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Introduction

John Coggon, Simona Giordano, and Marco Cappato

Scientific freedom

In this introductory chapter, we describe briefly the nature of this book, before presenting some detail on its contents, and finishing by outlining what we take to be some of the most interesting themes and ideas that it presents. It is, of course, a collection of essays. There is therefore no single, common position that is defended throughout the distinct chapters. Nevertheless, it is interesting to reflect on matters that recur, often under different emphases. At times the different arguments suggest general consensus, at times radical disagreement. Unsurprisingly, as the detail becomes finer, greater contrasts present themselves. But before looking at some of this substance, we need to ask and answer two questions: why produce a book on scientific freedom; and why do so with authors from such diverse professional and academic backgrounds?

That scientific freedom should be a matter of critical social, ethical, and legal concern is not a new thing. In this sense, we join a large literature that dates back some time. However, whilst some principles may seem to stand outside of any historical context, each generation can be seen to bring its own controversies, social differences, practical possibilities, and legal and regulatory nuances. In this sense, there is always a need for careful evaluations of the proper limits and supports that should be given to science. Constantly changing contexts demand ongoing discussion of how priorities should be set, how competing principles should be accommodated, and how obligations should be distributed amongst societies' members. As with any generation of scientific possibility, the current one has its areas of controversy. We face, for example, troublesome arguments about the ethical propriety of conducting research in areas of biomedical science that some consider to be outright wrong. We also need to explore the cases for and against directing funds into morally neutral, but financially expensive, areas of scientific research, especially if this promises no immediate technological 'payback'. So we do not consider this anthology to contain the 'last word' on scientific freedom. Rather, it speaks to it at a point in time, and presents the wide-ranging contextual and social issues that must be accounted for in contemporary analyses of scientific freedom.

Why have such a varied authorship? Although there are some co-authored chapters, this is not strictly an inter-disciplinary collaboration. Rather, it is a multi-disciplinary collection, with a range of disciplines from across the natural sciences and social sciences and the humanities. Furthermore, we

have invited contributions from authors with an interest in the regulation of science, who work, or have worked, in senior policy positions. It is our view that the intellectual insights and practical experience afforded by such a range of contributors lends the book considerable value. In part this is because of the natural divergences in approaches. However, beyond this it presents ideas in a way that is accessible to generalist readers, and allows critical reflection on the weight different writers give to different values and ideas. Some of the chapters carry strong normative messages; some are cast as more detached, analytic critiques; others still suggest practical means of effecting social and political change. These distinctions are part of what, we hope, will make this book an important, provocative, useful, and informative addition to the literature. Ultimately, the proof will be in the reading. Some will choose to view it as a whole, and read it from start to finish. Others will jump from chapter to chapter in a different order. We will give an overview here of the book's contents, and in so doing explain why the chapters are arranged as they are.

The structure of the book

The following chapters present both convergent and divergent themes. In collecting them, we have sought to provide a steady progression in substance and focus, and have divided the works into three Parts. Doing this may be seen to rely on a degree of artificiality, but our hope is that it highlights the flow of considerations that the book overall speaks to. We certainly do not mean for the Parts' titles to suggest exclusivity to their respective contents. Rather, they reflect to some degree the variation in focus taken by the book's contributors. In the remainder of this introduction, we will describe how the chapters progress before discussing the synergies and tensions that they suggest.

Part One, 'Understanding Science and Technology', serves several purposes. With five contributors representing expertise in discrete areas of science, it offers fascinating insights into the nature and value of scientific inquiry. There is discussion of how effectively to communicate scientific knowledge, but also how to begin to contextualize understandings of science. Chapter 1, by Carl Djerassi, emphasizes a distinction that some protagonists in debates on scientific freedom consider fundamental; the categorical differences between science and technology. The implications of recognising and accepting this distinction, it is argued, is crucial. However, the burden of the chapter lies in an engaging argument on the importance of communicating science to as wide an audience as possible, including to members who are cynical of science. Djerassi therefore speaks to the question of how to disseminate knowledge to people who do not have access to, or interest in reading, scientific journals and books. He is able to draw from his own experience of using art as a medium for doing this, specifically by use of science-in-fiction and theatre. It becomes clear how

effectively Djerassi can convey the substance of developments in reproductive science and technology, in particular regarding the contraceptive pill and *in vitro* fertilization. The plays that he cites present the science itself in a clear and accessible dialogue, but also raise and allow audiences to contemplate complex ethical controversies, such as reproduction tourism, sex-selection, and the removal of gametes from dead ‘donors’. Rather than develop long arguments on these, he provides a fantastic means of allowing a wide public to access understanding of the science, and to see the ethical issues that arise.

