Submitted View for the "Updated Report and Synthesis of Views in Response to Paragraph 7(b) of Decision XII/24; and Report of the Meeting of the Ad Hoc Technical Expert Group on Synthetic Biology" (UNEP/CBD/SYNBIO/AHTEG/2015/1/2 4 and UNEP/CBD/SYNBIO/AHTEG/2015/1/3)

Peruvian Society for Environmental Law (SPDA)

One can only regulate that which is defined, as duly noted in Section V29 of the "Updated Report and Synthesis of Views: Synthetic Biology" (UN Secretariat of the CBD 2015a, 6). Inasmuch as an erroneous definition could be most counterproductive, reflection is warranted. The point would not be lost on naturalists. E.O. Wilson opens *Consilience* with the admonition "The first step to wisdom, as the Chinese say, is getting things by their right names" (1998, 4). In defining Synthetic Biology, special care must likewise be taken that any agreed definition does not contain terms that are also incorrectly defined.

Economics is required to evaluate the definitions of Synthetic Biology proposed in the "Updated Report and Synthesis" and the "Report of the Meeting of the Ad Hoc Technical Group," as well as to ponder an alternative that emerges from the reflection. The analysis must also be put in historic context.

The 1992 UN Convention on Biological Diversity (CBD) did not take "the first step to wisdom", which now reverberates in the definitions of Synthetic Biology vetted in the aforementioned reports. Article 2 of the CBD (mis)defined "genetic resources" as "material" which results in the opposite of "fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (ABS) (Article 1). The category mistake is foundational and has enabled the Material Transfer Agreements (MTAs) of the bilateral approach. The resulting unfairness is twofold: rents are eliminated for Providers through competition for MTAs while Users are encumbered with the high transaction costs of negotiating the contracts. It is a lose-lose situation for everyone except the lawyers who perceive a boom in the offing (see, for example, Watanabe and Teh 2011, 874). As Nobel Memorial Laureate Joseph E. Stiglitz discerns, "[f]or lawyers, transaction costs are a benefit, because they are a source of their income" (2008, 1706). For those who labor in R&D, the commitment of the Parties to "endeavor to create conditions to facilitate access to genetic resources" (Article 15) has become a cruel joke.

Prior to the presentation of the CBD at the Earth Summit Rio'92, economists had "g[otten genetic resources] by their right name": information. Vogel (1990, 1991) contrasted the lack of

protection over "natural information"[1] with the limited-in-time monopolies of intellectual property rights over "artificial information." He soon developed the institutional requirements for what would now be recognized as the Global Multilateral Benefit Sharing Mechanism (GMBSM) (Vogel 1992, 1994). Transaction costs would be minimized (Vogel 2007, Winands-Kalkuhl & Holm-Müller 2015). Thinking like an economist, Christopher Stone (1995) and Tim Swanson (1992, 1994) also converged on similar conclusions (for a detailed chronology, see Vogel 2015). Nevertheless, both stakeholders and Parties to the CBD studiously ignored the economics of information, despite its elaboration over the next twenty years (Vogel et al, 2011, Oduardo-Sierra et al., 2012).

The Expert Forum of ABS-Clearing House Mechanism held online from 8 April to 24 May 2013 appears to be a tipping point (UN CBD Secretariat 2013). Many of the 142 participants convened were receptive to "natural information" as the object of access. One seasoned participant from the Global South found "the logic of bounded openness[2] over natural information...fairly unassailable" (Comment #5191). That logic has since been tested through thought experiments for two of the most publicized cases of bioprospecting: the poison dart frog, *Epipedobates anthonyi* (Angerer 2015) and the aphrodisiac root "maca", *Lepidium meyenii* (Oduardo-Sierra 2015). The counterfactual histories appear in the appendices of *Genetic Resources as Natural Information: Implications for the Convention on Biological Diversity and Nagoya Protocol* (Ruiz Muller 2015), whose central message is "bounded openness".[3]

---

[1] "Genetic information" is subsumed in "natural information", which includes phenotypical expressions and non-human cultures. Interchangeable use of "genetic" and "natural" to modify "information", risks the exclusion of sources of royalty income for Providers. It is therefore unfortunate that "genetic information" is assumed interchangeable with "natural information" in Young et al. (2015, 3 fn. 8) and has replaced "natural information" in Winands-Kalkuhl & Holm-Müller (2015, 306-309, 312 and 318). Besides the exclusion of royalty income for Providers, interchangeable use undercuts *quid pro quo* between "natural" and "artificial information" in setting the royalty (Vogel 1991). However, things could be worse. More unfortunate than the use of "genetic information" is that of "digital information": the object of access is overshadowed by the means of transmission, while the critical distinction between the natural and the artificial is eliminated. "Digital information" figures prominently in the work of Margo A. Bagely (2015).

