# Life scientists for peaceful research

ISTC Virtual course on responsible research, export control and ethics in the life sciences related to CBRN

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## Annotated reading list

The reading list is limited to some key open access literature and videos. It is sectioned by topic/theme and differentiated into two general core texts and for each module some additional video resources and further reading.

### Core texts

This course aims to offer researchers insight in responsible and ethically sound governance of life sciences with dual use potential in the global society. The following core texts explain the main concepts Responsible Innovation and (Web of) Prevention of misuse of dual use life sciences.

**Responsible Innovation:** Responsible Research and Innovation has four dimensions, which were first proposed by Stilgoe, Owen and MacNaghten (2013) Developing a framework for responsible innovation. Research Policy Volume 42, Issue 9, November 2013, Pages 1568-1580: <https://www.sciencedirect.com/science/article/pii/S0048733313000930>

**Web of prevention:** The origins and practical uses of the term “web of prevention” are explained in Daniel Feakes, Brian Rappert and Caitríona McLeish (2007) Introduction: A web of prevention? In Brian Rappert, Caitriona McLeish (eds) (2007, 2012)) A web of prevention. Biological Weapons, Life Sciences and the Governance of Research. Routledge: <https://ore.exeter.ac.uk/repository/bitstream/handle/10036/31457/9781844073733.pdf>

## Module 1: Exploring Core Concepts and Module 2: Addressing the special role of scientists

Module 1 presents working definitions of the core ethical concepts used in this course. To gain a good understanding of the concepts, users should read or view the following core texts and additional resources. Module 2 applies most of the concepts which were explained in module 1: responsibility, Web of Prevention, Responsible Research and Innovation, Ethical, Legal and Social Aspects and subsidiarity.

### Additional resources

In addition to the main concepts Responsible Innovation and Web of Prevention, other concepts are used in the course. The following additional resources explain these terms in an accessible way.

**Conceptions of technology:** The public perception of science and technology is an issue addressed by policy makers interested in funding research as well as in governing risks of emerging technologies. Social scientists working on science communication and science and technology studies have performed studies on public perceptions of science and developed different models of science communication. Bruce Lewenstein addresses problems in the public understanding of science in this online lecture:

Lewenstein, B. (2013) “The ‘problem’ of public understanding of science: Public knowledge of, attitudes towards, and interest in science,” audio and slides from presentation to US National Academy of Sciences Roundtable on Public Interfaces of the Life Sciences (Washington, DC): <https://www.youtube.com/watch?v=uD847XRuOlE>

**Responsibility:** The transformation from the traditional governmental responsibility to collective responsibility is also known as the move from top-down “government” to collaborative “governance” of science and technology. It is influenced by increasing insight in potential catastrophic risks caused by emerging technologies and by globalisation of the world economy, which undermines the capacity of national governments to take their responsibility. Hans Jonas, Ulrich Beck and other social scientists and philosophers have analysed these technological risks and new forms of collective responsibility. Read concise introductions to their work on Wikipedia:

Hans Jonas. The Imperative of Responsibility: In Search of Ethics for the Technological Age (translation of Das Prinzip Verantwortung) trans. Hans Jonas and David Herr (1979). ISBN -226-40597-4 (University of Chicago Press, 1984) ISBN -226-40596-6 c.f. <https://en.wikipedia.org/wiki/Hans_Jonas>

Ulrich Beck. Risk Society. Towards a new modernity. Sage Publications, 1992 [original in German 1986] c.f. <https://en.wikipedia.org/wiki/Risk_society>

**Responsible Research and Innovation:** The European Commission is a strong promotor of responsible research and innovation by making it a horizontal priority in the Horizon 2020 research programme. All projects funded under this programme must address RRI. Read: EU definition of Responsible Research and Innovation. European Commission: <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation>

**Research ethics:** Read a brief explanation of research ethics: ALLEA. Research Integrity and Research Ethics. All European Academies: <https://allea.org/research-integrity-and-research-ethics/>

**Precaution**: Several interpretations of the precautionary principle are used including the two cited in module 1. In this webinar, different interpretations of the precautionary principle are explained, for participants in societal dialogue on nanotechnology in the project Nano2All: <https://www.youtube.com/watch?v=2-j_Xa5ScdM>

