Chapter 4

Public ethics and the governance of emerging biotechnologies

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Chapter overview

In this Chapter we argue that the nature and potential of biotechnologies suggest that there is a significant public interest in emerging biotechnologies. This arises from a number of sources, including their capacity for public benefit and harm, the public resources invested in them and the collective action such support requires, the peculiar features of the use of living systems, and their potential to transform and 'lock in' social relations and forms of discourse.

There is a *prima facie* ethical reason to support biotechnology research in general, namely, the potential of that research to provide public benefits. However, the uncertainty that any particular line of research will produce expected benefits, coupled with the opportunity cost of pursuing that line of research to the neglect of others – particularly where those other lines of research promise benefits that might be valued more highly by others – suggests that there is a both a strong public interest in the governance of emerging biotechnologies and that the public interest varies, depending on which 'public' we are examining.

We argue that biotechnology governance should be guided by a notion of public good that invokes a 'public ethics'. This is different from individualistic ethics that attempts only to protect the freedoms of individuals in ways compatible with the freedoms of others within a society in that it recognises that a choice must be confronted as one that, to some extent, determines the conditions of common social life.

We argue that governance of emerging biotechnologies in which there is a strong public interest, particularly those that are (potentially) socially transformative, should therefore be subject to a public discourse, that is, subject to a public rather than a private negotiation that is dominated by a particular discipline or interest (or conjunction of disciplines or interests). This public governance should be carried out through an 'engagement' that is cultivated though virtues that serve to ensure that the public interest is expressed.

It is through this construction of a public discourse on emerging biotechnologies that governance conditions can be determined in relation to the public good, through an interrogation of contrasting imaginaries associated with different technologies and how these involve and express substantive values including, equity, solidarity and sustainability.

Introduction

4.1 So far in this Report, we have been concerned largely with biotechnologies as means to putatively desirable ends, although we have noted considerable space for argument both about the relative desirability of those ends and the likelihood of biotechnologies – either in general or particular – bringing them about. This has led us to adopt a sceptical approach to assessing the foundation of expectations about the prospects and timescales for promised benefits of biotechnology. We found that – where there is a deficit of relevant evidence supporting these expectations – this is often made good by features of discourse. This, in turn, has led to our conclusion that there is a need to interrogate the framing of decisions about committing material support to particular biotechnology pathways in order to appreciate and respond to uncertainties and ambiguities. Opening the framing in this way sets such commitments in the context of opportunity costs and alternative pathways. This is important because there is a danger that some social objectives may be 'captured' by a particular research programme and marked out as 'biotechnology' objectives.

4.2 We will argue in this Chapter for a distinctive 'public ethics' of biotechnology governance. Our argument has four parts: first, that there is a distinctive public interest in biotechnology governance; second, that this interest has an ethical dimension but one that may not be unified or necessarily discoverable through reason; third, that features of the policy and innovation system often act to frame and limit the full expression of this interest and, fourth, that this interest may be restored through a particular discursive approach to policy making and governance, reintegrating biotechnology governance with the broader exercise of social interests.

Public interest and the public good

Sources of public interest

4.3 It is often claimed that technologies in themselves are morally neutral, that it is the uses to which they are put and the intentions of those who use them that are morally relevant. This argument could be made about practically any technology. Arguments of this sort are usually deployed to support individual and commercial freedoms and to defend them from the encroachment of social values. While there may be private interest in developing biotechnologies, whether for commercial or other reasons, it is evident that, depending on the possible applications, there is almost certainly a public interest in biotechnologies, although this is not necessarily of a unified nature. So we may ask what distinctive features might make biotechnologies a matter of public interest in our society rather than private interest.

Public benefits and harms

4.4 The first of these distinctive features derives from the fact that the potential benefits and harms to which biotechnologies give rise may be of a public nature. We all share an interest in living in an environment that is conducive to our health and welfare, and having access to affordable food, health care and sustainable energy resources. Some of these are goods from which everyone benefits directly, such as environmental amelioration or the avoidance of impending harms such as pandemic disease. Others might be goods that everyone benefits from having them available, should they need them.

4.5 Potential harms may also be public harms, either direct (e.g. the accidental release of an engineered pathogen) or indirect (e.g. exacerbated social inequality). In some cases, biotechnologies may be different from other technologies in that their effects are mediated through complex biological and ecological systems that may have widespread, exponential (owing to system effects), or long term consequences. While not necessarily of greater magnitude or longevity than the adverse effects of other technologies (a nuclear accident, for example), the complexity of the biological systems in which they operate, and the obscurity of the effective mechanisms, can make these effects harder to envisage, predict and to control.

Public goods, and the fair and effective use of public resources

4.6 If 'biotechnologies' can be understood as conjunctions of knowledge, practices, products and applications, the goods thus bound together are conceptually distinct and may occur separately in practice. Knowledge, in particular, is a good that economists conventionally describe and treat as a 'public good', not in the sense of being 'good for the public' but in the sense of a commodity having certain characteristics that make it difficult to trade through private transactions. A public good is conventionally defined as a good that is *non-rivalrous* or *non-excludable*, or both. A good is non-rivalrous if my use of it does not in any way reduce the amount of it available for you to use. (So, for example, a musical performance is a non-rivalrous good because my enjoyment of it does not diminish your ability to enjoy the same performance.) Scientific knowledge is a public good in this sense because it may be put to use without being 'used up' in the process. Scientific knowledge may also exhibit the characteristic of being non-excludable. A good is non-excludable if it cannot be made available to you without also making it available to me and any number of others who might also wish to enjoy it. (The musical performance could be made excludable by selling tickets, so that those who have not bought tickets will not be admitted to the auditorium. The light from a street lamp or from a lighthouse, on the other hand, is generally regarded as a non-excludable good.[251]) Non-excludability

[251] Of course, it is possible to imagine street lighting being provided via commercial subscription by residents in a particular area while others may still always make use of the resource by 'free riding'. However irksome the free-riding, the subscription system could survive because the use of the good is of value to those who have paid and non-rivalrous (although a tipping point may be reached if the streets become overly congested by light seekers, street traders, etc.).

sometimes gives rise to what is known as the 'free rider' problem, where people enjoy for free a good that others have borne the cost of providing.[252] Thus, once a contribution to scientific knowledge becomes widely known, it is not possible to prevent anyone with a certain level of scientific understanding from learning about it and making use of it.

4.7 Some of the goods bound together in biotechnologies may be regarded as private and others as public. In contrast to the knowledge component, the product component of biotechnologies may very well be both rivalrous and excludable, and therefore a marketable good. (This is irrespective of whether it is a good, like vaccines or other medicines, whose wide availability is socially desirable to the extent that it is provided by the state and funded through general taxation). For example, biofuels, pharmaceuticals, medical treatments, genetically engineered seeds and animals may all be bought and sold at a price determined by the market (although their desirable characteristics may attract subsidies and other interventions, just as undesirable ones may attract regulatory burdens and other penalties). On the other hand, some biotechnology products are non-excludable. These include goods such as bioremediation (dealing with oil spills, for example) or environmental amelioration.

