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PERSPECTIVE ESSAY

No transition without participation: Why moving beyond animal studies requires public input into the research agenda

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Abstract

In many countries, a large portion of animal studies serve publicly funded research purposes, yet a transition beyond animal research is politically desired. This article argues that a gradual transition is obstructed by three commitments of traditional science policy: (1) the state should provide resources for research; (2) it should leave the direction of research to the scientific community; and (3) it should set side constraints for research. This framework severely restricts public influence on the amount and kind of animal research conducted with public funds. The public can allocate some extra resources to the innovation of alternatives to animal models or tighten legal side constraints, but neither approach is likely to significantly decrease reliance on animal research overall. A gradual transition away from publicly funded animal research toward new approaches is feasible only if the second commitment is reconsidered, allowing the public greater influence over the research agenda.

Keywords: animal research; animal experimentation; transition; science policy; research agenda

Introduction

A majority of animal experiments in places like the European Union,[1] the United Kingdom (UK Home Office, 2025), and Switzerland (FSVO, 2025) serves research—not regulatory toxicity testing, education, or other purposes—of which a substantial portion is publicly funded. At the same time, there is a palpable political desire to move beyond animal research. The goal of "full replacement" of animal experimentation is endorsed in Article 10 of Directive 2010/63/EU and has been repeatedly reaffirmed by the European Commission (EC, 2015, 2023). Strategic reduction or phase-out efforts for animal experimentation have been demanded by the European Parliament (EU Parl, 2021), two European Citizens' Initiatives (ECI, 2013, 2021), and petitions to the UK and Swiss governments (AFR, 2023; AFRUK, 2022), based on arguments ranging from animal welfare and economics to concerns over scientific quality and animal-to-human translatability. There is thus a tension between the public funding of animal research and the political desire to move beyond it.

What is needed for a transition beyond animal experimentation? The discussion often focuses on technological and scientific challenges, specifically that of innovating and validating alternatives to animal experiments. For example, the UK government published a strategy for increased support of the replacement principle, focusing on innovation and validation activities (UK Government, 2025). Indeed, over the last 20 years, specific animal experiments have been replaced by new approach methodologies

[1]Data available online on the ALURES database: https://webgate.ec.europa.eu/envdataportal/content/alures/section2_number-of-uses.html (last accessed 07.07.2025).

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based on cell cultures, organoids, organs-on-chip, and computer simulations, to name just a few (Vashishat et al., 2024). However, many countries have not seen a significant reduction in overall reliance on animals in the same timespan (Taylor, 2024). Potential reasons include lock-in effects (Abarkan et al., 2022), scientific inertia (Lohse, 2021), the outpacing of innovation in alternatives by innovation in novel animal models (Müller, 2023, 2026), and scientific trends that lead to more work in animal-reliant fields (NC3Rs, 2012).

Previous research has highlighted that the desired transition also depends on social and economic factors, such as how scientists are educated, what research networks are created, what research gets funded, and what infrastructure is provided (Abarkan et al., 2022; Baumgartl-Simons & Hohensee, 2019; Hutchinson et al., 2022; Marshall et al., 2022; Müller, 2024a; NCad, 2016).

The present article will argue that there is also a political condition: a gradual, controlled transition from animal models to new approaches requires public involvement in the research agenda. The public needs to have a say in what research areas and questions scientists prioritize—not just what methods they are allowed to use. Otherwise, the only tools the polity can use to support the transition are either too weak (providing marginal funding for alternatives development) or too strong (banning animal experiments). Therefore, legislators, animal advocates, and scientists who take an interest in phasing out animal research should also take an interest in getting society more involved in setting scientific priorities.

Three clarifications are needed before launching into the argument: first, the article's claim is not that giving the public a say in the research agenda is *sufficient* for a transition—obviously, a polity that desires animal experiments will direct its scientists to conduct them. The claim is that public input into the research agenda is a *necessary* condition of a gradual transition. Second, the article aims to articulate an overlooked *problem*—that the lack of meaningful participation of the public in the research agenda blocks the possibility of a gradual transition beyond methods that harm animals. Potential *solutions* will only be explored in a preliminary way. Third, this article focuses on publicly funded animal research—not on animal testing in regulatory toxicology, education, or other contexts, and not animal research by private entities. Distinguishing between these areas of animal experimentation is sensible because they depend on distinct policy areas (e.g., science policy versus chemicals policy), which raise different difficulties (see e.g., Rovida et al., 2023). Furthermore, moving away from animal models is especially challenging in research because animal models in research can, in principle, address infinite new questions, while in regulatory toxicology and education, they serve more limited purposes and can be replaced more easily. This reasoning compelled the European Commission to develop a phase-out plan for regulatory animal testing but not animal studies in research (EC, 2023, p. 14).