**Dual use and misuse:** The EU offers guidelines for assessing dual use and misuse potential of research to researchers applying for funding under H2020: EU Dual use guidance. European Commission, Brussels: <http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/guide_research-dual-use_en.pdf>

Misuse guidance. European Commission, Brussels:

<http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/guide_research-misuse_en.pdf>

**Subsidiarity**: A quick introduction to the term is available at: Subsidiarity. Wikipedia: <https://en.wikipedia.org/wiki/Subsidiarity>

### Further reading:

**Conceptions of technology:** The website of Bruce Lewenstein includes a wide variety of literature and online resources for further study: <https://blogs.cornell.edu/lewenstein/science-communication-resources/>

**Responsibility:**

The Wikipedia pages on Hans Jonas and the Risk Society include references for further study

The quote of Jerry Ravetz (1975) is from: ‘… et augebitur scientia’ in Rom Harré (ed.) Problems of Scientific Revolution. University Press, London, p 45.)

Read more about the Collingridge dilemma. Wikipedia: <https://en.wikipedia.org/wiki/Collingridge_dilemma>

**Responsible Research and Innovation:** For further study, several projects have developed concepts and tools for practicing Responsible Research and Innovation, e.g. <https://www.rri-practice.eu/> and [www.rri-tools.eu](http://www.rri-tools.eu)

The four dimensions of RRI were first proposed by Stilgoe, Owen and MacNaghten (2013) Developing a framework for responsible innovation. Research Policy Volume 42, Issue 9, November 2013, Pages 1568-1580: <https://www.sciencedirect.com/science/article/pii/S0048733313000930>

The EU offers guidance for addressing ethical issues in research projects: EC H2020 guide. Cross-cutting issues. Ethics. European Commision, Brussels. <https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/ethics_en.htm> and the TU Delft offers a MOOC on Responsible Innovation: <https://online-learning.tudelft.nl/courses/responsible-innovation/>

In the EU-funded project SATORI, the European Committee for Standardisation CEN has developed a pre-standard (CEN Workshop Agreement) on Ethical Impact Assessment: CEN (2017) CWA 17145-2:2017. European Committee for Standardization. Brussels. The document is available here: <https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT:65088&cs=15985768788487A731AC76A9942EDA697>

**Web of Prevention:** A more detailed analysis of the web of prevention is included in Brian Rappert, Caitriona McLeish (eds) (2007, 2012)) A web of prevention. Biological Weapons, Life Sciences and the Governance of Research. Routledge <https://www.taylorfrancis.com/books/e/9781849770354>

Malcolm Dando is a leading scholar who has contributed strongly to the development of the concept ‘web of prevention’ in many publications including Dando, Malcolm R. (2000) The New Biological Weapons: Threath, Proliferation and Control. Boulder, CO, USA, Lynne Wiener Publishers Inc. <https://bradscholars.brad.ac.uk/handle/10454/6267>

**Ethical, Legal and Social Aspects** of emerging technologies:

Read more about ELSA: Ethical, Legal and Social Aspects Research. Wikipedia: [https://en.wikipedia.org/wiki/Ethical,\_Legal\_and\_Social\_Aspects\_research](https://en.wikipedia.org/wiki/Ethical%2C_Legal_and_Social_Aspects_research)

NNI. Ethical, Legal, and Societal Issues. National Nanotechnology Initiative. USA: <https://www.nano.gov/you/ethical-legal-issues>

**Precautionary Principle:** Several interpretations of the precautionary principle are used. The World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) has analysed the discussion: COMEST (2005) The Precautionary Principle. UNESCO Paris, [https://unesdoc.unesco.org/ark:/48223/pf0000139578](https://unesdoc.unesco.org/ark%3A/48223/pf0000139578)

**Dual use and misuse:** A more extensive explanation of dual use and misuse is included in Ana Sánchez Cobaleda (2020) Chapter 2: Definitions of concepts: Dual-use goods. In Quentin Michel et al. A decade of evolution of dual-use trade control concepts: strengthening or weakening non-proliferation of WMD. University of Liege. <https://orbi.uliege.be/handle/2268/246711>

**Biosecurity:** The World Health Organisation offers a training course on Bio Risk Management. The presentations and lecture notes are available online and include further explanations of the concepts biosafety and biosecurity as well as illustrative cases: WHO (2012) Biorisk Management Advanced Trainer Programme. World Health Organisation, Geneva: <https://www.who.int/ihr/training/biorisk_management/en/>

