



## Funding Bodies and Late Modern Science

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### Abstract

Throughout the twentieth century, funding bodies have become a dominant force in scientific practice, influencing the success of certain types of research as well as certain types of researchers. As a late modern institution, they are part of a process of rationalization and planning in science. At the same time, however, funding bodies draw upon resources such as trust and familiarity that are usually identified as premodern.

**Keywords:** funding bodies, history of science, science policy, scientific practice

In April 1990, the well-known American physicist Daniel Kleppner published an op-ed in *Physics Today* that has become famous for its desperate portrayal of the life of a modern-day academic researcher.<sup>1</sup> The piece, called ‘Night Thoughts on the NSF’, describes how Kleppner often lies awake at night, tossing and turning, fretting about how he could obtain the funding he needs to keep his research going. Gradually, his worn-out mind starts to confuse his worries with fragments from Victorian novels and 1930s movies. Suddenly, *David Copperfield*’s Mr. Micawber is explaining that with an annual income of over twenty pounds life is bliss, but that if a scientist’s budget falls below this threshold life will be misery. Micawber morphs into Igor who limps down a stone stairway to retrieve an ancient book titled *The Collected Proposals of Dr. Frankenstein-Kleppner*. ‘I leaf through the mildewed pages, meditating on pain – the pain that I must inflict on my reviewers and the pain that

they will inflict on me with proposals of their own'. But there is little time to dwell, *The Collected Proposals* remind the physicist that he really must start incorporating the buzzword 'interdisciplinarity' in his next proposal. And, of course, the most famous orphan of the nineteenth century makes an appearance as well:

I am Oliver Twist and I tremble as I shuffle down the aisle of the NSF [National Science Foundation] orphanage, my empty soup bowl uplifted. The youngest orphans stare at me. They have no bowls, for they have never received NSF support, but their eyes are bright with longing ... Among the throng I spy the shocked and bewildered faces of scientific luminaries, prizewinners, even Nobel laureates. I raise my bowl to the Director and in a trembling voice ask, 'Please, sir, one little laser.'<sup>2</sup>

For many academic researchers today, Kleppner's wondrous descriptions of a scientist's night thoughts will sound both amusingly and depressingly familiar. In 2018, writing and evaluating grant applications remains a familiar routine for most. Often, researchers' 'fundability' determines not only whether they can stay in academia, but functions as an important measure of their professional success and even as a proxy indicator for their research qualities.

The authors in this special collection trace how research funding bodies came to exert their dominance in the twentieth century, exploring the ways in which this dominance influenced scientific practice in the late modern period. In recent years, the dependence of academic researchers on repetitive cycles of competitive research funding has been subject to much debate. Some have hailed its influence on academia as a way to stimulate new directions in scientific research and to increase productivity or scientific excellence.<sup>3</sup> Others have criticised its effects: a Matthew effect in the distribution of funding, a preference for predictable science, or worse, ethically questionable research practices.<sup>4</sup> Supporters and opponents agree, however, that research funding profoundly influences contemporary scientific practice, turning funding bodies into important institutions to steer the course of scientific investigations and to shape scientific careers. Somewhere in the twentieth century, these institutions have become core mechanisms for distributing money, prestige and power within science, and have come to function as a crucial apparatus for deciding what and who counts as authoritative in the sciences.

Research funding, of course, is not a product of the twentieth century, let alone modernity. Historians of early modern science have extensively shown that patronage was crucial to knowledge production already in the sixteenth and seventeenth centuries. For natural philosophers, the question of how to obtain a secure financial position often dominated the career choices they made, the type of instruments they could work with, and the type of research questions they were able to pursue.<sup>5</sup> Yet, it is generally acknowledged that research funding became an increasingly central part of knowledge production after the eighteenth century. ‘The importance of patronage in modern science’, Robert Kohler points out in his 1991 *Partners in Science*, ‘is almost too obvious to dwell upon’.<sup>6</sup> Particularly from the later nineteenth century onwards, research for many scientists increasingly came to depend on the ‘ability to command resources’, meaning that ‘getting and managing grants, and managing sponsors, gradually [became] a constitutive part of doing research and making careers in academic science, along with teaching, department and discipline building, or professional service’.<sup>7</sup> In this process, the skill to acquire funds, i.e. one’s fundability, became a marker of scientific quality. Whereas in the early modern period financial independence had been an important credential to qualify as truth speaker, the allocation of research funds became a crucial mechanism for distributing epistemic credibility in the later modern period.<sup>8</sup>

