



Convention on Biological Diversity

Distr.: General
17 December 2025

English only

Capacity-building workshop on synthetic biology

Isle of Vilm, Germany, 3–7 November 2025

Report of the capacity-building workshop on synthetic biology

Introduction

1. In its decision [16/21](#), the Conference of the Parties to the Convention on Biological Diversity urged Parties to provide financial and technical support for capacity-building and development and for technology transfer initiatives, including for research and development and for assessment in the field of synthetic biology. In the same decision, it requested the Executive Secretary of the Convention to facilitate capacity-building activities on synthetic biology.
2. In response to that request, the Federal Agency for Nature Conservation of Germany and the Secretariat of the Convention, with financial support from the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety of Germany, co-organized a capacity-building workshop on synthetic biology on the Isle of Vilm, Germany, from 3 to 7 November 2025.
3. The aim of the workshop was to acquaint participants with the processes related to synthetic biology under the Convention, present them with the most recent developments in the field of synthetic biology and exchange related experiences and information. The workshop also provided an opportunity for participants to gain an understanding of different regional needs in terms of capacity-building and development, access to and transfer of technology and knowledge-sharing.

Item 1

Opening of the workshop

4. The workshop was opened on 3 November 2025, at 7.30 p.m.
5. A representative of the Federal Agency for Nature Conservation welcomed the participants to the workshop and presented the agenda.
6. The Executive Secretary delivered opening remarks to the participants by videoconference and noted the importance of the workshop as the first capacity-building activity on synthetic biology to be conducted under the Convention.
7. The Deputy Director of General Sustainable Development Policy in Economy and Society of the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety welcomed the participants to the workshop by videoconference and emphasized the importance of the event for understanding synthetic biology in relation to the Convention and its three objectives.
8. The Head of Division I 2.1 of the International Academy for Nature Conservation of the Federal Agency for Nature Conservation provided a historical overview of the Isle of Vilm and of the establishment of the Academy.
9. The participants and resource team were then invited to introduce themselves.

Item 2**Synthetic biology under the Convention on Biological Diversity**

10. The representative of the Secretariat provided a detailed summary of the work conducted to date under the Convention in relation to synthetic biology, including information on decisions of the Conference of the Parties on synthetic biology, the publication entitled *Synthetic Biology* (CBD Technical Series No. 100),¹ the Kunming-Montreal Global Diversity Framework and the process for broad and regular horizon scanning, monitoring and assessment.² Given the coordinated approach to the Convention and its Protocols, information on the risk assessment of living modified organisms under the Cartagena Protocol on Biosafety was also provided, including on the publication entitled *Additional Voluntary Guidance Materials to Support Case-by-Case Risk Assessments of Living Modified Organisms Containing Engineered Gene Drives* (Biosafety Technical Series 07).³

Item 3**Overview of recent developments in synthetic biology**

11. The first presentation under agenda item 3 was delivered by a representative of the Atomic Energy Authority of Egypt, who provided an overview of the history and foundations of biotechnology, which had led to synthetic biology. He summarized various types of biotechnology and introduced participants to the application of generative artificial intelligence to synthetic biology.

12. In the second presentation, a representative of the Federal Agency for Nature Conservation provided information on the application of synthetic biology to animals, such as de-extinction initiatives (e.g. for the mammoth, the dodo and the thylacine), the potential use of genetic engineering for conservation (e.g. the genetic engineering of corals to increase their heat tolerance) and novel applications in farm animals (e.g. cattle, pigs and fish). She gave an overview of the results of a horizon scan,⁴ illustrative case studies in agriculture and aquaculture to identify potential hazards⁵ and some of the recent activities of the International Union for Conservation of Nature. She also introduced considerations concerning those applications in relation to their use in nature.

13. A representative of the Federal Office of Consumer Protection and Food Safety of Germany presented the work of the Central Committee on Biological Safety on monitoring developments in synthetic biology, including through an ongoing literature review. The monitoring reports were highlighted as important technical resources on new developments in synthetic biology.⁶ She also noted that mirror bacteria were currently under supervision by the Central Committee.

14. For the fourth presentation, a representative of the Federal Agency for Nature Conservation provided an overview of living modified organisms containing engineered gene drives as a case study for how new developments in synthetic biology could be approached. He described the timeline for the development of engineered gene drives, some relevant activities carried out at the international level, a recent technical report on the implications of gene drive organisms for the environment and nature conservation⁷ and some research on the modelling of living modified organisms containing engineered gene drives.⁸

¹ Available at www.cbd.int/doc/publications/cbd-ts-100-en.pdf.

