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Biosecurity

Origins, Transformations and Practices

Brian Rappert and Chandré Gould

Biosecurity

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New Security Challenges Series
Series Standing Order ISBN 978–0–230–00216–6 (hardback) and
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Origins, Transformations and Practices

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Softcover reprint of the hardcover 1st edition 2009 978-0-230-22356-1

First published 2009 by
PALGRAVE MACMILLAN

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Palgrave Macmillan in the US is a division of St Martin's Press LLC, 175 Fifth Avenue, New York, NY 10010.

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ISBN 978-1-349-30861-3 ISBN 978-0-230-24573-0 (eBook)
DOI 10.1057/9780230245730

This book is printed on paper suitable for recycling and made from fully managed and sustained forest sources. Logging, pulping and manufacturing processes are expected to conform to the environmental regulations of the country of origin.

A catalogue record for this book is available from the British Library.

A catalogue record for this book is available from the Library of Congress.

10 9 8 7 6 5 4 3 2 1
18 17 16 15 14 13 12 11 10 09

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Acknowledgments

Our thanks to all those who contributed to this book through their chapters and suggestions. A grant from the Alfred P. Sloan Foundation enabled Brian Rappert to undertake much of the editorial work in preparing this volume. A modified form of Jonathan Tucker's chapter 'Strategies to Prevent Bioterrorism: Biosecurity Policies in the United States and Germany' originally appeared in *Disarmament Diplomacy* (Spring 2007, pp. 36–47). It is reprinted here with permission.

List of Abbreviations

AHF	Argentine hemorrhagic fever
ANLIS	National Administration of Health Institutes and Laboratories (Argentina)
APHIS	Animal and Plant Health Inspection Service
ASM	American Society for Microbiology
ASSAf	Academy of Sciences of South Africa
BRCs	Biological Resource Centres
BSL	Bio-safety Level
BSP	Cartagena Biosafety Protocol
BW	Biological Warfare (or Weapons)
BWC	Biological and Toxin Weapons Convention
BWG	Biosecurity Working Group
CAS	Chinese Academy of Sciences
CBD	Convention on Biodiversity
CBM	Confidence Building Measures
CBRN	Chemical, Biological, Radiological and Nuclear
CBW	Chemical and Biological Warfare
CCS	Civil Contingencies Secretariat
CDC	Centers for Disease Control
CDSC	Communicable Disease Surveillance Centre
CEPR	Centre for Emergency Preparedness and Response
CfI	Centre for Infections
CIA	Central Intelligence Agency
CISAC	Committee on International Security and Arms Control
CITEFA	Armed Forces Scientific and Technical Research Institute (Argentina)
CONICET	National Scientific and Technical Research Council (Argentina)
CoW	Conference Committee of the Whole
CSGAC	Chinese Scientists Group for Arms Control
CSIS	Center for Strategic and International Studies
CW	Chemical weapons
CWC	Chemical Weapons Convention
DHHS	Department of Health and Human Services (US)
DHS	Department of Homeland Security (US)
DIGAN	Directorate of International Security, Nuclear and Space Affairs of the Foreign Office (Argentina)

DoD	Department of Defense (US)
ES	Embryonic Stem (cell)
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GM	Genetically Modified
GMO	Genetically Modified Organisms
HPA	Health Protection Agency
HPCSA	Health Professionals Council of South Africa
HSNO [Act]	Hazardous Substances and New Organisms Act (New Zealand)
IAEA	International Atomic Energy Agency
IAMP	InterAcademy Medical Panel
IAP	InterAcademy Panel
IBC	Institutional Biosafety Committees
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICRC	International Committee of the Red Cross
ICSU	International Council for Science
IFP	International Futures Programme
IL	Interleukin
INEVH	National Institute of Human Viral Diseases (Argentina)
INTA	National Institute for Agricultural Technology (Argentina)
IRB	Internal Review Board (Japan)
ISP	Intersessional Process
ISU	Implementation Support Unit
IUMS	International Union of Microbiological Societies
IUPAC	International Union of Pure and Applied Chemistry
JDA	Japan Defence Agency
KNAW	Royal Netherlands Academy of Arts and Sciences
LMO	Living Modified Organisms
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MHLA	Ministry of Health and Labour Affairs (Japan)
MMA	Moscow Medical Academy
MoD	Ministry of Defence (UK)
MOFA	Ministry of Foreign Affairs (Japan)
NAM	Non-Aligned Movement
NAS	National Academy of Sciences
NATO	North Atlantic Treaty Organization
NDMC	National Defence Medical College (Japan)

