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AN EDUCATIONAL IMPERATIVE: THE ROLE OF ETHICAL CODES AND NORMATIVE PROHIBITIONS IN CBW-APPLICABLE RESEARCH

ABSTRACT. This paper examines the role of ethics in research with potential applicability to chemical and biological warfare. It focuses upon biological warfare research, and examines the ethical dilemmas faced by those working with dual-use potential technologies. It discusses the normative, legal and ethical prohibitions against participation in chemical and biological warfare programmes from a Western perspective. It examines the motivations of individuals participating in CBW research and concludes with recommendations for increasing awareness about ethical and normative prohibitions. An appendix lists the results of a survey of ethical codes in relevant scientific disciplines conducted via the Internet.

INTRODUCTION

There is increasing discussion of the ethical issues raised by developments in biotechnology. However, the application of biotechnological advances to warfare is rarely discussed outside security circles, and ethical issues are seldom raised in the security context.[1] Biotechnology involves the use of living organisms to make or modify products. These processes have been used since antiquity, but are usually mentioned in the context of techniques like genetic engineering, or such products as interferon, human insulin, clotting factor, and growth hormones. The development of such products has garnered widespread public support for biotechnology. It has also enabled certain branches of the chemical industry to improve its reputation, where it has been badly damaged by the environmental impact of industrial activities, by allegations of complicity with the supply of incapacitating, anti-plant and incendiary agents during the Vietnam War.[2]

[1] See www.ornl.gov/TechResources/Human_Genome/home.html and Mildred K. Cho, David Magnus, Arthur Caplan, Daniel McGee and the Ethics of Genomics Group, 'Ethical Considerations in Synthesizing a Minimal Genome', *Science*, 286 (10 December 1999), 209.

[2] Robert Bud, 'In the Engine of Industry: Regulators of Biotechnology, 1970–86', in Martin Bauer (ed.), *Resistance to New Technology: Nuclear Power, Information Technology and Biotechnology* (Cambridge: Cambridge University Press, 1995), 300–302.

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These concerns, among others, have led policymakers to devise new regulatory standards, which have in turn affected industries and academic research.[3] The discussion of biosafety and containment was initiated at the Asilomar Conference of 1975, and soon afterwards many institutes, agencies, and governments implemented research guidelines for the handling of genetically modified living organisms. The latest development in this area is the Cartagena Protocol on Biosafety, concluded in January 2000.[4] Such guidelines notwithstanding, there is a vast distinction between regulation and ethical prescription. Legal regulations may serve only to set a 'moral minimum', and do not always address ethical issues. Meanwhile, developments in biotechnology and genetic engineering have led to deeper questions framed by the new eugenics, human subjects research, and cloning. While these questions have been discussed in the medical ethics (and bio-ethics) community – and while medical and bio-ethics institutes have emerged in the United States and Europe in response to the social, ethical, and legal questions surrounding the new biology – they remain marginalized in the wider context of biotechnology,[5] and have attracted relatively little attention in university research circles.[6]

Most discussion of genetic technology emphasizes therapeutic risks and benefits. By the same token, research on the human 'genome', living 'modified' organisms, and genetically modified organisms, all fall within a non-maleficence 'paradigm',[7] while chemical and biological weapon (CBW) research falls under a paradigm of maleficence. The legal and ethical status of CBW is contained in the 1972 Biological and Toxin Weapons Convention (BTWC) and the 1993 Chemical Weapons Convention (CWC). However, it is well known that legitimate and ethically

[3] *Ibid*., 296. In the 1970s, biotechnology, as a commercial technology, combined biochemistry, chemical engineering, microbiology, and their industrial frameworks. It includes the application of rapid chemical analysis in diagnostic microbiology.

[4] See www.biodiv.org/biosafe/protocol/.

[5] See www.forbes.com/asap/120296/html/jeremy_rifkin. htm and www.biotechcentury.org. Also, see J.T. Rifkin, *The Biotech Century: The Coming Age of Genetic Commerce* (London: Putnam Publishing Group, 1998).

[6] June Goodfield, *Playing God* (New York: Random House, 1977), 162. Additionally, there are university courses on research integrity and responsible research, but these must be actively sought out. Moreover, these courses are mostly addressed to social scientists, rather than laboratory scientists.

[7] Although the concept and application of genetic enhancement techniques (such as selective births) and the non-therapeutic use of growth hormones may be seen as improving the psychological component of a person, they can also be viewed as contributing to the new-eugenics – thus implying maleficence.

justifiable research, performed in the public interest, and for the public health, may also be relevant to CBW. The General Purpose Criterion (GPC) in both conventions delineates the ethical boundaries between intentionally maleficent and non-maleficent applications.[8] A point of overlap occurs, however, among researchers and clinicians who have the knowledge, information, and ability to develop chemical and biological weapons.

This paper explores the ethical dilemmas posed by dual-use research, and examines ethical codes and normative prohibitions in CBW-applicable research. It concludes with recommendations to improve awareness of the international regulations and ethical codes.[9]

NORMATIVE, ETHICAL AND LEGAL PROHIBITIONS

The dual-use potential of most chemical and biological technology makes it difficult to draw distinct boundaries between offensive and defensive research. This is especially problematic because neither the BTWC nor the CWC prohibit research for defensive or peaceful purposes. This creates a grey area in which norms, codes and laws can influence motivations and intentions and provide guidelines for action.

