIGURE 7-11

Correct answers to scientific process questions: Selected years, 1999–2018

**Note(s)**

Data represent respondents giving a correct response for each concept. Responses of "don't know" and refusals to respond are counted as incorrect and are not shown. See Table S7-28 for more detail on the probability questions.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1999, 2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2006–18).

Science and Engineering Indicators

With regard to understanding experiments, nearly half (49%) of Americans in 2018 correctly answered a question about how to test a drug, then provided a correct response to an open-ended question that required them to explain the rationale for an experimental design (i.e., giving 500 people a drug while not giving the drug to 500 additional people, who then serve as a control group) (Table S7-29). On average, the percentage of correct responses rose over the previous 20 years (Table S7-28); this is despite the substantial year-to-year variation that may be partially explained by reliance on human coders to categorize responses.¹³

Similarly, respondents were asked whether they have "a clear understanding," "a general sense," or "little understanding" of the term *scientific study*. About 27% in 2018 said they have "a clear understanding," whereas 51% said they have "a general sense." These respondents were then asked to use their own words to describe what it meant to study something scientifically, and their responses were coded. Overall, about a quarter of respondents (24%) adequately described a scientific study as involving something to do with testing theories or hypotheses, conducting experiments, or making systematic comparisons, similar to results dating back to 1999 (Table S7-28, Table S7-30, and Table S7-31).

In general, those with the most education and those who answered the most factual questions correctly were more likely to respond that they had “a clear understanding,” but many respondents with relatively limited background in science also reported high levels of understanding (Table S7-30). For example, 15% of those with the lowest level of science education reported having “a clear understanding” of what constitutes a scientific study, compared with 51% of those with the most scientific education.

All scientific reasoning questions can be combined into an overall measure of scientific inquiry understanding. Using this combined measure, about 43% of Americans in 2018 could correctly respond to the two probability questions and provide a correct response to at least one of the open-ended questions about experimental design or what it means to study something scientifically (Table S7-28). In general, respondents with more education and respondents with higher incomes performed better on the scientific inquiry questions (Table S7-29 and Table S7-30).

International Comparisons

Previous editions of *Indicators* have reported that people outside the United States generally do similarly (e.g., Canada) or less well than Americans on similar questions; however, few countries currently put substantial focus on public literacy surveys (Table 7-1). The 140-country survey for the Wellcome Trust (2019), however, included several questions about self-perceived knowledge and found that people in developed regions, such as North America and Europe, are more likely to say they know “a lot” or “some” about science; people in poorer regions and countries in Asia, Africa, South America, and the Middle East are much less likely to indicate science knowledge. Younger people (and those with more education) in all regions are also more likely to report higher knowledge levels.

Pseudoscience

Another indicator of public understanding about S&T comes from a measure focused on the public’s capacity to distinguish science from pseudoscience. One such measure has been included in *Indicators* because of the availability of data going back to the late 1970s: Americans’ views on whether astrology is scientific.¹⁴ Other examples of pseudoscience include the belief in lucky numbers, extrasensory perception, or magnetic therapy.

More Americans today than in the past see astrology as unscientific, although there has been some variation in recent years. In 2018, about 58% of Americans said astrology was “not at all scientific,” a value near the middle of the historical range and down somewhat from 65% in 2014 (Table S7-32). About a third of Americans thought astrology was “sort of scientific,” and the remainder thought astrology was “very scientific” or “didn’t know.” Men, older respondents, those with more education, and those with more correct answers on the factual science questions all tend to be more likely to see astrology as nonscientific.