**Just War Theory:** Read more about the philosophical concept: Just War Theory. Internet Encyclopedia of Philosophy. <https://www.iep.utm.edu/justwar/>. The Just War Principles underly international humanitarian law, which can be read in United Nations Documents: <https://www.un.org/en/sections/general/documents/>. UN Office of Disarmament Affairs: <https://www.ungeneva.org/en/topics/disarmament>

**Arms control:** Article 36, Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977. <https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/Article.xsp?action=openDocument&documentId=FEB84E9C01DDC926C12563CD0051DAF7>

**Proliferation:** Quentin Michel et al. (2018) Do academic activities contribute to WMD proliferation? ESU, University of Liege: <http://www.esu.ulg.ac.be/>

**Human Rights.** Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/entries/rights-human/>

**Subsidiarity:** A general introduction in the concept of subsidiarity is included in: Evans, Michelle, Zimmermann, Augusto (eds.) (2014) Global Perspectives on Subsidiarity. Ius Gentium: Comparative Perspectives on Law and Justice book series volume 37. Springer Dordrecht, Heidelberg, New York, London. An open access book review is available here: <https://academic.oup.com/icon/article/13/4/1085/2450830>

**Communitarianism:** The current discussion on universalism versus communitarianism dates back to the 1970s. A thorough introduction in this discussion is available at: Communitarianism. Stanford Encyclopedia of Philosophy: <https://plato.stanford.edu/entries/communitarianism/>

**Safe by design:** A good open access analysis of safe by design and related concepts is offered by: van de Poel, I., Robaey, Z. Safe-by-Design: from Safety to Responsibility. Nanoethics 11, 297–306 (2017). <https://doi.org/10.1007/s11569-017-0301-x>

**Ethical codes of conduct:** The Global Ethics Observatory hosted by UNESCO includes a database of currently 155 codes of conduct for ethics in all scientific disciplines in several languages: <http://www.unesco.org/shs/ethics/geo/user/?action=search&lng=en&db=GEO5>

The examples listed in this slide are available via these links:

UNESCO (2017) Recommendation on Science and Scientific Researchers. UNESCO, Paris : <http://www.unesco.org/new/en/social-and-human-sciences/themes/bioethics/1974-recommendation/>

UNESCO (2005) Universal Declaration on Bioethics and Human Rights, UNESCO, Paris: <https://en.unesco.org/themes/ethics-science-and-technology/bioethics-and-human-rights>

World Economic Forum (2017) Young Scientists code of ethics. WEF, Lausanne: <http://widgets.weforum.org/coe/>

Information about standards are available from the websites of ISO, CEN, and the World Health Organisation (laboratory safety standards, occupational health and safety) Links: <https://www.iso.org/home.html>

<https://www.cen.eu/Pages/default.aspx>

<https://www.who.int/>

Governments and authorities responsible for oversight of dual use life sciences offer guidance to research institutions on contributing their share to the collective responsibility. A good practice example is the Biosecurity self-assessment toolkit offered by RIVM in the Netherlands: <https://www.bureaubiosecurity.nl/en/toolkit>

**Transdisciplinary collaboration** means collaboration involving natural scientists and engineers as well as social scientists and philosophers. A good explanation is offered by: Choi BC, Pak AW. Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. Clin Invest Med. 2006;29(6):351-364. <https://pubmed.ncbi.nlm.nih.gov/17330451/>

**Science as a Human Right**: Jessica M. Wyndham, Margaret Weigers Vitullo. Define the human right to science. Science 30 Nov 2018: Vol. 362, Issue 6418, pp. 975 DOI: 10.1126/science.aaw1467 <https://science.sciencemag.org/content/362/6418/975.full>

## Module 3: Discussing ethical and professional dilemmas

In addition to the concepts explained already in module 1, some new concepts are introduced which you need to analyse the case studies where ethical and professional dilemmas are highlighted.