In Chapter 2, Lewis Wolpert picks up the theme that Djerassi begins with, arguing in favour of accepting a sharp distinction between science on the one hand, and technology and application on the other. By treating these differently, it is possible to conceive of science itself as value-neutral, whilst noting that the application of science can have profound social and moral effects. In Wolpert’s views, scientists are not in possession of any intrinsic expertise to assess these moral issues. He thus cautions against complete self-regulation of scientists working towards controversial applications of science and new technologies. Rather, deference to the public, the wider community, through government is essential. However, he cautions too that whilst scientific knowledge is morally neutral, it can be perverted by political or social aims. He emphasizes the problems raised by simplistic arguments that make villains of scientists, and notes also the effect of self-interest on people’s willingness to accept putatively ethical claims concerning the development of some technologies.

In Chapter 3, Lucio Piccirillo presents a challenge for researchers, and society more widely, in considering the value of ‘blue skies research’. He provocatively asks, at least where it is funded by public money, why invest in basic research instead, for example, of paying for a new hospital? He also stresses how important he thinks it is to ask his new students each year to ponder this. Piccirillo seeks to answer the question by considering what may be described as the ‘real politics of science’. Although in principle we are all ‘free’ to be scientists, an issue that he raises is that some positive conditions are necessary if people are practically free to engage in scientific research. Thus he explores two important questions: how are scientists chosen?; and how are scientific problems chosen? He describes how he perceives the reality of breaking in to the scientific community, and receiving sufficient favour and recognition to sustain a career in science. His argument is that the power of ‘oligarchs’ within the research community is not to be doubted, meaning there are two layers of ‘real politics’ to consider: one is external to the scientific community, in the form of governments or other funding bodies empowered to allocate funds; the other is internal to the scientific community, comprising the leading scientists with the greatest power to adjudicate on worthwhile *versus* non-worthy, or non-credible, science. Continuing the theme of distinguishing basic research and technological research, he notes that whilst both are needed, it is clear that funders may be keener to fund the latter. So can

‘blue skies research’ justifiably result in claims for public money? Much such research comes practically to nothing, but many of the great advances have followed from discoveries in ‘blue skies science’. Given this, Piccirillo hints to arguments rooted in intergenerational justice demanding investment in basic research, even at the cost of immediate life-saving, a suggestion that is thought provoking and ethically challenging.

In Chapter 4, Luca Beilelli Marchesini presents the facts about, and effects of, global warming over the past century. He is able to demonstrate scientifically how the rate of global warming is attributable to human activity, and is not just a natural occurrence. His arguments involve a discussion of the ‘Anthropocene’, a term attributed to Paul Crutzen that denotes a geological era in which ‘human activities are significantly modifying the great natural cycles of carbon, water and nutrients, together with climate biodiversity and other properties of the state and function of the earth system.’ This scientific groundwork leads to discussion of political recognition of climate change within the European Union, and the targets that that organization sets to reduce carbon emissions. It is crucial, Beilelli Marchesini argues, that the scientific community researching climate change should understand the roles of natural and human-caused changes to the climate, quantify the effect of human activities, and understand probable natural responses to them. He therefore spells out the research priorities for climate science, as well as urging the continuing importance for policy responses as the science becomes clearer. One of the fascinating, and testing, questions is that climate change is a global problem, and thus demands a globally coordinated response. This is true both socially, but also amongst the global scientific community, who must share their data through effective dissemination, and create networks of observation sites. Such a coordinated role for science, is not however limiting of scientific freedom; it increases it. But this freedom is only maximized and sustained if scientists recognize obligations to each other within the community, and with a shared purpose. Furthermore, political support is needed internationally. This raises difficulties where observations are required in states that are unwilling to allow scientists to come and conduct research. There is therefore a need for financial investment, political action, and the need for effective communication of the science to everyone, so that citizens and politicians can take their responsibility.

