Risks from the laboratory?

On the nexus of biosafety, biosecurity and pandemic preparedness

By Una Jakob

Photo: Martin Storz/imageBROKER/Süddeutsche Zeitung Photo

Natural outbreak or laboratory accident? Even a good year after the COVID-19 pandemic began, this question about its origins has still not been clarified once and for all. An investigation by the World Health Organisation earlier this year did not resolve this question but rather raised new ones.

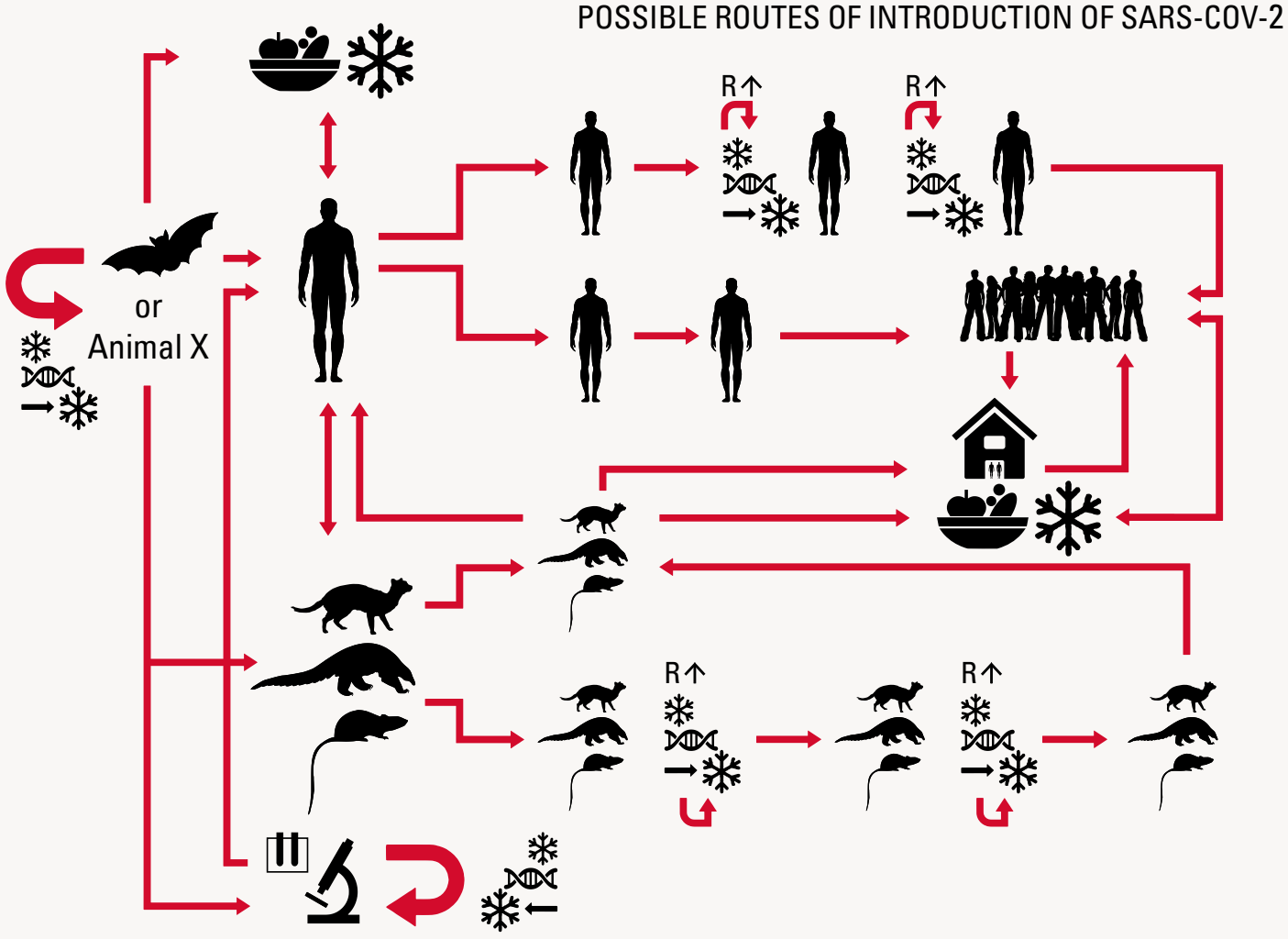
The WHO investigation carried out in January 2021 was preceded by a long preparatory process. In May 2020, the World Health Assembly (WHA) through WHA Resolution 73.1 tasked the WHO (World Health Organization) to investigate the origin of the pandemic. In January 2021, after protracted preparations and negotiations on modalities and access, a team of international experts from various pertinent disciplines travelled to Wuhan in China, where the origins of the COVID-19 outbreak had been suspected. Together with Chinese experts, the team investigated whether the pandemic could be traced back to a natural outbreak through direct transmission from bats, a natural outbreak via an – as yet – unknown intermediate animal host, contamination of frozen food or a laboratory accident. The latter hypothesis is the most sensitive politically: the question whether the pandemic was caused by the accidental release of the SARS-CoV-2 pathogen from a Chinese research laboratory. China has vehemently rejected this allegation and has, in return, suggested that the virus could have originated outside China (e.g. Molter/DiResta, 2020). While some scientists were convinced early on that this was a natural outbreak (Andersen et al., 2020), others had at least discussed the possibility of an accident and called for an international investigation (Lentzos, 2020). The WHO team's official report was published at the end of March 2021, but it did not produce any conclusive results (Lentzos, 2021). Although a laboratory accident is described in the report as highly unlikely, at the press conference on the occasion of the report's publication the WHO's Director General stated that further investigations in this regard were still needed (WHO, 2021a, b). Thus the origin of the pandemic remains unknown.

