was made to key institutions, such as the World Intellectual Property Organization (WIPO),[654] the Food and Agriculture Organization of the United Nations (FAO)[655] or the World Bank,[656] to build up a joint initiative. Besides, inspiration was drawn from said institutions, as well as from classic copyright collecting societies, to the extent that such entities are able to independently earn incomes from the services provided to the private sector, thus carving out an autonomous way for auto-financing themselves. Nevertheless, the lack of the strong political support necessary in the initial process at last determined the breakdown of the undertaking.[657]

From an overall perspective, a royalty collection clearinghouse mechanism may be more complicated to establish, in comparison to the less engaging clearinghouse models previously analysed. However, once in place, it could operate more effectively by facilitating the collection and distribution of IP royalties, which would take place within a centrally managed, comprehensive procedure. Still, the clearinghouse model under consideration would only be fruitful, from a business viewpoint, if on the one hand there is an effective need to carry on commercial transactions involving the patent rights administered by the clearinghouse, i.e. within the technological sector at issue, and, on the other hand, a significant number of patent holders or, ideally, an entire branch of industry would participate.[658]

IV. Open Source Clearinghouse

Another approach to the "anti-commons" issue, dealing with the fundamental problem of access to overly scattered and fragmented IP rights in the hands of separated, multiple patent owners, is modelled on the "open source" paradigm, which has notoriously first gained popularity within the software industry. In fact, institutions sympathising with such alternative model generally provide "open", i.e. royalty-free, access to targeted assembled technologies, eventually also patented ones, through an "open source" license, which namely subtracts the technologies at issue from private, exclusive appropriation by building a "commons" of contributed IP rights under the terms of the agreement, typically strengthened by a "grant-back"

ordination. The specific recommendations on the point were in fact used as a reference when addressing the creation of a Global Biocollecting Society.

654 For the official website, see: http://www.wipo.int/portal/index.html.en

655 For the official website, see: http://www.fao.org

656 For the official website, see: http://www.worldbank.org

657 Drahos P., "Towards an International Framework for the Protection of Traditional Group Knowledge and Practice", UNCTAD-Commonwealth Secretariat Workshop on Elements of National Sui Generis Systems for the Preservation, Protection and Promotion of Traditional Knowledge, Geneva, February 2004

658 See in this sense: Van Overwalle G. *et al.*, *supra*, fn. 652, p. 143 *et seq.*

provision, thereby further expanding the initial technology pool and consequently preventing the emergence of eventual blocking patents on improvements.[659]

1. Science Commons - A Creative Commons' project

Now, although not specifically limited to biotechnology, a peculiar and remarkable model of worldwide technology exchange promoting the implementation of "open source", i.e. royalty-free approach, in the scientific field is certainly represented by the Science Commons.[660] Since this project, launched in early 2005, has been brought into existence thanks to a successful initiative of the Creative Commons,[661] with which it indeed shares many significant resemblances deriving from the same fundamental inspiring principles, we will start introducing the latter.[662]

Expressing an innovative approach to copyrights, Creative Commons (CC) is actually a non-profit organization, whose tools, since its inception in 2002 and in response to the stand-off between the content industries and the online communities, are provided completely for free. They offer "flexible" copyright licenses for creative works, basically substituting the rigid "all rights reserved" default-concept of traditional copyright with an open and far more adaptable "some rights reserved" principle, following the by contrast called "copy-left" approach.[663]

Indeed, the spectrum of possibilities between full copyright, i.e. "all rights reserved", and the public domain, i.e. "no rights reserved", can be readily defined on a case-by-case basis through a "some rights reserved" approach, pursuant to the artist's individual choice between the standardized licensing options provided within the Creative Commons platform, under which an author basically agrees to give away its work for free, on the condition that, if he so wishes, some of his exclusive rights remain preserved. These could typically be resumed in the following points: the

659 Boettiger S., Burk D.L., "Open Source Patenting", Journal of International Biotechnology Law, 2004, vol. 1, p. 221 *et seq*. According to the authors: "The open source and free software movements have used self-perpetuating copyright licenses to maintain open access to publicly distributed software. This model of licensing has now migrated to the field of biotechnology, where patents rather than copyrights dominate proprietary rights. Consequently, a model for open source patenting or free biotechnology presents a constellation of legal issues not typically found in previous open source licensing. This paper discusses several of these issues, including the nature of the rights transferred, the activities that may trigger the terms of the license, and the legal prohibitions on certain forms of licensing".

660 For the official website, refer to: http://sciencecommons.org

661 For the official website, refer to: http://creativecommons.org

662 Indeed, also from an institutional standpoint, Science Commons - which is housed at and receives material support from the Massachusetts Institute of Technology (MIT), with whom it shares space, staff and inspiration - is overseen in its activities by members of the Creative Commons board.