Finally, Chapter 5, by Jim Falk, suggests that a distinct geo-political context exists now, and this historical setting has important implications for discussions of concepts of scientific freedom. He begins by noting how ‘[s]cientific freedom is of course many things: a normative code, an objective, a central feature of a methodology, an ideology and even, at times, a rallying call.’ Falk, however, would understand it as a practice of governance, found within a broader and highly complex context. That context can, for simplicity, be designated as appearing across three overlapping sectors: state, market, and civil society. Science is not an isolated, self-regarding, activity. It happens in this

context, and thus scientific freedom is qualified accordingly. The network of actors implicated in the governance structures of which science forms a part, from individuals through to supranational organizations, necessarily gives a distinct content to the contemporary understanding of scientific freedom. To understand ‘the relationship between the historically established concept of scientific freedom and the current struggle to shape governance to a form which will produce an adaptative future’, Falk discusses the disaster at the Fukushima Daiichi nuclear power plant as a case study. His chapter demonstrates the massive range of scientists involved in the nuclear industry. It shows too how a whole range of institutions house the scientists, and potentially suggest reasons why different curbs might be placed on the views they would express. Normative objections to constraints on scientific freedom (for example, ones in favour of free expression) may founder in the face of considerations about an institution’s purpose and ends. Fukushima Daiichi illustrates this well. It demonstrates how ‘scientific freedom is but one strand of the broader question of nuclear and energy governance.’ Good governance suggests a need for greater transparency, so outsiders can scrutinize policies. Falk therefore advances and defends the thesis that we should aspire to the (probably unreachable) ideal of ‘holoreflexivity’: a position that assures ‘all parts of the system being able to know and reflect on the component parts, but also on the whole.’ The chapter presents a strong case for the need to study questions of scientific freedom in their historical context.

So in Part One, we already find a whole range of provocative questions concerning regulation and ethics, from how effectively to engage and inform the public, to the possible roles and responsibilities of scientists. These and other themes are picked up in Part Two, ‘Science and Society: Law and Regulation’. It starts with Chapter 6, by Amedeo Santosuosso. Santosuosso argues that science is intrinsically universal, yet it raises many tensions. These are in part financial. As suggested in Part One, funding is a problem, particularly in an era when many governments are slashing budgets. Also, though, intellectual property regimes raise incentives that seem anathema to free science. Tensions are also in part due to special interests based on ideologies. Against this backdrop, the chapter considers how constitutional law in various jurisdictions in Europe and North America protects scientific freedom.

Santosuosso compares two approaches: in some European jurisdictions we find an enshrined right to scientific freedom in teaching and research; by contrast, in North America we find no specific constitutional protection of scientific freedom, but some derivative protections of it through constitutional protection of free thought and expression. Regulatory protections of scientific freedom might arise in three ways, Santosuosso suggests. First, it is protected (everywhere) by generic basic protections of free expression. Second, it may receive explicit recognition (Europe). Third, it may be bolstered by the positive support of states promoting research (everywhere). The important question

his chapter raises is whether the formal legal differences reflect distinctions in the normative content of laws. In Europe, the right to scientific freedom is qualified by an overarching and supreme duty to protect and respect ‘human dignity’. This leads to problems given the difficulty of establishing a robust definition of human dignity and politically it leads us to the question: who gets to define dignity? He argues that even if dignity is not a constraint on scientific freedom, further tricky constraints are imposed by the ‘harm principle’, and notes the importance of distinguishing a lack of support of a particular branch of science through the withholding of public funds, and the prohibition (eg by criminalization) of a practice. He then moves to a discussion of the ongoing *Myriad* litigation, and the regulatory impact of intellectual property. The chapter has obvious bridges from Falk’s chapter, again emphasising the relevance of the wider regulatory context, and of competing political claims other than scientific freedom.