One obvious reason for this development is that large-scale patronage systems began to be established in the nineteenth century, for what John Pickstone has called ‘the systematic production of novelty’, i.e. the realization of infrastructures designed to steadily churn out scientific and technological innovation.<sup>9</sup> Initially, industrial laboratories in Germany and the United States dominated this push towards new styles of organizing scientific work. In the early twentieth century, this development was augmented by the rise of philanthropic organizations, such as the Rockefeller Foundation and Carnegie funds.<sup>10</sup> In their recycling of industrial wealth, these private funds poured unprecedented sums of money into research and organized much scientific work along the lines of the corporate model that had come to dominate industry in the nineteenth century. ‘Just as the multiunit business structure depended on the team player and the coordinating manager’, Lily Kay writes in her history of the Rockefeller Foundation in the early twentieth century,

‘so the new science relied on management and group projects directed toward interdisciplinary work’.<sup>11</sup>

Over the course of the twentieth century, state support became a dominant factor as well in the growing influence of research funding schemes on scientific practice. In the first half of the century, the drive for military advantages pushed governments of industrial nations to set up research programmes for the advancement of technological innovation in particular. In preparation for, and during World War II, such programmes were scaled up, resulting in what historian of science Michael Dennis has famously referred to as the realization of state policies for ‘mass-producing’ scientists.<sup>12</sup> After the war, many industrial nations chose to maintain and elaborate upon these infrastructures by establishing national funding bodies for the support of scientific research, such as the National Science Foundation (NSF) in the United States.<sup>13</sup> Consequently, knowledge production increasingly took on the form of ‘Big Science’. As states became the foremost patrons of scientific research, the organization and execution of research projects grew explosively, often with hundreds of scientists working in teams to realize scientific and technological novelty.<sup>14</sup>

Together, these developments contributed to the central importance of research funding bodies in the production of scientific knowledge and careers in the late modern period, roughly defined in this special collection as the period from 1945 leading up to the present. Each of the following articles, therefore, explores one or more ways in which research funding has influenced scientific practice in precisely this period.

Still, it is not only in a temporal sense that funding bodies may be understood as a typical feature of late modernity. Also in their mode of operating they arguably fit a pattern that is often associated with this period. ‘Late modernity’, Steven Shapin argued in his 2008 book *The Scientific Life*, ‘is accounted the triumph of the bureaucrats and the planners, and, by extension, of science in bureaucratic and planning terms’.<sup>15</sup> Regimes of trust, familiarity and personal virtue that would have influenced domains of social life, including scientific practice, up and into the early modern period supposedly withered away in the modern era. After all, ‘What is modernity, and even more its “late” version’, Shapin challenges his readers, ‘but the subjugation of subjectivity to objectivity, the personal to the methodically mechanic, the individual

to the institutional, the contingent and the spontaneous to the rule of rule?'<sup>16</sup> *The Scientific Life* challenges this conventional wisdom about the late modern period. Yet, in this formulation, Shapin touches upon core characteristics typically associated with the theme of science and modernity: whereas in the early modern period knowledge production had relied on personal authority and familiarity – i.e. knowing who to trust – knowledge production in the late modern period would rely on rigid methods and procedures to efface the personal in science. 'People are arbitrary and malleable; rules and institutions are bound by stable criteria'.<sup>17</sup> Hence, supposedly, a transition from *Gemeinschaft* to *Gesellschaft* occurred, from small-scale informal communities to large-scale formal bureaucracies, in which scientific novelty became something that no longer relied on individual ingenuity or serendipity, but on automated systems for carrying out research activities. 'The full expression of the rule of rule over spontaneity', Shapin succinctly remarks, 'is found in the confidence that the production of truth can be not just rationally organized but effectively planned'.<sup>18</sup>

Within this framework, funding bodies in late modernity too can be understood as instruments of science planning. Theoretically, at least, the allocation of research funds by these institutions does not proceed on an informal basis in which charismatic personalities or personal bonds play a decisive role, but through the transparent administration of stable rules and procedures that are to ensure a rational use of available resources. As such, funding bodies would be able to plan and steer scientific innovation. This reliance on managerial rationality, anthropologist Marilyn Strathern explains, centres around a modernist belief that if the performance of individuals is made subject to regular inspection in organized settings, their professional conduct will be more efficient and, hence, their collective output more optimal.<sup>19</sup> Thus, funding bodies seem illustrative of the organized distrust that is assumed to be typical of late modern institutions, in which standardized rules and procedures are accounted rational and just, while human individuals with their fallible judgements and nepotistic tendencies are accounted arbitrary and unfair.