The discussion will proceed as follows: in the first section, traditional science policy will be characterized by three normative commitments: (1) the state should fund science, (2) it should leave the direction of research to the scientific community, though (3) it should set some minimal side-constraints for what researchers may do (Section "Three normative commitments of traditional science policy"). Second, it will be discussed how this arrangement inhibits a gradual transition to methods that do not harm animals (Section "How the three commitments block a gradual animal research transition"). Third, it will be argued that the second of the three commitments in particular should be reconsidered, namely, the determination of the research agenda by the scientific community alone. To illustrate the space of possibilities, some alternative approaches will be sketched (Section "Beyond laissez-faire communitarianism"). The last section concludes.

Three normative commitments of traditional science policy

Despite many variations across time and space, science policy in the Global North since the second half of the 20th century has converged towards some broad characteristics. Although their predominance is likely explained in part by the influence of special (researchers') interests, they are also in line with

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dominant normative views (Wilholt & Matthias, 2012, p. 213). In this section, three key normative commitments of traditional science policy will be discussed:

(1) *State support for research*: The state should provide resources for research.
(2) *Laissez-faire communitarianism*: The state should leave the direction of research (what problems are being investigated and how) to the scientific community.
(3) *State-issued side-constraints*: The state should set and enforce well-justified side constraints for research.

Taken together, these three commitments pose a major obstacle for a gradual transition beyond publicly funded animal research, as we will shortly see. First, however, consider each commitment in turn to see the sense in which it is "traditional" and how it features in science policy in many jurisdictions today.

State support for research

The first commitment is to the view that the state should provide resources for research. Of course, many states fund applied research for military, medical, and environmental purposes. But out of this practice grew a system of state support for science that goes beyond just meeting states' immediate knowledge needs. In the United States, the state invested heavily in research during World War II, the most famous example being the Manhattan Project that led to the atomic bomb (Kevles, 1979, p. 341). After the war, state support for science continued, but without the same system of top-down direction (Kevles, 1977). The National Science Foundation was formed in 1950, and other countries like Switzerland (Lepori, 2006) created similar institutions around that time.

Today, the normative commitment to state support of research is tangible in budgets across the world. The members of the *Organisation for Economic Cooperation and Development* (OECD) typically spend between half and one percent of their gross domestic product on research and development (AAAS, 2024)—a considerable public investment.

Why should the state support research? The classic argument was articulated by Vannevar Bush in his 1945 letter to President Truman titled "Science: The Endless Frontier" (Bush & Holt, 2021). The argument rested on the view, now called the "linear model" (Shaw, 2022), that technological innovations that benefit society depend on more fundamental advances in basic knowledge (Bush & Holt, 2021, pp. 79–81). Some ultimately valuable research is initially too far removed from commercialization to be conducted by private participants in the economy, and so state support is needed (Bush & Holt, 2021, p. 59). This is essentially an argument from market failure. Market failure occurs when prices do not adequately reflect value due to externalities (Mazzucato, 2021, p. 31). In the case of basic research, prices do not reflect the benefits that can be generated based on the fundamental knowledge gained. This is so particularly because fundamental knowledge behaves like a public good (Guston, 2009, p. 48), in that others cannot easily be excluded from its use and it can be shared without being diminished (Stiglitz, 1999, p. 309). Thus, markets typically provide little incentive to invest in basic research. In order to secure the long-term benefits of fundamental knowledge, the state needs to step in and provide the necessary funds.

Minor additional arguments for state funding of research include that it also supports higher education and the highly educated labor market. Particularly in biomedical fields, there often exists a pipeline of employment from publicly funded research projects to privately funded positions in industry, where research publications serve as signals of competency (Wilholt, 2006, pp. 84–85). Another supportive argument is that freedom of inquiry as a basic right can only be meaningfully guaranteed if the state also provides some resources for inquiry (Wilholt, 2010, p. 175). There can, in turn, be different reasons to value freedom of inquiry, including ones related to the value of autonomy and the importance of knowledge for democracy (Wilholt, 2010). However, it seems unlikely that arguments about the labor market and freedom of inquiry alone would motivate state spending on research

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anywhere near today's levels. The argument from market failure carries most of the argumentative weight.