The nature and processes of assuring and changing the regulatory context is taken up in Chapter 7 by Charles H. Baron. His arguments are informed by his personal experience in the United States, where, as elsewhere, people hold deep commitments to competing, contradictory values. He explores how scientific freedom might be maximized in this sort of context. In interesting parallels with Chapter 1, Baron considers the importance of public understanding. He advocates a position where respectful dialogue takes precedence over distrustful confrontation. This means emphasising the virtues of self-doubt, openness, recognition of people of different views as fellows in society, and of sustaining good faith in debate. Dialogue is not just about persuading others, but also understanding their views. Drawing from references to particular instances in Baron’s considerable personal experience of policy, we find a clear argument in favour of a process of dialogue that seeks mutual understanding and discussion rather than hostility and mutual distrust. Baron recognizes and respects great pluralities of fundamental views, and the role of the law given them. He also speaks to the real politics of policy-making: legislators want to be re-elected, and will appeal to polarising issues to achieve this, bringing out otherwise lethargic voters. He argues that we should note too, therefore, the power of the courts as a means to change the law or secure people’s freedoms. Amongst other things, judges do not suffer concerns about re-election. Furthermore, law reform litigation can raise public awareness. However, Baron cautions against too strong a role being given to courts, citing the famous case of *Roe v Wade*. The effect of this case on public debates on abortion, he argues, demonstrate why courts should not ‘overuse’ constitutional principles to achieve controversial ends, or their doing so will vex the public and stifle meaningful, constructive dialogue. The chapter offers carefully considered insights into the need to be strategic when urging law reform, and to remember that short term victories can have a negative long term cost if they mean problematic polarization amongst a people.

In Chapter 8, Sarah Devaney introduces a distinct perspective on the regulation of science, and the legitimacy of scientific freedom. Like earlier authors, she notes the tensions in the positive claims that may be inherent in a concept of scientific freedom; namely, the need for positive protections of the conditions in which research can be conducted, and access to the means to conduct research. Devaney's argument is an exploration of an interesting problem from the perspectives of law and justice. She considers whether individual contributors to scientific research, parties needed to allow research to happen, are due recompense. The case study she employs is of contributors to stem-cell science; specifically women who make their ova available for stem-cell research. Stem cell science, of course, can not happen without contributions of tissue samples. Devaney suggests that contributors are justifiably due payment, and that existing legal barriers to this should be removed. Her position is not that regulation is unnecessary, but that it should serve to enhance the freedom and claims in fairness of the women, rather than crush their freedoms and (moral) rights. She addresses commonly raised concerns, such as worries about exploitation, but notes that proper regulation can overcome these without problem. Her chapter draws out the important point that whilst scientific research is important, people have important rights that will not justifiably be overridden simply because of the goods that science leads to. Justice and good regulation allow the distinct interests to be harmonized.

In Chapter 9, Dick Taverne discusses the threat that dogma poses to science. Historically, he argues, the dogma have come from religion. The last century has seen it come from political ideology. To begin with, he accepts that generally scientists have great freedom today, and science flourishes more than ever. But there are some *areas* of science that are beset by problems based in ideology. The most problematic anti-science dogma of the moment, Taverne suggests, is 'eco-fundamentalism'. His reference to fundamentalism is sustainable because some of the anti-GM movement are fundamentalist, in the sense that no amount of evidence will shake their views on the harms and dangers of genetically modified crops. Following some factual detail about GM, he shows that eco-fundamentalism impinges on scientific freedom in various ways. First, it does so through violence and intimidation. Taverne's sentiment is strong: 'These vandals are the modern equivalent of book burners'. Second, there is the effect of finance: products made from GM crops can not be commercialized in the European Union. Globally, this causes considerable harm, though perhaps that is not a sufficiently pressing concern for rich, well-fed Europe. The third problem is that research on GM is inhibited by over-regulation. Particular problems arise with the risk-aversion dictated by the quasi 'eleventh commandment' that is the precautionary principle. Taverne sees the problems as existing on a two way street. He voices concern too at dogma in favour of suppression of voices expressing scepticism of climate change. Tolerance is vitally important in a liberal democracy, and must work both ways.