[2] Christopher May explained the concept of "bounded openness" without explicitly defining it in *The Global Political Economy of Intellectual Property Rights: The New Enclosures* (2010, 142-146). Inspired by the breadth and depth of his explanation, the following definition attempts to compress the meaning conveyed by May into one sentence:
"Bounded Openness: Legal enclosures which default to yet depart from *res nullius* to the extent the departures enhance efficiency and equity, which must be balanced when in conflict." The "default to yet depart from" is the key distinguishing feature; the clause "when in conflict" is not superfluous because economists usually assume that they are in conflict.

[3] N.B.: "Bounded openness" should not be confused with "unbounded R&D and bounded benefit-sharing" (Kamau and Winter 2015, 1), which adhere to the bilateral approach.

The circle widens. "Get[ting genetic resources] by their right name" cuts across issues in the CBD. The only new and emerging issue posted for COP13 is "Jurisdiction Shopping of Transboundary Resources in a non-Party" (SPDA 2015). It begins with the importance of correctly defining "genetic resources". The same can be said of the IUCN Submission for "Submissions on Article 10 of the Nagoya Protocol pursuant to decision NP-1/10 (Young et al. 2015) and its Annex (Vogel et al. 2015). All three submissions agree that resolving the definition of "genetic resources" for ABS is absolutely crucial.

Things can only fall into place for defining Synthetic Biology with the deployment of the right names in the CBD. The most comprehensive definition proposed for Synthetic Biology in the Updated Report and Synthesis is found in Section 33 (d) on page 7. Its 58 words can be compressed and amplified by a 13-word alternative, grounded in "artificial information" and "natural information," viz.,

Synthetic Biology: the extremely intensive use of artificial information in the manipulation of natural information.

The definition proposed above is broader and more discriminating than that of Section 33 (d) and the others found in the Updated Report and Synthesis. Serendipitously, the proposed definition exposes an egregious error embedded in Section 25 (d):

> The Cartagena Protocol broadly defines 'living organism' as one that is 'capable of transferring or replicating genetic material', while the Convention defines 'genetic material' as including nucleic acids from 'plant, animal, microbial or other origin', consequently, neither organisms created 'de novo' nor xeno-systems may be excluded from the Protocol's scope (UN Secretariat of the CBD 2015a, 5).

Thinking like a physicist about the definition of "living organism" in the above passage is as dispiriting as thinking like an economist about competition and the definition of "genetic resources" in the CBD. "Material", genetic or otherwise, cannot be "replicated". Replicating material is a violation of the First Law of Thermodynamics, more commonly known as the Conservation of Mass and Energy (or more reductively, as the Conservation of Energy). The natural information transmitted in genetic material is replicated in other material, which is drawn from the environment, i.e., nitrogen, carbon, hydrogen and so on.

The history of science can generate a timely insight for any definition of Synthetic Biology which incorporates "genetic material," such as that suggested in the "Report of the Meeting of the Ad Hoc Technical Expert Group" (UN Secretariat of the Convention on Biological Diversity

2015b).[4] The wry observation of Sir Arthur Stanley Eddington, regarding the Second Law of Thermodynamics, seems all the more apropos for the First:

> [I]f your theory is found to be against the second law of thermodynamics I can give you no hope; there is nothing for it but to collapse in deepest humiliation (1958, 74).

Would that humiliation ensue! Alas, Eddington commits what George Soros (2008) has identified as the Enlightenment Fallacy: "assum[ing] that the purpose of reason is to produce knowledge" (23) and that "the pursuit of truth [would] take precedence over the pursuit of power" (40).

A neophyte to ABS might think that re-defining the object of access from "genetic resources" to "natural information" in the CBD would be low-hanging fruit that would feed the Cartagena Protocol, the Nagoya Protocol and the Decisions of the COPs. After all, the CBD is a framework convention and arguably draws on science. An operational definition of Synthetic Biology with implicit exclusion and inclusion criteria, is in full sight. The more savvy observer to the twelve COPs will be less sanguine. Deference to entrenched groups may be quasi-instinctual (Vogel 2013).

