《关于禁止发展、生产和储存细菌(生物)及毒素武器和销毁此种武器的公约》缔约国第七次审查会议

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按照第十二条的规定审查《公约》的实施情况

在生物科学家中开展教育和提高认识的可能方法[1]

由澳大利亚、加拿大、日本、新西兰、大韩民国和瑞士(代表“JACKSNNZ”[2])、肯尼亚、巴基斯坦、瑞典、乌克兰、大不列颠及北爱尔兰联合王国和美利坚合众国提交

一. 导言

1. 关于禁止发展、生产和储存细菌(生物)及毒素武器和销毁此种武器的公约》第四条要求各缔约国“采取任何必要措施以便在该国领土境内，在属其管辖或受其控制的任何地方，禁止并防止发展、生产、储存、取得或保有本公约第一条所规定的物剂、毒素、武器、设备和运载工具。”该条可视为第一和第三条规定的一般义务与缔约国本国的规定之间的纽带，从而为本国的执行工作措施奠定了基础(另见工作文件 BWC/CONF.VI/WP.3 等)。此外，第四条措辞宽泛，暗示除必要的法律措施外，各国还需其他措施才能有效实施《公约》。

2. 第一次闭会期间(2003-2005 年)召开的专家会议提供了一个理想的平台，以审议各国的重要执行措施，如监督、发展合适的工作场所安全文化(包括行为守则)、在生物科学家中开展教育和提高认识。会议讨论突出了一点，即各国都认识到生物科学家在有效防止滥用生物技术和生物制剂的工作中起着关键性作用。这种认识在第六次审查会议的最后文件(BWC/CONF.VI/6)中有所体现，此次会议呼吁缔约国确保微生物剂或其他生物剂或毒素的安全和安保(第二部分，第 11 段

[1] 在本文件中，‘生命科学家’是指从事关于活生物体及其产品的科学研究的个人，并包括受过非生命科学领域(如工程、计算机科学和物理)培训而从事生命科学工作的个人以及在正式机构体制外从事生命科学工作的个人(如业余生物学家)。

[2] “JACKSNNZ”是一个非正式集团，成员包括日本、澳大利亚、加拿大、大韩民国、瑞士、挪威和新西兰。

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第(三)项)，同时敦促缔约各国“推进制定获准接触生物剂和毒素人员培训和教育方案，以提高其对有关风险及《公约》规定的缔约国义务的认识”(第二部分，第 14 段)。这种培训和教育至关重要，因为它们可以创造条件，使缔约国能够按照《生物武器公约》第十条的要求，“为预防疾病或为其他和平目的而发展和应用细菌学(生物学)领域内的科学发现”。

3. 此外，第六次审查会议鼓励缔约国“采取必要措施，提高有关专业人员对报告在其领土内或其管辖或控制下进行的、可能构成违反《公约》或相关国家刑法的活动的必要性的意识”(第二部分，第 15 段)。在这方面，第六次审查会议最后文件还强调，各国的此类执行措施对执行联合国安全理事会第 1540 号决议(2004 年)及消除或防止生物武器扩散十分重要。

4. 第二次闭会期间(2007-2010 年)进一步审议了生物安全和生物安保问题[3]，还审议了监督、教育和提高认识的问题，探讨了有哪些可能的方法让生命科学家参与这些问题。讨论中强调，通过参与生物安全和生物安保问题的讨论，生命科学家能够提高自身对潜在风险和《公约》义务的认识。此外，讨论还强调生命科学家作为学术界、产业界及政府机构中生命科学领域的从业人员可以为推动生物安全和生物安保做出哪些贡献。在这方面，日本代表“JACKSNNZ”编写的工作文件(BWC/MSP/2008/MX/WP.21)强调了防止滥用生物技术的三个有效手段：监督/管理和控制、教育和提高认识、科学家行为守则。文件还强调：让国内利益攸关方参与监督框架制定实施的各阶段十分重要；需确保此类措施不会造成不必要的负担，且不会对容许的生物活动带来不应有的限制。随后，在 2008 年缔约国会议上，各缔约国确认，生物科学工作者的认识十分重要；同时指出，正式要求开展一些教育活动可有助于提高认识和执行《公约》，缔约国还就教育和提高认识方案的价值取得一致意见(BWC/MSP/2008/5,第 25、26 和 27 段)。

5. 基于这些考虑及以上强调的共识，一些缔约国各自在本国开展了工作。在澳大利亚、日本、瑞典和瑞士，布拉德福特大学(英国)和埃克塞特大学(英国)的专家也参与开展了一些活动，这些活动的总体目标是调动科研人员讨论并思考生命科学、安全问题和其研究的运用可能产生破坏作用的问题。在由澳大利亚、日本和瑞士(代表 JACKSNNZ)以及瑞典向第七次审查会议提交的非正式文件(BWC/CONF.VII/PC/ INF.4)中介绍了首批案例，重点介绍了上述缔约国的经验和主要结论。加拿大、肯尼亚、巴基斯坦、大韩民国、乌克兰和大不列颠及北爱尔兰联合王国及美利坚合众国则在国家层面上开展了一些努力，有些是与民间社会合作开展，同样取得了大量的经验和重要发现。在国家和国际层面上，一些

[3] 在本文件中，生物安全和生物安保两个术语采用卫生组织《实验室生物安全准则》(2006 年)中的定义：“实验室安全指的是为防止无意中遭受病原体和毒素侵害或其意外释放而实施的封闭原则、技术和做法”，“实验室安保是指实验室内的重要生物材料[…]的保护、管制和问责制，以便防止未经许可对其接触、损失、盗窃、误用、转用或故意释放”。

科学组织也做出努力，鼓励加强教育和提高意识活动。一些非正式证据表明，在专门人士和组织的努力下，这些活动的数量在增加。[4]

6. 本文件以收集的国家经验为基础，旨在重点介绍关于对生命科学家开展教育和提高认识的可能方法的重要发现和初步结论(第二节)。根据提交本工作文件的缔约国的建议，这些对于缔约国在第七次审查会议上可能进行的审议和决定具有根本性意义(第三节)。国家经验汇编见本工作文件的附件。

二. 缔约国经验案例：重要发现和初步结论

7. 通过分析缔约国的各类经验(见附件)，似乎揭示出一些重要发现：

(a) 大学或研究机构中的现有课程和/或培训确实经常提到关于(生物)安全的内容，但很少包括有关(生物)安保的任何内容。

(b) 虽然在学生和生命科学从业者中间对有关(生命)安全的内容具有高度意识这一点一再得到确认，但总体而言，关于生物科学可能被恶意滥用的风险意识很有限。

(c) 生命科学家不会经常有意识地考虑到自己的具体工作会涉及到生物武器项目或被滥用而对人、畜、植物造成损害或导致重要资源无法利用。但是，当他们了解到自己的研究工作可能涉及到安保问题时，显然大多数科学家都认为提高认识活动很重要，并赞同研究人员要分担责任的观点。

(d) 生命科学家们对于《生物武器公约》等国际体制或相关国家立法的意识往往最多也只处于有限的水平。

(e) 各种国家经验也显示国家当局在应对这些挑战的办法方面存在相似之处，案例中提到：

(一) 采取与教育机构合作在科学界开展全国统一宣传的办法；

(二) 建立相关网络，设联络点；

(三) 同时推出针对研究人员的准则、教育模块和类似工具。

但是，这些措施如果不能长期坚持，效果也会很有限。

[4] 例如，见以下材料中提供的信息： National Research Council, 2011, *Challenges and Opportunities for Education about Dual Use Issues in the Life Sciences,* Washington, DC： National Academies Press, available at http://www.nap.edu/catalog.php? record_id=12958, and Judi Sture and Masamichi Minehata, 2010, *JSPS-ESRC Seminar Series, Dual-Use Education for Life Scientists： Mapping the Current Global Landscape and Developments： Seminar Report,* Bradford, UK：Bradford Disarmament Research Centre, available at http://www.brad.ac.uk/bioethics/monographs/。