Laissez-faire communitarianism

The second key commitment of traditional science policy is that the state should leave the setting of the research agenda (what problems are being researched and how) to the scientific community. While political ideas about freedom of inquiry trace back at least to the 19th century (Wilholt & Matthias, 2012, pp. 212–13), they rose to particular influence during the aforementioned debates about how to continue the United States' public support of science after World War II (Kevles, 1977; Miri, 2021; Wang, 1995). At the time, the idea of letting the scientific community direct its own efforts was contested. Some politicians, most prominently Democratic senator Harley Kilgore, favored a system of institutionalized democratic input into the research agenda, e.g., in the form of a research board that allocates funding to different fields, featuring non-scientist representatives of capital and labor alongside scientists (Kevles, 1977, p. 15). More radical proposals had existed since the 1930s, such as the visions for full-fledged state planning of scientific priorities advanced by socialist scientists like John D. Bernal and John B. S. Haldane (Werskey, 1978; see Section "Beyond laissez-faire communitarianism" for further discussion). In response, influential arguments *against* state involvement in the research agenda were articulated by Vannevar Bush in the United States (Bush & Holt, 2021; on his influence see Guston, 2009) and Michael Polanyi in the United Kingdom (Polanyi, 1962; on his influence see Thorpe, 2009; Beddeleem, 2020; Hartl, 2021).

Today, this commitment is tangible in institutional separations between state and science. While details of course vary between jurisdictions, some share of state-funded research is typically isolated from state direction. A good example is Switzerland, where the fully state-funded Swiss National Science Foundation is an autonomous private foundation on whose priorities the government does not take much influence, with the exception of politically initiated, but relatively small National Research Programmes (Lepori, 2006). Worldwide, however, an increasing amount of science funding since the 1990s has been allocated to programs focusing on specific societal challenges (Bührer et al., 2023). For example, under Horizon Europe, 53.5 billion Euros are allocated to research that addresses one of five societal missions, while 25 billion Euros are allocated based on science-internal criteria alone (European Union, 2021, p. 6). Thus, the traditional approach is no longer dominant everywhere. But it still structures the allocation of considerable sums of research funds.

The arrangement advocated by Bush and Polanyi, and recognizable in the basic setup of many science agencies today, is laissez-faire in a sense. The state lets the scientific community decide for itself what issues should be researched to what extent and what methods should be employed. However, post-war science policy was never laissez-faire for *individual* scientists—not everybody who wants to do research is enabled to conduct it (Hollinger, 1990). Rather, public research funding is distributed using various review procedures, including peer review, in ways largely devised by the scientific community itself. Thus, the self-direction at issue here is crucially that of a scientific *community* held together by common structures and rules (such as the Mertonian values, see Merton, 1973). Polanyi thus spoke of a "Republic of Science" (Polanyi , 1962), a community of equals who mutually enforce scientific standards. Hollinger (1990) coined the term "laissez-faire communitarianism" to describe this approach to the setting of the research agenda. In many countries, the emphasis on the self-direction of the scientific community has increased in the last 30 years with the ascent of New Public Management, a policy approach focusing on lessening public control and increasing market-like competitive mechanisms (Bührer et al., 2023, p. 143). Laissez-faire communitarianism can also be understood as a commitment to a kind of scientific freedom, namely the *negative* freedom from state intervention in the direction of research priorities, which applies at the *collective* level (see Wilholt, 2010, p. 175).

The main argument for laissez-faire communitarianism is social-epistemological (Wilholt, 2010, pp. 175–176): leaving the setting of the research agenda to a self-organizing community of researchers

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leads to an optimal distribution of researchers across problems, and state intervention would only hold the progress of knowledge back (Polanyi, 1962, p. 56). Polanyi emphasized that it takes many kinds of knowledge to make valuable scientific contributions: specialized scientific expertise (e.g., about what the most promising cutting-edge problems and approaches are), but also local knowledge (e.g., about labs and personnel), as well as non-communicable "tacit" knowledge (e.g., noticing patterns in data, Polanyi, 2009, p. 5, or guessing what problems are adequately challenging for the scientist's own abilities, 2005, p. 131). No central authority, such as the state, could feasibly collect, update, and process all this information to optimally distribute researchers across problems (Polanyi, 1962, p. 65). Better to let researchers self-distribute across problems and enforce scientific standards among each other (Polanyi, 1962, pp. 57–60).

