An introduction to Synthetic Biology

SBSTTA-28 Agenda Item 5
(SBI-7 Agenda Item 8)

Hendrik Segers
Belgian CBD SBSTTA NFP

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A (short) history of the “issue”

  - SBSTTA-14 (Nairobi, 2010): *Science* publication announcing the first self-replicating cell with entirely synthetic, man-made genome (DOI: 10.1126/science.1190719): XIV/16 New and Emerging Issues – enter ”synthetic biology”
- COP-10 (Nagoya, 2010): X/13 New and Emerging Issues – *application of precautionary approach*
- COP-11 (Hyderabad, 2012): XI/11 New and Emerging Issues related to the conservation and sustainable use of biodiversity - §3 *Noting*,…the need to consider the potential positive and negative impacts of components, organisms and products resulting from synthetic biology techniques on the conservation and sustainable use of biodiversity…
- COP-12, BS COP MOP 7 (Pyeongchang, 2014): XII/24 New and Emerging Issues: synthetic biology: §3 **coordinated approach between CBD and Protocols**; establishment of 1st AHTEG and OE online forum
  - SBSTTA-20 (Montreal, 2016) XX/8 Synthetic Biology: enter “digital sequence information” in relation to ABS
- COP-13 (Cancun, 2016): XIII/17 Synthetic Biology: §4 *Acknowledges*.…the AHTEG’s **operational definition of synthetic biology as starting point for deliberations** under the CBD and its Protocols, mandate of AHTEG and OE online forum extended. Enter ”gene drives”
- COP 14 (Sharm El-Sheikh, 2018): 14/19 Synthetic Biology: §3 *Agrees* that broad and regular horizon scanning, monitoring and assessing of the most recent technological developments is needed…, mandate of AHTEG (renewed membership) and OE online forum extended

CBD COP 15, decision 15/31 Synthetic Biology (Montreal, 2022)

A. Considerations for new and emerging issues and associated criteria:

- §2: **no conclusion on synthetic biology as "New and Emerging Issue"**
- §3: **not a precedent** regarding synthetic biology as a permanent item under the Convention or on any future work or processes **incl. horizon scanning**

B. Process for broad and regular horizon scanning, monitoring and assessment

- §4: ***Establishes* a process for broad and regular horizon scanning, monitoring and assessment** of the most recent technological developments in synthetic biology … and agrees to start its work for one intersessional period;
- §5: *Establishes* a mAHTEG to Support the Process for Broad and Regular Horizon Scanning, Monitoring and Assessment…

CBD COP 16, decision 16/21 Synthetic biology (Cali, 2024)

- §5 *Decides* to develop a **thematic action plan to support capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology**,…
- §7 *Invites* … [all] … submit information on their experiences, needs and priorities

- §6 *Establishes* a **new ad hoc technical expert group on synthetic biology**… (*OE online forum remains operational*)
- §8 *Invites* … [all] … to submit information on their priority areas in relation to synthetic biology…
- §9 *Requests* the ES … (b) To commission an **independent scientific study** … on synthetic biology applications that are relevant to achieving the Framework… (c) to synthesize the information shared pursuant to [above]

- §10 *Requests* the [SBSTTA-28] to consider … the draft thematic action plan and the outcomes of the work of the [AHTEG], and requests [SBI] to review the implementation aspects of the thematic action plan…

CBD COP 16, decision 16/21 Synthetic biology
(Cali, 2024)

ToR for the AHTEG: all “in relation to the three objectives of the Convention and the implementation of the Kunming-Montreal Global Biodiversity Framework”

- §3(a) Review and synthesize the compilations referred to in… 9 (c) …. 9 (b),
- §3(c) Identify the current and potential benefits of synthetic biology…
- §3(d) Identify the potential positive impacts of the most recent technological developments in synthetic biology…
- §3(e) Identify the potential negative impacts of the most recent technological developments in synthetic biology…
- §3(f) Provide advice on how capacity-building and development, access to and transfer of technology and knowledge-sharing in synthetic biology can be taken into account with respect to the draft thematic action plan, …

Results of intersessional work and SBSTTA pre-session documents (1)