4.8 Public goods typically require collective will and collective action to deliver.[253] Because of the absence of an adequate commercial incentive to develop public goods, they are generally provided by governments (or charities), either through the public sector providers or through purchasing from private providers funded by general taxation. In the case of some goods, such as national prosperity through innovation and military strategic advantage, the relevant collective may be equivalent to a national political jurisdiction. However, there is an argument – based on the fact that there are strong bonds and interests that cross national borders (the shared experience of, and interest in, climate change or pandemic disease, for example) – that some biotechnologies may belong to a special class of 'global public goods'. These are goods that "tend towards universality in the sense that they benefit all countries, population groups and generations".[254] Examples might include scientific and practical knowledge, and 'global policy outcomes' such as global health benefit sharing or bioremediation.[255]

4.9 Given that at least *some* component elements of biotechnologies are public goods requiring collective action, a further source of public interest is in the considerable quantity of public resources that are invested in generating them, for example, the funding of knowledge generation through academic research councils and in higher education, and various public schemes to support biotechnology science and innovation. Such funding is invested in the expectation of a return that will make a positive contribution to the good of the nation and, indeed, beyond, in terms of direct benefits within biotechnology sectors – such as health care and agriculture – and often, more prosaically, to national income generally.[256] It is this expectation that we expressed through the shorthand of the 'biotechnology wager'.[257] There is therefore a public interest that public resources are invested wisely and distributed fairly, and used in accordance with other public values.

The value of living things

4.10 In addition to the interest that people have in biotechnologies as means to further ends that are desired, a further set of ethical interests in the nature of biotechnologies themselves must also

[252] For an overview of the free rider problem, see: Hardin R (2003) The free rider problem *Stanford Encyclopedia of Philosophy*, available at: http://www.science.uva.nl/~seop/entries/free-rider.
[253] Olson M (1965) *The logic of collective action: public goods and the theory of groups* (Cambridge, Massachusetts: Harvard University Press).
[254] Kaul I, Grunberg I and Stern M (Editors) (1999) *Global public goods: international cooperation in the 21st Century* (New York: Oxford University Press). See also: O'Neill O (2011) *Broadening bioethics: clinical ethics, public health and global health*, available at: http://www.nuffieldbioethics.org/sites/default/files/files/Broadening_bioethics_clinical_ethics_public_health_&global_health.pdf.
[255] We look at ways in which these various goods are provided in Chapters 7 and 9, where we discuss issues of national research and innovation policy, and commercialisation, respectively.
[256] Although, as we note elsewhere, increased economic activity does not necessarily entail social benefits. See paragraph 9.31.
[257] See paragraphs 1.1 to 1.3.

be considered. These ethical interests are not about valuing biotechnologies only in terms of the outcomes they may bring about, but rather about valuing the practices they involve and what these mean for the individuals who take part and the society in which they take place. What is most distinctive about biotechnologies among technologies more generally is the implication contained in the prefix 'bio', namely that they utilise or affect living things including, therefore, ourselves. The significance of this distinction between technologies applying to inert matter and those applying to living things is, however, notoriously difficult to pin down.

4.11 For certain religious faiths, this intuition is consistent with injunctions codified in 'revealed' systems of ethics. These may attach distinctive kinds of importance to specific living things, and include, for example, prohibitions on treating them in certain ways. For example, where traditional Christian ethics tend to subordinate animals to human ends without moral consideration, Judaism and Islam both forbid causing pain to animals or hunting for sport, and Judaism has prescriptive rules about the production of food crops.[258] These have had to be successively reinterpreted in the modern scientific age in light of, for example, developments such as the *in vitro* creation and manipulation of embryos or the genetic engineering of plants. Such injunctions may often accord with the intuitions of folk morality regarding the treatment of complex and, especially, sentient beings that appear to exhibit autonomy in the way that non-living systems do not.[259]

4.12 Different cultures and religions have found ways of ordering living beings so as to express their relative importance but also, significantly, their continuity as a class (i.e. the relatedness, by intermediate steps or degrees of genetic similarity, of all living beings). The 'great chain of being' developed in medieval Christianity, for example, with God at its head and other beings arranged in descending degrees of perfection, has its roots in Plato and Aristotle; Darwinian evolution, and modern genetics similarly emphasise both continuity and difference in their theories of descent and inheritance. The distinctive autonomy of living beings is apparent in the often complex ways in which living things interact with and transform themselves and their environment, and by their powers of reproduction, allowing natural purposes – or 'ends' – to be imputed to them. Notions of a natural order, harmony and ends are deeply engrained in almost all cultures and bind groups and societies powerfully together. The term 'the wisdom of repugnance' has been coined to evoke and enjoin a shared sense of distaste for certain biotechnological practices that appear 'contrary to nature' in this sense.[260]This notion is close to what, from a less sympathetic perspective, is often referred to as the 'yuck factor'.[261] Where such sentiments are widely shared they can form a powerful basis for moral restraint and, indeed, for positive legislation[262]; however, where there are moral disagreements, moral arguments can quickly reach an impasse (since my sentiment towards a given action does not logically contradict your different sentiment).

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[258] See, for example, Brunk CG and Coward H (Editors) (2009) *Acceptable genes? Religious traditions and genetically modified foods* (New York: State University of New York Press).

[259] Different cultures have found ways of ordering living beings in a way that expresses their relative importance but also, importantly their continuity as a class (we are related by intermediate steps to all other living beings). The 'great chain of being' for example, has its roots in Plato and Aristotle but was a conspicuous feature of Neoplantonism and medieval Christianity, among other movements. Darwinian evolution and modern genetics similarly emphasise both continuity and difference in their theories of descent and inheritance.

[260] Kass L (1997) The wisdom of repugnance *The New Republic* **216**: 17-26, reproduced and available at: http://www.catholiceducation.org/articles/medical_ethics/me0006.html.

[261] As JBS Haldane remarked in *Daedalus: science and the future*: "There is no great invention, from fire to flying, which has not been hailed as an insult to some god. But if every physical and chemical invention is a blasphemy, every biological invention is a perversion. There is hardly one which, on first being brought to the notice of an observer from any nation which has not previously heard of their existence, would not appear to him as indecent and unnatural." Haldane JBS (1924) *Daedalus, or, science and the future: a paper read to the Heretics, Cambridge, on February 4th, 1923* (London: EP Dutton), reproduced and available at: http://cscs.umich.edu/~crshalizi/Daedalus.html.

[262] "[P]eople generally want some principles or other to govern the development and use of the new techniques. There must be some barriers that are not to be crossed, some limits fixed, beyond which people must not be allowed to go. Nor is such a wish for containment a mere whim or fancy. The very existence of morality depends on it. A society which had no inhibiting limits... would be a society without moral scruples. And this nobody wants." Committee of Inquiry into Human Fertilisation and Embryology (1984) *Report of the committee of inquiry into human fertilisation and embryology*, available at: http://www.hfea.gov.uk/docs/Warnock_Report_of_the_Committee_of_Inquiry_into_Human_Fertilisation_and_Embryology_1984.pdf, paragraph five. This report led to the UK's Human Fertilisation and Embryology Act 1990.