Interest, Information Sources, and Involvement

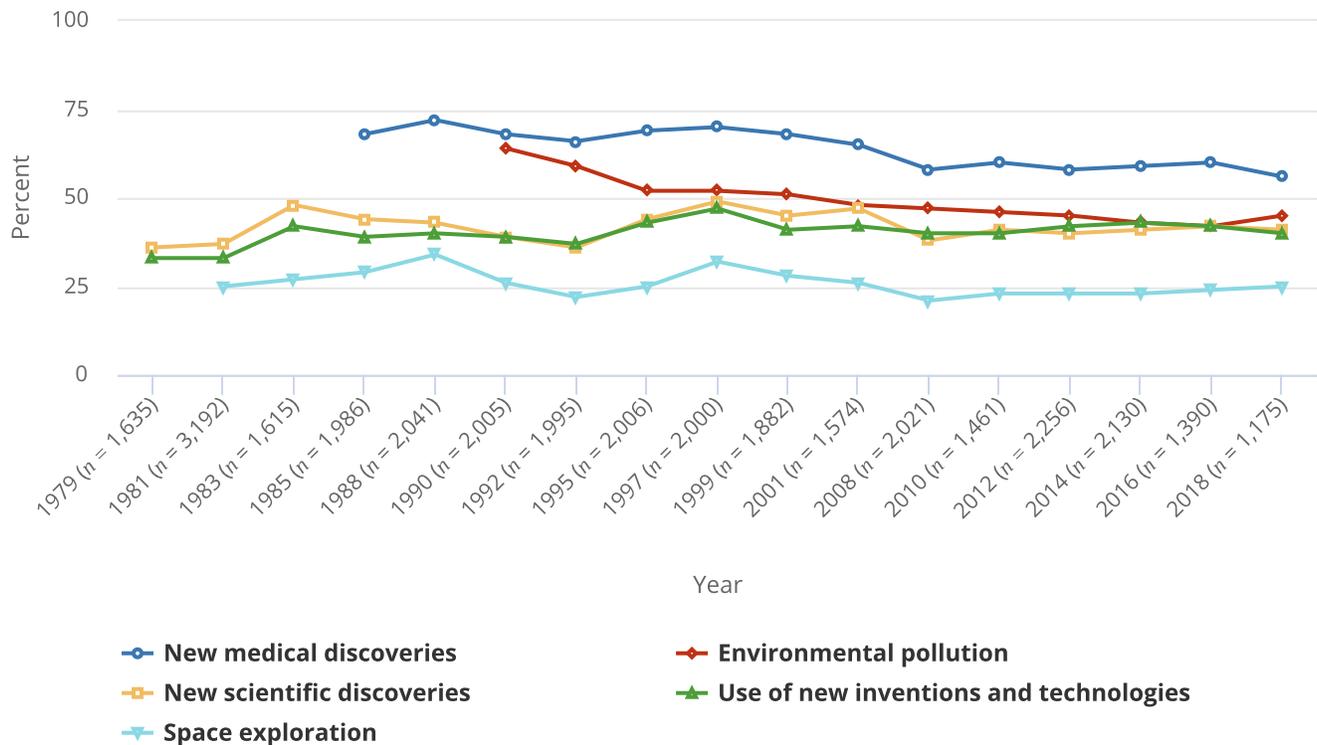
The final section of this report addresses the degree to which Americans pay attention to S&T-related content in their lives and where they are most likely to encounter this information. This includes measures of interest, preferred media, and visits to places where scientific ideas or research may be encountered.

Public Interest in S&T

Interest in S&T as an issue “in the news” has remained relatively moderate compared with other issues and has been stable over the last decade or more. In 2018, 41% of respondents were “very interested” in “new scientific discoveries” (Figure 7-12; Table S7-33 and Table S7-34), and a similar share (40%) were “very interested” in “the use of new inventions and technologies.” Of the 10 science and nonscience issues included in the survey, “new medical discoveries” drew the highest level of interest (56%). Americans have expressed relatively lower interest in two other science topics—“space exploration” (25% “very interested”) and “agricultural and farm issues” (20% “very interested”).

FIGURE 7-12

Public interest in selected science-related issues: 1979–2018



Note(s)

Data are not available for all years. Responses are to the following: *There are a lot of issues in the news, and it is hard to keep up with every area. I'm going to read you a short list of issues and, for each one, I would like you to tell me if you are very interested, moderately interested, or not at all interested.* This figure shows only “very interested” responses. See Table S7-34.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1979–2001); NORC at the University of Chicago, General Social Survey (2008–18).

Interest in science topics—as with most other topics in the survey—is positively associated with education. Women tended to be more interested in new medical discoveries (59% compared with 52% for men), whereas men tended to be more interested in other S&T topics. For example, 45% of men were “very interested” in new scientific discoveries, compared with 38% of women (Table S7-34).