In order for this argument to have purchase, it needs to be assumed that we always want whatever progress can be obtained most rapidly. This is not obvious—we might rather want progress in specific areas where society faces urgent challenges, even if those are not the areas where progress is most opportune. Defenses of laissez-faire communitarianism have however emphasized serendipity: advances in knowledge often yield societal benefits in unforeseen ways, so that the best procedure is to amass knowledge and let benefits arise, rather than trying to opt for specific benefits (Bush & Holt, 2021, p. 80).

State-issued side constraints

A third commitment of traditional science policy is that the state should set and enforce well-justified legal side-constraints for research. While scientists have historically never been above the law, the idea that *specific* laws need to regulate science gained traction in the 19th century (French, 1975; Parascandola, 2024). An important example is the introduction of the Cruelty to Animals Act of 1876. The Act set certain constraints for the permissible ends of animal research—that it needed to serve the search for knowledge that can advance human welfare (per article 3.1)—as well as for the way in which experiments may be performed, e.g., mandating anaesthesia for painful procedures if possible (per article 3.3). The Act was the hard-won achievement of a politically organized animal welfare movement that utilized public outrage at the evident cruelty inherent in some animal research at the time (Finn & Stark, 2015; French, 1975). In many countries today, the ends and means of (some) animal research are regulated through systems of harm–benefit analysis implemented by institutional (IACUC) or state-affiliated committees, which also check for compliance with the "three Rs" of replacement, reduction, and refinement in the proposed study (Bayne et al., 2024). Outright bans on scientific animal experiments are however rare, with the notable exception of bans on invasive research on Great Apes (Aguilera et al., 2021).

When it comes to human participants, ethical requirements for research were tightened in the 20th century. The Nuremberg Code (NC, 1949) was created in response to the scientific atrocities perpetrated by Nazi researchers (Annas & Grodin, 2008), and the Belmont Report (BR, 1979) was a reaction to the Tuskegee syphilis study (Beauchamp, 2008). Standards such as informed consent were thus first institutionalized. Today, side constraints on research with human participants are typically enforced through checks by state-run ethics committees (Meslin & Johnson, 2008). In addition, there exist some state-issued moratoria on certain research issues, e.g., on research on human cloning (Bonham, 2021) or the creation of new pandemic pathogens (Lipsitch & Inglesby, 2014).

All these different state-issued rules and regulations have in common that they are *side-constraints* in the sense that they do not tell researchers what to do, but only what *not* to do. They set limits, but do not positively direct research. In this respect, state-issued limits on research are compatible with laissez-faire communitarianism.

The argument for such state-issued side-constraints may seem obvious when faced with scientific atrocities or the prospect of catastrophic uses of science: these restrictions are necessary to safeguard the common good. This stands in some tension to laissez-faire communitarianism, at least if the latter is based on the presumption that rapid scientific advance is always desirable. But this presumption may be

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understood as defeasible, that is, progress is assumed by default to be desirable, and the burden of justification rests on the restrictive, not the permissive side.

The justificatory threshold for introducing new side-constraints is high. One reason for this is that many jurisdictions treat freedom of inquiry as a constitutional or basic right (Wilholt, 2010, p. 174), and it takes strong reasons to restrict such rights. Among other common conditions, restriction of the right must typically be a means of last resort and must be justified by strong public interest (Gardbaum, 2007). Add to that the aforementioned defeasible presumption that knowledge advances are themselves in the public interest, and thus that preventing them is not. Thus, the societal downsides of research typically need to be strong and uncontroversial for research to be restricted by the state. Research is unlikely to be restricted if its downsides are not serious and obvious enough to spark considerable public outrage.

In sum, traditional science policy is normatively committed to state support of research, to a laissez-faire communitarian approach to the research agenda, and to state-issued side constraints. In the next section, consider how these commitments inhibit a gradual transition beyond research that harms animals.