² See [CBD/SBSTTA/26/4](#), annexes I, II and III, and [CBD/SBSTTA/26/INF/5](#).

³ Available at <https://bch.cbd.int/en/database/VLR/BCH-VLR-SCBD-280754>.

⁴ See Marianne Miklau and others, “Horizon scanning of potential environmental applications of terrestrial animals, fish, algae and microorganisms produced by genetic modification, including the use of new genomic techniques”, *Frontiers in Genome Editing*, vol. 6 (June 2024).

⁵ See Marion Dolezel and others, “Governance perspectives on genetically modified animals for agriculture and aquaculture: challenges for the assessment of environmental risks and broader societal concerns”, *Animals*, vol. 15, No. 18 (September 2025).

⁶ See <https://zkbs-online.de/en/synthetic-biology/current-developments>.

⁷ Available at www.umweltbundesamt.at/fileadmin/site/publikationen/rep0705.pdf.

⁸ See Johannes L. Frieß and others, “Review of gene drive modelling and implications for risk assessment of gene drive organisms”, *Ecological Modelling*, vol. 478 (April 2023); Prateek Verma, R. Guy Reeves and Chaitanya S. Gokhale, “A common gene drive language eases regulatory process and eco-evolutionary extensions”, *BMC Ecology and Evolution*, vol. 21

15. In the fifth presentation, a representative of the Federal Agency for Nature Conservation introduced the participants to living modified viruses and presented a recent horizon scan on living modified viruses that were designed for environmental release.⁹ She drew attention to the various applications that were currently under research and development and their potential use (e.g. transmissible vaccines for wildlife, living modified citrus tristeza virus and engineered bacteriophages).¹⁰

16. In the last presentation under item 3, a representative of the Federal Agency for Nature Conservation summarized some of the global discussions on definitions of synthetic biology and gave insights into how various disciplines influenced the perception of that field. She then focussed on the convergence of generative artificial intelligence and synthetic biology for rebuilding and redesigning natural systems and on horizon scans of environmental applications of living modified microorganisms,¹¹ while noting the increased pace of technological development. She also provided an overview of a recent summit on the future of biotechnology.¹²

17. Following the presentations, participants engaged in two breakout sessions. In the first session, they considered a recent article on mirror organisms.¹³ In the second session, they shared their current experiences and current state of engagement in the field of synthetic biology.

Item 4

Needs for capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology

18. A representative of the Third World Network gave a presentation on civil society perspectives regarding capacity-building for synthetic biology and its assessment. She provided an overview of how synthetic biology could be considered to be increasing in complexity, when considering the first commercialized living modified organisms, and of considerations for capacity-building on the assessment of synthetic biology applications. She noted that capacity-building needed to be equitable, multidisciplinary and participatory and emphasized that technological applications should be safe for the environment.

19. A representative of the Atomic Energy Authority of Egypt then delivered a presentation on trends, issues and capacity needs in the field of synthetic biology. The presentation was based on the outcomes of the work of the multidisciplinary Ad Hoc Technical Expert Group on Synthetic Biology to Support the Process for Broad and Regular Horizon Scanning, Monitoring and Assessment.¹⁴ The presenter emphasized the importance of equitable and science-based governance, of ensuring that innovation supports the conservation and sustainable use of biodiversity and of the fair sharing of benefits from the use of genetic resources.

20. Following the presentations, participants were divided into regional groups to facilitate discussions on capacity-building and development, access to and transfer of technology and

(August 2021); and Prateek Verma and others, “The Effect of Mating Complexity on Gene Drive Dynamics”, *The American Naturalist*, vol. 201, No. 1 (January 2023).

⁹ See Michael F. Eckerstorfer and others, “Scanning the horizon for environmental applications of genetically modified viruses reveals challenges for their environmental risk assessment”, *International Journal of Molecular Sciences*, vol. 25, No. 3 (January 2024).

¹⁰ See Phil Huss and Srivatsan Raman, “Engineered bacteriophages as programmable biocontrol agents”, *Current Opinion in Biotechnology*, vol. 61 (February 2020); and Filippa Lentzos and others, “Eroding norms over release of self-spreading viruses”, *Science*, vol. 375, No. 6576 (January 2022).