8. 关于生物道德和生物安保风险意识问题，持续的学术研究似乎证明，许多国家的众多生命科学机构整体认识水平有限。[5] 分析表明，这种认识不足的原因包括：大学中涵盖《生物武器公约》相关内容及相关(生物)安保问题的课程不足，要么是课程制定者认为该问题不重要，或称课程过满难以加入生物安保教材，要么就是缺乏专业知识、难以获得相关教学材料。

9. 各缔约国的经验以及关于生物道德认识的学术研究的辅助结论确认，《生物武器公约》缔约国需采取进一步举措，在生命科学家中开展教育和提高认识活动，以此为预防性的国家执行措施，加强《公约》执行工作。因此，提交本工作文件的缔约国尤其鼓励在下次审查会议之前及会议期间审议以下方面。

三. 缔约国在第七次审查会议上可审议的问题

10. 为了根据《公约》第四条的精神，在生命科学家中开展教育和提高认识活动，作为预防性措施加强《公约》的执行工作，缔约国可审议以下问题：

(a) 对于生命科学家常常缺少对生物安保及《公约》义务相关内容的认识的问题，需要更迫切地从战略上全面加以解决；

(b) 这些工作可作为各个缔约国在国家层面上开展教育和提高认识活动并在国际层面上开展合作的基础；

(c) 这些活动将有助于持续引入关于《公约》的具体教育模块和活动，也可作为持续开展的提高认识方案的一部分；

(d) 这些提高认识活动以及闭会期间关于双重用途[6]、生物安全和生物安保教育方案的利益攸关方应包括相关政府部门、产业界、研究机构、学术界、供资机构、学术期刊编辑和相关科学社团等，它们应参与制定及实施监督框架的各个阶段。这些活动的形式和性质显然应由各缔约国按本国的规定和法规制订并实施，作为本国已有宣传活动的补充(即不搞‘一刀切’)；

(e) 可以较低成本开发并实施有效、(适当的)非强制性提高认识活动，包括采取各种具体措施，如：

[5] 例如，见 Dando, Malcolm, 2010, *Teaching Biosecurity,* Bulletin of the Atomic Scientists, available：http://www.thebulletin.org/web-edition/columnists/malcolm-dando/teaching-biosecurity [viewed 6 January 2011]， Rappert, Brian (editor)， 2010, *Education and Ethics in the Life Sciences* Canberra： Australian National University E Press, available： http://epress.anu.edu.au/education_ethics.html and： Whitby, Simon and Malcolm Dando, 2010, *Effective implementation of the BWC： The key role of awareness raising and education,* Review Conference Paper No. 26, University of Bradford, available：http://www.brad.ac.uk/acad/sBWC/briefing/RCP_26.pdf [viewed 6 January 2011]。

[6] 在本文件中，“双重用途”指用于和平目的的生物材料、知识、设施和技术有可能被滥用于交战目的。具有“双重用途”这一特点本身并不自动意味着滥用；在具体提到“双重用途教育”时主要是指一些教育模块，它们强调利用双重用途特点恶意滥用出于良好用意的研究成果的可能性。

(一) 解释生物科学和生物技术可能被滥用导致的风险；

(二) 说明利用生物科学者应承担的有关《公约》的道德和伦理义务；

(三) 提供指导，说明哪些类别活动可能违背《公约》宗旨和相关国内法律法规及国际法；

(四) 支助可用的教材、师资培训方案、研讨会、讲习班、出版物、视听材料；

(五) 面向首席科学家和负责监督研究工作或评估项目及出版物的资深科学家以及未来一代科学家，以培养和倡导一种负责任的文化；

(六) 结合国际、区域和国内现有的工作开展活动；

(f) 关于双重用途、生物安全和生物安保的教育活动及相关规定不应造成不必要的负担，也不应给容许的生物活动造成不应有的限制。科学家和所有其他利益攸关方可通过生物安保及生物道德教育培养和倡导一种责任和安全的文化，从而防止生物科学可能被滥用的行为。

(g) 各缔约国应比过去更全面地通报其在双重用途、生物安全和生物安保教育方面开展的提高认识的活动。(人们承认，缔约国可在《建立信任措施》之“其他措施”中的措施 E—宣布立法、规章和其他措施中报告这些活动，将其作为本国为确保有效执行《生物武器公约》而采取的措施。这些信息通过《建立信任措施》反馈等方式公布后，在开展双重用途、生物安全和生物安保提高认识和教育活动方面程度较为先进的缔约国就能够确定适当的合作，并向这方面较为落后的国家提出开展这种合作。

(h) 利用第七和第八次审查会议之间的闭会期间，缔约国之间、缔约国与国际组织及非政府组织之间应进一步开展交流并推进这一议题。作为这项工作的一部分，缔约国可制订和共享提高认识活动的目标和结果，并应鼓励缔约国为相关教育和宣传活动指定国家联络点。

11. 提交本工作文件的缔约国鼓励《生物武器公约》全体缔约国一致同意，将上述建议列入第七次审查会议最后声明中的“决定和建议”一节。

Annex

[ENGLISH ONLY]

Examples of experiences by States Parties

Australia

1. Australia commenced its outreach and awareness-raising on BWC-related issues in 1990, with a set of Guidelines developed by the Department of Foreign Affairs and Trade, to raise the awareness of industry and researchers about the risk of inadvertent involvement in the biological weapons programs of other countries. These Guidelines have been circulated to biological industry, universities, relevant professional associations and government agencies.

2. At the BWC Meeting of Experts in 2005, Australia reported that amongst its scientific community, there was a low level of awareness of the risk of misuse of the biological sciences to assist in the development of biological weapons[7]. One problem identified is that many scientists working in the 'dual-use' areas simply do not consider the possibility that their work could inadvertently assist in a biological weapons program.

3. To address this challenge, the Guidelines have been complemented in recent years by more prioritised outreach and awareness-raising activities by Australian government agencies to target those parts of the scientific community which are most directly affected by the BWC and biosecurity-related legislation, as discussed below.

4. An education and awareness-raising program has been developed by Australia's Department of Health and Ageing to promote recognition and understanding of the security sensitive biological agents (SSBAs) regulatory scheme established in November 2008, and to ensure that the regulated community is able to comply with their obligations. Briefings on the BWC and associated legislation, including the Crimes (Biological Weapons) Act 1976, are included in the SSBA outreach activities.

5. Australia's Defence Export Control Office (DECO)， as the agency responsible for the Customs Act 1901 and Weapons of Mass Destruction (Prevention of Proliferation) Act 1995 and their associated regulations, undertakes regular outreach seminars to provide information on the obligations related to exports of dual-use biological materials, equipment and technology. DECO also provides a range of publications which provide information on specific areas of export controls.

6. In 2006, Australia's National Framework for the Development of Ethical Principles in Gene Technology ('National Framework') was published to provide a national reference point for ethical considerations relevant to environmental and health issues in gene technology, GMOs and genetically modified products. Many of these considerations are relevant to the prohibitions outlined by the BWC, or strongly complement the objectives of the Convention and/or the promotion of sound biosecurity/biosafety practices. The National Framework can play a role in helping gene technology practitioners determine in a straightforward and non-prescriptive manner how to best carry out their activities without the risk of contravening the provisions of the BWC.