4.13 Even setting aside shared attitudes to the treatment of particular living things (albeit that, in a plural society, there will inevitably be marginal or 'grey' areas) there is an even more immediate shared interest in living systems generally, given that, as human beings, we interact with and depend on such systems, both individually and collectively. The environmental movement has drawn attention to the complexity and fragility of ecosystems and humanity's interdependence with them, prompting concerns that technological interventions are occurring too quickly, before their consequences can be understood,[263] or even that human understanding in science and technology are not sufficiently sophisticated to intervene in complex natural systems. It has also been argued that such interventions risk destabilising sensitive natural equilibria in a way that may lead to catastrophic consequences (such as climate change). A strong version of this concern suggests that there may be particular limits to human cognition such that it is inadequate to master high-order natural complexities, and that we instead frame or simplify them in conventional, if not arbitrary, ways that may give rise to severe errors in judgment.[264]

4.14 Although natural systems themselves present significant threats to humans (through, for example, plague, famine, floods and tempests), the ability to exercise new kinds of voluntary control over natural processes using the instrumental power of modern biotechnology adds a novel set of issues in which there is clearly a public interest, setting aside whether or not such control can be exercised effectively. These include questions about who exercises such control, their motives, and the quality of their judgment. There may be questions of accountability and vested interest concerning the motives of particular scientists, private firms or public research sponsors, advisors or governments. There may be questions about the dominance of technology within social and cultural change more generally, connected with an interest in ensuring that science and technology do not advance ahead of social and cultural understanding (i.e. because such understanding is an important enabler of technology governance), and with the related fear that, if they do, the dominance of a technological perspective may lead to a 'slippery slope' where ethical control of technology loses its purchase. All of these concerns involve questions about how people act within a shared physical, social and global environment and, in particular, the relationship between science and technology and social, cultural, religious, and other dimensions of life.

Technological determinism

4.15 These interests are intensified by the consideration that social and political commitments to biotechnology often necessarily involve opportunity costs and may create potential path dependencies and irreversibilities. A technology that possesses transformative potential will potentially affect a great many, if not most people. All of these people may have a legitimate interest in being involved in shaping exactly which of the many possible transformations are to take place. More insidious, however, is the potential of biotechnologies to determine the horizon of possibilities for society in a non-trivial way,[265] that is, that the technologies in use exert a dominant or shaping force on society and social organisation.[266] Indeed, it has been argued by some that the larger and more complex technological systems become, the more they tend to shape society and the less amenable they are to being shaped by it.[267]

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[263] This is an environmental analogue for the social concerns expressed in the 'Collingridge dilemma' – see paragraphs 1.27 to 1.29 and Box 1.2.

[264] A strong version of this concern suggests that there may be particular limits to human cognition such that it is inadequate to master high-order natural complexities, and that we instead frame or simplify them in conventional, if not arbitrary, ways that may give rise to severe errors in judgment. As noted previously, see the work of Amos Tversky and Daniel Kahneman for a discussion of the nature of human decision making: Tversky A and Kahnmann D (1974) Judgement under uncertainty: heuristics and biases *Science* **185**: 1124-31; Kahneman D and Tversky A (1979) Prospect theory: an analysis of decision under risk *Econometrica* **47**: 263-91; Tversky A and Kahneman D (1981) The framing of decisions and the psychology of choice *Science* **211**: 453-8.

[265] A nation becoming a 'knowledge economy', a 'biotech economy', for example. See also: Brinkley I (2008) *The knowledge economy: how knowledge is reshaping the economic life of nations*, available at: http://www.theworkfoundation.com/assets/docs/publications/41_ke_life_of_nations.pdf, p12. "

[266] See: Winner L (1978) *Autonomous technology: technics-out-of-control as a theme in political thought* (Cambridge, Massachusetts: MIT Press).

[267] Hughes T (1994) Technological momentum, in *Does technology drive history? The dilemma of technological determinism*, Smith M, and Marx L (Editors) (Cambridge, Massachusetts: MIT Press).

4.16 'Technological determinism' in this sense describes a state of affairs in which it is alleged that social relations, for example, are determined by technology more than technology is determined by social relations. Such determinism may be seen as doubly potent because it operates through both the material and discursive contexts, for example in the way societies become inured to new and potentially 'dehumanising' relationships with the world through technology, that might have seemed intolerable at earlier points in time.[268] Therefore, the public interest in biotechnology is in ensuring that social forces control the progress of technology rather than being controlled by it.

Public ethics

The public good

4.17 The interests of individuals in biotechnologies within communities will not always coincide. This is inevitable because the impact of biotechnologies will not be restricted to cases in which all individuals share an interest in common (e.g. security) but will also extend to areas in which those interests conflict (e.g. prioritisation of resource use). The notion of a public interest that transcends aggregate individual interests is associated with social contract theorists. The modern thinker most associated with this approach is the American political philosopher, John Rawls. Rawls suggested that citizens presented with the challenge of designing the rules for a state but ignorant of the place that each would take up in it would agree on at least one good that is common to all, namely, justice for all.[269] Thinking through the choices involved in designing a political association, Rawls suggested that people should be able to consent to a political arrangement in which their interests must sometimes be compromised for the sake of what would become, by their consenting, 'the common good'.

4.18 This liberal democratic view of common good has tended to overshadow a different conception of the common good,[270] originating in Aristotle, which sees it as an end that is shared by members of a community.[271] The argument in favour of the attempt to identify common ends rather than the protection of individual freedoms is essentially this: if biotechnologies are potentially transformative, it is not enough simply to protect and balance freedoms, since the technologies adopted transform the scope and meaning of freedom for all.[272] Therefore it is not a matter of one or more individuals having more or less freedom vis-à-vis one or more others, but of the choice of technology transforming the scope of the freedoms available to all.[273] Furthermore, it may do so in a non-trivial – and practically irreversible – way by processes of lock-in and feedback and transformation that we have discussed.[274] So, because a biotechnology choice is potentially 'enframing' (in other words, it alters the horizon of possibilities for the collective), it is a choice that can only be exercised in relation to the collective.

4.19 The promise of significant transformations in society from biotechnologies implies that it is not possible to adopt them while insulating sections of society from the consequences of doing so

[268] See, for example, Heidegger M (1977) *The question concerning technology and other essays* (New York and London: Garland Publishing).
[269] Rawls J (1972) *A theory of justice* (Oxford: Clarendon Press).
[270] At least until comparatively recently, with the revival of virtue ethics and theory. See, for example, the work of Elizabeth Anscombe, Alasdair MacIntyre, Martha Nussbaum and Amartya Sen.
[271] The use of the term 'common good' does not imply the notion that there is a good that is common to all who have an interest, of the 'lowest common denominator' type – a solution that all can tolerate but that serves none. It is a political concept that emerges from the interrelatedness of a group of heterogeneous individuals orientated towards a particular set of conditions which they experience together (technological opportunities and the threat of climate change or economic catastrophe, for example). We note that there is some confusion surrounding the terms 'common good' and 'public good' in the literature (common good deriving from the modern, individualistic tradition and public good from the tradition of Aristotle and Aquinas).
[272] In other words, they are 'enframing'; see: Heidegger M (1977) *The question concerning technology and other essays* (New York and London: Garland Publishing).
[273] In some circumstances, as we suggest in the section on global public goods, this can be the case at the global level. See paragraph 4.8.
[274] See paragraphs 1.27 to 1.33 and 3.22 to 3.25.

