human genome, which by its nature evolves, is subject to mutations. It contains potentialities that are expressed differently according to each individuals natural and social environment, including the individuals state of health, living conditions, nutrition and education.".

In humans the environment of an individual plays a more pronounced role in determining which genetic potentials would find expression than in other members of the animal kingdom. This is because of an extended period of psychological immaturity in humans (Remmel, 2006), and, in this period, a specially high capacity of learning and absorbing environmental influences in their behavioural pattern.

Both chimps and humans show two sorts of violence, inter-personal or in-group violence and inter-group violence, the latter war, if on a large scale. While wars are generally politically motivated, personal violence results from a personal urge for socio-economic rise or reproductive success.

Citing Wrangham, who has compared homicide rate in Europe from the twelfth century to the present, Jones (2008) points out that there has been a regular decline in in-group violence rate. This suggests that with developing civilization in-group conflicts have become increasingly infrequent. The time span for this change has been so small that it cannot be ascribed to evolution; it has to be through environmental influences. It may be added here that, with development of civilization, a finer function distribution takes place among members of a society, and, as a consequence a greater interdependence among the members and social coherence result. In these circumstances expression of the potentiality of altruism gets promoted.

Wars generally result from actions of a misadventurist and overambitious leader of a state, and underlying his action is the instinct of territoriality. Better understanding among states, realization and appreciation of interstate cooperation and coordination , and nations being led by leaders, who are aware of the highly destructive nature of modern warfare hampering development of civilization, and also of the extent misery wars cause to people, should avoid war-like situations. Enlightened voters will choose such leaders to lead their nation. Bioethics education in schools should help in this direction, as voters with such educational background will choose enlightened leaders. Besides removal of misgivings among various religious communities, and emphasis on need of healthy and compact societies through bioethics education will discourage in-group conflicts.

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Beyond Biosafety: Biosecurity and the dual-use dilemma as ethical concerns

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Introduction

Increasingly, bioethicists are turning their attention to the ethical and social challenges raised by the non-medical uses of bioinformation. One such challenge is biosecurity – that is, the attempt to prevent the deliberate use of the life sciences and biotechnology for political or criminal ends. As much of the literature on biosecurity has focused on the US, UK, or Australia (two exceptions being Enemark 2007 and Smithson 2007), there is a need, for reasons described below, to better understand Asian perspectives on these issues. Scientists, particularly in East and Southeast Asia, are understandably focused on preventing emerging disease outbreaks and on developing vaccines to treat re-emerging and existing diseases. However, in their focus on these important issues, it is possible that preventing deliberate disease outbreaks may be overlooked. Indeed, the fact that scientists are working so often with restricted agents as dengue fever virus, SARS, and avian influenza, is a reason to be concerned about the degree of biosecurity in the region. In this paper, I aim to encourage readers of *EJAIB* to begin to consider how they may contribute to these debates. Ethicists have much to contribute to this field of study since at the most basic level, biosecurity raises an age old ethical question: should we hold an agent morally responsible for the consequences of an action when those consequences were not intended and were, in some cases, beyond the agent's control?

What is the difference between biosafety and biosecurity?

Many life scientists are familiar with the concept of biosafety. The term simply refers to laboratory procedures and policies aimed at reducing accidental exposures. It includes instructions on how to work with, store, and export pathogens and toxins properly in order to avoid accidents that could be harmful to people, animals, and plants. Biosafety, in short, is about lab procedures, equipment, and the right handling of hazardous materials.

In contrast, biosecurity refers to the wider societal issue of the protection and control of pathogens and toxins to prevent their deliberate theft, misuse, or diversion for the purposes of biological warfare or terrorism. It includes researchers' personal knowledge, choices and behaviour, as well as society's collective responsibility to safeguard a population from the dangers of pathogenic microbes. Biosecurity, in short, is about measures taken to minimise the possibility of deliberate bioviolence.

There is some evidence to suggest that scientists are far less aware of biosecurity than biosafety (although part of the confusion may be that some countries use the same term to describe both meanings). A recent survey of over 300 Asian life scientists found that there was better awareness of laboratory biosafety issues compared to biosecurity and that overall, awareness levels and perceived threats about biological terrorism remained very low across Asia (Sandia 2006). Indeed, my own informal discussions with life scientists in China confirms this finding.