¹¹ See Michael F. Eckerstorfer and others, “Environmental applications of GM microorganisms: tiny critters posing huge challenges for risk assessment and governance”, *International Journal of Molecular Sciences*, vol. 26, No. 7 (March 2025); and Marianne Miklau and others, “Horizon scanning of potential environmental applications of terrestrial animals, fish, algae and microorganisms produced by genetic modification, including the use of new genomic techniques”, *Frontiers in Genome Editing*, vol. 6 (June 2024).

¹² See www.spiritofasilomar.org.

¹³ See Katarzyna P. Adamala and others, “Confronting risks of mirror life”, *Science*, vol. 386, No. 6728 (December 2024).

¹⁴ See [CBD/SYNBIO/AHTEG/2024/1/3](https://www.cbd.int/synbio/ahteg/2024/1/3).

knowledge-sharing in the context of research and development, and assessments in the field of synthetic biology. The discussions were centred on the three objectives of the Convention and the Kunming-Montreal Global Biodiversity Framework (see annex)

21. Participants were also asked how capacity-building could be provided in practice. Suggestions included dedicated webinars, the development of online platforms, the translation of scientific information into languages other than English, training-of-trainers courses and facilitated scientific or peer-to-peer exchanges.

Item 5

New developments in synthetic biology and their implications for assessment

22. A representative of the Atomic Energy Authority of Egypt gave an overview of Articles 2, 7, 8, 19 of and annex I to the Convention before providing information on Articles 15, 16, 26 of and annex III to the Cartagena Protocol. He also provided information on the conduct of an environmental risk assessment aligned with annex III to the Protocol, as well as on the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress.

23. In the second presentation, a representative of the Federal Agency for Nature Conservation provided insights into the monitoring of a living modified maize¹⁵ in Europe as a case study. She differentiated between general and case-specific monitoring and explained how monitoring was closely related to risk assessment.

24. In the third presentation, a representative of the Ministry of Climate and Environment of Norway described the Gene Technology Act of Norway (1993) and shared the national experience gained with incorporating ethics, socioeconomics and sustainability elements into formal assessments of living modified organisms. The example of a living modified maize¹⁶ was used to highlight how a broader assessment of biotechnology, which included socioeconomic and ethical considerations, could be done in practice.

25. A representative of the Kaunas University of Technology then gave a presentation on potential governance implications of synthetic biology. He discussed uncertainties with respect to the definition and scope of the term, risks and transboundary movements. The importance of anticipatory governance was emphasized in view of the pace of technological developments in synthetic biology.

26. In the fifth presentation, a representative of the Federal Agency for Nature Conservation introduced the participants to the general concepts and history of technology assessments and how they could be applied to the field of synthetic biology. The presentation also covered fact-value hybrids; the diversity of values;¹⁷ multi-, inter- and transdisciplinarity; and generic and case-specific assessments. An example of a project conducted in Mexico on an intercultural approach to new biotechnologies was also mentioned.¹⁸

27. In the final presentation, a representative of the Third World Network provided information on socioeconomic, cultural and ethical assessments conducted under the Convention. She gave an overview of Articles 7, 8 (g) and (j) and 14 of and annex I to the Convention, Target 17 of the Kunming-Montreal Global Biodiversity Framework, Article 26 of the Cartagena Protocol and related elements from recent decisions of the Conference of the Parties on synthetic biology. The Akwé: Kon Voluntary Guidelines¹⁹ and the guidance on the assessment of socioeconomic considerations in the context of Article 26 of the Cartagena Protocol²⁰ were also highlighted. She emphasized the

¹⁵ See <https://bch.cbd.int/en/database/LMO/BCH-LMO-SCBD-14750>.

¹⁶ See <https://bch.cbd.int/en/database/LMO/BCH-LMO-SCBD-14841>.

¹⁷ See the *Methodological Assessment Report on the Diverse Values and Valuation of Nature* of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

¹⁸ See C. Marchesino, S. Ribeiro and V. V. Arias, “An intercultural approach for the Assessment of new Biotechnologies”, *Development*, vol. 67 (October 2024).

¹⁹ Decision VII/16, annex, sect. F.

²⁰ [CBD/CP/MOP/9/10](#), annex.

importance of considering different world views, societal contexts, free prior and informed consent and responsible policy, regulation and governance.