(in the long run, at least) and that by adopting them, it will become progressively difficult, perhaps practically impossible, to resile from the path chosen. They therefore require us to confront questions of public good rather than the focus narrowly on the management of harms and the protection of individual liberties. This is the task of public ethics.

Public ethics

4.20 The field of bioethics is noticeably developing greater competence in questions at the public level. Bioethics, at least in the US and Europe, has often approached the evaluation of new technologies from the individualistic tradition in which it was initially rooted as an academic discipline. Within this broad tradition, there are differences between approaches that are grounded primarily in individual freedom and personal autonomy, and those that are based on positive rights. More recently, however, in the context of increasing globalisation, and of threats to collective well-being from environmental damage and pandemic disease, concepts of collective interest and collective action have moved to the fore. Some have identified the development and application of these concepts as a major re-orientation within bioethics, a 'communitarian turn',[275] which in turn offers new responses to areas addressed by traditional medical ethics. This new orientation is towards a notion of the public good rather than – and distinct from – the concern for negotiation between individual interests engaged by bioethical questions.

4.21 The implications of this reorientation are significant. They alter entirely the way in which technological development and innovation must be approached in discourse and in practice: rather than focusing on outcomes, products and impacts on individuals, the focus shifts onto broader social contexts, circumstances, implications, and alternatives. Advocacy of a particular choice is replaced by interrogation of assumptions on which the choice is founded; commitments and the pursuit of achievement leavened by caution and the concern for (opportunity) costs. Public ethics, like the provision of public goods, is a matter of collective consideration and action.

4.22 In a society that accommodates plural values, it is no longer plausible to suggest that the end of ethical reflection is a single, rational answer to the question "what is the good life?" This pluralism is compounded by the global reach of many questions about biotechnology (that, furthermore, often demand prompt and unilateral answers). But it is because of this pluralism and the 'public' nature of biotechnologies, that the task of determining the conditions of collective life has become such an urgent ethical question in the technological age. In such conditions, an ethical basis for action is not one that can be found by a single thinker reasoning in isolation but one that is to be established instead through a discursive engagement between differing perspectives. The work of public ethics is to establish the *context* of biotechnology governance. It is less concerned with following through 'impacts' than working back to assumptions.

Developing new biotechnologies as a moral mission

4.23 The reason most frequently given for developing new biotechnologies is that they promise ways to increase human welfare and well-being, that is, to avoid or alleviate harms and to secure benefits. Given that reducing harm and increasing benefit may be taken as a generally desirable aim, the case in favour of biotechnology research, development and innovation embodies a strong *prima facie* sense of moral mission. The capacity of biotechnologies to contribute benefits in health care, food and energy supply, and environmental and economic prosperity means that there are strong ethical reasons to support their development and, other things being equal, the development of as many biotechnologies as promise these benefits.

[275] See: Chadwick R (2011) The communitarian turn: myth or reality? *Cambridge Quarterly of Healthcare Ethics* **20**: 546-53. The Nuffield Council on Bioethics' own recent Report on solidarity as an emerging concept in bioethics may be seen as a contribution both to understanding and developing this thought. See: Prainsack B and Buyx A (2011) *Solidarity: reflections on an emerging concept in bioethics*, available at: http://www.nuffieldbioethics.org/solidarity-0.

4.24 According to the canonical definition of 'utility' proposed by JS Mill "actions are right in proportion as they tend to promote happiness, wrong as they tend to produce the reverse of happiness."[276] The difficulty in applying this evaluation to emerging biotechnologies is that their 'tendency' to produce one thing or the other comes up hard against a paucity of evidence, either of their production of these effects, or of relevant experiences from which such effects can be inferred reliably. In fact we know it is plausible that most prospective biotechnologies will actually not provide benefits, for the reason that they encounter hard constraints and fail during development, for example, or because they are crowded out by more dominant technologies.[277] Some technologies, we know, actually produce harms, although these may not be easily foreseen.[278]

4.25 A second consideration that tempers this *prima facie* ethical argument for biotechnology is the possible existence of opportunity costs, in the form of foregone opportunities to develop alternatives approaches. If there is a real possibility of alternatives that would be preferable (at least from some perspectives) being crowded out by contingent conditions that facilitate the development of those that *are* developed, this might result in foregoing some utility that would otherwise be available.

4.26 If we acknowledge uncertainty as an irreducible characteristic of emerging biotechnologies, the claims that any particular biotechnology will produce particular outcomes or 'impacts' must be treated with circumspection. This does not mean that the pursuit of particular outcomes is unethical; indeed, it is indispensible. The point of this scepticism is to draw attention to the error of committing prematurely to two sorts of potential frame: firstly, construing social 'challenges' as hypothecated to technological solutions (in general or particular) and therefore curtailing the exploration of other kinds of possible response; secondly, focusing the development of biotechnologies too tightly on solutions to particular challenges and therefore failing to be sensitive to the range of possible benefits they might bring, perhaps in radically different contexts.

4.27 In any case, what counts as a benefit or harm, or of whose happiness or unhappiness is relevant, may well be contested in the case of biotechnologies.[279] Such contested questions are clearly difficult to resolve, but that is what makes them the proper matter of bioethics.

Public values

4.28 In posing questions of public ethics, we wish to set out three underlying values that we believe should guide biotechnology assessment. Their point of application is the expectations and imaginaries that animate attitudes towards biotechnologies and orientate decisions relating to them. Their aim is to broaden out reflection on these orientations to take account of potential transformative effects – including effects on the structure of society – and opportunity costs. We do not claim these values are necessarily and eternally valid: they are simply those that, in relation to the emergence of biotechnologies in the present historical context, appear to us to be most important, taking into account the public interest in biotechnologies, and the broader context that prompts the 'biotechnology wager'.

[276] Mill JS (1863) *Utilitarianism* (London: Phoenix, 1993), p6.
[277] See paragraphs 1.26, 1.31 and 2.41.
[278] Such as CFCs or asbestos, as discussed in Box 1.1.
[279] As the authors of an ethical framework for stem cell research in the EU observe: "This question has proved resistant to resolution through philosophical analysis or by scientific definitions. The moral status, or degrees of protection to be accorded to the embryo is constituted linguistically, culturally, scientifically, politically and through religious and secular beliefs." Eurostem (2005) *An ethical framework for stem cell research*, available at: http://www.eirma.org/sites/www.eirma.org/files/doc/pubs/briefs/0410stemcell-ethframe.pdf/noproxy, p2.

Equity

The value of equity requires equal respect for the entitlements, interests and preferences of others, including in questions of fair and just distribution of expected benefits and costs.

4.29 This value implies a respect for freedom from discrimination but also the opportunity of groups and individuals to pursue their interests in different ways. The principle recognises the fact that different groups and individuals value different outcomes and states of being differently, and that not all equalities are fair and that not all inequalities are unfair. It provides a bulwark against the legitimate interests of individuals being set aside in the interests of the collective, or rather, it expresses the thought that it is in the interest of the collective that the interests of its *individual members* should not be set aside in this way, as the protection of such interests is important to the social enterprise. As such it implies the principle of 'just reward', which may be operationalised, for example, through upholding the rule of law (e.g. preventing theft), market conditions and the protection of intellectual property.