NEA	Nuclear Energy Agency
NGO	Non-Governmental Organization
NIAID	National Institute of Allergy and Infectious Diseases
NIH	National Institutes of Health
NIID	National Institute of Infectious Diseases (Japan)
NPC	Non-Proliferation of Weapons of Mass Destruction
NPT	Non-Proliferation Treaty
NRC	National Research Council
NSABB	National Science Advisory Board for Biosecurity
OBA	Office of Biotechnology Activities
OECD	Organisation for Economic and Cooperation Development
OPCW	Organisation for the Prevention of Chemical Weapons
R&D	Research and Development
RAAS	Russian Agricultural Academy of Sciences
RAMS	Russian Academy of Medical Sciences
RAS	Russian Academy of Sciences
RISTEX	Research Institute of Science and Technology for Society (Japan)
RSA	Republic of South Africa
S&T	Science and Technology
SANDF	South African National Defence Force
SARS	Severe Acute Respiratory Syndrome
SCJ	Science Council of Japan
SENASA	Bacteriology and Exotic Diseases divisions of the National Service of Agri-food Health and Quality (Argentina)
SIFEM	Argentine Federal Emergency System (Argentina)
TRC	Truth and Reconciliation Commission (South Africa)
UK	United Kingdom
UN	United Nations
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
UNSC	UN Security Council
UNSCOM	United Nations Special Commission
US	United States of America
USAMRID	United States Army Medical Research Institute of Infectious Diseases
WHO	World Health Organization
WMD	Weapons of Mass Destruction

Notes on Contributors

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Chandré Gould is a senior researcher in the Crime, Justice and Politics Programme at the Institute for Security Studies, an African policy research institute. She has published widely on the apartheid chemical and biological weapons programme and on dual-use issues in the life sciences, with a particular focus on Africa. Over the past three years she has been engaged in various initiatives in South Africa, and elsewhere in Africa, to discuss dual-use issues with life scientists and to develop educational programmes on dual-use issues. In 2006 she obtained her PhD from Rhodes University. Her publications include *Secrets and Lies: Wouter Basson and the Apartheid Chemical and Biological Weapons Programme* (2002) with Marlene Burger, *The Apartheid Chemical and Biological Weapons Programme* (2002) with Peter Folb, and she edited a volume on small arms in Southern Africa with Guy Lamb titled *Hide and Seek: Taking Account of Small Arms in Southern Africa* (2004).

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1
The Definitions, Uses, and Implications of Biosecurity

Brian Rappert

Hope and fear

Biosecurity is a term with a rising currency. New streams of funding, national and international conferences, and policy initiatives are being launched to enhance the state of it. For instance, when the outline for this volume was initially formulated in early 2008, the editors benefited from attending three relevant major international conferences – meetings that indicated the intensifying but simultaneously disputed importance of this notion.

In February, the National Centre for Biosecurity at the Australian National University in partnership with the University of Sydney hosted a symposium titled 'Biosecurity Challenges facing Australia and its Region'.[1] Billed as the first meeting of its kind in Australia, it brought together under a common banner life scientists, government officials, social researchers, and others concerned about topics as diverse as the physical security of research laboratories, public and media reactions to outbreaks of disease, the potential for the deliberate spread of disease through biological weapons, the transmission of outbreaks within livestock rearing and slaughter, and techniques for the diagnosis of pathogens. The title for the event expressed the international composition of its delegates, as participants derived from more than a dozen nations in the Asia-Pacific region. Convening a symposium incorporating many hitherto individuals provided a basis for building a national network of those working under a shared label. For some the symposium was also a way of trying to influence outside audiences. Certain speakers used the opportunity provided to make the case for additional government funding and heightened recognition of particular areas (for instance, the convergence of nanotechnology and biosecurity).