Still, it can easily be argued that trust remains very much central to the workings of funding bodies in late modernity. After all, in large-scale science systems, in which many of the larger funding bodies receive hundreds of applications per grant cycle, the committees

allocating these grants have to determine on the basis of relatively little information which applicants can be trusted as legitimate truth speakers, and thus can be entrusted with substantial sums of money that will actually yield a return on investment. The same goes for those asked to review grant applications or to take part in allocation committees: when such positions rotate frequently and the pool of possible participants is substantial, indirect measures for determining who possesses the right qualities for fulfilling these roles become increasingly important. 'Late modernity proliferates uncertainties', Shapin asserts, 'and it is in the quotidian management of those uncertainties that the personal, the familiar, and the charismatic flourish'.<sup>20</sup> In networks marked by anonymity and fluid social boundaries, in other words, supposedly pre-modern notions such as trust and familiarity become important proxy indicators for deciding what and who counts as authoritative in the production of scientific novelty.<sup>21</sup>

Each of the articles in this special collection acknowledges the centrality of funding bodies in late modern science and charts their influence on scientific practice in this period. Laura Stark explores the ways in which late modern funding bodies may be understood as what she calls 'declarative bodies': institutions capable of bringing new scientific worlds into being through their decision-making practices. She ties in the study of funding bodies in late modernity with recent approaches in the history of science that analyze regulative institutions, such as research journals, ethics review boards or academic admissions committees, as key actors in affecting not only the process of knowledge making, but the content of scientific knowledge as well.<sup>22</sup> In the twentieth century, Stark argues, the say-so of these declarative bodies increasingly has come to have tangible consequences for who can participate in the sciences. Hence, funding bodies should not just be understood as sites where grants are allocated and science policies administered, but as sites where experts are empowered to act as truth speakers and exert their expert judgements, and where knowledge production and dissemination thus actively take place.<sup>23</sup>

Mark Solovey investigates how the NSF, and particularly its status as a public funding body, has influenced social science research in the United States between 1945 to 1980. In the second half of the twentieth century, public research funding in democratic societies has been found to struggle with a tension between political interests to steer scientific

research and the requirement of scientific autonomy in an open society. This antinomy has typically been resolved by relying on specific decision-making practices in determining the fundability of research studies.<sup>24</sup> After the mid-twentieth century, Solovey explains, epistemological doubts about the scientific status of the social sciences in combination with vocal political distrust in the intentions of social scientists led the NSF to develop a strategy to funding social science research that can best be called ‘scientism’: i.e. only research studies that were modelled after the natural sciences and that rested on ideas about value neutrality in social science research were deemed eligible for public funding.<sup>25</sup>

Solovey’s article makes clear how the political functioning of the NSF in the post-war period created opportunity structures for specific types of research questions and methodologies in the social sciences. The institution’s scientific strategy for funding social science research empowered specific epistemological perspectives in fields such as political science and sociology, while actively limiting others by its refusal to fund them.<sup>26</sup> In his article on the role of Rockefeller philanthropy in the mathematics discipline in the mid-twentieth century, Michael Barany explores how the rise of large-scale funding schemes in this period created opportunity structures not so much for specific types of research, but for specific types of researchers. The agents of the Rockefeller Foundation did not possess much expertise on mathematics, nor did they seek it. Rather, the officers were looking for knowledge about science, ‘circumscientific knowledge’ as Barany calls it. This was the type of personal, informal and subjective knowledge that Rockefeller officials obtained through interviews, travels and house visits and that subsequently became formalized in the index cards and handbooks of Rockefeller bureaucracies. In the process, certain scientific personas were favoured in mathematical research in the mid-twentieth century, regardless of the scientific questions mathematicians addressed.<sup>27</sup> What is more, later in the century, these infrastructures were carried over to other types of research funding, thus reinforcing longstanding personal and institutional biases in the mathematical research community amidst vastly changing means of funding.