Solidarity

The value of solidarity requires the avoidance of social divisiveness and exploitation, and the active promotion of the welfare of those who are less advantaged.

4.30 While equity includes the thought that not all inequalities are unfair, some inequalities are manifestly *harmful* to certain groups. Poverty, hunger and sickness, for example, are not *necessarily* a matter of individual responsibility or the collective choices of groups that are affected by them. Biotechnologies may have the potential to decrease or increase social division, for example by offering advantages to those who can afford them that further widen existing social differences or, conversely, tackling problems that predominantly affect the most disadvantaged. Valuing solidarity therefore encourages us, recognising our own relative advantage and our capacity to help those who are less advantaged, to bear costs on behalf of others[280] including costs of research and providing knowledge. It also enjoins us to explore the implications of contending innovation trajectories, including those favoured by more marginal groups. Even in cases where such disadvantage is the result of a choice or judgment on the part of the disadvantaged, there is a moral case, one that highlights shared humanity and the contingency of differences between individual conditions, that disadvantaged people deserve our sympathy and assistance, rather than our censure.

Sustainability

The value of sustainability requires the avoidance of significant or irreversible depletion of exhaustible natural resources, or damage to ecosystems or the wider environment. It therefore favours the development of more sustainable alternatives to existing technologies.

4.31 The original formulation of the principle of sustainability focuses on "meeting the needs of the present without compromising the ability of future generations to meet their own needs".[281] This limits the pursuit of short term benefits where they may harm equally important long term interests or lead to relatively poorer conditions of well-being or welfare for future generations. In this sense the principle of sustainability gives the principle of equity an intergenerational aspect. It is notable, particularly in view of what we have said about the discursive basis of public ethics, that the value of 'sustainability' was first developed within social movements and outside institutional governance structures, but was subsequently institutionalised and is now accepted as an important bulwark defending the long term interests of society and of future generations against short term political, commercial or professional interests.

[280] See: Prainsack B and Buyx A (2011) *Solidarity: reflections on an emerging concept in bioethics*, available at: http://www.nuffieldbioethics.org/solidarity-0, paragraph 29ff.

[281] This is the formulation by the 'Brundtland Commission' (World Commission on Environment and Development), maintained in subsequent international policy discourse up to the present Millennium Development Goals. See: United Nations World Commission on Environment and Development (1987) *Our common future*, available at: http://www.un-documents.net/wced-ocf.htm.

4.32 Biotechnologies may, for example, address the unsustainability of current technologies by providing replacement technologies (for example, next generation biofuels for transport), or provide for future needs that cannot be met through existing means (e.g. food production). It is in this way the notion of sustainability arises as a driver for technological development.[282]

Developing new biotechnologies as a *prima facie* moral good

4.33 Insofar as the pursuit of biotechnologies is orientated towards advancing welfare in a way that is consistent with the values of equity, solidarity and sustainability, or towards promoting these values without a concomitant decrease in welfare, we believe that such initiatives constitute a *prima facie* moral good.[283] We believe that it is important to state this positive interest in the development of biotechnologies clearly as a positive ethical reason for biotechnology research and innovation. One reason for doing so is that, too often, ethical reflection can come to be seen as an impediment to research: slowing things down, holding back developments and innovations, rather than a primary source of motivation – for pushing ahead and making progress. The challenge now is how to move from here to normative conclusions in the context of practical uncertainties, ambiguities and equally uncertain and ambiguous alternatives.

Public ethics *in situ*

Normative complexity

4.34 Normative propositions express values or prescriptions. This is in contrast to descriptive propositions that represent factual states of affairs. In this Report we have been dealing with different discursive contexts including technical, social, political and economic contexts, and, of course, ethics. When asking any practical question, such as what is to be done in a given set of circumstances, there needs to be an implicit understanding of what kinds of normative consideration are relevant to determining the answer. For example, if the question is what to wear it might be social (dress conventions) or prudential ('wear a raincoat if you don't want to get wet'); if the question is about whether to tell the truth the source may be ethical ('it is wrong to tell a lie').

4.35 Although it is important to understand what kinds of normative considerations are relevant to answering practical questions, in reality most practical questions are complex and draw on different sources of normativity. There is therefore scope for ambiguity about the meaning of normative terms like 'good', 'bad', 'right', 'wrong', 'ought', 'must', etc., when applied to things like research proposals, business plans or policy options: what is 'good' or 'bad' can differ, as we saw in Chapter 3, according to whether it is seen from a technical, social or ethical perspective. For example, while enforced vaccination may be technically 'good' as a way of preventing the spread of potentially epidemic disease (it is an efficient way of achieving the objective), it may be ethically 'bad' (because it prevents individuals exercising autonomy).

4.36 When addressing complex questions of this sort it is easy to see the danger of, say, a technical perspective becoming over-dominant or of a relevant ethical perspective being ignored or suppressed. In facing complex practical questions these perspectives are commonly put together – government policy, particularly in science, relies heavily on advice from scientists

[282] For example, in October 2009, the UK's Technology Strategy Board launched an 'innovation platform' which focused on sustainable agriculture and food with the aim of increasing crop and livestock productivity whilst at the same time decreasing environmental impact. For a discussion of this platform, see: House of Commons Science and Technology Committee (2010) *Bioengineering – seventh report of session 2009-10*, available at: http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/220/220.pdf, paragraph 55. See also the EU's Europe 2020 growth strategy, which is based on the four priorities of smart growth, sustainable growth, inclusive growth and economic governance, available at: http://ec.europa.eu/europe2020/index_en.htm.

[283] See also the Nuffield Council's approach in its recent report on biofuels, which highlighted a moral duty to develop biofuels: Nuffield Council on Bioethics (2011) *Biofuels: ethical issues*, available at: http://www.nuffieldbioethics.org/biofuels-0, paragraph 4.46ff.

and, in business, from industry. Biotechnology – which can be seen as a science-based business or a business-enabled science –will rely on advice from both of these sources and several more besides. We have been referring to the process by which they are brought together – the encounter between different normative propositions, conducted through language and expressed in speech and writing – as a 'discourse'.

4.37 The picture becomes more complicated as a result of the potential for a number of different normative conclusions to be possible within any given discursive context. Different ways of framing a question can, as we argued in Chapter 3, lead to empirical 'facts' being construed in different ways, and the way people understand a concept depends not only on whether they are a scientist or a politician (and on which scientific theory or political party they espouse), but also on contingent facts about their individual histories, personal circumstances, education or culture. Frames, therefore, cut across disciplinary and discursive contexts, and across individuals and groups. Particular frames can become dominant in each discursive context (for example, that of the eminent professor within a research discipline or the finance director within industry).