Into this grey area enter scientists, bound by conflicting obligations.[10]

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[8] The GPC is contained in Article I of the BTWC and Article II of the CWC. Many of the technologies of relevance to both conventions are dual-use, and in order not to unduly hamper legitimate activities, prohibit only certain purposes to which these technologies may be applied. By 'dual-use', the authors mean research which has the potential to be utilized for both peaceful and aggressive purposes.

[9] Other papers in this issue delve more deeply into the motivations involved in specific weapons programmes.

[10] As R.W. Reid states, '... it is because this boundary [between constructive and destructive work] can seldom be seen with clarity, and can be raised or lowered according to the height of the individual's moral judgement, that the unified cry of the conscience of science cannot be heard and the scientists' dilemma still exists in spite of themselves', R.W. Reid, *Tongues of Conscience – War and the Scientist's Dilemma* (London: Constable & Co., 1969), 328. Owing to the difficulties in assessing individual morality, this paper focuses upon norms at the social and group level. For more on norms, see Frederick O. Bonkovsky, *International Norms and National Policy* (Grand Rapids: William B. Eerdmans Publishing Co., 1980); Martha Finnemore and Katherine Sikkink, 'International Norm Dynamics and Political Change', *International Organization*, 52 (4), (1998), 887–917; Ann Florini, 'The Evolution of International Norms', *International Studies Quarterly*, 40 (3), (1996), 363–389. For more on international norms against CBW, see the Introduction to this issue.

As Robert Sinsheimer argues:

> Scientists are citizens of three communities: their national society, with its history, goals, and ideals; the international fellowship of scientists with its history, goals and ideals; and the human race, past, present and future. To each of these they owe allegiance in greater or lesser degree and it is the conflicts of these allegiances and the divergence of values, and the temporal disjunctions among these communities that give rise to the moral dilemmas.[11]

Within each of these communities, the activities of scientists are moderated by norms, codes and laws.[12]

Norms are agreed-upon principles or standards that guide practice.[13] Norms are, evidently, social constructs – they emerge in an environment already rich with competing norms, and succeed or fail based on the social support they receive. Historically, the norm against the use and/or possession of chemical and biological weapons has transcended cultural, religious and political boundaries, and distinguishes CBW from equally lethal weapons. Understanding the operation of this norm provides a key to understanding why the use of CBW has been limited, and why so many states have become party to the BTWC and CWC.[14] The relationship between treaties, agreements and norms is complex. There is no standard formula – agreements may establish a norm, or vice versa. In order to succeed, norms must be actively promoted by so-called 'norm entrepreneurs'.[15] Norms at the group, national and international levels can be reinforcing, but they can also be in conflict. Norms against CBW emerge at the national or international level, and focus upon treaties and global prohibition.[16]

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[11] Robert L. Sinsheimer, 'Scientists and Research', in Susan Wright (ed.), *Preventing a Biological Arms Race* (Cambridge, Mass.: MIT Press, 1990), 73.

[12] This paper deals only with norms, codes and laws in Western culture, and does not discuss individual countries in detail.

[13] Robert Axelrod has suggested eight mechanisms to be used to support a partially established norm; see, Robert Axelrod, 'An Evolutionary Approach to Norms', *American Political Science Review*, 80 (4), (December 1986), 1095–1111.

[14] For a more general discussion of the development and evolution of norms see, Finnemore and Sikkink, *op. cit.* note 10, 887–917; Florini, *op. cit.* note 10, 363–389; Paul Kowert and Jeffrey Legro, 'Norms, Identity, and Their Limits: A Theoretical Reprise', in Peter J. Katzenstein (ed.), *The Culture of National Security – Norms and Identity in World Politics* (New York: Columbia University Press, 1996), 451–497.

[15] Finnemore and Sikkink, *op. cit.* note 10, 896–904.

[16] Ethan A. Nadelmann, 'Global Prohibition Regimes: The Evolution of Norms in International Society', *International Organization*, 44 (4), (Autumn 1990), 484. Nadelmann goes on to describe a common evolutionary pattern for the development of a global prohibition regime.

Ethical codes are instruments to formalize the structures that guide practice,[17] especially within a profession.[18] Before the Second World War, it was widely believed that scientists were working towards the common good of humanity and could detach themselves from the social context to offer objective scientific advice.[19] Ethical codes were regarded as redundant, unnecessary or even subversive.[20] Scientists today must contend with an increasingly complex environment and work within a framework of scientific responsibility.[21] As R.W. Reid has observed:

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[17] According to ethicist Dorothy Wertz, 'Although the terms "ethics" and "morals" are often used interchangeably, they are not identical. Morals usually refers to practices; ethics refers to the overarching rationale that may or may not support such practices. Morals refers to actions, ethics to the reasoning behind such actions. Ethics is an examined and carefully considered structure that includes both practice and theory', Dorothy Wertz, *Ethics: What is It and Why is It Important? A Primer for Non-Ethicists*, at www.umassmed.edu/shriver/research/socialscience/staff/wertz/ethics.cfm. For more on the distinction between ethics and morality see J.E. Hare and Carey B. Joynt, *Ethics and International Affairs* (Hong Kong: Macmillan, 1982) and J.H. Burns and H.L.A. Hart (eds.), *An Introduction to the Principles of Morals and Legislation* (London: Athlone Press, 1970).

[18] By profession, we refer to 'a calling requiring specialized knowledge and often long and intensive academic preparation'. Science qualifies as a profession under this definition, albeit a profession in which there are many distinct disciplines. Merriam-Webster Online Dictionary, www.m-w.com/.

[19] Note that while concerns about chemical and biological weapons and their legitimacy arose long before this, and especially after the use of CW in the First World War, these concerns did not lead immediately to discussions about the responsibilities of scientists for the consequences of their research.