An extensive survey about science media use by Pew Research Center reported somewhat lower levels of interest (Funk, Gottfried, and Mitchell 2017). This survey reported that just 25% of Americans were “very interested” in “science news,” with another 46% saying they were “somewhat interested.” Overall, 10% of Americans said that “nearly every day” they “read, watch, or listen to news about science.” About a quarter of Americans saw news about science “a few times a week,” and almost a third of Americans saw such news “a few times a month.” One reason that interest may have been relatively low in the Pew Research Center survey is that it included questions about a broader range of nonscience issues than the GSS.

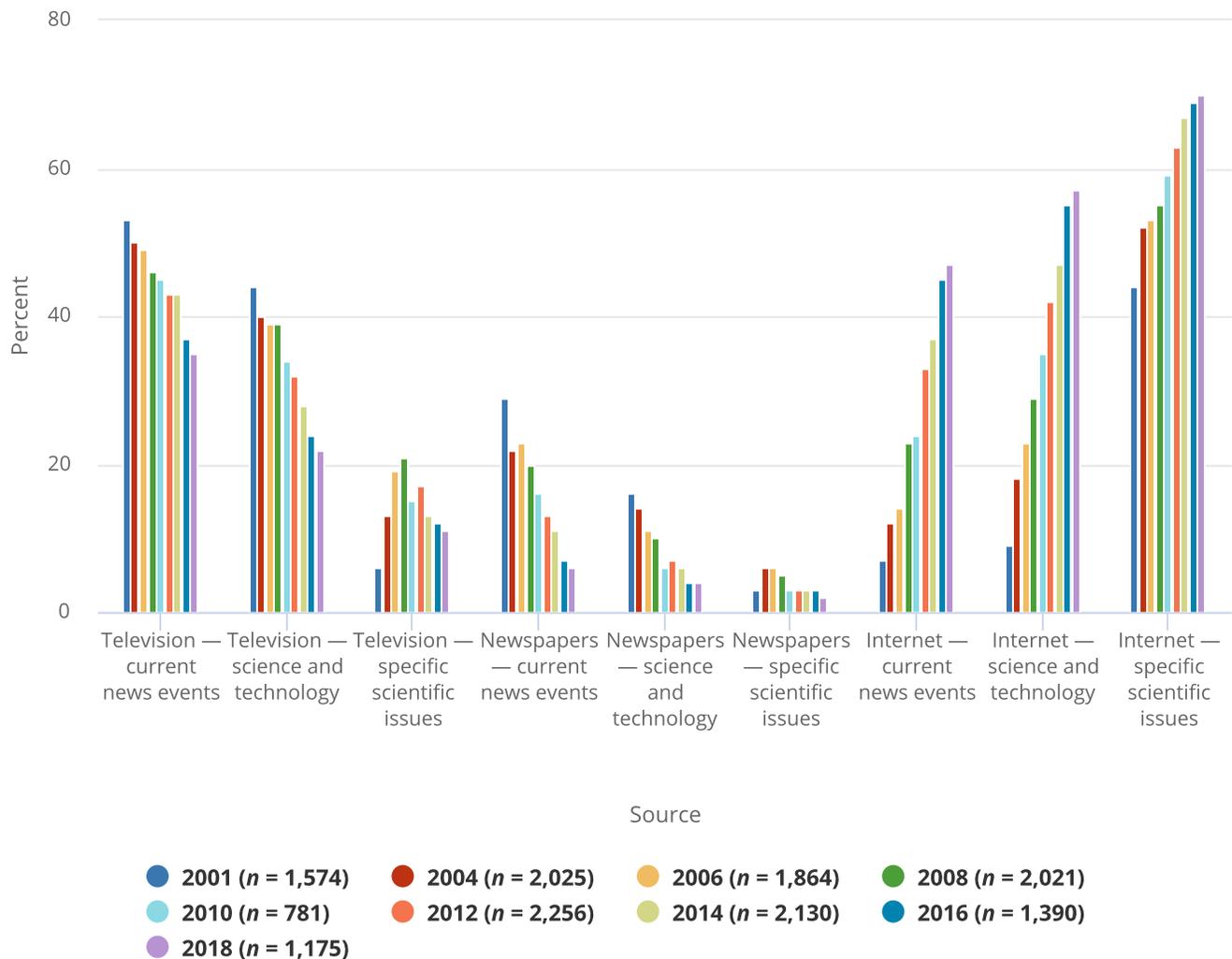
Outside the United States, interest in health issues has also generally been relatively high in comparison with interest in S&T and most other issues. A 2018 survey in China found that 93% of respondents said they were interested in “life and health,” compared with 77% who were interested in “new scientific discoveries.” Nearly three-quarters of people in China were interested in “new advances in medicine.” The “school and education” category also did very well in China, ranking the second highest (88%) behind “life and health” (CRISP 2018). The Wellcome Trust (2019) survey of 140 countries also found that people around the world were more likely to say that they had sought out health information “in the past 30 days” than science information. The likelihood of seeking out both types of information also tended to increase as countries became more economically developed. Overall, North Americans were the most likely to say they had recently sought out both types of information, with 72% saying they had sought health information and 56% saying they had sought science information.