To help understand the notion of biosecurity and why it deserves ethical attention, it is necessary to examine one of the key elements of the biosecurity debate: the dual use dilemma.

The dual use dilemma

The dual use dilemma simply refers to the possibility that the same scientific research or products which are intended for social good could also be used to threaten a population in a deliberate act of bioviolence. Two examples will help shed light on this idea.

One instance of a dual use experiment is the Australian mousepox tests (Jackson et al. 2001). Australian researchers modified the virus that causes mousepox in an attempt to make mice infertile. The hope was that they could limit the millions of dollars of damage mice inflict on Australia's grain belt. After their initial trials failed, researchers tried inserting an IL-4 gene (a cytokine that helps regulate immune system reactions) into the virus which they then administered to the mice. As a result, the researchers inadvertently created a recombinant virus which killed the mice, including 60% of those which had been vaccinated. Eventually it was discovered that the inserted gene had shut down the rodents' immune systems. Inevitably, researchers wondered if similar work could be done on smallpox or chickenpox to create a deadly modified form of those viruses that could overcome existing human vaccinations. The dual use controversy became worse when a team in the US duplicated the study with even greater lethality and conducted similar experiments with cowpox, a disease which can afflict humans.

A second dual use example is the recreation of the Spanish Flu. In 2005, US scientists identified the sequences for the remaining unsequenced parts of the virus's genome and described the reconstruction of the virus (Taubenberger 2005; Tumpey 2005; von Bubnoff 2005). This allowed the benefit of testing the function of certain genes in the transmissibility and virulence of the virus which was a major scientific advance but had the consequence of risking that the recreated strain might escape, and/or that the publication of the full genome sequence gives any rogue nation or bioterrorist group all the information they need to make their own version of the virus. A number of experts in the US believed that the decision to publish the flu's genome was a mistake since it amounted to a blueprint of a weapon of mass destruction.

In both these cases, the knowledge and techniques generated by scientific inquiry had the potential for dual use: that is, they could aid in the fight against disease or be used to further spread it. The issue at stake the thus raises fundamental questions about the role of science in society and the necessity of regulatory safeguards to protect innocent populations.

Security oriented regulation of the life sciences

In many ways, biosecurity and the dual use dilemma provides a new angle on an old question: if a researcher's intentions are good – to contribute to scientific progress and to save lives – then can we hold the researcher responsible for the unintended and unforeseen malevolent use of their discoveries? (Kelly 2006; for more sustained philosophical analysis of this question, see Miller and Segelid 2006).

Currently, self-regulation within the scientific community is the most commonly advocated strategy to minimize the risks posed by dual-use research.

At the moment, editorial boards of medical and scientific journals have taken responsibility for judging, on a case-by-case basis, whether particular studies should be edited or withdrawn because the data or methods might have dual use implications. However, there are proposals that there ought to be a international pre-project and pre-publication review system to monitor research. Additionally, the Biological and Toxic Weapons Convention (BWC) Intersessional Meetings for 2008 will specifically address the appropriateness of codes of conduct for scientists as part of a larger 'web of prevention' to help combat the malign use of biological research.

Proposals for a review system have stemmed from studies such as the so-called Fink Committee in the US. This board named seven 'experiments of concern' that would, in their view, warrant, stringent review for dual use implications. These are projects that would do any one of the following: demonstrate how to render a vaccine ineffective; confer resistance to therapeutically useful antibiotics or antiviral agents; enhance the virulence of a pathogen or render a non-pathogen virulent; increase transmissibility of a pathogen; alter the host range of a pathogen; enable the evasion of diagnostic/detection modalities; enable the weaponization of a biological agent or toxin (National Research Council 2003). Similarly, the Controlling Dangerous Pathogens Project (also conducted in the US but with international delegates) recommended that after a detailed questionnaire, the proposed project would be classified as either potentially, moderately or extremely dangerous. It is thought that most proposals would fall under the potentially dangerous category and would thus be reviewed at the local level. The other two categories (moderately and extremely dangerous projects) would require national and international scrutiny for their security implications (Steinbruner et al 2007).