### Additional materials:

**Group think**: University of Texas. Ethics Defined: Group Think. Video explaining group think: <https://ethicsunwrapped.utexas.edu/glossary/groupthink>

More explanation and references are collected in this Wikipedia page: <https://en.wikipedia.org/wiki/Groupthink>

**Do-it-yourself biology**: Biologist Ellen Jorgensen and her colleagues address the question of how to create personal biotechnology in their research. In her talk, she discusses the DIY bio community and mentions biosecurity and ethics. Ellen Jorgensen (2012) “Biohacking -- you can do it, too”. TEDGlobal 2012: <https://www.ted.com/talks/ellen_jorgensen_biohacking_you_can_do_it_too#t-588958>

### Further reading

**Philosophy of science literature:** Science. Internet Encyclopedia of Philosophy: https://www.iep.utm.edu/category/s-l-m/science/

Philosophy of Science. Wikipedia: https://en.wikipedia.org/wiki/Philosophy\_of\_science

Read more discussion on the CRISPR Baby scandal and the related ethical issues: David Cyranoski (2019) The CRISPR-baby scandal: what’s next for human gene-editing. Nature 26 February 2019 <https://www.nature.com/articles/d41586-019-00673-1>

Conflicts of interest in research are addressed in Research integrity guidelines and codes, e.g. EC H2020. Ethics code of conduct. European Commission. Brussels. <https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf>

The case study balancing safety and biosecurity is inspired by a session during the Biosecurity Knowledge Days organised for Bio Risk Managers by RIVM Bureau Biosecurity in the Netherlands: [www.bureaubiosecurity.nl](http://www.bureaubiosecurity.nl)

**Do-it-yourself biology and ethical issues**: The following background information clarifies what Do-it-yourself biology is and how ethical issues are addressed in that community. The International Genetically Engineered Machine (iGEM) competition is a contest between teams of university and secondary school students developing synthetic biology solutions to societal problems. As part of the ‘human practices’ dimension of the contest, students receive training in biosafety and biosecurity issues. Some teams have developed biosecurity by design solutions in the past. Info: [www.igem.org](http://www.igem.org)

The biosecurity code of conduct of the KNAW (NL) addresses different role responsibilities of institutions and companies handling dual use knowledge, materials and technologies, including postal services, scientific publishers, etc. Info: <https://knaw.nl/en/topics/veiligheid/biosecurity>

Selgelid, M.J. Gain-of-Function Research: Ethical Analysis. Sci Eng Ethics 22, 923–964 (2016). https://doi.org/10.1007/s11948-016-9810-1: <https://link.springer.com/article/10.1007/s11948-016-9810-1>

Download the KNAW biosecurity code of conduct here: <https://knaw.nl/en/news/publications/a-code-of-conduct-for-biosecurity>

ALLEA code of conduct for research integrity: <https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf>

Young scientists code of ethics – world economic forum: <http://www3.weforum.org/docs/WEF_Code_of_Ethics.pdf>

## Module 4: Raising context awareness

### Further reading

International Covenant on Economic, Social and Cultural Rights – article 15. The full text of this covenant is available here: <https://www.ohchr.org/en/professionalinterest/pages/cescr.aspx>

Read more about the Oviedo Convention here: <https://www.coe.int/en/web/bioethics/oviedo-convention>

Several non-binding UNESCO declarations and recommendations address other ethical issues of life sciences. Read more here: <https://en.unesco.org/themes/ethics-science-and-technology>

the Armenian and the Kyrgyz Handbooks: <http://www.istc.int/en/article/24199>

Biological and Toxin Weapons Convention (1975) [www.unog.ch/bwc](http://www.unog.ch/bwc)

Geneva Convention Article 36 - First Protocol (8 June 1977) <https://ihl-databases.icrc.org/ihl/WebART/470-750045?OpenDocument>

Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (1925) More information on the Geneva Protocol can be found here: <https://unoda-web.s3-accelerate.amazonaws.com/wp-content/uploads/assets/WMD/Bio/pdf/Status_Protocol.pdf>

Security Council resolution 1540 (2004) <https://www.un.org/disarmament/wmd/sc1540/>

The slides on knowledge are adapted from Kai Ilchmann (2019) Science and dual use concerns. CBRN Export Controls Executive Course. KAZGUU, Nur sultan, 17 28 June 2019

For a very good summary and elaboration see: Revill , J & Jefferson, C (2014) Tacit knowledge and the biological weapons regime. Science and Public Policy 41 (2014) pp. 597 610

UN Treaty Collection <https://treaties.un.org/>