S&T Information Sources

Americans continue to increase their reliance on the Internet for S&T-related news. In 2018, 57% of Americans cited the Internet as their primary source of S&T information; this has risen steadily from 9% in 2001 (Figure 7-13; Table S7-35 through Table S7-37). During the same period, reliance on television and traditional newspapers as primary sources of S&T news has declined. Pew Research Center (Mitchell et al. 2019; Shearer and Gottfried 2017) has found a similar pattern of increasing reliance on online news sources over the last decade.

FIGURE 7-13

Primary source respondents used to learn about current news events, science and technology, and specific scientific issues: 2001–18

**Note(s)**

See Table S7-35 through Table S7-37.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (2001); University of Michigan, Survey of Consumer Attitudes (2004); NORC at the University of Chicago, General Social Survey (2006–18).

Science and Engineering Indicators

The Internet has also been the most common resource that Americans say they would use to seek information about specific scientific issues. In 2018, 70% said they would go online to find information about a specific S&T issue, up from 44% in 2001 (Figure 7-13; Table S7-37). Generally, higher levels of education and income are associated with relatively higher levels of Internet use; respondents with lower levels of education and income are more likely to rely on television as a news source for scientific issues.

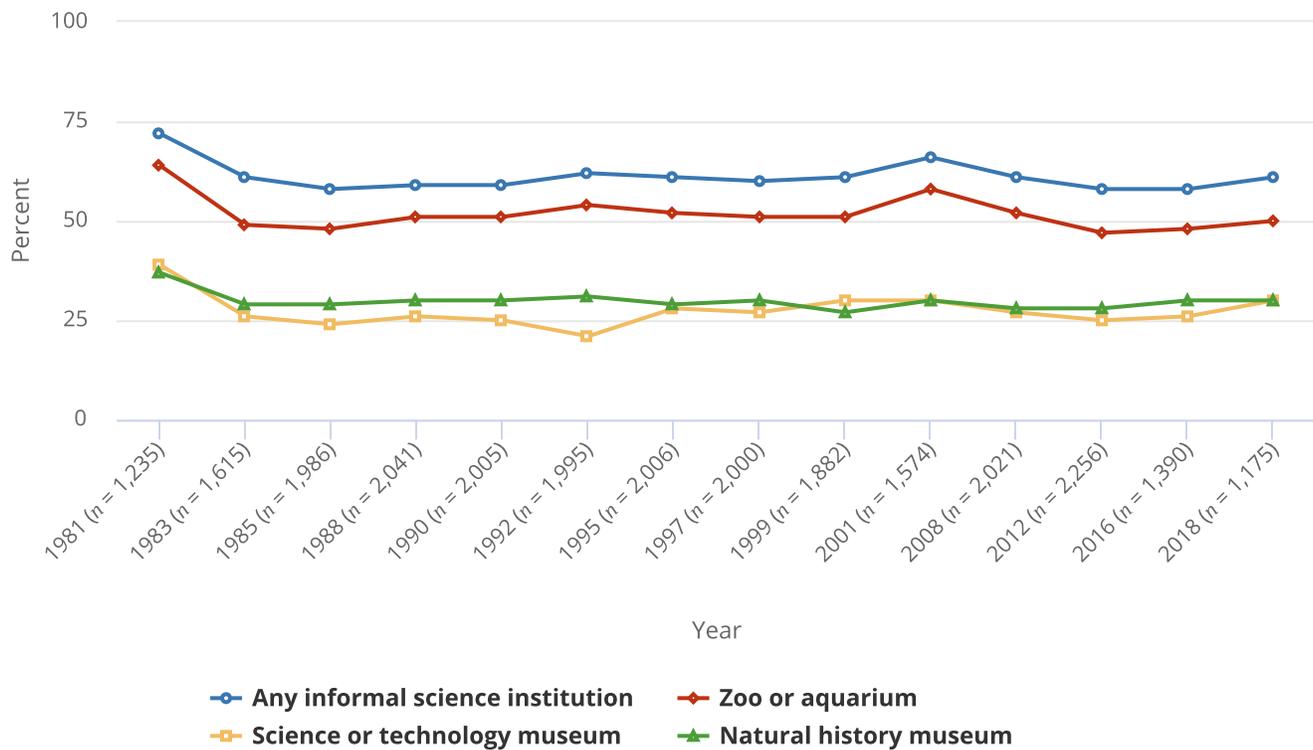
Outside the United States, the Internet has also become increasingly popular in recent surveys, although television remains quite popular. For example, in China, 69% said they saw S&T information on television every day, and 65% said they saw S&T information online every day. Just 10% said they saw such information in newspapers. About 38% said they get daily information about science from friends, relatives, or colleagues, making this channel the third most cited source (CRISP 2018). In Germany, 37% of respondents said they often watch television programs about science, whereas a similar share said they often get information about science and research from the Internet. The “friends” category was the third most cited source (31%), closely followed by newspapers (Wissenschaft im Dialog 2018).

Involvement in S&T Activities