Of course these proposals raise many questions about the norms of science and scientific openness. One study found that UK based life scientists believed that attempts to build a pre-project funding or pre-publication review system would potentially harm science, which in their view, was already subject to strict regulations and ethical review (Rappert and Dando 2005). Respondents to this study also indicated that in their opinion, scientific development and experimentation were in some sense ‘inevitable’. Importantly, there was also a strong view that the pressure to publish (and thus secure further grant money) made it hard for researchers to not publish their work. Thus finding that many life scientists were unaware of the dual use risk and sceptical of security oriented review systems, the authors of this study concluded that is ‘likely that large sections of the worldwide life sciences community have hardly begun to address the question of their responsibilities in regard to the dual-use potential of the results and techniques of their work’ (Rappert and Dando 2005: 27).

As mentioned that the start, however, most of these studies have focused on the views of Western based scientists. There is little doubt that Asian countries will have their own perspective on these issues and that within Asia, there will be considerable variation in concerns and opinions. Compared to their counterparts in the US and EU, Asian based life scientists report that a lack of funds and equipment, as well as delayed shipments due to export controls are serious problems (Sandia 2006). Arguably, there is a danger that further security oriented laws may unfairly limit access to key samples and technologies, needed for genuine research purposes. And yet, as many East and Southeast Asian labs handle a high degree of dangerous pathogens, it also seems that the potential for misuse is also real.

Asian based policy-makers and academics have, to some extent, been involved in international efforts through the work of the BWC, UN, and WHO. Yet there is still relatively little input from relevant parties (ethicists, social and life scientists) to the wider academic debates. Arguably, these voices need to be heard if only to confirm or to refute Western views of the importance of the dual use dilemma. Specifically, there is a need for better understanding of current biosecurity methods and review procedures across the region, both at institutional and national levels, as well studies into life scientists own views on the dual use risks of their work and their wider responsibilities for the how their research is used. Results from such studies can thus inform wider efforts to raise awareness and promote educational programmes to publicise the issue of biosecurity (as opposed to mere biosafety) and to aid in the construction of international codes and security oriented review systems which are sensitive to cost-benefit analysis and are able to perform objective judgments so as to not impede life saving work on vaccine development and the sequencing of emerging and re-emerging infectious diseases.

Of course nothing in this short paper denies the life saving importance of biosafety measures or the priority of research into infectious disease. But Albert Einstein is known to have been plagued with a sense of responsibility and guilt for how his work on atomic energy in the early 20th century contributed to the development of atomic and nuclear weapons (Einstein 1954). Potentially, life scientists today are facing a similar situation. It is hard to disagree with the statement that ‘the human species is relentlessly acquiring power far in excess of its vision and is thereby posing monumental problems of prudential judgement – problems that society is not yet conceptually or institutionally equipped to handle’ (Steinbruner et al 2007: 3).

Acknowledgements

This paper was supported by a Department of Universities, Innovation, and Skills UK-China Fellowship of Excellence, which the author gratefully acknowledges.

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Animals in Research: 7-R Principles and Corporate Responsibility

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Cross-cultural Consensus and Diversity

Culture and nature: Cultures are made and developed by humans, they are not natural. On the contrary, cultures overcome the obstacles, dangers, and cruelties of raw nature. Cultures manipulate wild plants and animals into cultured and farmed crops and animals for the benefit of humans and human communities. The term culture literally comes from *cultivare*, i.e. digging and working the soil. Cultures build houses and infrastructures to liberate humans and humanity from natural limitations, dependencies and uncertainties and to improve individual and collective health, life, and qualities of life.

Cultivation includes the cultivation [i.e. breeding, using, and manipulating] of animals, also the use of animals in research. In 1998, the official number of animals used in research in the US was estimated to be 1,213,814; but if rats, mice and birds would be included, which were not covered by the Animal Welfare Act, the real number would be tenfold, at around 12 million [4]. Today, worldwide probably 50 million animals are used in research, not including microbes, insects and annelids.