[7] Raising Awareness: Approaches and Opportunities for Outreach, working paper submitted by Australia, BWC/MSP/2005/MX/WP.29.

7. In 2009, members of Australia's National Centre for Biosecurity (a collaboration of the University of Sydney and the Australian National University) conducted a pilot series of four interactive seminars for Australian scientists and students on the potential security risks of laboratory research on pathogens micro-organisms, including the relevance of the BWC. This series of seminars, funded by the US-based Alfred P. Sloan Foundation, was based on the program developed in the United Kingdom by University of Bradford and University of Exeter.

8. In recognition of the high levels of cooperation necessary between Government officials and the relevant scientific communities to achieve progress in awareness-raising activities, there has been engagement by Government officials with a number of Australian universities, as well as the Australian Academy of Science, the National Centre for Biosecurity and relevant scientific societies, to develop a program to enable more effective outreach activities.

Canada

9. As Canada raised in its opening statement at the 2008 Meeting of States Parties, oversight, education, and awareness-raising among life scientists is essential for full implementation of the BTWC. As part of our ongoing commitments, Canada will be undertaking the following activity to educate and promote BTWC awareness and compliance in 2012.

10. The Public Health Agency of Canada (PHAC) and the University of Bradford, United Kingdom (UoB) are collaborating in the development and delivery of a curriculum for a university-level accredited pilot course on Applied Dual-use Biosecurity； Biosafety and Bioethics to be in Ottawa in 2012. With the aim of promoting BTWC awareness and compliance in Canada, the objectives of this course are to develop a foundation of the concepts of biosafety and biosecurity in the trainee such that increased awareness in regards to the ethical, legal and social relevance of dual-use biosecurity, as well as the responsible conduct of research can provide a foundation for the development of policies and procedures to enhance responsibility and prevent the malicious or misuse of pathogens and toxins.

11. This course will also assist in compliance promotion, and therefore, compliance with those undertaking activities with human pathogens and toxins, within the sphere of oversight of the Human Pathogens and Toxins Act (HPTA)， one of Canada's primary tools in BTWC compliance. This course is intended for those with low-level knowledge of biosafety, but a high level of responsibility with respect to compliance with the HPTA.

12. Dependent on a successful delivery of the first course, future plans include expansion into a 60 UK credit Post-graduate Certificate for delivery across Canada, and potentially the transition to a full MA programme (180 UK credits) accessible by the global community.

Japan

13. Japan expressed in its working paper submitted to the Meeting of Experts in 2008 (BWC/MSP/2008/MX/WP.21) that education and awareness-raising among scientists are basic means for preventing the misuse of biotechnology, while recognizing the importance to respect the autonomous responsibility of scientists without obstructing scientific development. In the same working paper, though, Japan also acknowledged that 'the

development of educational programmes at the governmental level has not seen great progress'.

14. In order to mitigate such deficiencies, the National Defense Medical College (NDMC) in Japan and the University of Bradford in the UK conducted collaborative research to analyse the current state of biosecurity education in Japan[8]. The research found that there was a lack of educational topics on biosecurity despite a certain level of presence on dual-use references, mainly due to an absence of space in the existing curricula, an absence of time and resources to develop new curricula, an absence of expertise as well as doubt about the need for biosecurity education. Parallel to this survey, the NDMC and the University of Bradford also jointly developed an online learning module in applied dual-use biosecurity education.

15. In addition to the efforts by the NDMC, other universities and institutions in Japan are also taking various approaches to tackle bio-threats. These approaches include a course on bio-ethics and the social responsibility of scientists conducted by Waseda University, a project on anti-bioterrorism conducted by Keio University, and a table-top exercise on response measures in the event of bioterrorism by Jikei Medical University. The University of Tokyo has also launched a Global Health Leadership Program aimed at cultivating human resources capable of addressing global health challenges from cross-sectional perspectives including life ethics. In August 2011, the Science Council of Japan hosted a symposium on "Emerging risks posed by the development of life sciences and the role of scientists" where presentation were made by the leading life scientists in Japan followed by discussions including on the necessity of a code of conduct.

16. Encouraged by such individual activities, a wide range of measures are required for preventing the misuse of biotechnology. It is, therefore, important to share best practices among scientists and institutions at national and international levels and to examine how to apply and implement such practices appropriately.

Kenya

17. In Kenyan universities or research facilities there are already references to aspects related to biosafety. However, these aspects rarely address issues related to biosecurity or dual-use issues. The level of awareness of the risk of misuse of bioscience research is very limited and in instances where the term Biosecurity is used, it is usually in reference to other issues, e.g. Food security or sustainability. Consequently, in the recently drafted Biosecurity policy, emphasis was put on the need to create awareness among the life science community on Biosecurity and also develop education programmes on the same.

18. University of Nairobi and the University of Bradford in the UK are in the early stages of planning a collaborative research to analyse the current state of biosecurity education in Kenya and the East African Region. The research results will be used to guide development of subsequent Dual-use biosecurity education programmes and curricula

19. University of Nairobi, in collaboration with the University of Bradford plans to conduct an online Biosecurity Education course for the life science community in East Africa. In the planned programme, experts will be invited to Nairobi where an intensive one week dual-use biosecurity education course will be delivered online by the University of Bradford.

[8] Masamichi Minehata and Nariyoshi Shinomiya, 'Chapter 5: Japan: Obstacles, Lessons and Future' in Brian Rappert ed., *Education and Ethics in the Life Sciences: Strengthening the Prohibition of Biological Weapons*, The ANU E Press, 2010.

20. The University of Nairobi, Centre of Biotechnology and Bioinformatics (CEBIB), is reviewing its curricular to introduce Dual-Use Biosecurity Education in its Masters Biotechnology course.

Pakistan

A. Introduction

21. Regarding legislations that may be relevant for biosecurity (as well as to comply with requests of international commitments such as the BTWC or the UNSCR 1540), Pakistan enforces a system of both specific regulations and adapted existing laws, like the 2000 CWC Implementation Ordinance; the 2004 Export Control on Goods, Technologies, Material and Equipment Related to Nuclear and Biological Weapons and their Delivery; the 2005 Pakistan Biosafety Rules; the 1976 Drugs Act; the 1997 Environmental Protection Act ; and the 1997 Anti-terrorism Act.[9]

22. Activities done by Pakistan for implementation of Biosafety, Biosecurity and Dual use education:

(a) Pakistan has developed biosafety guidelines in May 2005 and implements it in October 2005.[10]

(b) Pakistan has developed National Biosafety Centre under the umbrella of ministry of environment that is fully functional.