On the one hand, the political debate about a possible laboratory accident with SARS-CoV-2 mirrors the global political situation and the rivalry between China as an emerging power and the USA as a superpower struggling for its supremacy. For example, former US President Trump repeatedly held China responsible for the outbreak in the early phase of the pandemic. The current US administration, together with 13 other countries, has criticised the fact that the WHO team did not have access to all available information in the course of the investigation, by implication accusing China of not having cooperated sufficiently (USA, 2021). Moreover, US President Biden recently instructed the US intelligence community to investigate the origin of the pandemic more closely; China meanwhile continues to criticise such statements as being politically motivated (Hunnicutt and Bose, 2021)

Biosafety and biosecurity – concepts at the interface of security and health

On the other hand, the debate about the origin of the pandemic is part of the international and interdisciplinary discussions on biosafety and biosecurity in which the international security, global health and life sciences communities have engaged for several years. The term "biosafety" denotes measures to avert the accidental release of pathogens from laboratories, and "biosecurity" means preventing unauthorised access to such pathogens. Among many other issues, these discussions have addressed the question of how to handle research activities which pursue beneficial and legitimate goals but at the same time harbour a high potential for misuse or harm if the pathogens under study are deliberately or accidentally released.

Illustration: Vachagan Malkhasyan/shutterstock



Source: Own diagram based on WHO, 2021: 112

Where could the novel coronavirus have originated? The diagram shows the possible routes of introduction investigated by the WHO

Such research is referred to as "Dual Use Research of Concern" (DURC). In biology, DURC experiments often relate to the field of genetics and genetic engineering, especially in "gain-of-function" research. Here, pathogens are modified in such a way that either some of their properties are artificially altered (e.g. enhanced pathogenicity or person-to-person transmissibility) or new properties are added (e.g. resistance to drugs) (see Casadevall/Imperiale, 2014). Various synthetic biology experiments have also been criticised as (too) dangerous, such as the reconstruction of the "Spanish Flu" virus that triggered a devastating pandemic in 1918–1920 or the synthesis of a virus that is related to the smallpox virus (Koblentz, 2020). DURC experiments are often conducted to better understand the nature of dangerous pathogens and to be able to assess and reduce the risk of pandemic outbreaks more effectively. In the process, however, more dangerous pathogens can be created which, if deliberately or accidentally released from the laboratory, could trigger precisely those hazards they were supposed to reduce. This risk renders such research a security issue in the context of biosafety, biosecurity and biological risk reduction.

The spectrum of biological risks

Biological warfare, that is, the use of diseases or toxins as weapons, has been known for centuries. For example, during the siege of the city of Kaffa on the Crimean Peninsula in the 14th century, besieging troops are said to have catapulted the corpses of plague victims into the city. In the 18th century, in the course of the colonisation of North America, British military personnel issued blankets and clothing contaminated with smallpox to Native Americans (Wheelis, 2001). The aversion against and prohibition of such warfare can be traced back just as long. The use of biological weapons is universally and globally outlawed today. For almost 50 years, the Biological Weapons Convention (BWC) has moreover prohibited the possession, production and transfer of biological weapons for its current

Working under difficult conditions: the WHO's scientific delegation outside the fish market in Wuhan.