In 2018, zoos and aquariums remained the most popular type of informal science institutions, with half of Americans saying they had visited at least one such location in the previous year (Figure 7-14; Table S7-38). This percentage was similar in recent years and in much of the 1980s and 1990s. Beyond zoos and aquariums, 30% of Americans said they had visited a “natural history museum” in the previous year, and 30% said they had visited a “science or technology museum.” These percentages have remained stable over recent decades. Visitors at all types of institutions tend to be in the younger or middle-age categories and have relatively higher education and income. This pattern is particularly evident when it comes to museums (Table S7-38). Relative to the GSS, Pew Research Center data suggest that somewhat lower numbers of Americans have visited a zoo or aquarium, a museum, or a science or technology center. Differences between the surveys may be a result of question wording and mode of administration (online). Pew Research Center also asked about attending a “lecture or talk about science” in the previous year and found that 10% of Americans said they had participated in this type of event (Funk, Gottfried, and Mitchell 2017).

FIGURE 7-14

Visitors to informal science institutions: 1981–2018



Note(s)

Responses are to the following: *I am going to read you a short list of places and ask you to tell me how many times you visited each type of place during the last year, that is, the last 12 months.* Data represent respondents who visited an institution at least once. Percentages are based on total in the sample, including those who responded “don’t know” or refused to respond. See Table S7-38.

Source(s)

National Center for Science and Engineering Statistics, National Science Foundation, Survey of Public Attitudes Toward and Understanding of Science and Technology (1981–2001); NORC at the University of Chicago, General Social Survey (2008–18).

Science and Engineering Indicators

Data from China suggest that 58% of respondents in 2018 said that they had visited a zoo, aquarium, or botanical garden in the previous year; 32% said they had visited a science or technology museum; and 30% said they had visited a natural history museum (CRISP 2018). More importantly, rates of participation in a range of these types of activities had increased between the 2015 and 2018 surveys. The Chinese report notes that the 2018 data are now very similar to those from the United States, although the response options are slightly different.

Conclusion

The majority of Americans have had positive attitudes for several decades about the benefits of science and the scientific community. In 2018, most Americans saw more benefits than harms from science and agreed that S&T will offer more opportunities for the next generation. Americans also continue to strongly support federal funding of scientific research, and nearly half thought federal spending on scientific research was too low.

