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Dual Use Science and Technology, Ethics and Weapons of Mass Destruction

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Contents

Chapter 1
Introduction

Abstract The problem of dual-use science research and technology arises because such research and technology has the potential to be used for great evil as well as for great good. On the one hand, knowledge is a necessary condition, and perhaps a constitutive feature, of technologies that contribute greatly to individual and collective well-being. Consider, for example, nuclear technology that enables the generation of low cost electricity in populations without obvious alternative energy sources. So technological knowledge is a good thing and ignorance of it a bad thing. On the other hand, these same technologies can be extremely harmful to individuals and collectives. Consider, for example, the atomic bombs dropped on Hiroshima and Nagasaki. So it seems that, at least with respect to some technologies, knowledge is a bad thing and ignorance a good thing. Accordingly, the question arises as to whether we ought to limit scientific research and/or the development of technology and, if so, which research or technology, in what manner and to what extent.

The problem of dual-use science research and technology arises because such research and technology has the potential to be used for great evil as well as for great good.[1] On the one hand, knowledge is a necessary condition, and perhaps a constitutive feature, of technologies that contribute greatly to individual and collective well-being. Consider, for example, nuclear technology that enables the generation of low cost electricity in populations without obvious alternative energy sources. So technological knowledge is a good thing and ignorance of it a bad thing. On the other hand, these same technologies can be extremely harmful to individuals and collectives. Consider, for example, the atomic bombs dropped on Hiroshima and Nagasaki. So it seems that, at least with respect to some technologies, knowledge is a bad thing and ignorance a good thing. Accordingly, the question arises as to whether we ought to limit scientific research and/or the development of technology and, if so, which research or technology, in what manner and to what extent.

Evidently scientific knowledge that enables the development of dual use technologies is potentially dangerous and therefore, where possible, it should be restricted

[1] See, for example, Miller and Selgelid (2007, pp. 523–580), Rappert and Selgelid (2013), Meier and Hunger (2014) and Tucker (2012).

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or perhaps even not acquired in the first place. In short, contrary to popular opinion, there ought to be a degree of *collective scientific ignorance*, at least among members of the general population. But what is collective ignorance and how does it relate to collective knowledge? More generally, dual use science research and technology are collective epistemic or knowledge-aiming enterprises that produce collective benefits but can also at times cause collective harms. Indeed, they are enterprises conducted by institutions, such as universities, private sector firms and military organisations. Naturally, if the benefits are to flow there is a need to protect and promote scientific freedom. On the other hand, in relation to the potential for harm, scientists and others have a moral responsibility, even if not a legal responsibility, to cooperate in order to avert or, at least, minimise the risks; so dual use research and technology is a matter of *collective moral responsibility*. But what is collective responsibility and how does it figure in the varied scientific and institutional contexts of the collective epistemic enterprises in question? More specifically, should some dual use research be impermissible or, if not, should access to the resulting scientific knowledge be highly restricted, e.g. censored? What institutional arrangements, e.g. regulations, ought to be put in place in relation to dual use research? These are the questions that this work seeks to address.

Chapters 2, 3 and 4 are theoretical in character and could be skipped by those uninterested in the theoretical aspects of the problem. In Chap. 2 the key concept of dual use is defined. In Chap. 3 analyses of collective knowledge and collective ignorance are proffered. In Chap. 4 a theory of collective responsibility is presented. Chapters 5, 6, 7 and 8 each focus on a particular scientific field or industry of dual use concern, namely, the chemical industry, the nuclear industry, cyber-technology and the biological sciences (respectively).

The problem of dual-use research and technology arises in its most obvious form in the context of weapons of mass destruction (WMDs), whether chemical, nuclear, cyber or biological weapons. Scientific research originally conducted for beneficial peaceful purposes has also enabled WMDs. Moreover, the problem has been exacerbated by the growth of international terrorist groups, such as Al Qaeda and ISIS (Islamic State of Iraq and Syria), who evidently would be willing to use WMDs, if they could get their hands on them. Indeed, ISIS has already used chemical weapons in Iraq (as has their protagonist in Syria, the Assad regime). The use of chemical weapons in World War 1 and atomic weapons in World War 2 graphically illustrated the problem of dual use science and technology. In the biological sciences the dual use problem has arisen in its most acute form in relation to recent advances in synthetic biology which have enabled the creation of pathogens de novo. Unfortunately, this important scientific breakthrough has a downside; the potential for a 'superbug' pandemic. More specifically, this recent research includes gain of function (GOF) research, e.g. research that enables highly virulent pathogens to possess increased transmissibility to humans. Another area of dual use concern is new and emerging cyber-technology, including the development and deployment of computer viruses to engage in denial of service attacks that may well put lives at risk by, for instance, disabling life support systems in hospitals.