663 For a general outline, see: Garlick M., "A Review of Creative Commons and Science Commons", Educause Review, September/October 2005, vol. 40, no. 5, p. 78 *et seq*.

right of attribution, the prohibition of unauthorized commercial use or derivative works and, eventually, the obligation to distribute derivative works only under licensing terms that are identical to the original ones.[664] Practically, through sites and databases linked to Creative Commons a user can search for audio, images, text, video and educational material that can be freely shared online without restriction, using means of digital distribution, like Peer-to-Peer networks, with the author's given consent, and thus completely legally.[665]

Beyond copyrights, Science Commons aims to expand the Creative Commons' mission into the realm of scientific and technical data. Indeed, as the latter does with copyright issues regarding the use of protected material, the former primarily aims to encourage technology transfer by stimulating IP owners to take up standardized licensing terms inspired to transparency and openness in the use of biotechnologies, thus mostly implementing a royalty-free approach, basically inspired by the same "open source" community ethos which is gaining more and more ground within the software industry. For this reason, Science Commons may be seen as a model, in which technology exchange and an open source clearinghouse are combined: in fact, said organization does not merely link offer and demand, i.e. partnering technology holders and prospective licensees by providing the setting to eventually initiate negotiations, as all other considered examples of technology exchange clearinghouses do, but it additionally pursues the goal of promoting the adoption of standardised, transparent technology licensees, to a large extent conforming to a so-called "open access" approach, on a global scale.[666]

Concretely, Science Commons' constitutive intent is "promoting innovation in science by lowering the legal and technical costs of the sharing and reuse of scientific work" and by "removing unnecessary obstacles to scientific collaboration by creating voluntary legal regimes for research and development".[667] Their overall goal is therefore to encourage stakeholders to create – through standardized licenses and other means that we will properly consider in the following – common areas of free access and inquiry, i.e. a so called "science commons", built out of private agreements.

Among other things, the Science Commons Data project[668] explores ways to promote broader access to scientific data, taking greater advantage of the World Wide Web. In fact, promoters of this initiative have voiced some concerns about current expansive trends in intellectual property law as far as databases are concerned, mainly intervening through the creation of "sui generis" protection systems,

664 For more details, refer to: http://creativecommons.org/about/licenses

665 For more details on the licensing terms adopted, see, for example, for the distribution of music: http://www.jamendo.com/en/static/artists_why

666 For an overview on the particular debate on the important role of universities and research institutions for access to medicines, see: Nelsen L., "The Role of University Technology Transfer Operations in Assuring Access to Medicines and Vaccines in Developing Countries", Yale Journal of Health Policy, Law and Ethics, 2003, vol. 3, p. 301 *et seq.*

667 For the exact opening quotation from their official website, see: http://sciencecommons.org

668 For more details, see: http://sciencecommons.org/data

thus imposing new legal limits on the sharing of data both among scientists and with the general public.

Where IP protection applies to databases,[669] the Scientific Commons aim at encouraging the adoption of Creative Commons licenses, as examined in more detail above, subject to the right holder's consent, in order to foster the royalty-free diffusion to scientific data. Besides, one major goal in enhancing access to scientific data has been identified in the coordination of technical resources and research opportunities in a digitally networked environment so as to maximize the data's public utility.

This may be partly achieved by developing network standards[670] to facilitate research cooperation and by creating a collaborative platform linking to relevant databases covering targeted scientific domains.

In fact, Science Commons are not building a self-administered database of free-licensed content, as they believe in the Internet rather than a centralized information bank controlled by a single organization.[671]

Accordingly, they are not collecting content for a new, central database, but are building tools so that the semantic web can identify and sort databases, providing free access to users, in a coherent decentralized manner.

Increasingly, various sorts of data are indeed being stored in formats that computers can understand and manipulate, allowing databases, through particular web interfaces, to communicate. This enables the extraction and interpretation of data from different sources and the creation of entirely new data products and services.

In biotechnology research, for instance, rather than creating centralized monolithic databases, scientists could interrogate existing databases, wherever the data are held, weaving together, in hypothesis, all the relevant data on a species, from its taxonomy and genetic sequence to its geographical distribution.

