

# [Regulation of the long non-coding rna](https://assignbuster.com/regulation-of-the-long-non-coding-rna/)

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### Dual-use research is life sciences: Destructive knowledge

“ When and where serious and credible concern exists that legitimately intended biological material, technology or knowledge in the life sciences pose threats of harm to human health and security, the scientific community is obliged to develop, implement and adhere to precautious measures to meet the concern.” (Kuhlau et al, 2009)

## Biosafety and Biosecurity:

These terms are such that they do not encompass a definition that has a broad acceptance. While biosafety includes facility design, any containment principles, procedures and practices that entail in the prevention of possible infections in the biomedical environment or the public environment (American Biological Safety Association, 2008), biosecurity is the action of impeding bioterrorism or other disease breakouts, whether they are accidental, natural or a deliberate release, particularly relating to laboratory access (Matishak, 2008). Even though there hasn’t been a very severe incident regarding bioterrorism in general, the world is now perceived as a threatening environment, and the outlook on such events and its response has changed over the years. Measuring the risks and benefits has become a routine, including facility specifics and safety rules, as well as the training of the scientists or employees to cater for the safety of their own and the public (Nordmann, 2010). Therefore, the preliminary goal for biosafety and biosecurity is to protect human, animal and environmental health against any risk presented forward by organisms and the spread of disease, by focusing on omission, elimination and control, with the support of ideal protocols, a communal expert management system and the efficient and practical sharing of crucial information (Meyerson and Reaser, 2002).

## Dual-use:

Dual-use by definition is anything, such as information, an activity or an object, that can be applied, in two or more ways. One of the dual-use research concerns include information that can be used for military as well as civilian purposes. This particularly, relates to weapons of mass destruction and provides an excuse to justify the expenditure by the military on research and technology. Another concern, is research that is benign in nature, yet can be misused for malicious purposes. The control of such biological weapons was set by the Biological and Toxin Weapons Convention (BTWC 1972), and implemented in 1975. Many powers such as the Soviet Union followed the agreement, after the United States decided to stop its program on biological weapons (van der Bruggen, 2011). The article looked at eliminating the development, stockpile and production of microbial or other biological agents, as well as equipment, weapons and technology which helped in the transmission of such agents or toxins involved in armed struggle and hostile situations. However no part of this article mentioned dual-use possibilities. The events of September 11 2001 and the following anthrax attacks had awakened the public to the release of organisms with the intention of causing harm, labelling such incidences as “ bioterrorism”, even though there weren’t mass casualties, but was extremely disruptive (Meyerson and Reasor, 2002). Carus (2001), defines it as “ assumed to involve the threat or use of biological agents by individuals or groups motivated by political, religious, ecological, or other ideological objectives.” The Fink Report was then introduced to address and compile seven classes of experiments which required consideration before being carried out or approving content for publications. The National Science Advisory Board on Biosecurity (NSABB) was established in 2005 as a review system and oversee experiments of concern, which led to the Lemon-Relman Report, lead by two of the NSABB members, stating the merging of life sciences with other fields like nanotechnology, enabling the production of complete new biological threats and commented on the difficult nature of making future predictions about scientific research(Bezuidenhout and Rappert, 2012).

When thinking about publishing papers or releasing products into the public, scientists usually, don’t think about the unintentional uses or side-effects that might occur, thus a lot of policies being designed for the dual-use focus on creating awareness in the scientific community. Such a case, includes that of nuclear weapons which first made an appearance at the end of World War II, where the information and technology has lingered from the secretive government research programs into private businesses in numerous fields, allowing bioterrorist to find such programs using the expertise, technology and materials available from private corporations (Masters, 2009).

## Mousepox cure or dilemma?

The paper titled, “ Expression of mouse interleukin-4 by a recombinant ectromelia virus suppresses cytolytic lymphocyte responses and overcomes genetic resistance to mousepox.” by Jackson et al (2001) brought about a huge debate in terms of biosecurity concerns. The paper looked at the genetic resistance to clinical mousepox, which was a common disease in laboratory mice and was characterized by effective NK and CTL response in resistant mice.