(c) The National Commission on Biotechnology was established in November 2001 in Pakistan. It sets and implements the Biotechnology Pakistan National Policy and Action Plan 2003.[11]

(d) Recognizing the importance of Life Sciences the Higher Education Commission established the Core Group in Life Sciences (NCGLS) with six different disciplines. These include Botany, Genetics, Microbiology, Biochemistry/Molecular Biology, Zoology, Bioinformatics. Their main objectives are promotion of teaching and research in Life Sciences in Pakistan. Identification of areas in Life Sciences which have a direct and major impact on the economy and well-being of the country. Preparation of major projects in these areas. Human resource development in Life Sciences in Pakistan. By this programme more than 3500 teachers have been trained in various advanced biological techniques through 55 national and International workshops and conferences. The National Core Group in Life Sciences (NCGLS) has organized a first two day National conference of life scientists at Bhauddin Zakariya University, Multan on 13-14 November, 2006 in which almost 150 senior and young scientists from different universities of Pakistan have participated.[12] Four resource Centers have been established at various universities. This programme has also developed Life Sciences directory having complete contact information of all life scientists in Pakistan has been published and distributed

[9] Nasim N, (2011), Biosafety Education in Pakistan, Presentation to Side Meeting to the Preparatory Committee of the BTWC, Geneva April 13-15, 2011

[10] http://www.environment.gov.pk/act-rules/Biosftyrules.pdf

[11] http://www.blog.paksc.org/2010/11/promoting-bio-technology-in-pakistan/

[12] http://ncgls.hec.gov.pk/index/Workshop_Reports/National_conf_BZU.htm

among the scientists.[13] An important step is Joining of NCGLS with International Council for the Life Science (ICLS) as Associate Member.[14]

(e) The Pakistan Biological Safety Association (PBSA) has been launched under the auspices of the National Core Group in Life Sciences (NCGLS) of the Higher Education Commission in collaboration with OIC Committee on Scientific and Technological Cooperation (COMSTECH).[15]

(f) A Code of conduct for life scientist has been developed by the National Institute of Biotechnology & Genetic Engineering in 2009. International Biosafety working group recognized Pakistan Biological Safety Association.

(g) First International Seminar on Laboratory Biosafety Issues 21st March 2009.

(h) National Training Seminar on Bio-safety and Bio-security Initiatives June 18 to 19, 2007, Islamabad.

(i) The Ministry of Foreign Affairs established an inter-agency working group to develop a code of ethics and biosafety law Dr. Anwar Nasim elected convener of the Task Force 9th June, 2009.

(j) Visit of 3-Member Delegation of US Bio-security Engagement Programme (BEP) 22nd June 2009 at Aga Khan University

(k) Two Seminars on Laboratory Biosafety March 21, 2009 & December 05, 2009 at Agha Khan University,

(l) Biosafety and Biosecurity International Conference Healthier and more secure communities in MENA region 2009 Casablanca, MOROCCO April 2-3, 2009

(m) Pak-USA BEP Workshop-1 Cairo 3-6 May, 2010 12 Project proposals submitted 27 participants from Pakistan

(n) Pak-USA BEP Workshop-2 Istanbul, Turkey 20-23 September, 2010. Three Projects approved for funding.Dual-use project Quaid-e-Azam University Islamabad

B. Biosecurity and biosafety education at universities

23. All most all the universities that have biological science department started the course for various degree programs. Quaid-e-Azam University offers courses with Course code： Mic-441 Principles of Biosafety Course code： Mic-575 Biological Safety and Risk Management Course code： Mic-442 Risk Management. Agha Khan, Shifa international, Punjab Universities and Riphah International universities teach the subject of Bioethics in their bio departments.

(a) Course Contents offered at NIBGE Introduction to Biosafety；

(b) Introduction of laboratory safety, bio-safety procedures, use and disposal of bio-hazardous materials, regulator issues and established guidelines for safe practices.

A specialized course as a core subject is being offered at Quaid-e-Azam University on Biosafety, Biosecurity and Dual Use Education for M. Phil and Ph.D. students. Young

[13] http://ncgls.hec.gov.pk/

[14] http://app.hec.gov.pk/Press_Releases/2006/Octuber/Octuber%2004th.htm

[15] http://app.hec.gov.pk/Press_Releases/2008/August/Aug_05.htm

researchers from various disciplines like Biochemistry, Biotechnology, Microbiology, Botany, Zoology are attending the course as a pre-requisite of their degree.

24. In order to regulate the ethical issues of research national level committees has been established.

(a) Pakistan Medical Research Council's National Bioethics Committee (NBC), which is an advisory body which deals with all aspects of bioethics in the health sector.

(i) Research Ethics Committee

(ii) Medical Ethics Committee

(b) From June 2010, ICLS chapter regarding Pakistan has been established and Dr. Anwar Nasim advisor COMSTECH is its head. At Islamabad, Pakistan ICLS and COMSTECH jointly establish a group 'Responsible Conduct of Science'. It has organized the two conferences. ICLS sponsored a first conference on "Responsible Conduct of Science", which was hosted by the Organization of Islamic Conference's Standing Committee on Scientific and Technological Cooperation (COMSTECH) in partnership with the Pakistan Academy of Science on June 9-10, 2010. Prof. Zabta K. Shinwari, Terence Taylor and Professor Khalid Temsamani were among speakers and second conference of this held at F C University Lahore on Jan 31 to Feb 01 2011 for students' professors and media people.[16]

C. Education and networking projects on dual use and biosecurity

25. A research group for the awareness of Biosafety Biosecurity and dual use of research among university graduate has been established and it start working for implementation of Dual use education in the country. Giulio Mancini, (Italy), James Revill (University of Bradford), Anwar Nasim, and Zabta Khan Shinwari (Pakistan) are group members. This group has organized the first international workshop on Synthetic Biology & its Dual use at COMSTECH Islamabad from February 3 to 5 2011.This workshop was very successful. Total 30 participants from OIC region was selected for the workshop.[17]

26. A survey was conducted by QAU & LNCV on general perception about Biosafety, Biosecurity, Bioethics and Dual Use of research among university graduate. The result showed that Pakistani scholars had sound knowledge about biosafety as compared to other developing nations.

27. On May 24, 2011, a Workshop on Bioethics, Biosafety, Biosecurity and Dual Use Education was organized at the Quaid-i-Azam University (QAU) of Islamabad by the Department of Biotechnology and Bioinformatics of the same university and by the Landau Network-Centro Volta (LNCV). The Workshop had two main objectives: firstly, to inform and raise the awareness on bioethics, biosafety, biosecurity and dual use issues in the life sciences and technologies (more generally grouped as various aspects of "biorisk" reduction and management); secondly, to engage the scientific academic community in Pakistan over the promotion and implementation of education on these topics in national universities. The Workshop is indeed inserted in the framework of a joint project that QAU and LNCV have been carrying since October 2010, aimed at strategizing and promoting

[16] http://app.hec.gov.pk/Press_Releases/2006/Octuber/Octuber%2004th.htm

[17] COMSTECH (2011), Workshop on Synthetic Biology and Dual Use, OIC Committee on S&T Cooperation (COMSTECH), Islamabad (http://comstech.org/Synthetic_Biology/tabid/1377/ language/en-US/Default.aspx)

education and awareness raising on biorisk management in Pakistan (with special attention to the "holistic biosecurity" aspects). Furthermore, the organization of the Workshop was collaborated by a number of experts and institutions： the Biosecurity Engagement Program of the US Department of State (also supported of the project)； the Sandia National Laboratories (specialized in laboratory biorisk management) and the QAU Department of Strategic Studies which hosted the event in its premises. The Workshop was attended by over 80 participants who included invited experts and officials, students, and professors from various Pakistani universities. Distinguished guests (and keynote speakers) included HE Vincenzo Prati, Ambassador of Italy in Islamabad； Prof. Dr Masoom Yasinzai, Vice Chancellor of Quaid-i-Azam University； Dr Irfan Shami, Director General Disarmament of the Ministry of Foreign Affairs of Pakistan； Dr Anwar Nasim, Adviser Science of the Standing Committee on Science and Technology of the Organization of Islamic Countries (COMSTECH) and Prof. Zabta K. Shinwari, Chief Organizer of the event.[18]

28. National TB control programme has started an extensive programme for the training of staff from all over the Pakistani peripheral laboratories of NTP regarding Biosafety and Biosecurity. In future their platform in collaboration with QAU can play a key role in capacity building of country scientists for responsible conduct of sciences.