[20] For more on the philosophy and culture of science, see Paul T. Durbin, *A Guide to the Culture of Science, Technology and Medicine* (New York: The Free Press, 1980); Robert K. Merton, *The Sociology of Science* (Chicago: University of Chicago Press, 1973); Wolfgang Krohn, Edwin Layton, and Peter Weingart (eds.), *The Dynamics of Science and Technology. Sociology of the Sciences* (Dordrecht: D. Reidel Publishing Company, 1978), vol. II; Jürgen Habermas (translated by Jeremy J. Shapiro), *Toward a Rational Society – Student Protest, Science and Politics* (London: Heinemann Educational Books, 1971); and Gerald M. Verschuuren, *Life Scientists: Their Convictions, Their Activities and Their Values* (North Andover, Mass.: Genesis Publishing Company, 1995).

[21] See 'The Responsibility of Scientists' in William Epstein and Toshiyuki Toyoda (eds.), *A New Design for Nuclear Disarmament – Pugwash Symposium, Kyoto* (Nottingham: Bertrand Russell Peace Foundation, 1977); Joseph J. Byrne, 'Public Policy, Public Opinion and the Biomedical Scientist', in Kurt Bayertz, Hilmar Stolte and Ursula Zimmerman (eds.), *Ethical Dimensions of Technology Transfer in Biomedicine* (Frankfurt: Peter Lang, 1993), 117–125; Hans Jonas, *The Imperative of Responsibility – In Search of an Ethics for the Technological Age* (Chicago: University of Chicago Press, 1984); Erhard Geissler and Robert Haynes, *Prevention of a Biological and Toxin Arms Race and*

> Traditionally science has been a search for the truth, and it is this maxim on which the worldwide brotherhood of science was built. Many factors have contributed to its breakdown. Chief among these has been the application of science: its application to benefit mankind and to threaten it. Even if he wanted to be completely detached from the surrounding world (which most scientists do not) and not care whether his work is applied in society, the scientist cannot remain of choice in a cocoon.[22]

The use of the nuclear bomb in the Second World War forced scientists to rethink their involvement in military programmes, and led to public calls for scientific responsibility. The Russell–Einstein Manifesto, issued in 1955, led to the first Pugwash conference,[23] and to the Pugwash movement, which remains a strong voice for ethical and social responsibility in the sciences.[24] The movement has grown in importance as the politicization and militarization of the sciences have increased.[25]

A stronger push by scientists for formalized ethical codes emerged in the 1960s and 1970s,[26] and has re-emerged periodically, generally in response to new advances in science and technology. Despite these initi-

the Responsibility of Scientists (Berlin: Akademie Verlag, 1991), and the proceedings of Pugwash Conferences.

22 Reid, *op. cit.* note 10, 330.

23 This manifesto, signed by eleven prominent scientists who had been involved in the development of the nuclear bomb, called upon scientists to assemble to 'appraise the perils that have arisen as a result of the development of weapons of mass destruction', and to subscribe to the following resolution: 'In view of the fact that in any future world war nuclear weapons will certainly be employed, and that such weapons threaten the continued existence of mankind, we urge the Governments of the world to realize, and to acknowledge publicly, that their purpose cannot be furthered by a world war, and we urge them, consequently, to find peaceful means for the settlement of all matters of dispute between them.' *Russell–Einstein Manifesto*, issued 9 July 1955.

24 For more information on this science culture, specifically within the international Pugwash movement, see J.P. Perry Robinson, 'The Impact of Pugwash on the Debates over Chemical and Biological Weapons', in Allison L.C. de Cerreño and Alexander Keynan (eds.), *Scientific Cooperation, State Conflict: The Role of Scientists in Mitigating International Discord*, *Annals of the New York Academy of Sciences* (New York: New York Academy of Sciences, 1998), 866; and Joseph Rotblat, *Pugwash: A History of the Conferences on Science and World Affairs* (Prague: Czechoslovak Academy of Science, 1967).

25 The Cold War saw a dramatic shift in research resources to the military–industrial sector, which left researchers compromised by secrecy and possible ethical breaches. See Sinsheimer, *op. cit.* note 11.

26 For example, at the seventeenth Pugwash Conference in 1967, the Committee on Special Responsibility of Scientists recommended the formation of a study group to formulate ethical guidelines, 'Scientists and World Affairs', *Proceedings of the Seventeenth Pugwash Conference on Science and World Affairs* (London: Taylor and Francis Ltd, 1968), 70.

atives, however, there remains little in the way of formal codes within the sciences. A. Carl Leopold has described the current situation as one of 'science saturation and ethics starvation'. He argues that a schism between science and ethics has emerged, which must be remedied to meet an increasing desire for professional guidelines.[27]

This desire is reflected in a recent emphasis on written guidelines, representing a significant shift away from informal ethical codes. This has been accompanied by a move away from self-governance, and towards the external regulation of professional behaviour.[28] In a rule-based system, rules replace moral obligation as a guide for action.[29] Rule-based ethics are taught formally and informally – formally through university courses, codes, and regulations advertised or pledged at graduation; and informally, through publication and practice. In the sciences, ethics education, peer review, research protocols, and the adjudication of specific cases rather than abstract principles, all reflect an awareness that ethical understanding is a cultural product, varying from profession to profession and place to place. In addition, ethical codes are aimed at external audiences and regulatory bodies, which increasingly demand professional accountability.