The study was initially done to try and make a mouse contraceptive vaccine for pest control, however the findings took a different direction, including:

1. Suppression of cytolytic responses of NK and CTL and IFN-Υ in naïve mice.
2. Genetically resistance mice developed symptoms of acute mousepox accompanied with high mortality
3. Inhibited expression of immune memory responses in previously immunized mice

The scientists had produced a super strain of mousepox, where several dual use implications were uncovered. For example, the same technique might enable production of vaccine-resistant smallpox, as there’s no real cure and our only mode of defence is vaccination, raising fears that the technology could be used in biowarfare. Publications of studies like these alert bioterrorists, and therefore questions were raised as to whether the results should have been published or whether such an experiment should have been given approval or funding. Discussion also involved the responsibilities of those involved and Jackson had quoted, “ We wanted to warn the general population that this potentially dangerous technology is available. We wanted to make it clear to the scientific community that they should be careful, that it is not too difficult to create severe organisms.” (Novak 2001)(Bezuidenhout and Rappert, 2012). This study proves that reliance on just the scientific community and the scientists that mostly lack training in security studies cannot assess the risks and benefits of a publication. Instead someone with smallpox proliferation knowledge is essential to have as potential bioterrorists would require the smallpox virus, if a smallpox-resistant vaccine or another malevolent use is what they intend to produce, and apply the genetic engineering method, as shown in the paper, to it (Selgelid, 2009). In contrary, the techniques used are commonly found in microbiology books and a graduate student would be able to replicate it. Selgelid (2007) states that the debate of the omittance of the materials and method section of the paper would defy the rule of replication and verification. An article in New Scientist reported that a scientist funded by the US government had intentionally created an immensely deadly form of the mousepox virus, which then followed by genetic alterations on the cowpox virus, that affects animals including humans. These experiments were deemed to be “ necessary to explore what bioterrorists would do”, by Mark Bullmer (MacKenzie, 2003).

## My project:

The aim of my experiment is to look at the regulation of the long non-coding RNA that have been identified in mouse embryonic stem cells, which is potentially controlled by Ras/ERK signalling pathway and could itself have a role in modulating the outcomes of this oncogenic pathway. The dual-use potential for such an experiment primarily involves the gene expression technologies which make it possible to activate endogenous compounds in the body leading to disastrous and perhaps long-term effects. While it represents the advancement of the synthetic biology movement, it can also result in the accidental or deliberate creation of pathogenic components, and in turn result in the transmission of cancer cells. If the study is a success, regarding the hypothesis that the lncRNA (Ite1) is expressed and contributes to the cancerous pathway, can lead to development of targets via the Ras/Raf/Mek/Erk pathway, resulting in the malevolent misuse of the techniques and theory researched.

## Conclusion:

Awareness of dual-use has increased immensely in the last few years, however what has not been achieved is a global agreement on the regulations concerning the response to such dual-use research (Bezuidenhout and Rappert, 2012). Gronvall (2014) suggests that due to the lack of an international consensus, some work, which poses as a risk to biosecurity by one government, would not be funded by that body, but another government may agree to fund it. Similarly the publication of a study might be refused by one journal, but not by another due to different standards. Nordmann (2010) considers the stature of the researcher in contradiction to their responsibility to biosecurity and the scientific community. Biosecurity dilemmas will only further increase as we advance technologically and in terms of globalization. Thus, attention must be highly paid to preventative strategies, and being precautious of the risks involved, as well as rapid response to any potentially harmful organisms. With this in mind, policymakers weigh out the risks and benefits, as well as the synergistic effects on costs (Meyerson and Reaser, 2002). Various factors concerning the scientific community, their responsibility, the expertise, a global consensus and the public still need to be answered and the contradictory effects of most of these factors often make it improbable to differ right from wrong.

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