How the three commitments block a gradual animal research transition

In many leading research hubs, demands have been advanced to reduce or phase out animal research. For example, the European Parliament in 2021 called for a phase-out strategy for all animal experimentation including research (EU Parl, 2021), a demand repeated in a European Citizens' Initiative (ECI, 2021). The former German government promised the creation of a "reduction plan" for animal experimentation (SPD, Bündnis 90 / Die Grünen, and FDP, 2021), which was however never published, while in the United Kingdom and Switzerland, petitions have demanded phase-out strategies for animal experimentation (AFR, 2023; AFRUK, 2022). The UK Government in 2025 indeed published a strategy to better support alternatives to animal experimentation (UK Government, 2025). This suggests a concern on the part of some authorities and citizens with the overall amount of animal experimentation, which in many countries has not seen a significant decrease in the last 30 years (Daneshian et al., 2015; Taylor, 2024; Taylor & Alvarez, 2019).

Some authorities have picked up the demand for more strategy in animal experimentation policy, but have focused on regulatory toxicology rather than research. The United States Environmental Protection Agency began working on a phase-out strategy for the animal tests it requires and funds, though it abandoned the project in 2024 (Grimm, 2024a). More recently, the Federal Food and Drug Administration and the National Institutes of Health stated ambitions to reduce animal testing strategically (FDA, 2025; NIH, 2025). The European Commission, too, has committed to creating a reduction roadmap for regulatory animal testing (EC, 2023).

When it comes to research, however, traditional science policy offers little democratic control over how much animal research happens. There are two main approaches to encouraging a transition away from animal research in accordance with traditional science policy. Consider the two in turn.

Support for the innovation and validation of alternatives

One option is for authorities to provide extra financial support for research and development of alternatives to animal research methods (on the notion of an alternative, see Kramer, 2024). Many countries now have institutions devoted to this purpose, guided by Russell and Burch's (1959) "three Rs" approach of "replace, reduce, refine" (Neuhaus et al., 2022; Parascandola, 2024). The "three Rs" approach is compatible with laissez-faire communitarianism. After all, the approach refrains from influencing scientists' selection of research questions and focuses only on supplying more humane methods to answer them (Müller, 2024c; Tannenbaum & Bennett, 2015, p. 123).

At the same time, the provision of extra research funding for alternatives development can be viewed as a deviation from laissez-faire communitarianism. After all, the state does not leave it entirely to the

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scientific community to decide how much is spent on alternatives development rather than other scientific endeavors. However, this deviation is only very slight, as the funds devoted to these initiatives are marginal compared to overall biomedical research funding. For example, the Swiss National Research Program "Advancing 3Rs" was awarded a budget of 20 million Swiss francs over five years (SNSF, n.d.), paling in comparison with the country's public spending of around 1.88 billion Swiss francs on life sciences research in the 5 years from 2020 to 2024.[2] It is noteworthy that the approach currently favored by governments, of supplying extra funding for alternatives development, is only compatible with traditional science policy as long as that extra funding is relatively marginal. To further minimize deviation from laissez-faire communitarianism, decisions over what alternative projects get initiated and funded may be outsourced to the scientific community (e.g., by issuing open calls and selecting projects solely based on peer review), rather than being state-directed.

Compatibility with laissez-faire communitarianism also requires that "three Rs" institutions do not communicate precise visions, goals, and timelines for how science should be transformed—no matter whether it is in terms of replacement, reduction, or refinement, and no matter whether the described change would be an increase, shift, or decrease of animal research.[3] Trying to purposely steer science toward a desired goal state would mean interfering in the self-direction of the scientific community.

Available numbers do not reveal any major influence of such "three Rs" programs on overall reliance on animal models in science, which has been called the "missing 'three Rs' effect" (Grimm et al., 2023, pp. 2–3). Potential reasons include the following: lock-in effects may occur when more funding is available for animal models than alternatives (Abarkan et al., 2022); scientific inertia occurs when alternatives are used to meet specific data needs, but animal models continue to inspire research questions (Lohse, 2021); a "Lane-Petter's Pipeline" dynamic can arise when innovation in alternatives is outpaced by innovation in new animal models (Müller, 2023, 2026); or general scientific trends may favor heavily animal-reliant fields, leading to a stagnation or increase of overall numbers despite advances in alternatives (NC3Rs, 2012). In short, how much animal research is conducted depends not just on which methods are available but also on which research questions and problems are prioritized. But laissez-faire communitarianism significantly limits the state's ability to guide science in this respect.