Item 6

Conclusions of the workshop

28. Participants were asked for feedback on the workshop in plenary and through an anonymous survey.²¹
29. Participants expressed appreciation to the organizers and the resource team for delivering a well-organized and impactful workshop. They said that they had valued the case studies used as examples, the opportunity to network, learning from one another and working in small groups.
30. There was a view that additional future workshops would be helpful and could focus on further and more in-depth case studies and examples. It was suggested that future workshops be held at the regional level or with a hybrid component, to increase participation. Some participants also suggested that future workshops build on the present workshop and be organized as a second part to this initial meeting. The importance of conducting workshops in languages other than English was also mentioned.

Item 7

Closure of the workshop

31. The representative of the Secretariat thanked the Government of Germany for its generous financial contribution, which had made the workshop possible, the local organizers for their technical and logistical support, the International Academy for Nature Conservation for hosting the event and the participants for their active participation during the week.
32. A representative of the Federal Agency for Nature Conservation thanked the Secretariat for the partnership in organizing the workshop, the International Academy for Nature Conservation for hosting the workshop and the participants for their contributions.
33. The workshop concluded with a farewell dinner held at 6 p.m. on 6 November 2025, and participants departed the Isle of Vilm on 7 November 2025.

²¹ See www.cbd.int/documents/694427931313384dda6a9511 for the results of the survey.

Annex

Summary of the discussions related to capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology

1. The table below contains a summary of the views expressed by participants regarding needs for capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology, the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework.
2. Overall, participants recognized the importance of capacity-building and development, access to and transfer of technology and knowledge-sharing to support research and development and assessments in the field of synthetic biology. There was also an acknowledgement of the various levels of development of legal frameworks and institutional capacities in different countries.
3. There was a view that horizon scanning could assist with the identification of capacity-building, technology transfer and knowledge-sharing needs and inform the choice of relevant, potential activities.

Perspectives on the needs for capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology to support the implementation of the three objectives of the Convention and the Kunming-Montreal Global Biodiversity Framework

<i>Area</i>	<i>Need</i>
Capacity-building and development	1. Training sessions for scientists, skilled specialists, policymakers, government regulators, customs officers and State agency representatives 2. Capacity-building activities adapted to local contexts (e.g. geographical, cultural and constitutional) and community involvement 3. Development of human resources, including through the training of scientists, regulators and technical staff, to build expertise 4. Strengthened technical competencies and institutional capacities in research and regulatory oversight for the safe use of synthetic biology 5. Improved infrastructure and access to equipment, including upgraded modern laboratories, biocontainment facilities (upgraded biosafety levels), and tools for DNA analysis, sequencing and computational modelling 6. Training on laboratory safety and on risk assessment 7. Rules for biosafety in laboratories and methodologies for identifying the potential risks of novel applications, especially by using an ethical framework 8. Peer-to-peer learning and creation of regional or subregional groups 9. Enhanced awareness among regulators, policymakers, scientists and the general public of genetic engineering and synthetic biology
Access to and transfer of technology	1. Institutional capacity to review, negotiate and implement material transfer agreements 2. Capacity in and assistance with intellectual property management (e.g. patents), equitable benefit-sharing and fostering of fair partnerships

<i>Area</i>	<i>Need</i>
	3. Promotion of technology transfers and knowledge-sharing that respects ethical, social, environmental and cultural considerations 4. Inclusion of diverse stakeholders in decision-making processes 5. Facilitated access to specialized equipment, licensing and sharing of protocols for collaborative research 6. Identification of and documentation on flora and fauna to support research and innovation initiatives 7. Access to genome editors for small developers and public institutions 8. Reduced patent barriers to promote fair access 9. Use of agreements that ensure the fair sharing of monetary and non-monetary benefits 10. International, regional and South-South cooperation (e.g. joint ventures to share technology) 11. Formal agreements to share technology (e.g. licensing and other agreements)
Knowledge-sharing	1. Platforms and mechanisms to facilitate North-South and South-South collaboration for knowledge exchange 2. Harmonization of biosafety frameworks at the regional and global levels 3. Creation of digital information-sharing systems to support data exchange among national authorities at the regional and global levels 4. Strengthening of institutional capacity for public engagement and transparent communication on living modified organisms and synthetic biology research 5. Holding of conferences, seminars and workshops on synthetic biology 6. Development and maintenance of online and open-access resources and databases to share protocols, tools and scientific data and compare scientific findings 7. Establishment of biosafety and biosecurity networks to enhance coordination and information exchange 8. Dissemination of research findings through peer-reviewed journals and scientific publications 9. Awareness-raising of synthetic biology, including for the general public 10. Academic exchanges, international collaboration and joint research projects 11. Improved scientific communication, including on safety and ethical issues