29. Pakistani young scientists attended online course offered by Bradford University on "Dual Use Education".

Republic of Korea

30. The Ministry of Health & Welfare has exerted efforts to strengthen national biosafety and biosecurity supervision through comprehensive legislative acts such as the 2005 amendment of 'Act on the Prevention of Infectious Disease' and the 2008 enactment of 'Act on the Transnational Transportation of Genetically Modified Organisms.' The two legislations serve as a basis for various permission and control measures of highly dangerous pathogens such as Bacillus anthracis and living modified microorganisms containing genes of highly dangerous pathogens that have a high potential of being used in bio-terrorist attacks. The Ministry is also working to establish and strengthen biosafety and biosecurity culture in the domestic biomedicine field.

31. The recent outbreaks of infectious diseases such as AI (Avian Influenza) and PI (Pandemic Influenza) caused by new and mutated pathogens, as well as the growing possibility of bioterrorism have magnified the importance of biosafety and biosecurity. Add to this the increased probability of biomedical laboratory workers being infected by highly dangerous pathogens and living modified microorganisms containing the genes of such pathogens. Against this backdrop, the Republic of Korea has reorganized its legislative systems and amended biosafety guidelines to reinforce biosafety management in biomedical research. Such efforts have been led by the Ministry of Health & Welfare and the Korea Center for Disease Control and Prevention (KCDC). The two organizations are also working to develop and provide education and awareness-raising programs for scientists and workers in the bio-field.

32. To strengthen institutional capacities for biosafety and biosecurity at biomedical research laboratories, the KCDC has worked with Korea Human Resource Development Institute for Health & Welfare (KOHI) to develop an education program for public officers

[18] http://www.molecular-systematics.org/index.php?option=com_ content&view=article&id=30: international-consultative-workshop&catid=4:events&Itemid=25

and researchers working in the field of biomedical science. The program has offered 'Laboratory Biological Safety Course' since 2006, and provides information on laboratory bio-risk management, risk assessment, and biosecurity control management.

33. Heightened international concern regarding the use of modern biotechnology and the increased use of highly dangerous pathogens in biomedical laboratories have led to calls for the establishment of a national and international regulatory framework for biosafety, as well as national oversight and management measures for highly dangerous pathogens. The 'Infectious Disease Control and Prevention Act' was enacted following the comprehensive amendment of 'Act on the Prevention of Infectious Disease' and provides that all institutions working with highly dangerous pathogens should have biosafety-level laboratories. The Act also calls for related facilities to implement legal and administrative national security mandates that encompass the concept of biosecurity.

Sweden

34. In Sweden, no formal survey on awareness of obligations under the BWC or of potential risks related to misuse of biological sciences/biotechnology among life scientists has been carried out to date. Although biosafety aspects are considered in national life science fora, it has become apparent from networking, discussions and informal information gathering that dual-use and biosecurity issues are less well cared for.

35. As a result of contacts generated over time at BWC- and related meetings a series of awareness-raising seminars were arranged and conducted by experts of the University of Bradford (UK) and the University of Exeter (UK) in 2009, at three academic institutions in Sweden. In conjunction with these seminars, an informal network was established with the aim of developing a national education approach, covering biosecurity and dual-use aspects within life science, adapted to local education and curriculum at each academic institution. The Swedish Ministry for Foreign Affairs and the Swedish Ministry of Education took positions in the margins of this initiative.

36. The informal network has agreed to endorse the establishment of biosafety/biosecurity committees at all academic institutions that undertake education and research in relevant fields, as one area of specific importance and with great significance for future work also in dual-use education. These committees were suggested to have comprehensive responsibility for biosafety and biosecurity and, also, an advisory role in matters involving genetic modifications and education related to biosafety and biosecurity. Furthermore, the Centre for Research Ethics and Bioethics at Uppsala University was identified as a crucial element in any initiative to develop national bioethics, dual-use and biosecurity education. Existing educational programmes, which to some extent have started to include these topics in for instance biotechnology/engineering programs and biomedicine master programs, were identified as useful starting points for the formation of national networks with great potential for future implementation of dual-use education in Sweden.

37. Regarding awareness raising and dual-use education it has become evident that, from a European perspective, there is a convergence of BWC- and EU CBRN Action Plan[19]- related national commitments. The initiated bottom-up approach in this area is promising, but will require dedicated durable top-down support including provision of financial resources in order to establish a sustainable framework for facilitating the establishment of national biosecurity education in conjunction with related international efforts.

[19] EU CBRN Action Plan: http://europa.eu/legislation_summaries/justice_freedom_ security/fight_ against_terrorism/jl0030_en.htm [viewed 5 April 2011].

Switzerland

38. In Switzerland, initial surveys on awareness of potential security risks among life scientists revealed, in the vast majority of cases, a well-developed sense for aspects related to biosafety, but a considerably limited knowledge of aspects related to biosecurity. Moreover, most life scientists seem to be unaware of the BWC's obligations as well as the obligations' relevance to their work. In the same context, existing national legislation relevant for the domain of natural scientific research in general or biological research in particular seemed to be unknown to many.

39. Based on these findings, the Swiss government started to sensitize researchers with a brochure in 2008 ("Biology for Peace") and accompanied a series of awareness-raising seminars conducted by experts of the University of Bradford (UK) as well as the University of Exeter (UK) at various academic institutions in Switzerland in 2009. Further awareness-raising sessions organized and conducted by the Swiss government itself took place in 2010. The analysis of reactions by the attending audience revealed:

(a) that life scientists consider awareness-raising on aspects related to security as important (some even spoke of an "eye-opener"),

(b) that, due to the general academic autonomy and freedom of research and teaching in Switzerland, a governmental imposition of content within the curriculum would be met with scepticism,

(c) that particularly legally binding top-down approaches would therefore be inappropriate,

(d) that it is important to consider existing patterns of cooperation among researchers, institutions, and authorities, and that these existing patterns provide ideal platforms for an outreach, and

(e) that awareness-raising activities in the regular study and work environment of life scientists similarly provide an ideal base.

40. These lessons learned provide the base for possible ways forward, such as the inclusion of educational modules on biosecurity for biosafety officers in research facilities, or the encouragement to introduce educational modules on biosecurity in academic courses for future life scientists.

Ukraine

41. In 2004 Commission on Biosafety and Biosecurity (CBB) at the National Security and Defence Council of Ukraine (NSDCU) was established by the Decree of the President of Ukraine. CBB serves as advisory body to NSDCU headed by the President of Ukraine and it deals, inter alia, with all issues of national obligations relevant to the BWC.

42. In the frame of the "Biological Weapons Proliferation Prevention Program" the Ukrainian Ministry of Health and US Department of Defence have signed in 2005 an Implementation Agreement on cooperation in Biological Threat Reduction. Successful implementation of this Agreement？ Including provisions on biological research, biological threat detection and response, will provide fundamentals for Biosecurity (physical safeguard of pathogens' collections) and for prevention and eradication of infectious diseases in Ukraine.

43. Since BWC States Parties Meeting in 2005 Ukrainian delegation permanently stresses on the necessity to raise awareness and education amongst life scientists and

professionals in the field of Biotechnology and Pharmaceutical industry on dual use issues and on Biosafety and Biosecurity. Ukraine also reported that amongst its scientific community, there was a low level of awareness of the risk of misuse of the biological sciences' results.