To deploy reason, leadership is required.

---

[4] The definition proposed in 3.1.20 of the Report deploys "genetic material" as the 32nd and 33rd words of the 38-word sentence:

> Synthetic biology is a further development and new dimension of modern biotechnology that combines science, technology and engineering to facilitate and accelerate the understanding, design, redesign, manufacture and/or modification of genetic materials, living organisms and biological systems (UN Secretariat to the CBD 2015b, 4).

To perceive the equivocation requires an unpacking of the highly encumbered phrase. The first meaning of "design", the 25th word in the above definition, is "to create, fashion, execute, or construct according to plan" (*Merriam-Webster*). So, if one fashions, executes or constructs the "material" aspect of "genetic material", then the discipline is not synthetic biology but synthetic chemistry. The point becomes more evident with the 26th word "re-design". One can only re-design that which already has a design. Therefore, that which is created, fashioned, manufactured and/or modified in "genetic material" is not the "material" aspect but the "information" aspect, albeit transmitted in "material".

References:

Angerer, Klaus. 2015. *Epipedoates anthonyi* under 'bounded openness'. In *Genetic Resources as Natural Information, 98-109.* London: Routledge.

Bagley, Margo A. 2015 (December). Digital DNA: The Nagoya Protocol, Intellectual Property Treaties, and Synthetic Biology. Washington, D.C.: The Wilson Center. http://www.synbioproject.org/site/assets/files/1395/digital_dna_final.pdf?

Eddington, Arthur Stanley. 1958. *The Nature of the Physical World.* Ann Arbor, Michigan: The University of Michigan Press.

Kamau, Evanson and Gerd Winter. 2015. Unbound R&D and Bound Benefit Sharing: Introduction, Synthesis and Conclusions. In *Research and Development on Genetic Resources: Public Domain Approaches in Implementing the Nagoya Protocol,* 1-24. London: Routledge.

May, Christopher. 2010. *The Global Political Economy of Intellectual Property Rights: The New Enclosures*. London: Routledge.

Oduardo-Sierra, Omar. *Lepidium meyenii* under 'Bounded Openness'. In *Genetic Resources as Natural Information,* 110-117. London: Routledge.

Oduardo-Sierra, Omar, Joseph Henry Vogel, Barbara A. Hocking. 2012. Monitoring and Tracking the Economics of Information in the Convention on Biological Diversity: Studied Ignorance (2002-2011). *Journal of Politics and Law* 5, (2): 29-39. doi: 10.5539/jpl.v5n2p29

Ruiz Muller, Manuel. 2015 *Genetic Resources as Natural Information Implications for the Convention on Biological Diversity and Nagoya Protocol*. New York: Routledge.

Soros, George. 2008. *The Crash of 2008 and What it Means: The New Paradigm for Financial Markets*. New York: PUBLICAFFAIRS.

SPDA (Peruvian Society for Environmental Law). Convention on Biological Diversity. 2015 (September 6). Preventing 'Jurisdiction Shopping' for Transboundary Resources in a Non-Party: The Case of Puerto Rico. In "New and emerging issues relating to the conservation and sustainable use of biological diversity". UN Secretariat of the Convention on Biological Diversity. https://www.cbd.int/doc/emerging-issues/PeruvianSocietyEnvLaw-JurisdictionShopping-2015-en.pdf

Stiglitz, Joseph E. 2008. Economic Foundations of Intellectual Property Rights. *Duke Law Journal*, 57: 1693-1724.

Stone, Christopher D. 1995. What to Do about Biodiversity, Property Rights, Public Goods and the Earth's biological Riches. *Southern California Law Review,* 68: 577-605.

Swanson, Timothy M. 1992. The Economics of the Biodiversity Convention. Norwich: CSERGE, School of Environmental Sciences, University of East Anglia.

Swanson, Timothy M., David W. Pearce and Raffaello Cervigni. 1994. The Appropriation of the Benefits of Plant Genetic Resources for Agriculture: An Economic Analysis of the Alternative Mechanism for Biodiversity Conservation. Rome: Secretariat of the FAO Commission on Plant Genetic Resource.