And yet, while the symposium proved an occasion for fostering networks and advancing priorities, major differences in the basic framing of the issues at stake were also evident. These did not just pertain to the multiple notions of what should be included under the umbrella term of 'biosecurity'. Instead, they extended to whether it represented an unease or a goal. So, a keynote address 'Biosecurity: Upgrading the Web of Prevention' by Malcolm Dando employed a language of *risks and threats* to characterise the potential for advanced life science research to facilitate the development of bioweapons. In contrast, others spoke about the development of new diagnostics, sensors and surveillance procedures as means of *achieving* a state of security.[2] Such contrasting framings were not just abstract orientations, but unavoidably tied to determinations about what required attention and why.

On 11–12 March 2008, a second event held in Kampala, Uganda likewise exhibited diversity under a common heading. 'Promoting Biosafety and Biosecurity within the Life Sciences: An International Workshop in East Africa' was convened by the Uganda National Academy of Sciences. While not the first meeting held in the region primarily concerned with biosecurity, the principle audience for this one was practicing scientists rather than high-level policymakers. As stated in workshop background material, such an engagement was necessary since this group would 'ultimately be responsible for implementing and disseminating oversight procedures' (UNAS 2008: 6). As with the symposium in Australia, this meeting encompassed a wide range of topics. That included, for instance, the proper handling of common hazardous chemicals such as fertilisers. Yet, in the main, for the purpose of this workshop, biosecurity pertained to the implications of work conducted by scientists in laboratories. As contended during the workshop, this was a relatively new framing of a word that until then had been familiar to many participants in relation to controls over genetically modified food crops.

A recurring theme of many of the contributions from African participants was the novelty for practicing bioscientists to consider the security dimensions of their research. While at least the *policy framework* for lab safety was in place in a number of the countries in East Africa, the same did not hold for lab security. However, just what should follow from that existing low status was not a matter of agreement. Ben Steyn (Chemical and Biological Defence Advisor to the South African Surgeon General) for instance, argued that the risk to Africa from the deliberate spread of disease was dwarfed by the endemic diseases already prevalent throughout the continent. As such, the limited resources available should be spent to counter natural diseases rather than (largely hypothetical) threats associated with biological weapons (Steyn 2008). The further training of scientists to ensure they work safely would provide protection against the illegal diversion of pathogens from the laboratory in a matter proportionate to the human and financial resources at hand. Yet despite such sceptical interventions, much of the tone in the conference supported the suggestion that countries in East Africa and elsewhere should do more. This was particularly so for scientists from low biosafety level laboratories that work with viruses, including the hemorrhagic fevers, that reportedly kept no records of what the labs were working with or who worked with them.

The programmatic themes voiced during 'Promoting Biosafety and Biodiversity within the Life Sciences' were in line with the programmatic organisation behind the workshop. It was arranged through a joint collaboration between the Uganda National Academy of Sciences and the US National Academy of Sciences. Since the 2005 *Statement on Biosecurity* by the Inter-Academy Panel – the umbrella organisation for prestigious national academies of science around the world – a number of individual academies have initiated activities in relation to this subject, notably the one in the United States.

As part of efforts by national academies to bring more attention to biosecurity, a third major conference took place in early 2008. The 'Second International Forum on Biosecurity' was held in Budapest, Hungary between 30 March to 2 April.[3] A joint event between the US National Academies, the Hungarian Academy of Sciences, Inter Academy panel (IAP) and other scientific and medical organisations, this forum brought together high ranking professional representatives, practicing scientists, security analysts, and others. Following on the back of the Uganda workshop and with the inclusion of overlapping participants from Africa, the forum provided an opportunity to consolidate emerging attention to biosecurity in some parts of the world.

The 'Second International Forum on Biosecurity' was part of a wider programme of activities. The initial idea for it and the previous one held in Como, Italy in 2005 stemmed from a 2004 report by the US National Academies titled *Biotechnology Research in an Age of Terrorism* (NRC 2004). That report called for international meetings to ensure oversight measures developed in the US would be harmonised elsewhere.

And yet, while the 2008 forum brought together those that might well be regarded as leading biosecurity experts, many distanced themselves from the term. In one of the three breakout streams that dealt with the promotion of a research 'culture of responsibility', for instance, a proposal was mooted to establish a high level international working group that could clarify the meaning of the term. Participants acknowledged the confusion resulting from the contrasting definitions given to it throughout the world and even within the very deliberations of the second forum. The proposal for a clarifying committee was roundly rejected by those present though in favour of abandoning the term. In its place, attendees agreed on language that spoke to minimising the national, accidental, and deliberate spread of disease. Thus, a group of experts assembled under the heading of biosecurity concluded that it had enough drawbacks as to best be avoided. In a further twist, despite the many reservations expressed about the use of the term, the final report of the second forum frequently employed the term biosecurity (NRC 2008).