Stricter side constraints

The second option to decrease animal experimentation in keeping with traditional science policy is to increase the side constraints for research, for example, in the form of a ban on all animal research, or on certain types of animal research (e.g., no more primates, Clulow & Lauwereyns, 2020, p. 111). However, ban proposals have not generally been successful. A stark example is Switzerland, in whose semi-direct democracy voters have rejected a total ban on animal experimentation four times since the 1980s (Bundeskanzlei, 1985; 1992; 1993; 2022).

While traditional science policy allows the state to set side constraints for research, the justificatory threshold for doing so is high. If only a small minority thinks that a certain type of research poses a serious threat to the common good, side constraints cannot be tightened. In some societies, many people appear to be morally conflicted about animal research (McGlacken, 2022), but moral *outrage* seems to be limited to a small minority. Thus, the conditions for introducing significant new side constraints for research are unlikely to be met.

[2]Data available online at the SNSF Data Portal: https://data.snf.ch/key-figures/disciplines?s2=1&s3=3&s5=4 (last accessed 28.01.2026).

[3]For example, at the time of writing, the websites of the following 3Rs institutions appeared to offer no information about their vision (overall intended outcomes and impacts) as opposed to their mission (activities carried out): 3R Center Tübingen, 3Rs Centre Utrecht, Austrian A3RC, French FC3R, Norecopa, Slovak SNP3Rs, Swedish 3Rs Center. The following 3Rs institutions did articulate visions, goals, or objectives, but did so exclusively in terms of open-ended activities (e.g., "support scientists to develop new or improved alternative methods to animal experiments"): Charité 3R Berlin, Swiss 3RCC. A notable partial exception is the British NC3Rs, which has formulated an extensive vision statement for the period from 2015 to 2025 (NC3Rs, 2014) that includes some quantifiable outcomes, including that animal use in UK science shall not increase overall.

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It is worth noting that traditional science policy gives opponents of animal research (or of any other research practice) reasons to try to spark public outrage. Researchers have complained that activists sometimes use misleading information to cast animal research in a bad light, for example, by using shocking images of long-outdated practices (e.g., Holder, 2014; MacArthur Clark et al., 2019). But the provocation of outrage is incentivized by a system of science policy that offers the public little say in the direction of science—except through side constraints typically introduced in response to public outrage. Another point worth noting is that those defending freedom of inquiry and those advocating for bans on animal research implicitly agree on the three traditional commitments—their disagreement is merely on whether the justificatory threshold for stricter side constraints is met in the case of animal research.

Blocked options

Beyond supporting alternatives and banning animal research, there is a plethora of subtler ideas on how the state could encourage research to move away from animal models (Müller 2024a, 2024b, 2026). The problem with these proposals is that they conflict with traditional science policy in general and with laissez-faire communitarianism in particular.

Recurring proposals include shifting funds away from heavily animal-reliant approaches and toward less animal-reliant or fully animal-free approaches, the provision of extra organizational support for animal-free research, and an official commitment by the state to specific reduction goals that act as checkpoints for strategic reevaluation (Müller, 2024a). In principle, all this could happen in a gradual and controlled way, so that research is simultaneously expanded in animal-free areas as it is reduced in heavily animal-reliant areas, resulting in equal or greater social utility (Müller, 2024d). What unites these policy approaches is that they rely on tools of government beyond the regulation of animal experimentation—they concern the distribution of resources, the provision of information, and the creation or adaptation of institutions. And in crucial contrast to mere regulation, these approaches try to change what questions and problems are prioritized by researchers, not just what they are allowed to do. This deviates from laissez-faire communitarianism.

Thus, traditional science policy does not allow for the piecemeal steering of science in socially desired directions, including the direction away from animal research. It does allow for steering, but only through the rough mechanism of side-constraints that can usually only be adjusted in response to widespread public outrage. Whoever takes a serious interest in reducing or phasing out animal research should thus reconsider the three commitments of traditional science policy. The next section will argue that laissez-faire communitarianism can be relaxed most easily among the three.

Beyond laissez-faire communitarianism

In principle, the total amount of publicly funded animal research in a given jurisdiction could be reduced or eliminated by relaxing any of the three commitments. The options are as follows:

(1) The state could defund science;
(2) It could exert greater influence on scientific agenda-setting;
(3) It could lower the justificatory threshold for tightening side-constraints;
(4) Or any combination of the above.