Codes are subject to multiple interpretations. There may be, for example, a generally accepted social meaning; a specialized official meaning; a distinct meaning within a given working environment; and also unique individual shadings of meaning. Scientists may distinguish between weapons intended for first use, and for retaliation or defence. The research involved may be exactly the same, but research motivations may reflect different ethical perceptions. The meaning of a code is always

[27] A. Carl Leopold, 'The Science Community is Starved for Ethical Standards', *The Scientist* (6 January 1992), 11. Leopold cites a poll by the American Association for the Advancement of Science in 1990, in which scientists listed the development of ethical principles as the most urgent requirement of the profession. Yet, as he says, despite this sentiment, there is little discussion of the matter in the scientific literature or curricula. Leopold is W.C. Crocker Scientist Emeritus at Cornell University.

[28] Jan Hult has proposed a distinction among several levels of ethics, from abstract recommendations to norms of action, including: (1) laws governing scientific research, (2) ethical rules, (3) ethical guidelines, and (4) ethical codes of conduct. He describes the latter as being 'formulated by learned societies to ensure the preservation of international norms and standards of scientific conduct'. See Joshua Jortner, 'Ethics in Modern Science – A Framework for Discussion', *Chemistry International*, 17 (5), (1995), 163.

[29] Alistair Preston *et al*., 'Changes in the Code of Ethics of the U.S. Accounting Profession, 1917 and 1988: The Continual Quest for Legitimation', *Accounting, Organizations and Society*, 20 (6), (1995), 526.

context dependent.[30] The observance of given ethical norms may reflect a consensus. However, when ethical norms and codes are not disseminated, they are not internalized, and may end up serving only a symbolic function.[31] For this reason, ethical direction must also come from outside the profession, as well as from its leadership. Together, informal and formal sources can create an ethically-conscious environment, as valuable as any formal code of ethics.[32]

Laws form a third category of prohibitions. These may be the formal embodiment of existing norms, or they may create new norms. Both play an important role in influencing professional activities and relationships. With respect to CBW, formal prohibitions evolved, from unilateral declarations and customs governing the conduct of war, to multilateral treaties. The BTWC and the CWC ban all development, production, stockpiling and use of chemical and biological weapons. Both conventions require parties to adopt measures to enforce treaty provisions at the level of individuals and groups. However, treaties legally bind only states, not their citizens.[33] Not all states have met these obligations; and the laws to which researchers are subject vary from country to country.[34]

Prior to the BTWC and the CWC, there were no international treaties prohibiting the possession of CBW. The 1925 Geneva Protocol addressed only the issue of use, and did not preclude research.[35] While the BTWC and the CWC ban activities that violate the object and purpose of the respective conventions, both permit research for defence, protection and

[30] Edward C. Arrington, 'Tightening One's Belt: Some Questions About Accounting, Modernity, and the Post-Modern', *Critical Perspectives in Accounting*, 8 (1/2), (February/April 1997), 5.

[31] Terry Thompson, 'Rhetoric and Reality', *CA Magazine* (August 1992), 54.

[32] This discussion was central to a recent conference of the International Network of Scientists and Engineers (INES), which developed a final statement on Science, Engineering and Social Responsibility. The student contingent of the conference is planning a website to increase awareness and discussion of these issues. Another example of a student-driven initiative regarding ethics is the Graduation Pledge Alliance. See ares.manchester.edu/department/Peacestudies/gpa.html.

[33] 'A Draft Convention to Prohibit Biological and Chemical Weapons under International Criminal Law', *Quarterly Journal of the Harvard–Sussex Program on CBW Armament and Arms Limitation*, 42 (December 1998), 1–2.

[34] The CWC explicitly requires states to adopt national legislation to ensure treaty implementation, while the BTWC only requires states to take 'any necessary measures' to prohibit the development, production, stockpiling and acquisition of such weapons.

[35] In the United States, The Chemist's Creed required chemists to 'discourage enterprises or practices inimical to the public interest or welfare', and to enrich science by 'contributions for the good of humanity'. *The Chemist's Creed* (American Chemical Society, 14 September 1965). This was replaced by The Chemist's Code of Conduct in 1994, see www.acs.org:80/membership.conduct.html.

prophylaxis. For researchers, this dual-use potential creates ambiguity.[36] Are there any long-standing norms, derived from international codes of conduct, to guide the researcher in ethical decision making?

With regard to chemical and biological warfare, a peremptory norm (*jus cogens*)[37] is closely related to the concept of the 'just war' (*jus in bello*). Before the BTWC and the CWC, scientists justified participation in CBW programmes as defensive, and viewed such activity as just and moral. The peremptory norm grew from international customary law, and from laws of war and international humanitarian law, and may in future be reinforced by international criminal law. The 1969 Vienna Convention on the Law of Treaties stipulates, for example, that the provisions of humanitarian treaties concerning the protection of human beings are peremptory.[38] Indeed, many normative principles found in peremptory norms and theories of natural law have evolved into universal humanitarian obligations, which are seen as protecting the international community and the survival of humankind.[39] From the perspective of natural law, all states are bound by customary international law, whether or not they are formally party to specific agreements.

There is a long history of efforts to formalize moral norms in the laws of war. For example, it has been argued that a weapon should not cause superfluous injury or be used indiscriminately, so that non-combatants do not suffer unduly.[40] Although the customs and laws of war are based

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[36] The dual-use nature of technology can be positive in that a great deal of research initiated for military purposes has had useful 'spin-off' civilian applications.

[37] The definition a peremptory norm generally accepted in international law, found in Article 53 of the 1969 Vienna Convention on the Law of Treaties, is '. . . a norm accepted and recognized by the international community of states as a whole as a norm from which no derogation is permitted and which can be modified only by a subsequent norm of general international law having the same character'. The Vienna Convention can be found on the ICRC International Humanitarian Law database at www.icrc.org/ihl.