44. National Academy of Sciences of Ukraine (NASU) and CBB in cooperation with Bradford and Exeter Universities (UK) have organised an interactive Seminar in 2007 on Biosafety education including the relevance of the BWC for Ukrainian scientists and students. NASU and CBB, under the patronage of Science and Technology Centre of Ukraine, have also conducted an International Conference on Biosafety and on national implementation of BWC in 2009. Another International Conference on Biosafety and on national implementation of BWC under the patronage of BWC Implementation Support Unit in Geneva is planned to be organised in Ukraine in spring 2012. The detailed list of activity of different interested authorities of Ukraine in this field, inter alia, is traditionally reported through providing annual declarations on Confidence Building Measures in the frame of BWC.

45. In February 2009 NSDCU held a special meeting on Biosafety and Biosecurity when the whole range of Biosafety problems was addressed. State Programme on Biosafety and Biosecurity is under final approval now by the Ukrainian Government now. This State Programme includes issues of Biosafety and Biosecurity education and awareness rising.

46. National Academy of Sciences of Ukraine (NASU)， which is the main scientific Institution in Ukraine responsible, inter alia, for strategic planning and expertise of fundamental research in the country, has adopted in 2009 National Code of Ethics for Scientists (including Bioethics for Life Scientists) in. This National Code has been circulated to government agencies, universities, research institutes, biological and pharmaceutical industry, relevant professional associations etc. National Committee on Bioethics was established in Ukraine and this Committee organizes National Congresses (with wide international participation) on Bioethics each two years.

47. Ukrainian Biochemical Society (UBS)， which unites scholars in the field of Biochemistry, Molecular and Cell Biology, has organised special sessions and/or lectures on Biosafety and Biosecurity during IX (2006) and X (2010) Ukrainian Biochemical Congresses, VII (2009) and VIII (2011) International Parnas Conferences on Biochemistry and Molecular Biology, as well as during III (2010) Ukrainian-German Symposium on Nanotechnologies. UBS also launched an initiative to create special Committee dedicated to Biosafety education at the Federation of European Biochemical Societies.

48. Ukraine's State Export Control Administration (USECA) undertakes regular outreach seminars to provide information on the obligations related to exports of dual-use biological and chemical materials, equipment and technology. UECA takes part in meetings of states parties to the Australia Group.

49. NASU in cooperation with the Canadian Global Partnership Program and the UK University of Bradford is conducting a collaborative research survey now (2011-2012) on the current state of Biosecurity education, of BWC awareness and of dual use issues in Ukrainian Universities and Medical Schools. A Conference and series of seminars are envisaged discussing the results of the survey, and the brochure to be published as recommendations to the education on Biosafety and Biosecurity in Ukraine.

United Kingdom of Great Britain and Northern Ireland

50. Since 2003 the UK has held five Biological & Toxin Weapons Convention-related seminars for academics, research councils, professional and trade organisations, and the

pharmaceutical and biotechnology industries. These seminars assisted the UK's preparations for the intersessional meetings on codes of conduct issues by ensuring that we had, and continue to have, a clear sense of the views of relevant stakeholders as well as their advice. Our most recent event took place in March 2008 and was devoted primarily to oversight, education and awareness-raising. While previous seminars largely focussed on the theory and general principles, the March 2008 seminar concentrated on the practicalities such as:

(a) What are the emerging lessons from work on elaborating codes of conduct and practice?

(b) What are the problems that have been encountered during the promulgation and implementation of codes of conduct? What are the solutions?

(c) How can we develop effective and practical oversight mechanisms for research?

(d) How can we develop educational programmes? (There have been many statements calling for such programmes, but specifics on what that education should cover are often absent).

51. At the 2008 Meeting of Experts we also presented a paper on examples of UK approaches to the oversight of emerging technologies, focussing on nanotechnologies and synthetic biology, which had been included in the UK contribution on scientific and technological developments to the Sixth Review Conference. This suggested that these approaches might be relevant for other States Parties as they grapple with the complex issues that are associated with dual-use technology.

52. We would note that there are still considerable difficulties in convincing some members of the academic community that oversight and awareness in the context of the Biological and Toxin Weapons Convention (BTWC) and Chemical Weapons Convention (CWC) are issues deserving attention and action. We had, for instance, developed plans, in collaboration with two universities, for a series of awareness raising seminars in 2009 at various UK universities. These would have addressed CWC issues such as the problems posed by the governance of dual-use technology and codes of conduct, oversight, awareness raising and education, but it was not possible to proceed because of a lack of interest on the part of universities.

53. A more recent initiative in the chemical context however comes from the UK's National Counter Terrorism Security Office. This is an awareness-raising project aimed at universities known as REVISE (REducing Vulnerability In the Scientific Environment) that seeks to inform academics and laboratory personnel about the potential dual use of everyday lab-based resources and the terrorist aspiration to acquire them without attracting attention. It encourages those responsible for laboratory security to introduce a culture change within the laboratory environment which in turn develops baseline levels of access control, challenge culture and stock control.

54. We have also taken opportunities where they arise to address awareness raising with the academic and industrial communities – for instance presentations at the annual Institute of Safety in Technology and Research's Biosafety Section's autumn symposium in 2008 and at other conferences addressing relevant biological science issues, and at seminars organised by the chemical industry.

55. Within the UK, the University of Bradford has devoted considerable efforts to developing educational material to support awareness-raising and education. The University's Education Module Resource (EMR) offers content that includes history and national implementation of the Biological and Toxin Weapons Convention, dual-use issues

in the contemporary life sciences, and responsible conduct in scientific research. The EMR is freely available online and the content can be tailored in order to fit it into different educational contexts. It is currently available in English, Japanese, Russian, French and Romanian/Moldovan, and will shortly be available in Spanish, Urdu, Polish, Portuguese, Arabic and other languages. In order to facilitate development of best practice so that biosecurity education can be assimilated and implemented in different academic contexts in different regions, the University of Bradford has tested the EMR at universities in Italy, Japan, Portugal, Spain, Sweden, the Netherlands and the UK.

56. The UK Global Partnership Programme is currently funding Bradford University to develop a National Series for a number of specific countries including in the Former Soviet Union. This series includes the essential values of the current EMR, but the themes, contents and learning outcomes for educational contexts are designed to be country specific. The main objective is to provide user friendly educational resources for use in the immediate introduction of short educational programmes for higher education. By providing detailed teaching guidelines (MS Word) and teaching material (Power Point) for a facilitator (not necessarily an expert of biosecurity issues)， the National Series will help a range of universities and other educational institutes to implement biosecurity education programmes.

57. The University of Bradford is also the only higher education institution globally currently offering university-accredited training in biosecurity, via its Train-the-Trainer programme, which is offered in 6-week and 12-week versions at UK Masters level.[20] This innovative provision uses online teaching technology and allows classes of students to take part in the programme via web connections for twice-weekly classes and seminars. Assessment is via online group presentations and by traditional written assignments. Now in its second year, the programme has attracted praise from students and sponsors and has accredited participants in over 20 countries. Students have included lecturers, science professionals, security personnel, military personnel and government policy-makers. Bradford is also currently planning a full Masters degree in Applied Dual Use Biosecurity to begin in September 2012, which will be provided online using the same technology, teaching and assessment techniques as the Train-the-Trainer programme.

United States of America

A. Overview

58. Managing security risks associated with life-sciences research is a shared responsibility of all those engaged in the life sciences, including the researcher, institution, local community, national government, and international community. Biosafety/Biosecurity education and awareness-raising across the life sciences communities is a critical component of effective risk management and is also a shared responsibility.