Identifying normative partiality

4.38 The first task of a more open and reflective approach to biotechnology governance is the identification of cases in which there is a public interest and where there is a danger that deliberation is framed largely in terms of sectional interests and dominated by particular forms of normativity (for example, economic or technical forms). This may be caused or compounded by the isolation of the discourses from engagement with other perspectives. The restrictive framing of such questions and the failure to make this framing explicit is recognised as the most insidious dimension of power. Of course, the exercise of power is not in itself to be deplored; indeed, it is essential for achieving any positive social end. What makes power insidious in this sense is when the framings in accordance with which it is deployed are rendered so invisible and unaccountable that the idea of questioning them does not suggest itself, and might even appear absurd. Alternatives are deleted not by argument or by force, but by the circumscribing of imagination itself.[284] This is not to imply any malign intention on the part of those in whom power is vested. It is rather to draw attention to phenomena such as the invisible effects of socialisation and the self-reinforcing dynamics of elites that lead to the phenomena we discussed in Chapter 2, namely, dissonance between the discourse on biotechnologies, on the one hand, and the material states of affairs to which they relate, on the other.[285]

4.39 It is therefore first necessary to awaken a critical reflection on the framing of biotechnology decisions, which might be achieved in a practical and constructive way through a number of straightforward questions.[286] To open up ethical deliberation in this way may appear to run against the grain of much technology decision making, which has acquired some of its sense of importance from the urgency with which we are often told it must be approached. In technology decisions, to act slowly is often presented as a failure, to cede strategic advantage to potential competitors, to miss opportunities to allow remediable harms to persist. However, opening up these opportunities does not mean to call a halt to technology but rather that recognition is given to the need to put in place appropriate measures to recognise public interests and counteract the potential premature locking in of a particular technological trajectory. It is, as we have said above, about creating a context that frames operational decision making rather than intervening in a process of decision making ('tick box ethics') that is already framed by unexamined forces and forms of normativity.

[284] See: Lukes S (2005) *Power: a radical view*, Second Edition (London: Macmillan). Also available online at: http://www.polsci.chula.ac.th/pitch/tgcm12/ps1.pdf.

[285] See paragraph 2.30ff.

[286] The 'critical' aspect of the approach may be characterised as an 'opening up' of technology selection (for example, through confrontation with alternative framings) that reveals implicit value commitments and the underlying dynamics of power. See, for example, Stirling A (2011) From enlightenment to enablement: opening up choices for innovation, in *The innovation for development report 2009-2010*, López-Claros A (Editor) (Basingstoke: Palgrave Macmilan); Stirling A (2008) "Opening up" and "closing down": power, participation, and pluralism in the social appraisal of technology *Science, Technology & Human Values* **33**: 262-94. See also responses to the Working Party's consultation, notably that of Cesagen (ESRC Centre for Economic and Social Aspects of Genomics).

Box 4.1: Identifying closures

The following series of general questions offer ways to illuminate the framing of emerging biotechnologies. Their effect should be one of assisting greater reflection over the terms and conditions of closure.

- Are there incentives that actively consider and explore a full range of alternative research, development and innovation pathways?
- Do all those who stand to be affected enjoy a direct voice in debates over regulation and research?
- Has due attention been given to the full depth and scope of complexity, ambiguity and uncertainty?
- Is a suitably legitimate balance struck between consideration of alternative views of pros and cons?
- Has there been explicit reflection on the ways power shapes choices and associated understandings?
- Is there confidence that positive and negative impacts will, in practice, be equitably socially distributed?
- Do measures and practices exist to ensure accountability and responsibility in the face of surprise?
- Is the political nature of social choice of emerging biotechnologies subject to appropriate democratic governance?
- Has appropriate consideration been given to the benefits and barriers to adoption of the emerging biotechnology, relative to alternative technologies, both those in prospect and what is already available?

4.40 A negative response to one of these questions would indicate a potential form of closure, of a kind that might be judged to require additional justification. It would then follow that what would count as cogent justification might, in turn, be judged in accordance with one or more of the values set out in this Chapter. In other words, the recognition of this kind of closure is the first step in opening up opportunities for public ethics.

Applying public ethics: towards a public discourse ethics

4.41 When we say that biotechnology governance is 'a matter of public ethics', we do not mean that all the conditions that govern biotechnology emergence should be set by 'the public' or 'in public', or that biotechnology research and development should be restricted to the public sector. That would rather unnecessarily inhibit legitimate private and commercial activities. What we mean by public ethics is that, given that there *is* a public interest in emerging biotechnologies, and *insofar as there is* a public interest, normative propositions can be made about emerging biotechnologies that are guided by the good of the public collectively. In virtue of their public role, a corresponding duty falls on public authorities to use their powers in accordance with such normative propositions, if they (the propositions) can be publicly identified. A similar injunction would fall on individuals, groups or firms as a matter of moral responsibility.

4.42 From what has been said above, it should be clear that we regard finding the terms of an unbiased and open engagement between relevant normative positions, mediated through different interpretive frames, as being the proper subject of an 'ethics' of emerging biotechnology governance. The way in which this may be achieved is through what we will call a 'public discourse ethics'.[287] This is essentially a method for determining matters of public interest 'publicly' and in accordance with the public good. It implies that the determination of conditions shaping the emergence of biotechnologies should be 'public' in two senses: those of being *non-private* and *non-partial*.

- *Non-privacy* means that the determinations in which there is a public interest, while not necessarily taking place 'before the public' (in a public forum or broadcast), nevertheless do not exclude the possibility of public scrutiny or influence. So, for example, it should be possible

[287] This approach may appear to owe some debt to the 'discourse ethics' of the 'Frankfurt school' philosopher and sociologist, Jürgen Habermas (see Habermas J (1983) *Moral consciousness and communicative action* (Cambridge, Massachusetts: MIT Press, 2001), although it employs a more transpersonal (rather than intersubjective) concept of framing than perhaps Habermas would allow and does not share the expectation that something like an ideal speech community can be constructed around questions concerning biotechnologies.

for interested parties to know that such a determination is to be made, who is charged with making it and how they may make representations, including higher representations concerning the nature of process or the competence or conduct of those responsible. (Public determinations in this sense are contrasted with decisions made by anonymous and unaccountable powers behind closed doors.)

- *Non-partiality* means that determinations in which there is a public interest should not be made in accordance with a conditional or private good but should be orientated by promotion of the public good and therefore strive to determine the nature of the public good in relation to the determination to be made. Public determinations in this sense are contrasted with subordinating public decision making (deliberately or inadvertently) to the pursuit of private or sectional interests. So, if proponents of a given biotechnology build their arguments for why it should be supported and facilitated on claims that it will have public benefits, then consistency entails that public interests should be taken properly into account in decision making about the technology. It is not necessary that those involved should be free from all personal interest in the decision but this must be subordinated to and subsumed within the public good.[288]

Procedural virtues

4.43 We set out below a number of virtues that are intended to foster a public discourse ethics in practice, addressing the problems of privacy and partiality. We are not here primarily talking about virtues attaching to individual people involved in governance, but institutional and procedural virtues that concern the way in which policy is developed and governance conducted. Our reasons for setting out virtues in this way are twofold.