[38] Vienna Convention on the Law of Treaties, 1969.

[39] Lauri Hannikainen, 'Peremptory Norms (*jus cogens*)', *International Law – Historical Development, Criteria, Present Status* (Helsinki: Lakimiesliiton Kustannus, 1988), 622.

[40] These sentiments found expression in prohibitions on the use of poison in the 1899 and 1907 Hague Conventions and in the 1899 Hague Declaration IV (2) on the use of asphyxiating gases and then in the 1925 Geneva Protocol. The Martens Clause, first formulated in the 1899 Hague Convention II, supplements the treaties in the case of types of new weapons or if the international treaty ceased to be applicable. Marc Lappé, 'Ethics in Biological Warfare Research', in Susan Wright (ed.), *Preventing a Biological Arms Race* (Cambridge, Mass.: MIT Press, 1990), 78. It provides protection for civilians and non-combatants via principles of customary international law, principles of humanity, and the dictates of public conscience that are not covered by specific international agreements. *UN Report of the International Law Commission on the Work of its Forty-sixth Session*, 2 May–11 July 1994, GAOR A749/10, 317.

on moral norms, how they affect research remains open to interpretation. A total ban on CBW under the customs and laws of armed conflict has been impossible to achieve, owing to a lack of legal agreement on what constitutes 'superfluous injury' or 'unnecessary suffering'.[41] As a result, judgements have been made on subjective factors, rather than on objective assessments of whether a weapon's effects outweigh its military need.[42]

Moreover, determining whether a peremptory norm exists is not always easy. Proponents argue that it is evident in resolutions passed by the United Nations General Assembly. From a positivist legal perspective, however, if resolutions are not unanimous they cannot be considered normative. Indeed, states which do not consent to a norm or to a customary law are not obligated to abide by that law.[43] However, there is a growing tendency to make individuals responsible for their actions under international criminal law. Participation in research resulting in mass-casualty and destruction could be considered a crime against humanity, and the perpetrators of such a crime could be held accountable before the International Court of Justice or the proposed International Criminal Court.[44] Clearer recognition of a scientist's international obligations could provide researchers with much needed guidance. In the medical profession, for instance, guiding ethical documents have been formulated and have gained global recognition and adherence.[45] Formulating such useful ethical documents requires an in-depth understanding of motivations.

41 This view was reinforced by the recent decision of the International Court of Justice on the legality of nuclear weapons. See 'Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion', *International Court of Justice Reports*, 1996, para. 79.

42 From a legal standpoint, it remains unclear what constitutes 'superfluous injury' or 'unnecessary suffering', and whether CBW falls under these headings. The SirUS Project, organized by the International Committee of the Red Cross, attempts to use health-related data to aid the legal community in defining these concepts. See Robin Coupland and Peter Herby, 'Review of the Legality of Weapons: A New Approach – The SirUS Project', *International Review of the Red Cross*, 835 (1 September 1999), 583–592.

43 Rupert Ticehurst, 'The Martens Clause and the Laws of Armed Conflict', *International Review of the Red Cross*, 317 (1 March 1997), 132.

44 International humanitarian law includes principles emerging from the Nuremberg Trials; the Convention on the Non-Applicability of Statutory Limitations to War Crimes and Crimes Against Humanity (1968); and the European Convention on the Non-Applicability of Statutory Limitations to Crimes Against Humanity and War Crimes (1974).

45 Examples include the 1948 Declaration of Geneva, the 1949 International Code of Medical Ethics, the 1956 Regulations in Time of Armed Conflict, and the 1964 Declaration of Helsinki. See the World Medical Association website, www.wma.net.

MOTIVATIONS OF SCIENTISTS INVOLVED IN CBW-APPLICABLE RESEARCH

Scientists have played an indispensable role in CBW research.[46] Their motivations, and those of the scientific community more generally, for engaging in these projects are difficult to assess.[47] Rita Colwell and Raymond Zilinskas have listed different motivations that, in combination, have been cited by scientists knowingly involved in BW research and development programmes in Japan, South Africa, Canada, the UK, the US, and the USSR in the Cold War, and in Iraq prior to the Gulf War. The list includes such factors as 'scientific interest', 'scientific challenge', 'pay and perquisites', 'job security', 'national security', and even explicit or implicit 'threats'. The phrase 'scientific interest' masks the tenuous line, so easily

46 Examples of activities initiated by scientists include programmes in Canada and Germany. See John Bryden, *Deadly Allies: Canada's Secret War, 1937–1947* (Toronto: McClelland and Stewart Inc., 1989); Friedrich Hansen, 'Towards a History of German Biological Warfare', in Erhard Geissler and Robert Haynes (eds.), *Prevention of a Biological and Toxin Arms Race and the Responsibility of Scientists* (Berlin: Akademie Verlag, 1991); Donald Avery, *The Science of War: Canadian Scientists and Allied Military Technology during the Second World War* (Toronto: University of Toronto Press, 1999); Erhard Geissler, 'Biological Warfare Activities in Germany, 1923–45', in Erhard Geissler and John Ellis van Courtland Moon (eds.), *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, SIPRI Chemical and Biological Warfare Studies, 18 (Oxford: Oxford University Press, 1999), 91–124; and Donald Avery, 'Canadian Biological and Toxin Warfare Research, Development and Planning, 1925–45', in *idem.*, 190–213.