Photo: ullstein bild – AP

LEGEND

- Bat
- Tier X — Any other animal
- Food (any)
- Frozen product
- Person
- Group/community
- Market
- Evolution
- Possible hosts
- Laboratory
- R↑ — Adaptation, transmissibility increase

183 member states. A research project at the Peace Research Institute Frankfurt (PRIF) is examining the question of whether this prohibition can now also be considered a norm under customary international law.[1]

Non-compliance with the ban on bioweapons has been rare (see Carus, 2017). However, due to changing political circumstances and technological developments, bioweapons could become an option in the future for countries that would not shy away from norm violations. To date, there are only isolated examples of attempted or actual terrorist attacks with pathogens or toxins. These include, for example, the "anthrax letters" in the USA in October 2001 or the foiled attempt in Cologne in 2018 to disperse the plant toxin ricin via an explosion. Some transnational terrorist organisations are also said to be interested in biological weapons (Lentzos 2020). The technological hurdles for synthesising or modifying pathogens for terrorist use are very high. Access to such pathogens stemming from DURC experiments might possibly represent a desirable option for terrorists or criminals. Since such experiments are usually carried out under high safety and security precautions, illicitly acquiring such pathogens is difficult and accidental release improbable. Accidents with pathogens nevertheless have occurred repeatedly (Furmanski, 2014), and DURC experiments might be conducted even more frequently in future considering the current pandemic experience. Effective and appropriate biosafety and biosecurity measures should therefore be discussed and introduced early on.

The keywords "biosafety" and "biosecurity" encompass issues that were originally tackled in separate research areas. The containment and prevention of infectious diseases falls within the scope of global health promotion and research. Protection against the accidental release of dan-

[1] https://www.hsfk.de/en/research/projects/projects/the-prohibition-of-biological-weapons-a-norm-of-customary-international-law

Literature

Andersen, Kristian G., Andrew Rambaut, W. Ian Lipkin, Edward C. Holmes und Garry, Robert F.: The Proximal Origin of SARS-CoV-2, Nature Medicine, 2020, 26: 450-452, https://doi.org/10.1038/s41591-020-0820-9.

Casadevall, Arturo/Imperiale, Michael J.: Risks and Benefits of Gain-of-Function Experiments with Pathogens of Pandemic Potential, Such as Influenza Virus: a Call for a Science-Based Discussion, Editorial, 2014, MBio 5: 4, e01730-14, doi:10.1128/mBio.01730-14.

Furmanski, Martin: Threatened Pandemics and Laboratory Escapes: Self-Fulfilling Prophecies, Bulletin of the Atomic Scientists, 2014, 31 March 2014, https://thebulletin.org/2014/03/threatened-pandemics-and-laboratory-escapesself-fulfilling-prophecies.

Koblentz, Gregory: A biotech firm made a smallpox-like virus on purpose. Nobody seems to care, Bulletin of the Atomic Scientists, 2020, 21 February 2020, https://thebulletin. org/2020/02/a-biotech-firm-made-a-smallpox-like-virus-on-purpose-nobody-seems-to-care/.

Lentzos, Filippa: Natural spillover or research lab leak? Why a credible investigation is needed to determine the origin of the coronavirus pandemic, 1 May 2020, Bulletin of the Atomic Scientists, 2020, https://thebulletin.org/2020/05/natural-spillover-or-research-lab-leak-why-a-credible-investigation-in-needed-to-determine-the-origin-of-the-coronavirus-pandemic/.

Molter, Vanessa/DiResta, Renee: Pandemics and Propaganda: How Chinese State Media Creates and Propagates CCP Coronavirus Narratives, The Harvard Kennedy School Misinformation Review Vol. 1, 2020, 1-24, DOI: https://doi.org/10.37016/mr-2020-025.

USA: Joint Statement on the WHO-Convened COVID-19 Origins Study, Media Note, U.S. Department of State, 2021, 30 March 2021, https://www.state.gov/joint-statement-on-the-who-convened-covid-19-origins-study.

Delegates of the 2019 BWC Meeting of States Parties in Geneva.

gerous pathogens moreover touches on questions related to occupational safety. Preventing unauthorised access and deliberate spread also calls for action in the areas of law enforcement, judiciary and security policy. Preventing the use of diseases as weapons ultimately requires diplomatic, intelligence and defence efforts. Together, these topics span the entire spectrum of biological risks – from natural disease outbreaks to laboratory accidents, criminal activities, bioterrorism and state-run bioweapons programmes.