- Draft **thematic action plan to support capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology:** see CBD/SBSTTA/28/4/Add.1 – CBD/SBI/7/8/Add.1
  - Note by the secretariat
  - Annex,
    - I. Introduction, II. Structure, III. Linkage to the Convention on Biological Diversity, the Kunming Montreal Global Biodiversity Framework and existing plans, IV. Use of the thematic action plan, V. Guiding principles,
    - VI. Means of implementation => link to GEF, GBFF, BioFin, UNDP,…
    - VII. Role of the Secretariat and of the scientific and technical support centres,
    - VIII. Monitoring and reporting on progress in the implementation of the thematic action plan => link to PMRR process, LTSF for CB&D, and TSC mechanism.
    - Enclosure

"CBD 16/21 §10 *Requests* the [SBSTTA-28] to consider … the draft thematic action plan and the outcomes of the work of the [AHTEG], and requests [SBI] to review the implementation aspects of the thematic action plan…"

Results of intersessional work and SBSTTA pre-session documents (2)

Enclosure: *The "Draft thematic action plan to support capacity-building and development, access to and transfer of technology, and knowledge-sharing in the context of synthetic biology for the implementation of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework"?*

Three outcome areas are:

(a) Strengthened capacity for research and development in and the assessment of synthetic biology;

Objective: **actors** have improved capacity for undertaking research and development in and the assessment and oversight of synthetic biology applications that are relevant to the implementation of the three objectives of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework

(b) Improved access to and transfer of technology relevant to synthetic biology;

Objective: …. ensure access to synthetic biology technology that is relevant to the conservation and sustainable use of biological diversity and does not result in significant damage to the environment, and to create enabling environments that facilitate the transfer of such technology,…

(c) Enhanced knowledge-sharing on synthetic biology, including its development, assessment, governance and regulation.

Objective: knowledge relevant to synthetic biology research, development, assessment, governance and regulation is shared widely, …, and made available for use by all actors for research and development in and the assessment, governance and regulation of synthetic biology

Enclosure

Outcome areas and indicative strategic actions to support capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology for the implementation of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework

Outcome area 1: strengthened capacity for research and development in and the assessment of synthetic biology **Objective:** actors[a] have improved capacity for undertaking research and development in and the assessment and oversight of synthetic biology applications that are relevant to the implementation of the three objectives of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework	
Output	*Indicative strategic actions*
1.1 Identification of needs and priorities	(a) Assess capacities and identify needs related to research and development, access and transfer of technology, regulation, assessment, monitoring and knowledge-sharing in the context of synthetic biology; (b) Prioritize activities for short-, medium- and long-term action on the basis of identified needs and national circumstances; (c) Integrate synthetic biology research and development and assessment needs into various sectoral budget plans, and identify training needs.
1.2 Strengthened physical infrastructure	(a) Establish, strengthen or provide access to technical laboratory infrastructure (e.g. polymerase chain reaction machines; sequencing equipment; DNA synthesizers; molecular biology, microbiology and biosafety laboratory facilities; biocontainment facilities; automated equipment; biomanufacturing platforms; genome editors; and detection, traceability and monitoring tools);[b] (b) Develop governance mechanisms, technical support and sustainability models to ensure long-term functionality and equitable use of laboratory infrastructure; (c) Develop in silico infrastructure (e.g. computational facilities for data processing, computer-aided design, modelling, bioinformatics and artificial intelligence; software; and servers); (d) Establish or strengthen public laboratories, university laboratories, reference laboratories, mobile laboratories and biofoundries at the national, subregional or regional level; (e) Promote continued and sustainable financing for the maintenance of infrastructure and the procurement of reagents and materials.
1.3 Support for personnel capacity	(a) Institutionalize capacity-building processes and ensure continued capacity-building through global, regional and national institutions (e.g. centres of excellence, groups of national experts and public-private partnerships); (b) Provide scholarships, internships and mentorships at the undergraduate and postgraduate levels for areas related to research and development in and the assessment of synthetic biology, in particular for students and women from developing countries and indigenous peoples and local communities; (c) Support the development or use of existing exchange programmes as mechanisms to build capacity, transfer knowledge and promote sustained communication and collaboration across relevant stakeholders;

[a] National Governments, indigenous peoples and local communities, women, youth, academia, research institutions, the business sector, civil society and other relevant organizations.