47 For more information about motivations in specific programmes, see Reid, *op. cit.* note 10; Robert Harris and Jeremy Paxman, *A Higher Form of Killing* (London: Chatto & Windus, 1982); Sheldon Harris, *Factories of Death: Japanese Biological Warfare 1932–1945 and the American Cover-Up* (New York: Routledge, 1994); Seymour Hersh, *Chemical and Biological Warfare – America's Hidden Arsenal* (Indianapolis: The Bobbs-Merrill Company, 1968); Tim Trevan, *Saddam's Secrets – The Hunt for Iraq's Hidden Weapons* (London: HarperCollins, 1999); Peter Williams and David Wallace, *Unit 731 – The Japanese Army's Secret of Secrets* (London: Hodder & Stoughton, 1989); Barton J. Bernstein, 'America's Biological Warfare Program in the Second World War', *Journal of Strategic Studies*, 11 (3), (September 1988), 292–317; Ed Regis, *The Biology of Doom: The History of America's Secret Germ Warfare Project* (New York: Henry Holt & Company Inc., 1999); Theodor Rosebury, *Peace or Pestilence – Biological Warfare and How to Avoid It* (New York: Whittlesey House, 1949); Bryden, *op. cit*. note 46; Hansen, *op. cit*. note 41; Arthur L. Caplan, 'How Did Medicine Go So Wrong?' in Arthur L. Caplan (ed.), *When Medicine Went Mad: Bioethics and the Holocaust* (Totowa, NJ: Humana Press, 1992); Ken Alibek with Stephen Handelman, *Biohazard – The Chilling True Story of the Largest Covert Biological Weapons Program in the World – Told from the Inside by the Man Who Ran It* (London: Random House, 1999); J. Agar and B. Balmer, 'British Scientists and the Cold War: The Defense Research Policy Committee and Information Networks, 1947–1963', *Historical Studies in the Physical Sciences*, 28 (2), (1998), 209–252.

crossed, between research for peaceful and hostile purposes; 'job security' speaks to the reality that government positions are generally more secure than those in private institutions; while 'threats' refers to scientists forced to work on CBW against their will.[48]

The motivations that figure most prominently are those of 'national security' and 'scientific challenge'.[49] The latter is generally portrayed as 'science for science's sake' or 'pure science', and is accompanied by the argument that science is not political, for which reason scientists cannot be held responsible for the implications of their research.[50] But, as R.W. Reid stated, 'If the brotherhood [of science] is ever to be built up again, then the precept of science for science's sake will have been left far behind. The conscience of science has only developed with the realisation that science in the end cannot exist for itself, but must be for the sake of society.'[51] As the line between pure and applied science blurs with every advance in biotechnology, this attitude is less accepted, even within the scientific community.[52]

Scientists may be involved in 'defensive' projects with offensive applications, or in civilian programmes which have potential 'spin-on' military potential. Their motivations are generally assumed to be 'scientific interest', 'scientific challenge', and an interest in the public good. There may also be a strong financial motivation, given the enormous profits

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48 Rita R. Colwell and Raymond A. Zilinskas, 'Bioethics and the Prevention of Biological Warfare', in Raymond A. Zilinskas (ed.), *Biological Warfare – Modern Offense and Defense* (Boulder: Lynne Rienner, 2000), 231.

49 Nationalism has been the strongest motivation of scientists participating in wartime CBW programs. The findings of this paper are consistent with those of Colwell and Zilinskas, *op. cit.* note 48, 225–245. As Theodor Rosebury, a scientist involved in the American BW program stated, 'In time of war or if the danger of war is clear and imminent, most scientists, like other men, find no great difficulty in resolving the conflict in their own minds sufficiently to direct a course of action which we cover and condone under the wartime meaning of the word "patriotism" ', Rosebury, *op. cit.* note 47, 174.

50 As late as 1952, Bernard Barber argued that '. . . neither scientists taken as a whole group nor any individual scientist alone can be considered responsible, in any sensibly direct fashion, for the social consequences of their activities.' His argument is that the social consequences of science are inevitable; that scientists cannot predict the consequences of their discoveries; and that science does not produce consequences in a vacuum, but interacts with the rest of society to produce these consequences. Bernard Barber, *Science and the Social Order* (Glencoe: The Free Press, 1952), 227.

51 Reid, *op. cit.* note 10, 333.

52 See Ron Johnston and Tom Jagtenberg, 'Goal Direction of Scientific Research', in Wolfgang Krohn *et al.* (eds.), *The Dynamics of Science and Technology. Sociology of the Sciences Yearbook* (Dordrecht: Reidel, 1978), vol. II, 29–58, for one explanation of the distinction between pure, 'ideologically engaged', and 'useful' science.

to be made in both the chemical and biological industries, and this may supersede ethical considerations.[53]

In categorising those involved in CBW-applicable research, it is possible to define four groups:

– those who participate knowingly in offensive CBW-applicable research programmes, despite an awareness of normative, ethical and legal prohibitions against such research;
– those who participate knowingly in an offensive programme, unaware of the prohibitions;
– those unaware of the prohibitions against offensive research, doing research that is not dedicated to offensive weapons, but that has potential application to biological weapons development; and finally,
– those who are aware of the prohibitions and are engaged in research with potential, but not dedicated, offensive applications.

Such categories are not rigid, and their boundaries may change. They may, however, indicate the level of consciousness of those working in a CBW programme in violation of accepted norms, ethical codes, or legislation.

