RESEARCH FUNDING

Politics and Funding in the U.S. Public Biomedical R&D System

Research grant allocations can be affected by appropriations committee representation.

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Federal funding for biomedical R&D through the National Institutes of Health has grown from $8.3 billion in FY1984 to $28.7 billion in FY2008 (*1*, *2*). The NIH supports half of all federal nondefense R&D and more than 60% of federally funded research in American universities (*3*). The agency awards funds to research performers based on "peer review" but the decisions are not insulated from political influence.

How do congressional appropriations committee members influence the allocation of federal funding for biomedical research? We investigated this question by studying congressional appropriations bills and appropriations committee meeting reports covering the 20 fiscal years between 1984 and 2003. During every year of this period, the director of the NIH negotiated with the Department of Health and Human Services and the Office of Management and Budget within the Executive Office of the President to craft a budget request for the NIH that was consistent with White House priorities. The NIH's budget is considered by the Appropriations Committees of the House and Senate. In the House Appropriations Committee (HAC), the NIH budget request is handled by the Labor, Health and Human Services, and Education and Related Agencies Subcommittee (LHHE). A similarly named subcommittee of the Senate Appropriations Committee (SAC) evaluates the NIH budget request in that chamber. The LHHE subcommittees consider the NIH budget request, amend the funding requests in the presidential budget, and "mark up" the appropriations bills, sometimes specifically for institutes and centers at the NIH, that are ultimately reported to the House and Senate by each chamber's appropriations committee.

The subcommittee meeting reports that accompany the appropriations bills to the floor contain additional detail and guidance on the allocation and disbursement of appropriated funds by the NIH. Transfers affecting the level of support may involve (i) reallocation for NIH funding among the agency's institutes and centers, (ii) subcommittee support for specific fields of biomedical research associated with particular diseases, and (iii) project-level transfers that reallocate funding among particular lines of research and/or research projects within a given disease field. (See Supporting Online Material for examples).

To test whether these reallocations are affected by representation on the relevant appropriations subcommittees and committees, we analyzed data on the amount of NIH peer-reviewed grants received by 8310 "extramural" biomedical research institutions for every congressional NIH appropriations bill during the 1984–2003 period (*4*, *5*). The primary data were drawn from the NIH's "Consolidated Grant Applicant File" (CGAF) database, which contains a record of every research proposal for which a grant was made by the NIH. We matched these data to the number of appropriations committee and LHHE subcommittee members from the state that was home to each NIH grant recipient during the corresponding appropriations year. Hence, for example, the House and Senate appropriations committee composition data for the 107th Congress (years 2001 and 2002) are matched to the NIH grants made during the years 2002 and 2003. During 1984–2003, the HAC had 57 to 64 members, 12 to 17 of whom were assigned to the LHHE subcommittees; the Senate Appropriations Committee had 28 to 29 members, 13 to 15 of whom sat on the corresponding LHHEs. During that period, 11 to 15 states were represented in the LHHE subcommittee of each chamber (*5*).

We estimated a "pooled least squares" regression to analyze the influence of committee membership on the amount of NIH peer-reviewed grants received by performers (i.e., we estimated the effect of membership on the size of grants, conditioned on the institution's receiving grants during the time period) (*5*). A challenge in identifying the causal impact of committee membership is controlling for other "unobserved" attributes of research performers, such as their previous success in obtaining grants, size, or location in states with a high demand for public biomedical resources, which may be correlated with both committee representation and receipts of NIH awards. We used research-performer "fixed effects" regression models in order to control for such confounders. In additional robustness tests, we estimated the effects of members' exit from their subcommittee positions on the NIH grants received by research performers in their states (*5*).

ESTIMATES OF APPROPRIATIONS COMMITTEE MEMBERSHIP EFFECTS

Congress year	Total political effect (B$)	Total allocations (B$)	Political effect as % of total
1983–84	0.57 (0.31)	8.46	6.74 (3.66)
1985–86	0.68 (0.38)	10.45	6.50 (3.63)
1987–88	0.81 (0.45)	12.80	6.33 (3.51)
1989–90	0.91 (0.5)	14.95	6.09 (3.34)
1991–92	1.01 (0.56)	16.81	6.01 (3.33)
1993–94	1.18 (0.66)	18.73	6.30 (3.52)
1995–96	0.74 (0.44)	20.43	3.62 (2.15)
1997–98	0.69 (0.42)	24.24	2.85 (1.73)
1999–00	1.13 (0.67)	30.44	3.71 (2.20)
2001–02	1.66 (0.99)	37.35	4.44 (2.65)

Additional research benefits, 97th to 107th Congress. First column, estimates ($P < 0.01$) of the effects of House and Senate appropriations committee representatives (from "pooled least squares" regressions in table S1) on the receipts of represented research performers to calculate the additional amounts received by performers in the states of committee members, ceteris paribus. The second column reports the total extramural peer-reviewed allocations made by the NIH during the corresponding Congress (covering two fiscal years). Figures in parentheses indicate 95% confidence intervals around the estimates (*5*). B$, billions of dollars.