[b] Where needed to complement infrastructure supported under the capacity-building action plan for the Cartagena Protocol on Biosafety and the capacity-building and development action plan for the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization, for Parties to these respective

- Wide range of actions identified
- Identification of relevant actors?

Results of intersessional work and SBSTTA pre-session documents (3)

- **ES's Considerations on synthetic biology**: CBD/SYNBIO/AHTEG/2026/1/2

Based on: Synthesis of submissions on synthetic biology CBD/SYNBIO/AHTEG/2026/1/INF/1 , Summary of the discussions of the Open-ended Online Forum on Synthetic Biology CBD/SYNBIO/AHTEG/2026/1/INF/2, Independent scientific study on synthetic biology CBD/SYNBIO/AHTEG/2026/1/INF/3

  - Annex I Potential benefits of synthetic biology in relation to the Kunming-Montreal Global Biodiversity Framework (see 16/21 §9(b))
  - Annex II Most recent technological developments in synthetic biology and their potential impacts in relation to the Kunming-Montreal Global Biodiversity Framework

- **Report of the Ad Hoc Technical Expert Group on Synthetic Biology** CBD/SYNBIO/AHTEG/2026/1/3

  - Annex I Conclusions of the Ad Hoc Technical Expert Group on Synthetic Biology
  - Annex II Current benefits of synthetic biology in relation to the targets of the Kunming-Montreal Global Biodiversity Framework
  - Annex III Potential benefits of synthetic biology in relation to the targets of the Kunming-Montreal Global Biodiversity Framework
  - Annex IV Selected information related to the potential positive and potential negative impacts of the most recent technological developments in synthetic biology – *Artificial intelligence and computational biology considered*

Draft recommendations for COP 17 (*operational elements*)

1. *Welcomes* the outcomes of the meeting of the Ad Hoc Technical Expert Group on Synthetic Biology;

2. *Adopts* the thematic action plan to support capacity-building and development, access to and transfer of technology and knowledge-sharing in the context of synthetic biology for the implementation of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework, as contained in annex I to the present decision;

5. ... and decides that work should continue on the following specific areas of technological development:

(a) Applications for conservation use;

(b) Artificial cells, synthetic genomics and artificial biochemical pathways;

(c) Artificial intelligence and computational biology;

(d) Bioremediation and waste reduction applications;

(e) Microbiome engineering;

6. *Decides* to establish a new ad hoc technical expert group on synthetic biology, in accordance with the terms of reference contained in annex II to the present decision;

Draft recommendations for COP 17 (*operational elements*)

7. *Invites* Parties, other Governments, indigenous peoples and local communities, women and youth organizations, academia, research institutions, the business sector and relevant organizations to submit information on the areas of technological development listed in paragraph 5 above and, as appropriate, any other relevant areas of development;

8. *Decides* to convene new discussions of the Open-ended Online Forum on Synthetic Biology to gather information related to the areas of technological development listed in paragraph 5 above and, as appropriate, any other relevant area of development;

9. *Encourages* Parties, other Governments and relevant organizations to facilitate capacity-building and development in the field of synthetic biology in the context of the Convention and the Framework;

Draft recommendations for COP 17 (*operational elements*)

7. *Invites* Parties, other Governments, indigenous peoples and local communities, women and youth organizations, academia, research institutions, the business sector and relevant organizations to submit information on the areas of technological development listed in paragraph 5 above and, as appropriate, any other relevant areas of development;

8. *Decides* to convene new discussions of the Open-ended Online Forum on Synthetic Biology to gather information related to the areas of technological development listed in paragraph 5 above and, as appropriate, any other relevant area of development;

9. *Encourages* Parties, other Governments and relevant organizations to facilitate capacity-building and development in the field of synthetic biology in the context of the Convention and the Framework;

10. *Requests* the Executive Secretary, subject to the availability of resources:

Annex II
Terms of reference for the Ad Hoc Technical Expert Group on Synthetic Biology

3. The Ad Hoc Technical Expert Group is to:

(a) Assess the five areas of technological development listed in paragraph 5 of the present decision;

(b) Assess any other areas of technological development identified in the submissions and the Open-ended Online Forum on Synthetic Biology referred to in paragraphs 7 and 8, respectively, of the present decision;

(c) Provide recommendations on ways to address the areas of technological development, as necessary;

Thank you for your attention!

Questions?