In political practice, this is reflected, for example, in a shift in the discourse within the institutions for biological disarmament. As the author has explored in a project in the framework of the "Normative Orders" cluster of excellence in Frankfurt[2], the key issues in the diplomatic efforts concerning biological arms control have continuously moved away from classical biological disarmament over the last 20 years: State-centred, binding transparency and verification measures were largely sidelined, and countries have increasingly concentrated on national preparedness for and defence against biological risks across the entire spectrum instead. International cooperation in the peaceful use of the rapidly developing fields of biology and biotechnology, including to promote global health, is playing an increasingly important role. This brings us back full circle to the question of how to deal with DURC as an important and at present controversial aspect of biosafety and biosecurity.

IN A NUTSHELL

- Even after a WHO investigation, it remains unclear whether the COVID-19 pandemic originated from a natural outbreak or a laboratory accident.
- Pandemic research often includes security-relevant experiments in which pathogens are synthesized or modified.
- Their unintentional release is one of the biological risks on a spectrum ranging from natural disease outbreaks to laboratory accidents, criminal or bioterrorist activities and state-run bioweapons programmes.
- The question of the origins of the COVID-19 pandemic must therefore also be seen in the context of the global debate on biosafety and biosecurity, that is, efforts to contain these risks.
- To improve international biosafety, interdisciplinary research from the perspectives of the natural, social and legal sciences is needed.

Enhancing biosafety and biosecurity requires interdisciplinary research

On the basis of the information currently available, it is impossible to tell whether the COVID-19 pandemic outbreak originated from a natural outbreak or a laboratory accident. To answer this question, further independent investigations would be necessary, which would have to be conducted without the limitations set by the WHO's mandate and with extensive access rights. The results of such investigations could yield important insights, beyond the specific case in hand, into how the risk of a pandemic could be minimised in future and how risks in security-relevant research could be better assessed and reduced.

Studying these topics and devising policy options require an interdisciplinary approach to the topics of biosafety and biosecurity from the perspectives of the natural, social and legal

[2] https://www.hsfk.de/en/research/projects/projects/from-biological-disarmament-to-biosecurity-securitization-or-humanization-of-biological-weapons-control-after-september-11-2001

sciences. To name just a few important topics: It could, for example, be explored whether globally harmonised standards and regulations could sustainably improve biosafety and biosecurity, that is, protection against all the biological risks outlined above, and how such standards and regulations could be agreed upon. This includes making laboratories safe and secure, as well as strengthening international bioweapons control. Criteria for a risk-benefit assessment in DURC experiments would also have to be defined on an interdisciplinary basis, carefully balancing the goals of minimising the potential risks of biological research and of avoiding undue restrictions on the freedom of science. The results from such research could also help prepare and support political decisions.

The current pandemic highlights areas in which further research would be necessary in order to be better prepared for similar events – not only in terms of health but also (bio)safety and (bio)security policy. Hopefully, the pandemic experience will provide the incentive to tackle this work. ●

The author

Dr Una Jakob is a research associate at the Peace Research Institute Frankfurt (PRIF), a member institution of the Leibniz Association. Her research looks at the disarmament and non-proliferation of biological and chemical weapons from a theoretical and political-practical perspective as well as at the interconnections between biological disarmament, biosecurity and global health. She has participated regularly in the diplomatic conferences of the Biological Weapons Convention (BWC) in Geneva since 2004 and been a member of the Joint Committee on the Handling of Security-Relevant Research of the German Research Foundation and the National Academy of Sciences Leopoldina since April 2021.

una.jakob@hsfk.de

Wheelis, Mark 2001: Biological Warfare Before 1914, in: Geissler, Erhard/van Courtland Moon, John Ellis 2001: Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945, Oxford: Oxford University Press, 8-34.

WHO 2021a: WHO-convened Global Study of Origins of SARS-CoV-2: China Part, Joint WHO-China Study 14 January–10 February 2021, https://www.who.int/publications/i/item/who-convened-global-study-of-origins-of-sars-cov-2-china-part.

WHO 2021b: WHO Director-General's remarks at the Member State Briefing on the report of the international team studying the origins of SARS-CoV-2, 30 March 2021, https://www.who.int/director-general/speeches/detail/who-director-general-s-remarks-at-the-member-state-briefing-on-the-report-of-the-international-team-studying-the-origins-of-sars-cov-2.