UN Secretariat to the Convention on Biological Diversity. 2013. "Synthesis of the Online Discussions on Article 10 of the Nagoya Protocol on Access and Benefit-sharing". UNEP/CBD/ABSEM-A10/1/2. http://www.cbd.int/doc/?meeting=ABSEM-A10-01

---. 2015a (September 4). "Updated Report and Synthesis of Views in Response to Paragraph 7(b) of Decision XII/24 on New and Emerging Issues: Synthetic Biology". UNEP/CBD/SYNBIO/AHTEG/2015/1/2 http://bch.cbd.int/synbio/peer-review

---. 2015b (October 7) "Report of the Ad Hoc Technical Expert Group on Synthetic Biology". UNEP/CBD/SYNBIO/AHTEG/2015/1/3 http://bch.cbd.int/synbio/peer-review

Vogel, Joseph Henry. 1990 (May). Intellectual Property and Information Markets: Preliminaries to a New Conservation Policy. *CIRCIT Newsletter,* 6.

---. 1991 (June). The Intellectual Property of Natural and Artificial Information. *CIRCIT Newsletter*,, 7.

---. 1992. *Privatisation as a Conservation Policy*. Melbourne: Centre for International Research on Communication and Information Technologies/.

---. 1994. *Genes for Sale*. New York: Oxford University Press.

---. 2013. The Tragedy of Unpersuasive Power: The Convention on Biological Diversity as Exemplary. *International Journal of Biology* 5 (4): 44-54. http://www.ccsenet.org/journal/index.php/ijb/article/view/30097/18019.

---. 2015. On the Silver Jubilee of 'Intellectual Property and Information Markets: Preliminaries to a New Conservation Policy'. In *Genetic Resources as Natural Information Implications for the Convention on Biological Diversity and Nagoya Protocol*. New York: Routledge. https://s3-us-west-2.amazonaws.com/tandfbis/rt-files/docs/9781138801943_foreword.pdf

Vogel, Joseph Henry, Nora Álvarez-Berríos, Norberto Quiñones-Vilche, Jeiger L. Medina-Muñiz, Dionisio Pérez-Montes, Arelis I. Arocho-Montes, Nicole Vale-Merniz, Ricardo Fuentes-Ramirez, Gabriel Marrero-Girona, Emmanuel Valcárcel Mercado, Julio Santiago-Rios. 2011. The Economics of Information, Studiously Ignored in the Nagoya Protocol on Access and Benefit Sharing. 7/1 *Law Environment and Development (LEAD) Journal*, 7/1: 51-65. http://www.lead-journal.org/content/11052.pdf

Vogel, Joseph Henry, Manuel Ruiz Muller and Klaus Angerer. 2016 (January). Annex A: Formal Contributions Submitted by ABSSG Members to the "Collective submission of the IUCN Joint SSC-WCEL Global Specialist Group on ABS, Genetic Resources and Related Issues (ABSSG) in preparation for the Expert Meeting on the need for and modalities of a Global Multilateral Benefit-sharing Mechanism of the Nagoya Protocol". https://www.cbd.int/abs/submissions.shtml

Watanabe, Kazuo N and Teh, G. H. 2011. Wanted: Bioprospecting Consultants. *Nature Biotechnology,* 10: 873-875.

Wilson, Edward O. (1998). *Consilience*. New York: Alfred A. Knopf.

Young, Tomme, Annie Minnis, Klaus Angerer, Lisa Benjamin, Evanson Chege Kamau, Graham Dutfield, Christopher H. C. Lyal, Estelle Mawal, Sonia Peña Moreno, Manuel Ruiz Mueller, Than Thi Huong Trang, Joseph H. Vogel. 2016 (January). Collective submission of the IUCN Joint SSC-WCEL Global Specialist Group on ABS, Genetic Resources and Related Issues (ABSSG) in Preparation for the Expert Meeting on the Need for and Modalities of a Global Multilateral Benefit-sharing Mechanism of the Nagoya Protocol. https://www.cbd.int/abs/submissions.shtml

Winands-Kalkuhl, Sarah and Karin Holm-Müller. 2015. Bilateral vs. Multilateral? On the Cconomics and Politics of a Global Mechanism for Genetic Resource Use. *Journal of Natural Resources Policy Research*, 7:4, 305-322, DOI: 10.1080/19390459.2015.1097022