Number (2) is preferable for quite clear reasons. Consider the other options only briefly. Regarding (1), defunding science leaves the market failure of basic research unaddressed. Although industrial research might be better than its reputation from an epistemic standpoint (Wilholt, 2006), a fully privatized system of research would surely produce different, and less, basic knowledge than a partially state-supported one. At the time of writing, the United States government is making sweeping cuts to research grants (Kozlov and Ryan 2025). Other countries, such as the UK and Switzerland, are also reducing

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science funding due to austerity (Foster et al., 2024; SNSF, 2025). Some animal protection organizations have hailed some of these funding cuts because it may effect a decrease in animal experimentation (Grimm, 2024b). But the ethical risks of these cuts are obvious.

Option (3) is to lower the bar for new restrictions on science. One could, for instance, fast-track moratoria on lines of research about which a majority of society is morally conflicted, even if only a minority is outraged about them. This would make it possible to gradually suffocate animal experimentation with new restrictions. However, this strategy would require turning away from freedom of inquiry as a basic right, as we saw in the Section "State-issued side-constraints", which sets a high justificatory threshold. This is not only very difficult to do, but it would also open the floodgates to various other restrictions only endorsed by some societal minority.

Option (2) may initially seem just as unattractive, particularly as the United States government has been increasing authoritarian control over project funding, including cancellations of research grants for projects whose descriptions contained specific keywords such as "diversity" and "undeserved" (Kozlov and Ryan 2025). However, authoritarian control over science funding is by no means the only alternative to laissez-faire communitarianism. As we saw in the Section "Three normative commitments of traditional science policy", laissez-faire communitarianism was once a contested doctrine, and it is not universally practiced today. A majority of European research funding through Horizon Europe is allocated so as to address specific societal challenges, though a substantial portion is still allocated according to scientific criteria alone (European Union, 2021). In the remainder of this section, consider some criticisms of laissez-faire communitarianism and some competing—and non-authoritarian—visions for state-supported science.

The fundamental challenge of science policy, argue Daniel Sarewitz and Roger Pielke Jr, lies in aligning the supply of research outputs with society's demand for new knowledge (Sarewitz and Pielke, 2007). To accomplish this, information plausibly needs to flow from science to society and back. But laissez-faire communitarianism, by leaving the determination of the research agenda to the scientific community alone, fails to receive input from most of society (Sarewitz & Pielke, 2007, p. 7). This separation between science and society leads to more problems than just the inability to steer science away from certain methods such as experiments that harm animals. It also enables misalignment between societal needs and research outputs, e.g., when biomedical research priorities deviate from disease burden in undesirable ways (see Millum, 2023) or when the social aspects of climate research go neglected (Overland & Sovacool, 2020). And as scientist and former United States congressman Rush D. Holt has pointed out, it can also alienate the public from science and scientific thinking in general (2021, p. 31).

What are some alternatives to laissez-faire communitarianism? Its historical nemesis is the central planning of science. In his *Social Function of Science* (Bernal, 1939), Bernal described a setup of interlocking state-directed research organizations at different levels: a central coordinating academy with many subdivisions would focus on fundamental issues, technico-scientific institutes would relate new insights to the needs of industry and vice versa, and industrial laboratories and agricultural field stations would solve problems immediately in the context of application (1939, pp. 281–289). New insights would be communicated downstream and new problems upstream (1939, p. 284). The allocation of research resources would be based on consultation between representatives of research, of teaching, and of the national economy (1939, p. 311).[4]

Sarewitz and Pielke (2007, pp. 12–13) sketch a post-laissez faire system based on a systematic assessment of the supply and demand of science. High-priority areas such as, for example, carbon cycle science, are singled out, and the match between supply and demand is assessed (2007, p. 13). Supply of and demand for science are aligned by adjustments on both sides, rather than by society unilaterally

[4]Although Bernal's (1939) proposal was inspired by the organization of science in the early USSR (Werskey, 1978, p. 146), some of its elements also happen to align with the American Land-Grant college system. Specifically, Land-Grant colleges were created to collaborate closely with their surrounding communities to help meet the latter's agricultural and technical needs (Gavazzi & Gee, 2018).

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steering science. Sometimes, opportunities are missed because existing research outputs are not considered by decision-makers, and in such cases, institutional innovation is required (2007, p. 13).