Despite favorable attitudes toward science and support for public funding, about half of the American public expressed concern in 2018, and over the last decade, that S&T may be making “life change too fast.” This is higher than in recent decades. In addition, public concern is relatively high compared with past years for several environmental and technological issues, including climate change, genetically engineered food, and nuclear energy. Surveys of attitudes in other countries, particularly advanced industrialized countries, generally report similar results—strong public support for science and concern about specific S&T issues.

Americans have had relatively moderate interest in S&T issues, including new scientific discoveries and new inventions and technologies, and relatively higher interest in several S&T issues, including medical discoveries and the environment. More than half of Americans rely primarily on the Internet as a source of science and general news. Reliance on the Internet has grown steadily over the last 20 years with sharp declines in reliance on television and traditional newspapers. Zoos and aquariums continue to be the most popular type of informal science institution.

Overall, the best predictor of positive views about S&T in the United States is education. Highly educated Americans—measured by overall education level, science and mathematics education, and/or familiarity with scientific ideas—are more likely to report more optimistic views about science and support for scientists. In addition, more highly educated people typically report the most concerns about environmental threats. Results of surveys in other countries are generally consistent with highly educated people expressing the most support and the most positive views of science.

Glossary

Definitions

Climate change: Any distinct change in measures of climate lasting for a long period. Climate change means major changes in temperature, rainfall, snowfall, or wind patterns lasting for decades or longer. Climate change may result from natural factors or human activities. Global warming is often the focus of climate change discussion (Royal Society and U.S. National Academy of Sciences 2014).

Genetically engineered (GE) food: A food product containing some quantity of any GE organism as an ingredient. Also sometimes called genetically modified food, genetically modified organisms, or agricultural biotechnology. Genetic engineering involves purposefully altering the genetic code (DNA, RNA, or proteins) of an organism. This is typically done in order to obtain a trait such as pest, drought, or herbicide resistance that could not be readily achieved using conventional breeding techniques (U.S. National Academies of Sciences, Engineering, and Medicine 2016a).

Global warming: An average increase in the Earth's temperature. Increases in temperatures in the Earth's atmosphere can contribute to changes in global climate patterns. Global warming can be considered part of climate change along with changes in precipitation, sea level, and so on (Royal Society and U.S. National Academy of Sciences 2014).

Greenhouse effect: Atmospheric gases such as carbon dioxide trap heat in the Earth's atmosphere. Increases in the concentration of these gases contribute to global warming (Royal Society and U.S. National Academy of Sciences 2014).