In Chapter 10, the final chapter of Part Two, Emma Bonino and Simona Giordano discuss the politics surrounding claims for and against greater or better supported scientific freedom, and issues about making progress and achieving compromises. Their arguments focus on embryonic stem cell research and cell nuclear transfer research, matters on which there is apparently intractable moral disagreement. But rather than rehearse the ethical arguments, their focus is on the nature of political decision-making in the EU context, including on the funding of controversial research. Bonino and Giordano start by asserting that science is a fundamental good, and that scientific research is protected by justiciable rights entrenched across legal systems. Yet they note too that some research proves highly controversial, particularly where it is seen (by some protagonists in the debate) to threaten ‘human nature’ or the environment. They also reaffirm the importance of ethical structures constraining scientists’ freedom, and note how these serve further to enhance human rights. However, echoing concerns raised earlier in the book, they consider it important to distinguish genuine and meaningful concern about people, which provides reasoned grounds for limiting scientific freedom, and ideology, which does not. Within a political and regulatory system, a crucial role of political leaders is to ensure clear understanding of the science, especially where controversy arises. The bottom line for politicians is not an ideology, but the good of the people. In this sense, it is vital to recognize the strength and importance of political compromise, even when the final position seems not to accord with the logic of the views of participants of either ‘side’ of particular debates. Politics, especially in a liberal democracy, provides the basis for recognising pluralism, yet also puts constraints on what people can do notwithstanding their plural positions. In such a system, part of the politicians’ role is not to let ideology (even their own) stand in the way of benefits to others. Another part, again as emphasized in other chapters, is the duty to ensure sound and balanced communication of the issues to the people. This applies as much to eradicating misinformation or unrealistic hopes about the benefits of science as it does to eradicating bogus or irrelevant ideological arguments against science. As Bonino and Giordano’s case-study shows, a crucial part of this political process involves bringing in a great range of ‘stakeholders’ – including patients, scientists, politicians, ordinary citizens – and ensuring that their voices are heard.

Part Three of the book, ‘Science, Ethics, and the Politics of Scientific Research’, develops the regulatory, contextual, and ethical arguments that are raised earlier in the book, and places them in frames of moral and political philosophy. In Chapter 11, Gilberto Corbellini and Elisabetta Sirgiovanni address a theme that is raised but not so systematically explored in earlier chapters: the relationship between science and democracy. They begin by describing the ways that science is portrayed as an affront to democracy, caricatured as the struggle between the expert and the common man. They detect a sense that since the 1960s across the Western world science has been cast as a threat to democracy. However, in

response to this position, they aim to show that science is essential to democracy. To do so, they employ the case study of Italy, where they show considerable resistance to scientific freedom through institutional and political interference. Problems come for scientists trying to communicate the value of scientific freedom from relativistic positions (there is no truth, *ergo* there is no scientific truth) and from contraposed dogma (eg religious claims that some activity will offend God). Studying the weakness of science's position in Italy requires recognition of multi-factorial causes, including a historical lack of cohesion of the scientific community, political and legislative interference, lack of transparency, nepotism, and decreasing quality amongst the national, political and intellectual elites. Specific instances are given to reinforce the arguments. In particular, a conspiracy of influence from the Vatican and widespread scientific illiteracy have proven problematic for scientific freedom. Public engagement is a crucial part of the process in which scientific freedom can be assured. Corbellini and Sirgiovanni demonstrate, in rebuttal of those who see a tension between science and democracy, that there was a causal relationship between the rise of modern science and the rise of modern democracy. Furthermore, scientific understanding allows us to understand the function of our brains, how we have evolved, the effects of our brains' functions on our rationality, and the inherent biases they give rise to. Educating people to be able to think scientifically helps them understand the world, and combine normative and empirical approaches rationally. They conclude: 'Science provides individuals with autonomy, self-determination and critical thought, which are the basis for protecting democratic thought and political pluralism. And this is exactly what we mean when we say that freedom of science *means*, rather than threatens, democratization.'

Chapter 12, by Søren Holm, stands in interesting contrast. Whilst some chapters in this book suggest reason to be cautious, or even cynical, of the strength and legitimacy of religious reasoning where it bears on the practical freedom enjoyed by scientists, Holm mounts a forceful defence of the protections due to alternative liberties to scientific freedom. He specifically defends protections of religious freedom within secular democracies. His is not a defence of the position that religion should alone determine science policy, but the more modest claim that it has a legitimate *role* in determining it. And whilst issues such as stem-cell research suggest (from advocates of greater scientific freedom's perspective) that the influence of religion on science policy is unwelcome, we can also find examples where religious leaders positively advance the cause of scientific inquiry. To understand and evaluate the competing claims that may be under issue, Holm examines justifications of scientific freedom, and their implications for the legitimate scope of scientific freedom. First, we need to distinguish negative and positive scientific freedom. The former denotes freedom to be left alone, the latter entails positive claims for material support for scientific activity. Unlike some negative freedoms, Holm argues, scientific freedom is extremely important, and thus worthy of special