The final contribution to this special collection shifts gears and directs attention away from the large-scale (and in the previous cases, exclusively American) funding structures that are often argued to

dominate late modernity to inspect the influence of small-scale funding practices in this period. In his article on the spectacular rise of Dutch clinical epidemiology to the international forefront in the late twentieth century, Timo Bolt shows that it was neither the Dutch state nor Dutch industry that was central in this transformation, but the deliberate policies of a seemingly small charity fund, the Dutch Heart Foundation, combined with the targeted activities of the Dutch Health Insurance Fund Council. By simply ‘following the money’ at the level of scientific practice itself, Bolt argues, the dominance of large-scale funding structures in late modernity becomes less overpowering than it is often made out to be.

Combined, the articles in this special collection contribute new insights into the ways in which funding bodies mediate between science policy and scientific practice. The articles are explorative in nature and focus on funding bodies large and small, public and private, from the United States and the Netherlands. The special collection does not claim to offer a systematic overview of one type of funding body or one (national) science system, but rather to understand the many ways in which funding bodies have functioned and still function in assigning scientific authority in the late modern period. This effort to grasp the workings of funding bodies ties in with a renewed attention for the role of money in science. Recently, historians of science have argued that following ‘the money trail’ will enhance our understanding of the production and use of scientific knowledge.<sup>28</sup> The articles in this issue give an indication of how the money trail in science can be studied within the context of political power, cultural preferences and social goals. Together, by demonstrating the influence of funding bodies on scientific practice, they show the validity of such an approach.

## Notes

- 1 This special collection was made possible by support from the Descartes Centre for the History and Philosophy of the Sciences and the Humanities and the Department of History and Art History at Utrecht University. We thank Bert Theunissen (Utrecht University) for sharing his insights.
- 2 D. Kleppner, ‘Night Thoughts on the NSF’, *Physics Today* 43 (1990), 9.



- 3 L. Hessels et al., *Excellent geld. De rol van excellentiesubsidies bij vier toponderzoeksgroepen in Nederland* (Den Haag, 2016).
- 4 M. Anderson et al., 'The Perverse Effects of Competition on Scientists' Work and Relationships', *Science and Engineering Ethics* 13 (2007), 437–61; K. Powell, 'Young, Talented and Fed-up', *Nature* 538 (2016), 446–9; R. Harris, *Rigor Mortis. How Sloppy Science Creates Worthless Cures, Crushes Hope, and Wastes Billions* (New York, 2017).
- 5 See, for instance: B.T. Moran (ed.), *Patronage and Institutions. Science Technology, and Medicine at the European Court, 1500–1750* (Woodbridge, 1991); R.S. Westfall, 'Science and Patronage. Galileo and the Telescope', *Isis* 76 (1985), 11–30; M. Biagioli, 'Galileo the Emblem Maker', *Isis* 81 (1990), 230–58; P.O. Long, 'Power, Patronage, and the Authorship of *Ars*. From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age', *Isis* 88 (1997), 1–41.
- 6 R.E. Kohler, *Partners in Science. Foundations and Natural Scientists, 1900–1945* (Chicago, 1991), 1.
- 7 *Ibid.*, 1.
- 8 S. Shapin, *A Social History of Truth. Civility and Science in Seventeenth-Century England* (Chicago, 1994); S. Shapin and S. Schaffer, *Leviathan and the Air-Pump. Hobbes, Boyle, and the Experimental Life* (Princeton, 1985). A specific instance of this transition, in geology, is discussed in P. Lucier, *Scientists and Swindlers. Consulting on Coal and Oil in America, 1820–1920* (Baltimore, 2010).
- 9 J.V. Pickstone, *Ways of Knowing. A New History of Science, Technology and Medicine* (Manchester, 2000), 3.
- 10 For a general and well-informed overview of such developments, J. Agar, *Science in the Twentieth Century and Beyond* (Cambridge, 2012).
- 11 L.E. Kay, *The Molecular Vision of Life. Caltech, the Rockefeller Foundation, and the Rise of the New Biology* (Oxford 1993), 7.
- 12 M.A. Dennis, 'Accounting for Research. New Histories of Corporate Laboratories and the Social History of American Science', in *Social Studies of Science* 17 (1987), 479–518, at 511.
- 13 Agar, *Science in the Twentieth Century*, 264–8; V. Bush, 'Science. The Endless Frontier. A Report to the President of the United States on a Program for Postwar Scientific Research', July 1945; D.J. Kevles, *The Physicists. The History of a Scientific Community in Modern America* (New York, 1979); H.J. Marks, *The Progress of Experiment. Science and Therapeutic Reform in the United States, 1900–1990* (Cambridge, 1997).