Other major international deliberations were later organised in 2008. This included a regional seminar in Indonesia (Indonesia and Norway 2008), a workshop about education and biosecurity in Italy,[4] a conference on biothreats in Jordan,[5] and (not least) the meeting of states parties to the Biological Weapons Convention. To this list of more policy-orientated conferences could be added many, many more dealing with the funding of research, the development of therapeutics and diagnostics, as well as first line responses to attacks. With each, questions can be asked about how biosecurity was defined and positioned.

Three premises underlining biosecurity: Its origins, transformations, and practice

However multiply conceived and fraught, 'biosecurity' is a topic of increasing prevalence in public policy in many quarters. In trying to understand its place, three premises underline this volume:

1. The meaning of biosecurity derives from its uses, not just the way it gets defined

As the previous section suggested and the next one elaborates, biosecurity is varyingly defined. As often noted, even at the basic level of wording, it is a source of some confusion. In Spanish and French, for example, the same word is used for both biosecurity and biosafety. This situation frustrates effective communication. As a result, various calls have been made to clarify the meaning of the term by establishing a precise and agreed definition (see Chapters 5 and 6).

And yet, while such points of language are valuable reminders for caution, to reduce the meaning of biosecurity to this or that specific definition is to discount the ways in which the term is made meaningful. In this regard it is worth remarking that, to date, much of its utility seems to have derived from its plasticity rather than its definiteness.

Moreover, the manner in which biosecurity is raised as a topic should be understood as a form of situated action. The evoking of 'biosecurity' can be part of bringing together previously disparate activities, assembling shared agendas for the future, empowering certain individuals and groups as vital experts, and advancing multiple organisational goals. Even the discussion of definitions can have this social action dimension, rather than simply being about clarity and precision. Take the previously mentioned proposal made during the 'Second International Forum on Biosecurity' to set up a high level definition working group. In a later discussion within this forum, it was proposed to the author that this suggestion was motivated as much by the desire to ensure those new to discussions (particularly those outside the West) had a forum for having their concerns heard as much as it was by the expected prospect for avoiding confusion by agreeing to word usage. Thus, in considering place of biosecurity today it is worth bearing in mind a classical sociological distinction between substantive (what something is) and functional (what something does) definitions of concepts.

2. Biosecurity is contestable because security is contestable

What should count as 'security' can be a matter of considerable disagreement. Security for who, security from what, and security defined by whom, are only some of the many points of contention. Is security a sense of well-being, an avoidance of risks and threats, a way of life, or the assurance that precautions have been taken to reduce the risk of harm? For whatever notion of security is used, how should it be prioritised against other goods? Is it something to be traded off against other political goals (such as liberty) or a fundamental prerequisite for achieving those goals?

As with other aspects of security then, the meaning of biosecurity should be approached as a matter of potential disagreement. Just what should be done in response, say, to high consequence but low probability events – such as mass deaths from the deliberate spread of a contagious agent – is a matter where contrasting appraisals are likely. If social fear of such attacks is considered disproportionate to likely threats, then should this be dismissed as irrational or should the prevalence of fear be treated as serious because it undermines a sense of well-being? Likewise, how much and in what way a country in East

Africa with limited resources for even basic healthcare and various endemic disease should concern itself with threats from bioweapons is the very stuff of politics. So too is the manner in which officials are enrolled into agendas through becoming made to feel uneasy with the *status quo*. Thus, within this volume, the negotiated emergence of 'biosecurity' offers the opportunity to chart the early formation and contestation of an identified challenge.

3. Current discussions would benefit from understanding rather than seeking to resolve differences

The '-security' portion of biosecurity is not the only contested element. Across the globe the place of the 'bio-' has been a matter of keen discussion. The conduct of research, the value of genetic manipulation, and the proper priorities for healthcare are just some of the many topics in such conversations. So as of 2008, while the language of biosecurity is now widespread, just what that interest does and should mean for practice is hardly straightforward. The elasticity of the term makes it useful in bringing together varied agendas, but it also can result in confusion.