Moreover, such decentralization would help to solve the problem that databases are often the fruits of individual or lab research projects that unfortunately are vulnerable to the vagaries of funding. Accordingly, although discipline-specific databases have an indisputable role, science also needs to capitalize on large common

669 About the problem of data access, the Journal of the American Medical Association published a study in 2002 describing a world where 47% of academic geneticists had been rejected in their efforts to secure access to data or materials related to research by other academics. This represented an increase from 34% from a previous study in the mid 1990s. For the integral study, see: Campbell E., *et al.*, "Data Withholding in Academic Genetics: Evidence from a National Survey", Journal of the American Medical Association (JAMA), April 2002, 287, p. 1939 *et seq.*

670 For an overview on the legal and policy debate on the merits of promoting IP in connection with network standards, see most recently, i.a.: Mackenrodt M., "Assessing the Effects of IP Rights in Network Standards", In: Drexl J. ed.: Research Handbook on Intellectual Property and Competition Law, Cheltenham, UK, Northampton, MA, USA, Edward Elgar, 2008, p. 80 *et seq.*

671 See: Benkler Y., "The Wealth of Networks: How Social Production Transforms Markets and Freedom", Yale University Press, 2006.

repositories for data, whose preservation is guaranteed, and in which the data can easily be used by anyone.

However, the functioning of such web services is certainly also dependent on computers being able to freely retrieve data, without access barriers, in real time. On the one hand, scientists can be well justified in wanting to retain privileged access to data in the collection of which they have heavily invested, with publications mostly pending; on the other hand, there are also huge amounts of data which do not need to be kept behind walls and which could be, in hypothesis, made available under a Creative Commons licence, allowing their seamless access by computers, without prejudices for their owner.[672]

2. BioBricks Foundation

The BioBricks Foundation (BBF)[673] - a not-for-profit organization founded by engineers and scientists from the Massachusetts Institute of Technology (MIT), Harvard, and the University of California at San Francisco (UCSF) with significant experience in biotechnology research - provides for an example applying the free, collaborative Science Commons' philosophy to data access, thus also reflecting the model of an open source clearinghouse.

The BBF encourages the development and use of technologies based on BioBricks, i.e. standard DNA parts that encode basic biological functions. Using BioBricks, they claim that a synthetic biologist or biological engineer can already, to some extent, program living organisms in the same way a computer scientist can program a computer. In conformity with the Science Commons' philosophy, the DNA sequence information and other characteristics of BioBricks are made available to the public, free of charge, via the MIT's Registry of Standard Biological Parts.[674]

Indeed, BBF's stated goals are to encourage the development of codes of standard practices for the access of scientific data, as well as to implement legal strategies to ensure that BioBricks remains freely available to the public both to use and improve existing sequences and to contribute to new developments, thereby contrasting the growing trend of biotechnologies being tied up through patents held by different companies, which makes the design of integrated biological systems, that use these technologies, very difficult.

Finally, BBF believes that having a shared pool of basic biotechnology functions would help innovation and growth in the life sciences industry as a whole. In fact, although there is no "Microsoft" of biological engineering to fight, as is instead the case for the Open Source Community within the strongly bi-polarized structure of

672 Editorial, "Let data speak to data", Nature, December 2005, vol. 438, p. 531 *et seq.*
673 For the official website, see: http://bbf.openwetware.org
674 For the website, see: http://parts.mit.edu/registry/index.php/Main_Page

the software industry, supporters of the Science Commons ethos still hope to see biological engineering develop differently than the latter: in this respect, early establishment of a biological commons to be shared by industry as well as individual researchers might help to prevent the "us vs. them" attitude that occurred for software.

Nevertheless, concrete evidence about successful BioBricks-based technological applications is maintained as confidential and, therefore, a more far-reaching assessment on the practical merits of such initiative could not be reached within the scope of this contribution.[675]

3. CAMBIA's Biological Open Source (BiOS)

The Biological Open Source (BiOS) initiative[676] falls under the institutional umbrella of CAMBIA,[677] the same Australian-based, not-for-profit plant biotechnology research centre that has also boosted the Patent Lens[678] free-accessible biotechnology database, which has been already briefly outlined when analysing some illustrative, practical applications of the simpler information clearinghouse scheme within the domain of life sciences.

The present initiative aims to build a "protected commons" of biotechnologies, i.e. a collaborative environment to share and contribute to innovations,[679] by adopting non-exclusive, royalty-free licensing terms and thereby attempting to extend the so called "open source" paradigm, as already broadly established in the software industry, to the domain of life sciences.[680]

In fact, the open source model can be seen, in general terms, as a business practice based on the free sharing of technologies among all those who agree to stick to non-restrictive contractual terms, also as far as further related improvements are

675 This conclusion follows a personal attempt to gather tangible, practical evidence by specifically addressing the representatives of the organization in order to provide for reliable references supporting the institutional goals proclaimed. Regrettably, the feedback received has been evasive and therefore non-satisfactory in this respect.