59. Over the past 10 years the U.S. government, academic and scientific institutions, industry and non-governmental organizations (NGOs) have worked together to develop, implement and raise awareness about biosecurity and biosecurity education. Diverse groups, including the biosafety community, scientific societies, and pertinent professional and institutional associations have also played critical roles in advancing the dialogue and engaging stakeholders on these issues.

[20] This work is supported by funding from the US Department of State.

60. These education and awareness-raising efforts have sought to expand the robust culture of responsibility that already exists within the life-sciences community[21] to include biosecurity. They have focused on raising awareness about the threat of/potential for misuse and on developing and making available the tools, information and resources needed to empower the life sciences communities to manage security risks associated with life-sciences research.

61. Recent advances in science and technology have expanded the 'individual researchers' beyond the traditional life-sciences communities to include groups such as engineers, informaticists, amateur biologists and researchers conducting work outside traditional institutions. In response the U.S. Government has expanded its educational target audiences to include these communities.

62. Below is a summary of U.S. government and non-government biosafety/biosecurity outreach, training and awareness-raising activities. While not exhaustive, the list is representative of the diverse efforts the United States conducts and resources available.

B. United States Government

The National Institutes of Health (NIH) Office of Biotechnology Activities (OBA): manages a program to address concerns about dual use research and research done for legitimate purpose that could yield information, products or technologies that could be misused by those who would intend to harm national security or public health. http://oba.od.nih.gov/oba/index.html

The National Science Advisory Board for Biosecurity (NSABB): is a Federal advisory committee (managed by NIH OBA) that provides advice to the United States government (USG) regarding biosecurity oversight of dual use research. A key charge to the NSABB is to provide recommendations on the development of programs for outreach, education, and training on dual use research issues for all scientists and laboratory workers at federally funded institutions. http://oba.od.nih.gov/biosecurity/about_nsabb.html

Federal Bureau of Investigation (FBI) Biological Science Outreach: FBI conducts outreach to the scientific community (academia and industry) to raise awareness the biosecurity roles and responsibilities of law enforcement, research institutions, and community stakeholders and build a culture of responsibility and trust between the scientific and security communities. http://academicbiosecurityworkshop.org

U.S. Department of State Biosecurity Engagement Program (BEP): BEP's mission is to engage biological scientists and combat bioterrorism worldwide by providing assistance to improve biosecurity, biosafety, pathogen surveillance, and infectious disease surveillance and response. http://www.bepstate.net/

U.S. Department of Defense (DOD) Cooperative Biological Engagement Program (CBEP): CBEP aims to cooperatively assist partner nation governments to counter the threat of bioterrorism and prevent proliferation of biological weapons technology, pathogens and expertise. CBEP provides education and training to enhance

[21] For example the National Institutes of Health Policy on the responsible conduct of research requires all trainees, fellows, participants, and scholars receiving support through any NIH training, career development award (individual or institutional), research education grant, and dissertation research grant receive instruction in responsible conduct of research: http://grants1.nih.gov/grants/guide/notice-files/NOT-OD-10-019.html

clinical, laboratory and epidemiological safety and security and works to strengthen the partner nation's disease detection, diagnostic and reporting systems.

C. U.S. Government outreach to emerging life sciences communities

FBI Synthetic Biology Program: FBI outreach to public and private synthetic biology companies to raise awareness about the potential security risks inherent to the industry, and work with the companies to develop common standards and best practices for risk management. The international component of this program fosters dialogue between international companies and their respective government/law enforcement agencies to develop processes to mitigate the risk of misuse of harmful DNA sequences.

FBI Amateur (Do-It-Yourself) Biology Initiative: FBI outreach to amateur biologists and biologists that conduct projects outside the traditional research setting to promote a culture of responsibility by raising the level of awareness regarding potential security vulnerabilities and exploitation, developing lines of communication between members of the community and their respective local FBI WMD Coordinator who serves as a resource to assist community members in the development of a safety and security best practices.

D. Training programs

The National Biosafety and Biocontainment Training Program (NBBTP): http://www.nbbtp.org

Emory University -Biosafety Training Course: Biosafety Level 4: This five-day training offers participants the opportunity to learn and practice new skills for BSL4 laboratories. http://www.sph.emory.edu/CPHPR/biosafetytraining/bsl4.html

University of Texas Medical Branch (UTMB) - National Biocontainment Training Center (NBTC) dedicated to preparing the worldwide community of infectious disease scientists to work safely in high-containment research laboratories: http://www.utmb.edu/nbtc/

Select Agent Program Training Workshops: U.S Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA) conduct a yearly training workshop to inform individuals of their legal responsibilities for implementing the Select Agent Regulations. http://www.selectagents.gov/Training.html

Joint Criminal and Epidemiological Investigation Training Program: developed jointly by the FBI and the Centers for Disease Control and Prevention (CDC) to improve efforts to identify and investigate potential overt or covert biological threats. Initially designed as a domestic program, FBI and CDC have expanded this training to international partner countries.

The Field Epidemiology Training Program (FETP) and the Field Epidemiology and Laboratory Training Program (FELTP): applied epidemiology programs offered by CDC to help foreign countries develop, set up, and implement dynamic public health strategies to improve and strengthen their public health system and infrastructure. The FE(L)TP programs include biosafety and bioethics training in support of epidemiological activities. http://www.cdc.gov/globalhealth/fetp/

E. On-line resources

1. Education/training

The CDC Learning Connection： maintains a compendium of free learning products on a wide variety of health issues, including Emergency Management, Infectious Disease, Legal/Ethical Issues, Policy/Planning, Preparedness and Response, and Public Health. http://www.cdc.gov/Features/CDCLearning/

The CDC Online Training Course： provides education regarding key principles for securing biological agents in research laboratories and biomedical facilities where loss, theft, release or intentional misuse of the agent might have significant public health or economic consequences. http://www.cdc.gov/biosafety/biosecuritytraining/page1024.html

The FDA's Food Defense and Emergency Response-Training： The U.S. Food and Drug Administration (FDA) works with other government agencies and private sector organizations to help reduce the risk of tampering or other malicious, criminal, or terrorist actions on the food and cosmetic supply. Web-based training and additional educational resources： http://www.fda.gov/Food/FoodDefense/default.htm

NIH materials for Research Conduct and Ethics Instruction： including case studies for the 2010 theme (Science and Social Responsibility)： http:// sourcebook.od.nih.gov/resethicscases/2010-cases.pdf

Federation of American Scientists (FAS) ***Case Studies in Dual-Use Biological Research：*** http://www.fas.org/biosecurity/education/dualuse/

Dual Use Dilemma in Biological Research, Southeast Regional Center of Excellence for Emerging Infections and Biodefense (SERCEB)： http://www.serceb.org/dualuse.htm

Biosecurity： Risks, Responses and Responsibilities, Center for Arms Control and Non-Proliferation. http://www.armscontrolcenter.org/policy/biochem/ biosecurity_ educational_materials

The Life Sciences, Biosecurity and Dual Use Research： Dual Use Role Playing Simulation, University of Exeter (UK)， University of Bradford (UK)， and University of Texas at Dallas (USA). http://projects.exeter.ac.uk/codesofconduct/ BiosecuritySeminar/ Education/index.htm

Biology and Security, Student Pugwash USA (USA) http://www.spusa.org/pubs/peace_security/biosecurity/index.html

BSL-3 Facility Inspection videos. These informational videos are for entities or individuals who currently possess, store, or transfer Select Agents and those who are planning to begin work with Select Agents or toxins. http://www.selectagents.gov/FIV.html

Emergency Preparedness and Biodefense： NIH Videocasting and Podcasting. Seminars and training events broadcasted live to a world-wide audience over the Internet and also recorded and made available for viewers to watch at their convenience as an on-demand video or a downloadable podcast. http://videocast.nih.gov/PastEvents.asp？c=58

Global Biorisk Management Curriculum Development (GBRMC)： CBEP is developing and implementing a biorisk management curriculum to address biosafety and biosecurity training. Users of the training materials can participate in a virtual network of trainers via a web-based portal, and provide lessons learned, updates, and feedback for the continual improvement of the materials. The network of trainers currently consists of over 100 biosafety professionals active in the United States, Europe, Asia, and Africa.