Key to Acronyms and Abbreviations

CRISP: China Research Institute for Science Popularization

GE: genetically engineered

GM: genetically modified

GSS: General Social Survey

NASEM: U.S. National Academies of Sciences, Engineering, and Medicine

NSB: National Science Board

NSF: National Science Foundation

S&T: science and technology

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Notes

- 1 The report relies largely on data on the U.S. public's attitudes about S&T and awareness of basic science facts that have been collected through the GSS since 2006 and by a standalone S&T survey managed by NSF in prior years. Data from other high-quality American surveys are also noted for context. Where possible, U.S. attitudes are placed in an international context using data from high-quality surveys in other countries. For 2018, 1,175 respondents to the GSS answered questions about science. This provides a sampling margin of error of approximately plus or minus 3%, 19 times out of 20, when looking at the full sample (sampling error is smaller when looking at subgroups). Sample sizes are similar for recent years, although some previous surveys were larger. The term *Americans* is sometimes used in the report to refer to GSS respondents, but some respondents may not be American citizens.
- 2 Because of rounding, the aggregate will not always equal the sum of components and this may result in slight differences between the text, figures, and/or tables.
- 3 It is not clear why earlier Pew Research Center data were lower than the GSS data, although the question asked is slightly different because it specifically asks about confidence of scientists "to act in the best interests of the public," whereas the GSS question asks about the "scientific community" rather than "scientists." It is also noteworthy that respondents to the GSS had the choice of "a great deal of confidence," "only some confidence," or "hardly any confidence," whereas Pew Research Center respondents chose among "a great deal," "a fair amount," or "not too much." This middle category, in particular, may have been seen as more positive than the equivalent middle category in the GSS.
- 4 Previous research has shown that these perceptions are associated with a range of additional negative views about scientists (Besley 2015) and that these types of negative views might affect the degree to which people are willing to support a group (Fiske and Dupree 2014).
- 5 Pew Research Center also published a report on Americans' views about space and found that many had positive views about the role of government in space exploration (Funk and Strauss 2018).
- 6 A main problem is that these questions focus on only "danger" and not associated benefits (where appropriate) which means that only one aspect of respondents views is assessed.
- 7 The focus on the "greenhouse effect" in this question (which was first asked in 1993) is somewhat unusual, and the 2010 GSS (as part of an international survey process) replaced the term with *climate change* (the common term used in academic and public debates). The 2016 and 2018 GSS returned to the original question wording to maintain the time series. The response pattern for *climate change* is also similar to that of the other questions reported in this section. This suggests that the term may not make a substantive difference in an overall trend that shows increasing concern about climate change. However, other research suggests that the term used can affect how some people respond to questions about the topic (Schuldt, Konrath, and Schwarz 2011). The term *greenhouse effect* has therefore continued to be used in the GSS.
- 8 The wording of questions varies across these surveys, limiting their direct comparability.
- 9 Data source is SRI International (2020).
- 10 The nature and origins of this difference were discussed at length in the 2018 edition of Indicators using 2016 data that showed similar patterns. The analyses suggested that people who responded correctly to the other factual questions were also more likely to respond to the modified Big Bang and evolution questions. However, correct responses to the original Big Bang and evolution questions were not as closely connected to correct responses to the other questions (NSB Indicators 2018: Science and Technology: Public Attitudes and Understanding).
- 11 Data source is SRI International (2020).

12 Earlier NSF surveys used for *Indicators* employed additional questions to measure understanding of probability. Bann and Schwerin (2004) identified a smaller number of questions that could be administered to develop a comparable indicator. Starting in 2004, the NSF surveys used these questions for a trend factual knowledge scale. This scale does not include the questions aimed at studying scientific reasoning and understanding (e.g., questions about probability or the design of an experiment), and the current report attempts to avoid describing the combined questions as an overall knowledge scale. Instead, the report recognizes that the nine questions “are *not* understood to certify comprehension of any canonical set of facts or principles. Rather, they are conceptualized as observable (or manifest) indicators of an unobservable (latent) cognitive capacity that enables individuals to acquire and use scientific knowledge” (Kahan 2017:997).

13 Declines, such as those seen in 2012, need to be regarded with caution. In that case, the percentage of Americans who correctly answered the initial multiple-choice question about how to conduct a pharmaceutical trial remained stable between 2010 and 2012. It was the only follow-up question that asked respondents to use their own words to justify the use of a control group that saw a decline. For this question, interviewers recorded the response, then trained coders to use a standard set of rules to judge whether the response was correct. Although the instructions and training have remained the same in different survey years, small changes in survey administration practices can sometimes substantially affect such estimates.

14 Some respondents might understandably argue that because astrology is based on systematic observation of planets and stars, it is “sort of scientific.” The fact that those with more formal education and higher factual science knowledge scores are consistently more likely to fully reject astrology suggests that this nuance has only a limited effect on results. Another problem is that some respondents may also confuse astrology with astronomy, and such confusion seems most likely to occur in some of the same groups (i.e., relatively lower education and factual knowledge) that might be predicted to get the question wrong. This could artificially inflate the number of incorrect responses. However, the question comes immediately after a question that asks respondents if they have ever “read a horoscope or personal astrology report,” which offers respondents a hint that astrology is not astronomy. Also noteworthy is the fact that a Pew Research Center study (2009) using a different question found that 25% of Americans believe in “astrology, or that the position of the stars and planets can affect people’s lives.” Gallup found the same result with the same question in 2005 (Lyons 2005). In contrast, the 2010 GSS found that 6% saw astrology as “very scientific,” and 28% saw astrology as “sort of scientific” (34% total). Pew Research Center found that 73% could distinguish between astrology and astronomy and that there were few demographic differences beyond education (Funk and Goo 2015).

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