ADDRESSING MOTIVATIONS

Most research necessary for CBW has not been developed explicitly for weapons purposes. Scientists cannot foresee all future applications of their work, but an ethical code asks them to do so to the best of their ability. While understanding intent helps to differentiate between outwardly similar acts, there remain difficulties in assessing motivation. Today, owing to the covert nature of offensive CBW programmes, motivations are usually easily ascertained only via whistle-blowers and other defectors, whose accounts can rarely be verified. However, it is possible to identify certain factors that may affect an individual's awareness of normative, ethical and legal prohibitions. Sources which provide important information include:

– the curricula of university ethics courses, tailored to research training;
– the presence and dissemination of ethical codes in various disciplines, the method of disseminating this code to members, and disciplinary actions for violating the code;

[53] According to Zilinskas and Colwell, *op. cit.* note 48, 225–245, scientists in the UK, USA and Canada working in BW programmes during the Second World War did not receive significant material benefits as a result. However, their colleagues in totalitarian countries did receive significantly higher pay, and had access to the best equipment and supplies. The same was true for scientists in the Iraqi BW programme.

- the presence or absence of an epistemic community;[54]
- the efforts of professional societies to promote knowledge of norms, codes, and
- treaty obligations among their members;
- the discussion of norms, codes and international or national legislation within the commercial setting; and
- public discussion of these issues.

Although universities in the Western world offer many courses dealing with ethics, these are rarely compulsory for science students. Ten years ago, Carl Leopold observed, 'Opportunities for scientists to discuss or learn about ethics practically disappeared from academic programmes.'[55] In the past decade, however, an interest in ethics has gained greater attention within society at large, and this awareness has spread into the scientific community.[56] Nevertheless, even when ethical issues are discussed in science, they rarely touch upon questions of commercial or governmental secrecy, let alone upon biological or chemical warfare. Nor is there any obligation to mention such agreements as the BTWC or CWC. Particularly within the commercial setting, scientists may be left unaware of CBW-relevant regulations or controls. Within the chemical industry, this awareness should increase with the implementation of the CWC. With respect to the BTWC, increased awareness may result if measures proposed at the Fifth Review Conference are implemented. At this time, national export controls are the only means of raising awareness of BTWC-relevant activities within industry.

The CWC and the proposed protocol to the BTWC contain incentives to promote universality through scientific and technological exchange. Universality is regarded as essential to the CWC and BTWC,[57] as it ensures that the dual-use potential of such technologies is fully recognized. Implementation of these provisions will not only attract more states into the disarmament regime, but will also make technology transfers and research facilities more transparent. Through exchange programmes,

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[54] This concept is similar to that of 'transnational peer grouping', a concept used by J.P. Perry Robinson *op. cit.* note 24, 226. Perry notes that two key attributes of the Pugwash movement leading to its success were access to policy levels of government and transnational peer grouping.

[55] Leopold, *op. cit.* note 27, 11.

[56] 'Science, Ethics, & Education', Student Pugwash USA, *mindfull*, 2 (9), (February 1999), www.spusa.org/pugwash/publications/mindfull/mindfull_see.pdf.

[57] For a further discussion of universality with regard to the BTWC, see Jean Pascal Zanders, *Security Through Universality – Some Fundamentals Underlying Article X of the Biological and Toxin Weapons Convention*, projects.sipri.se/cbw/research/sec-uni-X-BTWC.PDF.

researchers will be socialized into the international and professional norms against CBW, and may, as a result, be less inclined to engage in proscribed activities.

Foreign-trained scientists who return to their countries of origin are often agencies of informal technology transfer. Scientists educated in North America and Europe have, when returning home, applied their knowledge in ways suspected of proliferating chemical and biological weapons. Even if university education is improved, nationalism provides a very powerful motivator. That said, legal and professional restraints could have a greater impact than they do. Even more could be achieved through the moral resources of wider 'epistemic communities', which exist at both national and international levels, and cut across professions.[58] Members of the community share values, causal beliefs, common notions of validity and a common policy enterprise.[59] They are often composed of transnational 'moral entrepreneurs', who mobilize popular opinion and support for cosmopolitan norms on issues which transcend national boundaries.[60] In the words of Peter Haas, '. . . their members share knowledge about the causation of social or physical phenomena in an area for which they have a reputation for competence, and a common set of normative beliefs about what actions will benefit human welfare in a domain'.[61]

Epistemic communities can be especially influential where their specialized knowledge gives them influence upon policymakers who lack such knowledge. Members of the communities concerned with the prevention of biological or chemical warfare may work in universities, private laboratories or foundations, in policy institutes, or in government-sponsored research.

Since epistemic communities cut across professions, their ethical standards are functional, politically driven and ideologically self-contained,

[58] Peter M. Haas, 'Introduction: Epistemic Communities and International Policy Coordination', *International Organization*, 46 (1), (Winter 1992), 3. See also Emanuel Adler and Peter Haas, 'Conclusion: Epistemic Communities, World Order, and the Creation of a Reflective Research Program', *International Organization*, 46 (1), (Winter 1992), 367–390; Emanuel Adler, 'The Emergence of Cooperation: National Epistemic Communities and the International Evolution of the Idea of Nuclear Arms Control', *International Organization*, 46 (1), (Winter 1992), 101–145; and James K. Sebenius, 'Challenging Conventional Explanations of International Cooperation: Negotiation Analysis and the Case of Epistemic Communities', *International Organization*, 46 (1), (Winter 1992), 323–365.

[59] Peter M. Haas, 'Epistemic Communities and the Dynamics of International Environmental Co-operation', in Volker Rittberger (ed.), *Regime Theory and International Relations* (Oxford: Clarendon Press, 1993), 179.

[60] Nadelmann, *op. cit.* note 16, 524.