2. Awareness-raising

The Executive Office of the President, Office of Science and Technology Policy website： established to inform the public, academic and private sector research communities about government policies related to the safe and secure conduct of biological research and the technologies arising out of the application of the life sciences. http://www.whitehouse.gov/administration/eop/ostp/nstc/biosecurity

The S3 (Science, Safety, and Security) website： provides information on biosafety, biosecurity, biocontainment, and biorisk management. http://www.phe.gov/s3/Pages/ default.aspx

NSABB Dual Use Research video： http://oba.od.nih.gov/biosecurity/biosecurity.html

NSABB Dual Use Research Brochure： http://oba.od.nih.gov/biosecurity/pdf/EducationalBrochureDualUseResearch.pdf

NSABB Responsible Communication of Life Sciences Research with Dual Use Potential： http://oba.od.nih.gov/biosecurity/pdf/Communication_ Tools%20_Dual_Use_ Potential.pdf

Biological Risk Management and Nonproliferation website： established by HHS, Office of the Assistant Secretary for Preparedness and Response (ASPR) for increased awareness of BWC and UN Security Council Resolution 1540 (UNSCR 1540). http:// www.phe.gov/about/OPP/Pages/bwc.aspx

The FBI's International Biosecurity and Prevention Forum (IBPF) Currently under development this website is intended to provide an international forum for the coordination and sharing of information and best practices related to the prevention and response to the misuse of biological agents as weapons of mass destruction.

F. International efforts

1. U.S. Government-supported

The International Centers for Excellence in Research (ICER) program： An NIH/National Institute of Allergies and Infectious Disease (NIAID) program to develop and sustain research programs in resource-poor countries through partnerships with local scientists. NIAID has developed core programs at the ICER sites and, over time, has facilitated the expansion of research capacity by training young scientists, improving laboratory and clinical infrastructure, and enhancing information technology capabilities. http://www.niaid.nih.gov/about/organization/dir/Pages/internationalCenters.aspx

International workshops and tabletop exercises with BWC-relevant lessons learned： HHS/ASPR co-organized with DOD three international workshops and tabletop exercises in 2010–2011 strengthening the core capacities required by the WHO International Health Regulations (IHRs) and existing national measures consistent with the obligations under the BWC and UNSCR 1540 to deter, prevent, and respond to biological incidents or threats.

"Applied Dual-Use Biosecurity Education Train-the-Trainer Course" run by Bradford University - (Bursaries for participation provided by BEP since 2009. The program is taught on line and over the four semesters of funding, will reach 60 students from over 20 countries

American National Academy of Sciences project (2011): *Develop Global Norms and Educational Standards Against the Misuse of Biotechnology,* aims to develop said standards. (BEP funded)

American National Academy of Sciences in 2011 project (2011): *Implementing an International Faculty Development Project on Dual Use Education.* (BEP funded)

Landau Network Centro Volta's survey-based work on biosafety, biosecurity and bioethics education in Morocco and Pakistan. This work included the workshop referenced in the LNCV text (see para 23), as well as activities to develop educational programs to rectify knowledge gaps elucidated in the survey. (BEP funded since 2009)

CWA 15793-Laboratory Biorisk Management standard Set requirements necessary to control risks associated with the handling or storage and disposal of biological agents and toxins in laboratories and facilities. (CBEP and BEP support implementation of the CWA and supported the development of and participation by international representatives in the development of the accompanying guidance document)

WHO Biorisk Management Advanced Trainer Program (BRM ATP) aims to increase the number of qualified trainers who train and educate others in biorisk management. (Department of State funded development and initial implementation)

2. Non-U.S. Government

AAAS: Responsible Bioscience for a Safe and Security Society These workshops incorporate ethical and risk management (including security risks) in special sessions and throughout the meeting and address underlying issues associated with international scientific cooperation/collaboration. http://cstsp.aaas.org/ International Meeting/home.html

G. Studies, reports and articles

Ethics Education: What's Been Learned? What Should be Done? 2009. NAE (National Academy of Engineering). Washington, DC: National Academies Press. http://www.nae.edu/nae/engethicscen.nsf/weblinks/NKAL-7LHM86?OpenDocument.

2nd International Forum on Biosecurity: Report of an International Meeting, Budapest, Hungary, March 30-April 2, 2008. 2009. NRC. Washington, DC: National Academies Press.

A Survey of Attitudes and Actions on Dual Use Research in the Life Sciences: A Collaborative Effort of the National Research Council and the American Association for the Advancement of Science. 2009. NRC. Washington, DC: National Academies Press. http://www.nap.edu/catalog.php?record_id=12460

Responsible Research with Biological Select Agents and Toxins. 2009. NRC. Washington, DC: National Academies Press.

Challenges and Opportunities for Education About Dual Use Issues in the Life Sciences. Washington, DC: National Academies Press. http://www.nap.edu/catalog.php? record_id=12958

Outreach and Education in the Life Sciences A Case Study of the U.S. Department of Energy National Laboratories. Weller RE, RL Burbank, and HA Mahy. 2010. PNNL-19237, Pacific Northwest National Laboratory, Richland, WA.

http://www.pnl.gov/main/publications/external/technical_reports/PNNL-19237.pdf

Competing Responsibilities？ Addressing the Security Risks of Biological Research in Academia. 2010. AAAS/AAU/APLU. http://cstsp.aaas.org/content.html？contentid=2331

Professional and Graduate-Level Programs on Dual Use Research and Biosecurity for Scientists Working in the Biological Sciences. 2008. AAAS. http://cstsp.aaas.org/content.html？contentid=1899

Biological Safety Training as a Component of Personnel Reliability. 2009. AAAS. http://cstsp.aaas.org/content.html？contentid=2049

Workforce Development： Preparing the Next Generation for Infectious Disease Threats. 2009. AAAS. http://cstsp.aaas.org/files/Preparing%20the%20Next%20Generaltion%20for%20Infectious%20Disease%20Threats.pdf

Building the Biodefense Policy Workforce. 2009. AAAS http://cstsp.aaas.org/files/AAAS_BiodefensePolicyWorkforce_Report.pdf

Guidance for Enhancing Personnel Reliability and Strengthening the Culture of Responsibility, NSABB, September 2011.

http://oba.od.nih.gov/biosecurity/pdf/CRWG_Report_final.pdf

Strategies to Educate Amateur Biologists and Scientists in Non-life Science Disciplines About Dual Use Research in the Life Sciences, NSABB, June 2011. http://oba.od.nih.gov/biosecurity/pdf/FinalNSABBReport-AmateurBiologist-NonlifeScientists_June-2011.pdf

Addressing Biosecurity Concerns Related to Synthetic Biology, NSABB, April 2010. http://oba.od.nih.gov/biosecurity/pdf/NSABB%20SynBio%20DRAFT%20Report-FINAL%20(2)_6-7-10.pdf