- 14 P. Galison and B. Hevly (eds.), *Big Science. The Growth of Large-Scale Research* (Stanford, 1992).
- 15 S. Shapin, *The Scientific Life. A Moral History of a Late Modern Vocation* (Chicago, 2008), 9–10.
- 16 *Ibid.*, 3.
- 17 *Ibid.*, 3. For the notion of modernity and its contested meanings, Joris van Eijnatten et al., ‘Shaping the Discourse on Modernity’, in *International Journal for History, Culture and Modernity* 1 (2013), 3–20.
- 18 Shapin, *The Scientific Life*, 10.
- 19 M. Strathern, ‘Afterword: Accountability... and Ethnography’, in M. Strathern (ed.), *Audit cultures. Anthropological Studies in Accountability, Ethics and the Academy* (London, New York, 2000). See also M. Powers, *The Audit Society. Rituals of Verification* (Oxford, 1997); Cris Shore and Susan Wright, ‘Governing by Numbers. Audit Culture, Rankings and the New World Order’, in *Social Anthropology* 23 (2015), 22–8.
- 20 Shapin, *The Scientific Life*, 5.
- 21 See also Z. Bauman, *Liquid Modernity* (Cambridge, 2000).
- 22 M. Baldwin, *Making Nature. The History of a Scientific Journal* (Chicago, 2015); A. Csiszar, *The Scientific Journal. Authorship and the Politics of Knowledge in the Nineteenth Century* (Chicago, 2018); I. Clarke, ‘The Gatekeepers of Modern Physics. Periodicals and Peer Review in 1920s Britain’, *Isis* 105 (2014), 70–93; L. Stark, *Behind Closed Doors. IRBs and the Making of Ethical Research* (Chicago, 2011); N. Jacobs, ‘Ethics by Committee. Governing human experimentation in the Netherlands, 1945–2000’ unpublished PhD dissertation, Maastricht University, 2018.
- 23 See also: M. Lamont, *How Professors Think. Inside the Curious World of Academic Judgment* (Cambridge MA, 2009).
- 24 S. Fuller, *The Governance of Science. Ideology and the Future of the Open Society* (Buckingham, 2000); D. Braun and D.H. Guston, ‘Principal-Agent Theory and Research Policy: an Introduction’, in *Science and Public Policy* 30 (2003), 302–308; B. van der Meulen, ‘New Roles and Strategies of a Research Council. Intermediation of the Principal-Agent Relationship’, *Science and Public Policy* 30 (2003), 323–36; L. Tournès (ed.), *L’argent de l’influence. Les fondations américaines et leurs réseaux européens* (Paris, 2010).
- 25 See also: M. Solovey, *Shaky Foundations. The Politics-Patronage-Social Science Nexus in Cold War America* (New Brunswick NJ, 2013).
- 26 For more on how funding policies can influence ways of knowing in the sciences, see: C. Haufe, ‘Why do Funding Agencies Favour Hypothesis

- Testing?', *Studies in History and Philosophy of Science* 44 (2013), 363–74; O-H. Ylijoki, 'Projectification and Conflicting Temporalities in Academic Knowledge Production', in *Teorie Vědy / Theory of Science* 38 (2016), 7–26; D. Braun, 'The Role of Funding Bodies in the Cognitive Development of Science', *Research Policy* 27 (1998), 807–21; T.A. Appel, *Shaping Biology. The National Science Foundation and American Biological Research, 1945–1975* (Baltimore, 2000). See also T.M. Porter, *Trust in Numbers. The Pursuit of Objectivity in Science and Public Life* (Princeton, 1995).
- 27 See also L. Daston and O.H. Sibum, 'Introduction: Scientific Personae and Their Histories', *Science in Context* 16 (2003), 1–8; P. Huistra and K. Wils, 'Fit to Travel. The Exchange Programme of the Belgian American Educational Foundation. An Institutional Perspective on Persona Formation', *BMGN-Low Countries Historical Review* 131 (2016), 112–34.
- 28 C. Andersen, J. Bek-Thomsen and P.C. Kjærgaard, 'The Money Trail: A New Historiography for Networks, Patronage, and Scientific Careers', *Isis* 103 (2012) 310–15. This article is the introduction to the Focus Section of *Isis* entitled 'Follow the Money: Networks, Peers, and Patronage in the History of Science'.

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