4.44 Firstly, the uncertainty and ambiguity that characterise emerging biotechnologies make the use of criteria or decision rules to guide actions difficult, since it is not possible to anticipate what kinds of actions might satisfy such rules or criteria. On the contrary, it is precisely the *frameworks* of rules, and the conditions of their application, that are in question here. Rather than concrete prescriptions, for emerging biotechnologies we must therefore look to how the business of policy making and governance is carried out, rather than its substantive content.

4.45 The second reason is that the diversity of emerging biotechnologies means that our approach must be developed at a relatively abstract level. The virtues therefore have a broad scope of application such as to enable the development of action-guiding principles in a variety of concrete contexts. We have therefore avoided setting out specific principles in favour of ways of acting that can be cultivated in a wide variety of contexts. It is also important that they are cultivated by all those engaged in biotechnology policy and governance, rather than merely followed by those in positions of authority: a public discourse ethics strives for the establishment of common ground through balanced engagement, even if operationalising it may rely on authority and power.

Openness and inclusion

The virtue of openness and inclusion is the virtue of members of society having the information and, where appropriate, access required to participate in biotechnology governance; it embodies respect for the potential plurality of views on how biotechnology choices might be framed.

4.46 The virtue of openness and inclusion reflects the fundamental public interest in biotechnologies and in their potential to affect, beneficially or detrimentally, the common conditions of life. The cultivation of this virtue is intended to offset the potential for dominance by sectional interests and to draw attention to any power structures that result in legitimate interests being excluded (for example, through control of publication media). It does not entail, of course, that members

[288] This calls to mind the Enlightenment ideal of the public use of reason (see Kant I (1784) An answer to the question: 'what is Enlightenment?', in *Kant: political writings*, Reiss H (Editor) (Cambridge: Cambridge University Press, 1991)). This, however, somewhat idealises the human spirit and places too much faith in individuals as rational seekers of truth. Instead we put our faith here in open and fairly conducted discursive engagement to confront partiality with its alternatives, in conditions that mitigate against prejudice regarding the outcome.

of the public should be involved in all biotechnology governance, nor even necessarily that all governance decisions themselves should be democratically mandated. Furthermore, even the benefits of public access to information must be balanced against the potential harms that may arise if that information is capable of being misused, for example, when there are irreconcilable threats to security.

Accountability

The virtue of accountability involves an explicit acknowledgment and acceptance of where responsibility for governance lies, how this responsibility connects with democratic lines of accountability and (therefore) how social actors might influence it or seek to have it revised.

4.47 The virtue of accountability has a variety of different meanings depending on the context, but these are united by the notion of the obligation to render an account for the exercise of power vested in an actor on behalf of others. For example political accountability, in a democratic political system, requires that members of the executive answer for their actions to the people or their elected representatives (in Parliament).

4.48 Non-political forms of accountability exist through all sorts of different social, professional and business structures. The difficulty for social participation in these is the accountability of those structures themselves, so the public interest may, for example, justify the imposition of a principle requiring constructive engagement with a broader range of perspectives in aspects of biotechnology governance that have significance for common life.[289]

Public reasoning

The virtue of public reasoning is the cultivation of clear and explicit reasoning orientated towards the discovery of common grounds rather than in the service of sectional interests, and the impartial interpretation of all relevant available evidence.

4.49 The virtue of public reasoning counteracts the habits of instrumental reasoning. When engaging in public policy or governance, it is not sufficient to rely on the assumptions and commonplaces that are customary in professional or social contexts. This is not merely a quality to be developed in individuals (although it certainly applies to individuals) but more importantly a property of discursive engagements in which matters of public interest are at stake, through challenge and argument. Reflection on reasons and reasoning is intended to address biases such as 'groupthink' and 'framing effects' to which groups and influential individuals who participate in discourses may be vulnerable.[290] For this to be the case the reasoning by which conclusions are asserted needs to be open and explicit and the interpretation of any evidence relied upon clear and open to interrogation. Symmetrically, the reason for disregarding any apparently germane evidence should be equally explicit. For example, in professional life, executives of pharmaceutical firms may wish to select from among clinical trial results evidence that supports the case for the clinical utility of the drug that they are trying to sell.[291] In a public discourse, in contrast, the full range of evidence needs to be adduced.

Candour

The virtue of candour encourages uncertainties associated with emerging biotechnologies to be represented truthfully and in good faith.

[289] For example, the research councils could be mandated to consult with social groups on questions of sustainability.
[290] See: Kahneman D (2011) *Thinking, fast and slow* (New York: Farrar, Straus and Giroux).
[291] See, for example, House of Commons Health Committee (2005) *The influence of the pharmaceutical industry (fourth report of session 2004–05) HC 42-I*, available at: http://www.parliament.the-stationery-office.co.uk/pa/cm200405/cmselect/cmhealth/42/42.pdf.

4.50 In the evidence we have considered, there was significant concern about the danger of systematic 'overstating' of the anticipated impacts and delivery timescales of biotechnology research.[292] Those who shared this concern included scientific researchers involved in the very emerging biotechnologies that they perceived as being overstated. We infer from what we have heard that, in emerging biotechnology research, a kind of systematic distortion is often encouraged, about which many researchers feel uncomfortable. On the other hand, a similar concern exists in relation to over-exaggerating the potential for harms, or over-interpreting evidence of risk. While participants may understand and accept the 'language games' in which they are embroiled, and are therefore able to discount hyperbole, these language games may spill into other discursive contexts, effectively misinforming other audiences. Furthermore, resulting over-expectations of feasibility and timescale for anticipated applications and impacts may have distorting effects on technology pathways (for example by attracting support and resources to one line of research at the expense of others).

4.51 This may be partly a consequence of expectations placed on researchers as a result of institutional structures, such as the emphasis that research councils place on the 'impact' of research.[293] Such expectations may make demands beyond the competence of researchers who are unlikely to have expertise in commercialisation, for example, or understand the timescales, processes and obstacles involved. This concern is not restricted to researchers, however: it is just as relevant to political and commercial actors, and interest groups. Public scientists often find themselves in a double bind: they need to be both *candid* (in order to be trusted), and *decisive*. However, candour is often about uncertainty and, in a context where certainty is judged to be a measure of competence, this may create a tension between candour and the appearance of competence.[294] The virtue of candour can only be inculcated by a systematic deflation of overpromising across all fields of research (so that no field of research is disadvantaged vis-à-vis any other by suddenly appearing more uncertain) and a change in the expectations of policy making, which demands clear answers and avoids engaging with radical uncertainty.

Enablement

The virtue of enablement supports wider political debate about emerging biotechnologies. It encourages appraisals of emerging biotechnologies – whether expert or broader participatory appraisals – to highlight, in a balanced way, alternative social and technological choices and their associated rationales rather than asserting single, ostensibly definitive prescriptive conclusions.

4.52 Effective appraisal of a technology option should not merely address questions such as "yes or no?", "how much?" or "how fast?". Instead, it should focus on the enabling of choice so that attention can extend beyond the anticipated benefit or harm of a single innovation, and identify other actual or possible alternatives.[295] This goes beyond the virtues of 'openness', 'accountability' and 'public reasoning', in that each of these may be equally expressed by focusing simply on particular biotechnologies. The virtue of enablement, on the other hand,

[292] Oral evidence from the fact-finding meeting on policy, regulation and governance, held by the Working Party, 8 July 2011; the PHG Foundation, responding to the Working Party's consultation: "One problem in the field of genomics is that there is a tendency towards researchers overstating the likely benefits of the research and understating the risks involved."