More inspiration for how to combine state coordination with self-organization can be drawn from industrial policy. Economist Mariana Mazzucato has emphasized the importance of state action in innovation and growth (2018) and has promoted a "mission economy" (2021) in which the state – or a supranational organization – proactively shapes new markets. In her view, societal challenges should be selected politically and with citizen engagement. Authorities should then break the selected challenges down into clearly articulated outcomes ("missions") and should actively engage private enterprise in relevant sectors to achieve specific sub-goals (Mazzucato, 2021, p. 112). For example, if the societal challenge is climate change, the European Commission may formulate the mission of 100 carbon neutral cities in Europe by 2030, and then actively engage the real estate and construction materials sectors to achieve, say, a sufficient supply of carbon-neutral building materials, and the energy and social sectors to achieve clean electric mobility in cities (Mazzucato, 2021, p. 114).

Under Horizon Europe, the European Union is devoting a major portion of its research funds to mission-oriented research and innovation (European Union, 2021, p. 6). Societal input, mediated through elected and unelected representatives though it may be, enters resource allocation at the level of societal challenges to be addressed and at the level of breaking those challenges down into more clearly defined missions (The Democratic Society, 2018). Bottom-up initiative by researchers and other innovators is still necessary in this scheme, but it is proactively solicited through calls for proposals and other programs based on predefined societal missions.

Despite the recent ascent of mission-oriented research and innovation policies, the received wisdom of Bush and Polanyi still often prevails where basic research is concerned. Excellence-based resource allocation, thus allocation by scientific criteria alone, is still an important part of Horizon Europe (European Union, 2021, p. 6). However, even if basic research needs special support, one can question whether the allocation of that support needs to be based purely on scientific criteria. If Polanyi was right that science resembles a market, then, like a market, it might profit from some proactive shaping in accordance with societal interests. In parallel to the practical missions that structure mission-oriented research and innovation policies, one could determine "theoretical," "pure," or "curiosity-based" missions in a democratically accountable way. This would give the public a say on how many of its resources should be spent on, say, curiosity-driven astronomy, curiosity-driven biology, and curiosity-driven sociology, respectively.

The obvious objection to this idea is that the public is too irrational or uninformed to make such choices responsibly. But the democratic approach to this problem is to improve the public's ability to choose well, not to take that ability away. Though the precise way in which the public should have a say in the direction of basic research goes beyond the scope of this paper, here we can conclude that there is room for manoeuvre.

How, then, would any of this move publicly funded research away from animal models and toward new approaches? It would not, all on its own. But it would remove a major obstacle, laissez-faire communitarianism. Opening the research agenda to more societal input could open a transition pathway in two ways: first, it would create a space for deliberation about how much animal research, and what kinds, for what purposes, a polity wishes to conduct—not just *whether* it wants to conduct *any*. The consideration might then hold some weight that advances in some areas can only be bought at the cost of great animal suffering, especially if advances elsewhere can yield equally valuable benefits without harming anyone. Of course, this would be decisive only if a polity cares significantly about animal suffering. Second, the development of models that outperform animals as disease models and in drug screening could itself become one of the challenges addressed in a mission-oriented way. A polity could decide, for example, that developing reliable and affordable "human-on-chip" microfluidics systems capable of high throughput (see Patel et al. 2022, p. 279) should be made a priority due to a confluence of animal welfare, public health, and economic concerns.

Of course, these potential pathways would still need to be actually taken. Relaxing laissez-faire communitarianism is no guarantee for fewer animal experiments—indeed, experimentation could

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increase if polities are so inclined. The major advantage of having more public participation in setting the research agenda is however that changes to scientific activity can be piecemeal and controlled, something that is not possible under systems based on a laissez-faire principle that only lets the public set minimal side constraints.

Conclusion

This article has called attention to an important and overlooked condition of a gradual transition beyond publicly funded animal research: public input into the research agenda. Without much of a say in the research agenda, the public cannot gently steer science towards new research questions and problems. Traditional science policy allows society to influence the research agenda only in exceedingly feeble ways (allocating marginal funding to alternatives development) or in exceedingly harsh ways (banning research that sparks overwhelming outrage). Thus, the idea that the scientific community alone should set the research agenda needs to be reconsidered if a transition beyond publicly funded animal research is to become feasible. Though greater public participation in setting the research agenda is by no means a sufficient condition for an animal research transition, it is a necessary condition. The public can only seriously debate how much animal research it wants—and what kinds, for what purposes—once it has a serious say in science at all.

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