[61] Haas, *op. cit.* note 59, 180.

and do not arise from a professional code.[62] This is not the same for academic and professional societies, which are both the primary source and users of ethical codes. In recent decades, a wide variety of professional organizations have formulated ethical codes, including scientific organizations.

The Appendix presents the results of a cursory survey of the prevalence of ethical codes in the chemical and biological sciences relevant to CBW.[63] It is not comprehensive, and industry and manufacturing associations, private sector companies and universities are not included. In addition, the survey is restricted to web-based media in English, which had a significant effect on the results. However, even at first glance, it is clear that few scientific disciplines (as represented by professional organizations) stipulate ethical codes. Only eleven per cent of international organizations surveyed, and twelve per cent of national/regional organizations, have such a code (at least, accessible via the Internet). Many international scientific societies do not have such codes, but encourage national or regional member organizations to formulate them. Of course, most scientific professional codes do not mention chemical or biological warfare explicitly, but contain general provisions that may be interpreted as covering the issue. Addressing this absence will be an important step in the larger process of raising awareness.[64]

It is a testament to the strength of the norm against CBW that there is little public discussion of its features. The norm is now so strong, at least within the developed world, that it is no longer even questioned, and has become embedded in the public consciousness. Extending this norm globally, however, will require much more open discussion. Today, CBW is generally discussed in the context of the threat that proliferation poses to national and international security. Biological and chemical weapons have been grouped with nuclear weapons under the heading of ‘weapons of mass destruction’. Unfortunately, they are often presented in a ‘scare tactic’ manner, with little factual information, and even less mention of the BTWC and CWC.

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62 Adler, *op. cit.* note 58, 116.

63 The survey forms the basis of a SIPRI project which will produce a comprehensive listing of professional ethical codes.

64 Gail H. Cassell, Linda A. Miller and Richard F. Rest, ‘Biological Warfare: Role of Scientific Societies’, in Raymond A. Zilinskas (ed.), *The Microbiologist and Biological Defense Research – Ethics, Politics and International Security*, *Annals of the New York Academy of Sciences*, 666 (New York: New York Academy of Sciences, 1992).

CONCLUSION

There are many benefits arising from the peaceful application of biotechnology and chemistry. Unfortunately, there are also risks. These risks have increased with widening access to, and transfer of, dual-use technologies. Research and development programmes are coming under closer investigation owing to the perceived threat of biological and chemical weapons and potential terrorist use of CBW. Ethics education can help to deter the misuse of new discoveries. Among scientists, there are likely to be benefits from the development of ethical codes prohibiting the misuse of skills, knowledge, materials and equipment for weapons purposes in the disciplines involved in CBW-applicable research. There are also likely to be benefits from the incorporation of ethics courses in core curricula; the development of ethics resources for students, professors, practicing scientists and policymakers on the Internet;[65] ethical awareness campaigns within professional societies; improved use of revenue; legislation to protect whistleblowers;[66] increased transparency in research budgets; more accountability in human subjects research and clinical trials; and greater provision of confidential ethical advice and mentor services.[67]

At the national and international level, efforts should be focused upon strengthened international treaties and verification mechanisms; the completion of negotiations on a protocol to the BTWC; the implementation of national legislation in keeping with CWC and BTWC obligations; and the funding of peaceful research to avoid ‘brain-drain’, with the proliferation risks that this poses. Prospects for success in these areas will be improved by increasing technological co-operation in verification and confidence-building.

Ethical dialogue takes time, and must be continuing – at the local, national, regional and global levels. A first step in this process is to establish frameworks for discussion within established organizations, regulatory bodies, and professional societies. However, dialogue alone is not enough to strengthen the norms against chemical and biological weapons. There must also be active efforts to strengthen institutional, academic, and commercial commitment against the misapplication of new technologies to chemical and biological warfare.

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[65] An example is found at: helpline@onlineethics.org.

[66] See www.whistleblower.org, for activities in this area.

[67] The organization ‘Scientists for Global Responsibility’ is working on this type of initiative. See its website: www.sgr.uk/SaE.html

APPENDIX: SURVEY OF PROFESSIONAL ORGANIZATIONS FOR ETHICAL CODES

Professional occupation	Number of ethical codes in international organizations surveyed	Number of ethical codes in national–regional organizations surveyed
Aerobiologist	0/2 (0 codes, 2 organizations)	0/5
Agrologist	N/A (N/A = no data found)	5/5
Biochemist	0/5	1/14
Biologist	0/4	1/14
Biotechnologist	0/1	0/3
Botanist	0/1	0/1
Chemist	0/1	2/6
Chemical Engineer	0/1	2/5
Climatologist	N/A	2/3
Endocrinologist	0/2	1/11
Entomologist	0/0	0/10
Geneticist	0/2	0/17
Hematologist	0/1	1/5
Horticulturist	N/A	1/2
Immunologist	0/3	0/14
Epidemiologist	3/7	2/9
Laboratory Technician	0/10	1/1
Mechanical Engineer	0/1	2/6
Medical Doctor	1/2	2/3
Medical Technologist	1/1	2/3
Microbiologist	1/1	3/19
Molecular Biologist	N/A	1/2
Mycologist	0/1	0/1
Parasitologist	0/0	0/4
Pathologist	0/2	1/10
Pharmacist	1/5	4/24
Physiologist	0/1	1/3
Plant Pathologist	0/1	0/43
Scientist (general)	0/12	0/4
Toxicologist	0/2	1/4
Veterinarian	N/A	1/8
Virologist	0/1	0/5
Zoologist	0/1	0/3

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