[293] Oral evidence from the fact-finding meeting on research and development, held by the Working Party, 6 May 2011. See also, for example: EPSRC (2012) *Delivering impact*, available at: http://www.epsrc.ac.uk/plans/implementingdeliveryplan/goals/deliveringimpact/Pages/default.aspx and BBSRC (2012) *BBSRC research grants: the guide*, available at: http://www.bbsrc.ac.uk/web/FILES/Guidelines/grants-guide.pdf.

[294] See: John S and Lewens T (2010) *The universal ethical code for scientists and the 'crisis of trust in science': report to the Science and Trust Working Group*, available at: http://interactive.bis.gov.uk/scienceandsociety/site/trust/files/2010/03/Ethical-Codes-and-Trust-16-Feb-20101.pdf, p25: "...scientific work, particularly in cutting-edge areas, is often characterised by high levels of disagreement and uncertainty. Presenting this uncertainty and disagreement to the public might be the best way in which to act sincerely. Unfortunately, it may also be the best way in which to appear incompetent." See also: Science and Trust Expert Working Group (2010) *Science and Trust Expert Group report and action plan*, available at: http://scienceandsociety.bis.gov.uk/trust/files/2010/03/Accessible-BIS-R9201-URN10-699-FAW.pdf.

[295] European Science and Technology Observatory (1999) *On science and precaution in the management of technological risk,* available at: http://ftp.jrc.es/EURdoc/eur19056en.pdf; O'Brien M (2000) *Making better environmental decisions: an alternative to risk assessment* (Cambridge, Massachusetts: MIT Press); European Environment Agency (2001) *Late lessons from early warnings: the precautionary principle 1896-2000,* available at: http://www.eea.europa.eu/publications/environmental_issue_report_2001_22; Leach M, Scoones I and Stirling A (Editors) (2010) *Dynamic sustainabilities: technology, environment, social justice* (London: Earthscan).

encourages consideration to extend to alternative options that offer credible alternative pathways to the achievement of stated social ends. In this sense, the virtue of enablement is a crucial defence against the 'instrumentalisation' of the governance of emerging biotechnologies that restricts consideration only to the means by which a given technology is developed, rather than the more fundamental 'ends' towards which this development (alongside many others) might be orientated.

Caution

The virtue of caution means that the greater the degree of exposure to uncertainty and ambiguity, the greater the responsibility deliberately to gather deeper and more extensive knowledge prior to making policy commitments.

4.53 In these terms, the virtue of caution concerns the nature and quality of the appraisal process through which alternative courses of action (and inaction) come to be examined. It contrasts with the relatively narrow and closed form of conventional regulatory risk assessment (focusing on a single proposed product, in relation to the probabilities of specific defined possibilities of harm). Instead, caution urges that, as uncertainty and ambiguity increase, correspondingly greater attention, effort and time should be devoted to:

- broadening the array of issues that are considered (e.g. indirect as well as direct effects);
- gathering a diversity of relevant knowledge on each of these (e.g. different disciplines and specialist expertise);
- engaging a plurality of different perspectives (e.g. experiences, values, interests);
- symmetrically interrogating a range of alternative options (including that of 'doing nothing');
- weighing up both the pros and the cons of each option (rather than considering just 'risks' or 'acceptability'); and
- exploring a variety of potential scenarios (to address different possible notions of pessimism or optimism) and deliberation over general qualities of different technologies that might not otherwise come to the fore (like their reversibility, flexibility, diversity and adaptability in the event of surprise).

4.54 In these terms, then, it is important to recognise that caution is not about irrational fear of novelty, nor necessarily about imposing bans, nor in any way at odds with science. It is about helping to guide the direction of innovation under uncertainty and ambiguity.

4.55 In stating this virtue of caution we are conscious of the weight of literature that has grown up around the 'precautionary principle' and the various interpretations to which that principle has been subject. Our formulation here is intended to capture what many regard as the authentic force of the precautionary principle. However, by avoiding this specific terminology we hope to avoid an engagement with what, for our purposes, would be distracting academic – or tactically misleading political – debates.

Conclusion

4.56 In this Chapter we have endorsed the claim that there is a *prima facie* moral case for developing some biotechnologies (to alleviate harms and increase welfare), but that the public interest in governance comes, in part, from biotechnology's potential to generate harms as well as benefits and, importantly, to lock in the technologies that generate these harms/benefits and crowd out alternatives. The *prima facie* case cannot therefore be further advanced owing to ambiguity and uncertainty, independently of broader reflection and concrete experience. We do not state as independent values either the pursuit of benefit or the avoidance of harm. Although they implicitly underlie our ethical approach, we recognise that the pursuit of benefit and avoidance

of harm mean different things to different people. We nevertheless identify three key values to qualify the pursuit of benefit and avoidance of harm at a public level (equity, solidarity and sustainability).

4.57 In setting out an ethical approach we wished to avoid the temptation to propose simply a supplementary set of 'decision rules' that can be applied to a set of available options to select an 'ethically preferable' option. It would not be possible to establish a single set of rules that would operate consistently for early-stage emerging biotechnologies where the applications and products are speculative, subject to high levels of unpredictability and without clear precedent. Instead, we have proposed a number of procedural virtues to which we believe the practice of discursive decision making should aspire (openness, accountability, public reasoning, candour, enablement and caution). These are intended to open up decisions to ethical reflection and provide a bulwark against undue concentrations of power within research systems, to render the exercise of power more transparent and deliberate, and so amenable to professional and democratic accountability.

4.58 The choice of ethical values and procedural virtues that we advance here is, of course, no less ambiguous or contested than any other framing, but it has two important virtues. Firstly, in terms of procedure, it aims to ensure that questions of social and ethical value and conduct are raised in public discourse and, having been raised, should be pursued alongside questions of prudential values such as economic return. Secondly, it comprises, in effect, a set of conceptual tools with which questions of value and conduct may be addressed.

4.59 In discussing the ethics of emerging biotechnologies we are aware that we are not the first or only body – and will undoubtedly not be the last – to do so, either in the particular (synthetic biology, stem cell research, stratified medicine, etc.) or the more general (emerging technology, responsible innovation, etc.). The Nuffield Council on Bioethics has itself produced a number of earlier reports on particular contemporary emerging biotechnologies, including xenotransplantation (1996), genetically modified crops (1999) and biofuels (2011).[296] In preparing our Report, we have consulted many of these sources, from a number of different independent, professional and official bodies, national and international organisations, and from different political, legal and cultural traditions, although there are no doubt more that have escaped our attention. We have profited greatly and drawn freely from these, but we do not claim in any way to have synthesised or supplanted them. We do, however, believe that the approach advanced in this Report, if applied to the governance of biotechnology, will provide a useful tool to open up and reframe decision making processes in a way that makes them more ethically robust.

[296] Copies of all Nuffield Council on Bioethics reports can be accessed via: http://www.nuffieldbioethics.org/previous-projects.