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Chapter 2
Concept of Dual Use

Abstract There are a number of different preliminary definitions of dual use familiar in the literature. Research or technology is dual use if it can be used for both: (1) Military and civilian (i.e. non-military) purposes; (2) Beneficial and harmful purposes—where the harmful purposes are to be realised by means of Weapons of Mass Destruction (WMDs); (3) Beneficial and harmful purposes—where either the harmful purposes involve the use of weapons as means, and usually WMDs in particular, or the harm aimed at is on a large-scale but does not necessarily involve weapons or weaponisation. I favour the third definition of "dual use"—at least as a preliminary definition—since some dual use research, such as Gain of Function research in the biological sciences, need not involve a process of weaponisation or a military purpose. However, further conceptual unpacking is called for and provided in this chapter.

2.1 Definition of Dual Use Science and Technology

As noted in Chap. 1, the expression "dual use" refers to scientific research or technology that can be used for both beneficial/good and harmful/bad purposes.[1] However, this general sense of dual use is too broad since it has the effect that almost everything could count as dual use. For instance, machetes are used for farming, but they were also used in the Rwandan genocide in 1994 as tools of murder. So we require a narrower notion of dual use. Most of the current debate has focused on research and technologies with implications not simply for weapons but for weapons of mass destruction (WMDs), in particular—i.e., where the harmful consequences of malevolent use would be on an extremely large scale (and, likewise, the benefits of benevolent use would be large-scale). That said, as mentioned in the Chap. 1,

[1] See, for example: Miller and Selgelid (2007), van der Bruggen et al. (2011, 1–122), Miller (2013), Meier and Hunger (2014) and Tucker (2012). Some material (as opposed to technologies), e.g. toxins, might be dual use if, for instance, they are not naturally occurring but were man-made. However, for the sake of simplicity I will not refer to dual use materials unless this is required in the particular case under discussion.

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defining dual use simply in terms of WMDs yields too narrow a notion given, for instance, GOF research in the biological sciences[2] (see Chap. 8). Accordingly, let us try to get a better fix on a serviceable notion of dual use by setting out a number of different preliminary definitions of dual use familiar in the literature[3] and doing so on the assumption that any definition will involve a degree of stipulation.

Research or technology is dual use if it can be used for both:

1. Military and civilian (i.e. non-military) purposes;
2. Beneficial and harmful purposes—where the harmful purposes are to be realised by means of WMDs;
3. Beneficial and harmful purposes—where either the harmful purposes involve the use of weapons as means, and usually WMDs in particular, or the harm aimed at is on a large-scale but does not necessarily involve weapons or weaponisation.[4]

I favour the third definition of "dual use"—at least as a preliminary definition—since some dual use research, such as GOF research in the biological sciences, need not involve a process of weaponisation or a military purpose. However, further conceptual unpacking is called for.

(1) In relation to the *purposes* (or ends) of the research, we need to distinguish the following conceptual axes: (i) beneficial/harmful; (ii) military/non-military; and (iii) within the category of military purposes, the sub-categories of offensive/protective. Consider the aerosolisation of a pathogen undertaken for a military purpose. The purpose in question might be offensive, e.g. biowarfare; but it might simply be protective, e.g. to understand the nature and dangers of such aerosolisation in order to prepare protections against an enemy known to be planning to deploy the aerosolised pathogen in question as a weapon.

The categories beneficial/harmful and military/non-military do not necessarily mirror one another. Some non-military purposes are, nevertheless, harmful, e.g. the supplier of a vaccine releasing a pathogen to make large numbers of people sick in order that the sick buy the vaccine against the pathogen and, thereby, increase the supplier's profits. And some military purposes might be good, e.g. the above-mentioned research on the aerosolisation of a pathogen undertaken for purely protective purposes in the context of a morally justified war. The United States Project BioShield is an example of research aimed at providing "new tools to improve medical countermeasures protecting Americans against a chemical, biological, radiological or nuclear (CBRN) attack."[5] However, some of the protective research would probably yield results that could assist in the development and delivery of biological weapons.

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[2] National Science Advisory Board for Biosecurity Framework for Conducting Risk and Benefit Assessments of Gain-of-Function Research (2015), Selgelid (2016).

[3] Rappert and Selgelid (2013).

[4] These definitions assume that the benefits are also on a large-scale. Moreover, there is a distinction between an object which is a weapon merely because used as one, e.g. a brick used to hit someone on the head, and a weapon which was designed as such from material which is not in itself useable as a weapon and, therefore, needs to go through a process of weaponisation, e.g. a biological agent used in a bioweapon.

[5] US Department of Health and Human Services (2004).