protection. Nevertheless, where it clashes with other special freedoms, it will sometimes have to yield. Likewise, the grounding of positive scientific freedom is also found in the intrinsic and instrumental values of science, and again is subject to limits. But of course, without more we can accept that competing values will limit scientific freedom without taking it that religious values can. So he continues his argument by taking as his context a real-world democratic system (i.e. not some idealized abstraction such as we find in Rawlsian or Habermasian philosophy). Holm argues that it is not possible coherently to rule out one sort of comprehensive world view that provides positive arguments in policy (religion) without also excluding others. This suggests that we should after all let religious ones remain, just as we do others. Otherwise we end up in a very limited political system where few positive protections and rights exist. Nothing other than self-identification as religious worldviews provides a relevant commonality to religious worldviews, or relevantly distinguishes them from other comprehensive worldviews that do have standing. As long as democratic societies exist in the non-ideal frame, pressure groups have a legitimate role. Again, there is nothing that singles out religious pressure groups suggesting they should get special (negative) treatment.

In Chapter 13, Malcolm Oswald emphasizes the positive claims intrinsic to full scientific freedom. Being left alone is not always enough to allow scientific inquiry, and thus competition will arise for finite resources. Oswald suggests that scientific knowledge is, in economists' terms, a durable public good. Because of the need for money, and the incentives at play, a range of factors interfere with the purity of scientific freedom. Real world limitations of many varieties serve as partial bars to scientific freedom, and that should be taken as a given. However within real world constraints, he asks, should we seek to maximise scientific freedom? He considers arguments for funding to be allocated according to the wisdom of a body of scientists, rather than a political body, for what Braben labels 'transformational research'. It is demonstrable that basic research contributes to economic development: scientific freedom contributes to prosperity. However, as seen above, it is also controversial to divert funds to 'blue skies research'. Oswald makes clear why this is the case. Cost benefit analysis raises problems for allocating funds to basic research, given that they could go elsewhere, especially where the goal of the research is knowledge: there are no guarantees that knowledge will result; it is hard to value the knowledge, especially in advance; and given conditions of scientific freedom, it will be hard to know a lot about the nature of the knowledge the scientists are pursuing. So, asking public bodies to allocate funding, essentially in blind faith, to exceptional scientists presents real problems. Oswald notes various reasons to suggest ethical side-constraints on scientific freedom, especially harm to others reasons, and competing claims for public money. Even scientific self-regulation may be a bad idea, depending on matters such as public distrust. Nevertheless, the benefits of science should not be overlooked,

even as we acknowledge that limits should be put on scientific freedom. Oswald urges that there are good arguments in favour of allowing exceptional scientists considerable latitude and support in their endeavours.

Chapter 14, by Michael Boylan, explores what limits may ethically be put on scientific freedom by combined reference to recent historical examples and the principle of plenitude. This principle, attributed to Lovejoy, holds that ‘what can be known, should be known’. In line with other contributors to the book, Boylan quickly accepts that of course there should be limits to the exercise of scientific freedom, to the principle of plenitude. He suggests that there are two qualitatively distinct bases of side-constraints on science. The first exists where the means of acquiring knowledge would be unethical, the second where the context in which the knowledge will exist is itself immoral. On the first, Boylan makes two further distinctions. On one hand, we find things that right now can only be achieved by immoral means, but given means that are currently unavailable would be perfectly acceptable. For these, the limits to scientific freedom are not absolute, but rather contingent on practical possibility given background side-constraints. On the other hand, Boylan argues that some things are in principle just wrong. In this regard, the problem is not that we currently lack the means to conduct the research ethically, but that the research could *never* be ethically sound. Having illustrated well these differences, he then moves to the (perhaps more controversial) discussion of limits to scientific freedom given the context in which information will come to exist and be used. In possible contrast with some earlier contributors, he argues that scientists can not plead irresponsibility for the foreseeable outcomes or applications of their science. Awareness of the context in which the science is undertaken requires responsibility for the work in that context and its consequences. Boylan’s use of a range of real examples, both past and contemporary, demonstrates clearly the different categories of ethical concern represented in claims to scientific freedom. He provides some arguments too in relation to the role of regulatory reasoning, with specific reference to people serving as physicians and researchers, and asking whether these roles should not be simultaneously held by the same person.