Cultures represent different traditions and visions, but they share common concerns, intuitions and visions regarding health, life and environment as well. Among those common visions and goals are first and primarily the priority of human security and liberty to be defended and protected against unfavorable powers and seasons of nature, against dangerous animals and dangerous humans. But then there is also secondly an understanding of the close relatedness of humans and humanity to nature and natural laws and limits, including different forms of recognition, even compassion with other living beings. For example, mortality, suffering and disease are essential to all living beings, but visions of immortality, health and enhancement of health and happiness has been virulent in all cultures at all times.

A story told by Al Ghazali, the great Iranian scholar and unknown to the West, is the story of the prophet Moses who one day fell ill. His doctors recommended that he takes a special herbal medicine. Moses replied that God's will be respected; if God wanted him to suffer and be sick or even dead, then God as well could heal and make him feel better. The next day Moses' condition got worse and his doctors told him, that God had put healing powers into natural herbs and had given them the knowledge to know about those powers and to prescribe the most efficacious doses. Moses accepted the argument, took his medicine compliantly and got well, - a complex story narrating the relation between nature and culture, medical expertise, scientific inquiry and human solidarity more impressively than the best analytical essay. We humans of all cultures use nature to protect, to comfort and to cultivate our lives and communities.

Compassion and respect: Compassion and respect for the 'other', i.e. for fellow humans, in particular the weak and suffering, is one of the core principles in all cultures. But morally and metaphysically, nature and animals are included indirectly or directly. A German proverb holds 'Do not harm an animal for fun, as it feels pain just like you'. Even more encompassing is a Chinese proverb 'heaven and man are an integral one; as a result they are in constant pursuit of harmony between humanity and nature'. This Chinese proverb was recently prominently quoted by Pan Yue, Vice Minister of State Environmental Protection of the Peoples Republic of China [12]. Both proverbs are not just part of cultural history, but very much in the minds of people, educated and uneducated, in Eastern and Western cultures.

An indication of a transcultural sensitivity towards cruelty to animals, in particular to animals in research, has led to the widely accepted 3R's presented by WMS Russell and RL Burch 1959 in their book '*The*

Hence, dual use considerations should be an essential part of a biosecurity program. While laboratory biosafety and biosecurity manage different risks, â€œthey share a common goal: keeping VBM safely and securely inside the areas where they are used and storedâ€ (WHO, 2006). Preventing Development of Biological Weapons and Addressing Bioterrorism.Â Both on the international and the regional or local level, additional provisions for handling of biological materials are imbedded in diverse regulatory texts, several of which on first sight would not be immediately recognized as being relevant for biosafety and biosecurity in containment. Conversely, biosecurity focuses on controlling access to pathogens of consequence and on the reliability of the scientists granted this access (thereby reducing the threat of an intentional release of a pathogen) and/or access to sensitive information related to a pathogenâ€™s virulence, host-range, transmissibility, resistance to medical countermeasures, and environmental stability, among other things".[8][9].Â Dealing with this challenge, which has been labelled the "dual-use dilemma," requires a number of different activities.Â "Biosafety and Biosecurity in the Realm of Dual-Use Research of Concern" (PDF): 2. Retrieved 23 May 2020. Cite journal requires |journal= (help). ^ National Academies of Sciences, Engineering, and Medicine (14 September 2017). The critical aspects of biosafety, biosecurity, and biocontainment have been in the spotlight in recent years. There have also been increased international efforts to improve awareness of modern practices and concerns with regard to the safe pursuit of life sciences research, and to optimize current oversight frameworks, thereby resulting in decreased risk of terrorist/malevolent acquisition of deadly pathogens or accidental release of a biological agent, and increased safety of laboratory workers. Our purpose is to highlight how the World Health Organization's (WHO) revised International Heal The dual-use dilemma arises in the context of research in the biological and other sciences as a consequence of the fact that one and the same piece of scientific research sometimes has the potential to be used for harmful as well as good purposes. Discoveries that may lead to important advances in science and medicine might therefore also facilitate development of biological weapons of mass destruction.