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Each additional member on the House subcommittee that deals with NIH appropriations (the "LHHE" subcommittee of the HAC) was associated with a 5.9% ($P < 0.01$) increase in NIH funding for institutions in their state (*5*, *6*) (tables S1 and S2). LHHE senators and non-LHHE House appropriations committee members did not have a statistically significant (at $P < 0.01$) impact on funding for research performers in their states (*7, 8*), with one exception. New York Senator Alfonse D'Amato, a member of the SAC from 1983 to 1994, significantly increased NIH funding for performers in New York State.

We estimated that the distribution of $1.7 billion of the $37.4 billion awarded by the NIH to extramural performers in the years 2002 and 2003 (appropriated during the congressional year 2001–2002) was influenced by representation on the HAC-LHHE subcommittee (*5*) (see table on page 1797 and table S2).

Do some types of research performer benefit more than others from subcommittee representation? We found that an additional HAC-LHHE member increased NIH funding for public universities in the member's state by 8.8% ($P < 0.01$) and grants to small businesses by 10.3% ($P < 0.01$). HAC subcommittee membership had no statistically significant effect (at $P < 0.01$) on grants to private universities, large firms, or other nonprofit institutions (*5*) (table S3).

R-series grants or awards for research projects make up the largest category of activities funded by the NIH (about 60% of the total NIH extramural grants). They fund research projects rather than programs. HAC-LHHE membership increased performers' R-series awards by 4.4% ($P < 0.02$) during this period (*5*) (table S4).

R-series grants are further divided into several subcategories; R01 is the traditional research grant supporting research initiated by investigators associated with research institutions. Research institutions typically are responsible for providing facilities necessary to conduct the research proposed by the investigator and are accountable for the grant funds. R03 or "Small Research Grants" support small research projects such as pilot or feasibility studies and secondary analysis of existing data. R41 to R44 are associated with the Small Business Innovation Research and Technology Transfer grants (SBIR and STTR), and so on. "P-series" awards can be P01 grants to support multidisciplinary or multifaceted research programs that have a focused theme. Estimates of the returns to representation on these more finely specified grant types (R01, R03, R41 to 44, and P01) suggest that HAC-LHHE members do not significantly affect allocations within any one of these classes, but that the effects appear in the overall funding amounts received by represented performers. This result is consistent with an avoidance by political representatives of direct interference with peer review of individual proposals, while influencing the institutional allocation of research funds (*5*, *9*) (table S4).

In an extension of our baseline model, we tested the extent to which an R&D performer's historical strength in specific research fields mediates the influence of subcommittee membership on its NIH funding (*5*) (table S5). Our estimates indicate that House LHHE representation increases NIH funding for research performers in the lowest two quartiles of grant recipients within any biomedical field by an average of 3.6 ($P < 0.02$) to 6.4% ($P < 0.01$). Performers in the top quartile, however, did not receive significantly larger allocations than otherwise comparable but unrepresented performers.

The congressional "power of the purse" is mandated by the Constitution. Political oversight of NIH funding decisions provides an important mechanism for public input into scientific judgments concerning health-research needs. Nevertheless, the exercise of such influence clearly mediates the effects of rigorous peer review. Moreover, the channels through which such influence operates may be more complex than directives contained in appropriations bills. We hope that our findings will spark a clearer debate over the extent and effects of political involvement in the resource allocations of the largest single source of federal civilian R&D spending.

References and Notes

1. Figures represent budget authority in constant FY2008 dollars (*2*).
2. *Historical Data on Federal R&D, FY 1976–2009* (AAAS, Washington, DC, 2008); www.aaas.org/spp/rd/hist09p2.pdf.
3. National Science Foundation, Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges (NSF, Washington, DC. 2006); www.nsf.gov/statistics/nsf08300/pdf/nsf08300.pdf.
4. We utilized those research performers with observations and/or variation in at least two time periods. Those performers that received NIH grants once or twice during the period of our study received less than 13% of the total grant amount allocated by the NIH during 1984–2003, and the mean size of these grants was less than half the mean size for performers that were represented in our data set more than twice. Our estimates capture the effect of subcommittee representation on the size of grants for grant recipients. The presence of a "new grant effect" will not alter our results on the influence of appropriations committee representation unless we believe that applicants of new grants and additional grants differently affect the probability or number of representatives on the committee (which does not seem plausible).
5. Further information, including background, construction of the data set, the empirical model, results, and estimates, as well as examples, are provided in the supporting online material available in *Science* Online.
6. D. Hegde, *J. Law Econ.* (in press) contains additional robustness checks that investigate the endogeneity of LHHE representation and grant receipts, and various related results.
7. This result may reflect the tendency for senators, who serve on many more committees and subcommittees, not to specialize in analyzing and influencing appropriations for individual agencies to the same extent as House appropriations committee members. See, for instance, (*8*).
8. R. F. Fenno, *Power of the Purse: Appropriations Politics in Congress* (Little, Brown, Boston, 1966).
9. NIH, *Activity Codes, Organizational Codes, and Definitions Used in Extramural Programs* (NIH, Bethesda, MD, July 2007), http://grants.nih.gov/grants/funding/ac.pdf

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