This collection takes the varying definitions both within and between countries as its starting point for analysis. This is done, for instance, in contrast to working towards a single notion of what should properly be called biosecurity. No notionally unifying definition will be offered in this introduction for sifting the wheat from the chaff. As an intervention into current deliberations, this book seeks to sensitise, map, and index how the concerns associated with biosecurity are varyingly defined, their historical origins, and the implications for particular policy discussions today. The intent is to place future discussions on a more solid footing by flagging a range of issues at stake in what gets said.

In order to do this, the contributors come from varied national contexts and institutional backgrounds. With regard to the former, the authors are located in eight countries. This volume includes those from universities, research institutes, government ministries, professional science associations, and intergovernmental agencies. The wide range of national contexts and institutional affiliations are meant to convey a range of different experiences.

Bounds, framings and linkages

By way of prefacing the detailed analyses that appear in subsequent chapters, this section expands on the points previously raised regarding the alternative characterisations of biosecurity prevalent today. The goal though is not simply to convey a sense of diversity. Instead, the alternative framings provide the basis for asking wider questions about the governance of science and technology. This includes issues such as the regulation of research, the politics of hope and fear, and the relation between science and society.

Before doing so, it is worth making a few points about the bounds of this volume. Although the contributions to *Biosecurity* seek to convey a sense of difference, not everything labelled biosecurity today is equally addressed. In the past, this term was probably most frequently referred to measures designed to keep livestock and crops free from disease; largely transmitted from other livestock or crops. This sort of thinking, for instance, informed one of the keynote addresses at the 'Biosecurity Challenges facing Australia and its Region' symposium. Under the title 'The Social and Spiritual Dimensions of Biosecurity: The Collective Survival of Mankind', Dr. Suwit Wibulpolprasert spoke to wide ranging negative economic and social repercussions of recent attempts to prevent the spread of avian flu within duck and bird populations in southeast Asia.

More recently though, biosecurity has taken on additional dimensions aligned with national security agendas. Those security dimensions associated with the deliberate spread of disease provide the shared concern for the chapters in this volume. While attention to the inadvertent and so-called natural spread of disease also informs the chapters, biosecurity is addressed principally through attention to its intentional spread. In this sense, the bulk of this volume is in line with an Organisation for Economic Cooperation and Development (OECD) definition of biosecurity as measures to 'protect against the malicious use of pathogens, parts of them, or their toxins in direct or indirect acts against humans, livestock or crops'.[6]

Biosecurity: In the lab

Much of the concern about malicious use has related to the diversions of laboratory materials from legitimate facilities. The 2006 World Health Organisation (WHO) report *Laboratory Biosecurity Guidance* worked with this meaning. Biosecurity was said to pertain to 'reducing the risk of unauthorized access, loss, theft, misuse, diversion or intentional release of [valuable biological materials] to tolerable, acceptable levels' (WHO 2006: 11). The range of measures noted for enhancing biosecurity included: limiting access to certain materials, keeping records (for instance, about inventories), enacting approval procedures for those working with materials, undertaking biorisk assessments, disposing of materials, reporting security breaches, and fostering a positive culture of responsibility. Salerno and Gaudioso's (2007) *Laboratory Biosecurity Handbook* offers a detailed risk assessment guide for lab workers and managers.

This interpretation of the term biosecurity is perhaps most easily made sense of by contrasting it with more long-standing preoccupations about biosafety. If, in simple terms, biosecurity is about keeping biological agents safe from dangerous people, then biosafety is about keeping people safe from dangerous biological agents (see Chapter 6). WHO has defined laboratory biosafety as 'reducing the risk of unintentional exposure to pathogens and toxins or their accidental release' (WHO 2006: 11). In its *Laboratory Biosafety Manual*, it set out a four category tier classification for necessary equipment and procedures in working with particular agents. Incidents such as the laboratory acquired SARS infections of 2003–2004 in Singapore, Taipei and Beijing due to inadequate training and poor laboratory practices illustrate the types of concerns associated with biosafety. Organisations such as American Biological Safety Association and the European Biological Safety Association seek to promote international standards for practice.

Biosafety though is a term with its own history. Within the context of the agricultural applications of current biotechnology (as in the Cartagena Protocol on Biosafety), it has referred to ensuring biological diversity.