In Chapter 15, John Coggon ends Part Three with an argument that considers scientific freedom as a ‘claim to the protection or assurance of the conditions in which scientific inquiry may be undertaken.’ This definition combines the negative and positive freedoms alluded to in earlier chapters. Coggon’s analysis begins with science understood on its own terms, suggesting that a free scientist properly understood is not anarchic: science dictates its own norms. However if we look outside of science, is it always supreme? Again echoing earlier chapters, the answer is clearly no and in tension with some earlier claims, Coggon expresses doubts about how useful or meaningful it is to separate categorically science and consequent technologies, or contemporary or consequent applications. If science is good in the sense that it demands positive measures to protect and support it, this is largely down to its consequences.

A protagonist can not claim the good without also taking responsibility for the bad. Nevertheless, scientific freedom may be conceived as special, and requiring protection, insofar as the public interest permits and demands. The question then is: do legal systems with no specifically enumerated right to scientific freedom automatically fail in best protecting scientific freedom? This question is usefully asked in the context of politically ordered human societies that present moral pluralism. Coggon's answer is that it is not a weakness not to have an enshrined right to scientific freedom. Rather, he suggests that even in a system that works on the idea that different basic freedoms are offered protection, albeit in 'competition' with each other, it is arguable that scientific freedom is better protected as derivative in different instances from other more fundamental rights. 'Science' denotes such varied things that a unitary 'right to scientific freedom' may limit or circumscribe scientific inquiry in so narrow a way that it would diminish overall the protection of science. From a practical perspective, the abstract concept 'scientific freedom' can not denote a consistently or universally supreme value. We therefore need to be able to defend particular instances on a case-by-case basis.

Synergies, tensions, and the road ahead

In the volume's concluding chapter, we describe how the project that gave rise to this anthology all started with a marathon. That provides a good metaphor too for the nature of inquiry undertaken in this book, and the future debate it might provoke. The great variety of perspectives and experience represented by the contributors suggests that the directions of the road ahead may be unclear, and that there is a long way yet to travel. A clear advantage of drawing from a wide range of disciplinary and professional outlooks, and drawing from an international authorship, is that we find a clear presentation both of synergies and tensions in thought on scientific freedom. In this final brief section, we will mention five points that seem particularly to stand out when reading this collection.

First, it is interesting to compare the arguments of authors who would distinguish science and technology, and those who see the divide as formally valid but practically not so useful. In arguments directed to the maximization of scientific freedom, it is clear that this division can have both positive and negative effects. On the positive side, it suggests the legitimacy of very few restraints on scientists' freedom, provided we allow that as soon as science is 'done' – that experiments are performed – the likelihood of ethical concerns appears. On the negative side, by separating science from its consequences, we deny the positive value that these add to the worth of science.

Second, a recurring point is that claims to scientific freedom often entail both 'negative' and 'positive' rights. Although it is not hard to frame arguments

that people should be left alone to do as they wish, provided they harm no-one else, it is much more complicated to develop an argument that places positive demands on others. Why should any of us pay taxes to fund ‘blue skies research’ in astrophysics? Or support a government that funds research that we consider to be intrinsically immoral? As soon as the claims to scientific freedom become positive ones, protagonists must open up arguments in moral and political philosophy, and be able to defend their claims against competing positions.

Third, the related themes of democracy and sound communication are striking. The ‘scientific literacy’ of the public seems to be of crucial importance, but so is the willingness of scientists to frame their ideas in ways that make them accessible to as broad an audience as possible. There seems to be general acceptance of the idea that where science is to be limited, this is in accordance with justifiable political limits. In a political democracy, this means accountability to the people, and requires the possibility of discourse across society. Contributors have emphasized the need to be able to communicate both to those who are (as yet) uninformed about issues, as well as to those who are informed but fundamentally opposed.

Fourth is a brief but important point. Science is a global phenomenon. The scientific community is not defined by membership of a nation state. There are clear benefits to cross-national collaborations and communications. Furthermore, some of the problems that we would wish science to address, perhaps most pressingly climate change, require international cooperation from governments as well as scientists.

Finally, many of the chapters suggest an importance in contextualising analyses of scientific freedom. This means being able to explain and defend the very defining of ‘relevant context’, and being prepared to give reasons for why a principled view is pertinent. The contexts here may be, for example, historical, social or regulatory. Combinations too can fruitfully exist, and perhaps reaffirm the great merit in drawing collaborators from a range of disciplines, backgrounds, and parts of the world.

In sum, it is our view that the subject of scientific freedom is of such importance that there is considerable value in public discussion of how it should be defined, assured, and limited. We hope that the following chapters contribute well to the sometimes heated debates on these questions.

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