

Regional and global work by academies on biosecurity issues associated with emerging technologies in the biosciences

Robin Fears

Director Biosciences Programme

EASAC

Purposes of this presentation

- To note recent developments in genome editing (alteration of selected DNA sequence in a cell)
- To explore how rapid advances in science may lead to divergent governance of science, requiring international dialogue to ensure responsible research and innovation
- To stimulate discussion between disciplines and countries
- Focus on biosecurity (deliberate misuse) but recognise overlap with biosafety issues

Recent examples of work by academies on biosecurity (Europe/global)

EASAC (network EU science academies)

- Synthetic biology 2013
- Genome editing 2017

IAP (global network of academies)

- Synthetic biology 2014
- Responsible science 2016
- Biosecurity 2016-2018

EU national academies

- Leopoldina with DFG 2014
- KNAW 2016

Relevant roles of academies in providing collective voice of science

Convening

- Evidence gathering across disciplines
- Sharing perspectives between sectors and countries

Horizon scanning

- Foresight for emerging technologies
- Clarifying and defining boundaries in new areas

Raising awareness

- With other stakeholders, policy-makers and public-at-large
- National, regional, global

EASAC and its international linkages

- European Academies' Science Advisory Council is formed by the national science academies of EU Member States to enable them to collaborate in giving advice to policy makers
- Founded in 2001, independent of commercial or political bias, and is open and transparent in its processes
- Secretariat based at Leopoldina Academy in Halle, Germany with policy networking office in Brussels, Belgium
- EASAC is academy network for Europe for IAP and has links worldwide with academies and regional academy networks

Herrenhausen workshop on security implications of genome editing technology

- Co-organised by IAP, EASAC, NASEM and Leopoldina to convene >100 experts in genome editing, security studies and public policy (October 2017)
- Considered benefits, security concerns and prevention or mitigation of potential harm, and public engagement issues
- Participation from Africa, Asia, Americas and Europe; biological, clinical and social sciences
- Report published January 2018

Potential benefits of genome editing

- Molecular alterations can be introduced more efficiently, precisely, simply, but there are ethical and social questions
- Builds on other recent advances in biosciences, e.g. decreasing cost of DNA sequencing and synthesis
- Potential applications in *human cells* (somatic or germ line), *agriculture* (improving food security during climate change), *gene drives* (controlling insect vectors of disease), *microbes* (tackling pathogens, building bioeconomy)
- Help to develop counter-measures to other security threats

What are the security concerns about genome editing?

- Concerns raised by US National Intelligence, Biodefence
- Media postulate various types of misuse e.g. altered pathogens, “super-soldiers”, gene drives to damage ecology
- What may be specific concerns for genome editing and how might present regulatory frameworks prepare for future challenges?
- It may be difficult to separate security and safety concerns: IAP and EASAC previous recommendations on dual use concerns more broadly and how to mitigate.

Security concerns: points from the Herrenhausen workshop

- Need for clarity on what are the concerns, for whom and in what timeframe
- National security issues cover a wide range: biological weapons but also e.g. security of natural resources and data
- Pace of S&T might challenge traditional security frameworks
- Not just pathogens, e.g. “neurological weapons” and “military neuroenhancement”

How might potential security concerns be prevented or mitigated (Herrenhausen)?

Legal, regulatory, policy approaches

- Biological Weapons Convention
- World Health Organisation
- International research standards e.g. clinical trials

Norms of responsible behaviour

- Work of academies in developing codes of conduct and new regional co-operation
- Initiatives in education and sharing good practice

Scientific and technical strategies

- Achieving balance between preventing misuse and encouraging responsible research
- e.g. safeguarding gene drives

Continuing global efforts in engagement

- Broader range of voices worldwide must be heard to clarify and address potential benefits and risks
- Importance of credible scenarios in risk management
- Currently for genome editing, not concluding “no risk” but rather “no extra risk”. Recognise that uncertainty causes public concern and that understanding standards of evidence are critically important in differing perceptions of threats
- Scientists needs open and inclusive dialogue – including co-design of engagement mechanisms and use of social media

Examples of other EASAC reach-out on benefit-risk issues

- *Ethics* – EASAC work on Gain of Function reprinted by Annual Journal for Science and Ethics
- *Wider scientific community* – work on Genome Editing published in “eLife”, correspondence on Gain of Function in “Nature”
- *Industry* – work on Genome Editing discussed with European plant breeders, chemical industry
- *Continuing follow-up to Herrenhausen* – e.g. IAP publication in “Frontiers in Bioengineering and Biotechnology”

Next steps in academy work on genome editing

- Academies have important attributes for engaging key stakeholders: quality, independence, timeliness, inclusiveness
- Herrenhausen international workshop was a good first step but more work is needed, including on issues arising from research outside traditional locations
- Scientists across the disciplines must engage with the public:
 - To clarify what developments are or are not likely, and build trust
 - To articulate benefits alongside concerns, taking account of public values and perceptions