Even referring to laboratory-specific considerations, in practice the terms biosafety and biosecurity have been used interchangeably. For instance, the official inquiry into the outbreak of foot-and-mouth disease in August and September 2007 in the UK concluded that it was 'highly likely' to have originated from the Pirbright research site. This site includes the public Institute of Animal Health and the private company Merial Animal Health. Although there was no suggestion of intentional spread of the foot-and-mouth disease by those in or outside the research site, the *Final Report on Potential Breaches of Biosecurity at the Pirbright Site 2007* by the British Health and Safety Executive used a language of 'biosecurity' (instead of 'biosafety') to describe what happened (see Rhodes 2007).

The instances of the accidental release at Pirbright and the laboratory acquired SARS infections raise questions about the adequacy of procedures in place for biosafety and biosecurity (as in Gaudioso and BioInformatics 2006). While providing a detailed evaluation of these matters is beyond the scope of this introduction, grounds for concern about the adequacy of standards have been offered. To name but a few, countries such as Denmark, Israel, Japan, and Canada have introduced new national legislation and regulations in recent years to enhance the physical security of pathogens and other bioagents. Internationally, bodies such as the European Committee for Standardisation have sought to formulate standards for laboratories. Improving the security of laboratories has become part of government's assistance and development programmes. Again to name but a few, Australia, France, Norway, and Canada are among those countries that have initiated significant assistance programmes in recent years. By far the largest country funder of such activity is the US. The US Department of Defense's Biological Threat Reduction Program and the Department of State's Biosecurity Engagement Program are just two of the panoply on initiatives (US 2008). Yet, even in relation to relatively rich resource countries such as the US, the adequacy of biosafety measures and the variability of biosecurity measures have been topics of concern.[7]

Biosecurity: Beyond the lab

In recent years, attention to biosecurity has not just pertained to laboratory agents. Rather it has stretched to how the knowledge and techniques generated through advanced life science research might enable new destructive capabilities. In other words, focus is not simply with the *process* of research but its *products*. The latter requires attending to what sort of research gets done and what information is made available in the scientific literature.

The highly prominent 2004 US National Research Council (NRC) report *Biotechnology Research in an Age of Terrorism* argued that the problem that needed addressing was 'the intentional use of biotechnology for destructive purposes' (NRC 2004: 14–15). The chair of the committee responsible for the report – Professor Gerald Fink of the Whitehead Institute for Biomedical Research – summarised the issues at stake in this way:

> (...)[A]lmost all biotechnology in the service of human health can be subverted for misuse by hostile individuals or nations. The major vehicles of bioterrorism, at least in the near term, are likely to be based on materials and techniques that are available throughout the world and are easily acquired. Most importantly, a critical element of our defense against bioterrorism is the accelerated development of biotechnology to advance our ability to detect and cure disease. Since the development of biotechnology is facilitated by the sharing of ideas and materials, open communication offers the best security

> against bioterrorism. The tension between the spread of technologies that protect us and the spread of technologies that threaten us is the crux of the dilemma (NRC 2004: vii).

That dilemma of threat coinciding with hope raised by Professor Fink has since become referred to as the 'dual-use' potential of knowledge and techniques. On the back of the recommendations of *Biotechnology Research in an Age of Terrorism,* in 2005 the US federal government launched a National Science Advisory Board for Biosecurity (NSABB) to advise on needed policy responses. The NSABB set up a number of Working Groups to deliberate options and provide recommendations; including on the development of 'guidelines for the oversight of dual-use research, including guidelines for the risk/benefit analysis of dual-use biological research and research results'.[8] Related to this, since 2003 a number of scientific journals and funding agencies have enacted processes for weighing the risks and benefits of research manuscripts and applications (Rappert 2008).

As mentioned at the start of this chapter, one of the recommendations of *Biotechnology Research in an Age of Terrorism* was that the oversight measures undertaken in the US be paralleled elsewhere. The first and second international forums on biosecurity were efforts at realising this aim. In part following the US lead (and wording), the Israel Academy of Sciences and Humanities and the Israel National Security Council issued a report in 2007 titled *Biotechnology Research in an Age of Terrorism* (Friedman *et al.* 2008). Although addressing concerns about the 'dual use' potential of knowledge and techniques, it also made recommendations regarding the need for new regulatory measures regarding the physical control of pathogens, the security of laboratories, and the export of equipment.

The 2006 Institute of Medicine and NRC's report titled *Globalization, Biosecurity, and the Future of the Life Sciences* and the 2006 British Royal Society's report titled *Scientific and Technological Developments Relevant to the Biological & Toxin Weapons Convention* also attended to dual-use issues and thus an expanded notion of biosecurity. Reflecting a sense of biosecurity beyond the doors of laboratories, as part of the *Globalization, Biosecurity, and the Future of the Life Sciences* it was defined as:

> security against the inadvertent, inappropriate or intentional malicious or malevolent use of potentially dangerous biological agents or biotechnology, including the development, production, stockpiling or use

> of biological weapons as well as natural outbreaks of newly emergent and epidemic disease. Although it is not used as it is often in other settings, to refer to a situation where adequate food and basic health is assured, there may be significant overlap in measures that guarantee 'biosecurity' in either sense (IoM and NRC 2006: 25).

The report made use of rather stark terms to characterise forthcoming dangers. The report section titled 'Advancing Technologies Will Alter the Future Threat Spectrum' started with the statement:

> Although this Report is concerned with the evolution of science and technology capabilities over the next 5–10 years with implications for next-generation threats, it is clear that today's capabilities in the life sciences and related technologies may have already changed the nature of the biothreat 'space.' (ibid: 39)

Such conclusions were substantiated by examples such as the following:

> …advances in technology have led to the possibility that, even if a new lethal influenza A virus does not emerge in nature within the near future, one could be artificially generated through reverse genetic engineering (…). Although not possible until recently with negative-strand RNA viruses, in October 2004, researchers from the University of Wisconsin used reverse genetic engineering techniques to partially reconstruct the highly virulent strain of influenza responsible for the 1918–19 pandemic and, the following year the complete sequence and characterization of the 1918–1919 influenza A virus was reconstructed. Although the knowledge, facilities, and ingenuity to carry out this sort of experiment are beyond the abilities of most non-experts at this time, this situation is likely to change over the next 5 to 10 years (ibid: 40).

One noteworthy aspect of the *Globalization, Biosecurity, and the Future of the Life Sciences* was that it made a case for the destructive potential of the life sciences beyond traditional areas of concern such as virology (for instance, through the use of bioregulator compounds). Synthetic biology was one of the areas that received considerable attention in the report in terms of how it might enable the widespread proliferation of capabilities for spreading disease (see Garfinkel *et al*. 2007). The 2007 Bio-preparedness Green Paper of the European Commission likewise expresses wide ranging and high-level policy concern with the developments in science and technology.

Such alarm about the potential for destructive application of research raises thorny questions about what should be done. Determinations of the wisdom of reviewing or even limiting research because of its security implications are inexorably tied to assessment of the severity and the probability of bioattacks – these by both state and sub-state groups, now and into the future.[9] Evaluations of the wisdom of encouraging widespread discussion of threats are tied to how security is conceived in the first place. If it is about enhancing the public's sense of protection or improving general state of well-being, then the extent to which biothreats are made matters of concern is as exactly important as it is problematic.[10]

There is no small irony in discussions about threats from science today. Over the last two decades, highly provocative metaphors (e.g., such as 'the Holy Grail', 'the book of life') and revolutionary promises have been attached to initiatives such as the Human Genome Project (see Nelkin and Lindee 1995). Indeed, it is not uncommon to hear that we are entering a new age. In this, genetics and related fields in the life sciences will revolutionise our understanding of the world this century as much, if not more, than physics did in the twentieth century. In short, many expectations for gene-based medical technologies as well as others have been fostered. Yet, the commercial therapeutic deliverables from genomics and biotechnology more generally have lagged far behind expectations and portrayals (see Nightingale and Martin 2004; Martin 2006). While there seems little room for doubt that the claims made on behalf of advanced life science research have been instrumental in securing significant funding in the past, with the contrast between 'hype' and deliverables comes the prospect for disillusionment.

The irony is that in relation to the themes of this book, the revolutionary therapeutic potential so often accorded to biotechnology has buttressed many of the fears about the scope for its destructive application. The logic of 'doom' and 'boom' share many of the same assumptions. With the concern about the link between life science research and bioweapons, any discrepancy between exceptions and possibilities threatens to bring untoward oversight responses. In short, an important question today is whether advanced research will be the victim of its own, somewhat inflated claims.

Biosecurity and public health

As what counts as 'biosecurity' expands, so too does the range of institutions that should take responsive action. So concerns with the dual-