676 For the official website, see: http://www.bios.net/daisy/bios/home.html

677 For the official website, see: http://www.cambia.org/daisy/cambia/home.html

678 For the official website, see: http://www.patentlens.net/daisy/patentlens/patentlens.html

679 Nevertheless, a personal attempt to gather tangible, practical evidence by specifically addressing the representatives of the organization in order to provide for reliable references supporting the institutional goals hereby proclaimed has remained unfulfilled. Indeed, the feedback received has been evasive and non-satisfactory in this respect.

680 The term "open source" refers to software whose source code - i.e. the human readable code as opposes to the only computer readable binary "object code" - is published and made available to the public under a license that permits users to study, change, and improve the software, and to redistribute it in modified or unmodified form. It is often developed in a public, collaborative manner. For more information, see: http://opensource.org; For a thorough analysis on the open source model and ethics, see i.a.: Hope J., "Biobazaar: The Open Source Revolution and Biotechnology", Harvard University Press, 2008; Raymond E., "The Cathedral and the Bazaar", O'Reilly Media, 1999.

concerned and towards all who have subscribed to the same conditions, i.e. within the community.[681] Besides, promoters of the initiative under consideration, aside from actively fostering a collaborative work environment among researchers, are advancing their tenets directly by making their own IP rights in the area of plant biotechnology available according to the same terms of their BiOS licenses.[682]

In other words, scientists adopting BiOS licenses may still own patents on their inventions, but cannot keep others from employing or eventually building innovative solutions based on the core-technologies at issue, i.e. they agree not to assert exclusive rights against the licensor or other licensees within the "protected commons".[683] In fact, instead of paying royalties, contractual parties to the BiOS project are to adhere to legally binding conditions, at the outset, in order to obtain a license and access to the shared technology platform: in brief, what is provided with open access has to be further maintained and redistributed on the same terms, as licensees shall not appropriate the fundamental "kernel" of the technologies at issue exclusively for themselves. The underlying idea of the employed licensing scheme is in fact explicitly inspired to the widely employed open source software's General Public License (GPL),[684] actually taken as a benchmark by the BiOS promoters.

However, from a critical point of view and pursuant to its self-perpetuating character, alongside similar models, the GPL has been described by its opponents as being "viral", because its conditions require that all modified versions of the software must in turn be licensed under the GPL.[685] Besides, if licensors adhering to the "protected commons" scheme should desist from claiming royalties for all innovations based on BiOS technologies - by the way, regardless of the substantial weight the latter actually had on the subsequent invention - then the arising question shall be the one of whether there are any incentives left to spur further innovations at all, with the connected non-negligible research and development costs. In other words, if we cut out the regular sources of income coming from prospective licensing fees, how can valuable R&D expenditure, aside from considerable patent expenses, be covered in the first place? In fact, even maintaining that research barriers are lowered because of the free access provided by the sharing platform in place, high patenting costs cannot be neglected, and this aspect seems to have been quite under-

681 For a general overview, see: Perens B., "Open Sources: Voices from the Open Source Revolution", O'Reilly Media, 1999; Lerner J., Tirole J., "Some Simple Economics of Open Source", Journal of Industrial Economics, 2002, vol. 50, no. 2, 197 *et seq.*

682 Sheridan C., "Out to Break Biotech's IP Stranglehold", Science Business, June 2006, p. 1 *et seq.*

683 For an outline on BiOS' business model, see i.a.: Van Caenegem W. et al., "Biological Innovation for Open Society", "Intellectual Property Policy Reform: Fostering Innovation and Development", Edward Elgar Publishing, 2009, p. 143 *et seq.*

684 For the General Public License terms, see GNU's official website at: http://www.gnu.org/licenses

685 Mundie C., "The Commercial Software Model", Speech Transcript, Prepared Text of Remarks, The New York University Stern School of Business, May 2001, also available at: http://www.microsoft.com/presspass/exec/craig/05-03sharedsource.mspx

mined when affirming that the BiOS platform is also perfectly suitable for patented technologies.[686]

Ultimately, the claim of the BiOS supporters that companies can make money out of the end product and services as an alternative to the licensing of the underlying IP (which they call mere "tools of innovation")[687] seems quite naive, as it completely overlooks the fact that when a newly released biotechnology is left to the free disposal of others, competitors may well come out with very similar, if not identical, products taking a rather unfair advantage of the long and costly research and development already done by others. In fact, here a key difference to the software industry is that it is actually hard to make money out of the end product or services, i.e. the developed biotechnology, without enforcing the underlying IP rights, as one is closely connected with the other;[688] the successful business enterprises based on the open source software model, on the other hand, seemingly found a real opportunity of success in the fact that, although software and hardware are closely inter-related, the latter has a market on its own and represents a commercially viable means of distribution for the former, as the IBM case proves.[689]

Moreover, although BiOS licenses are purportedly available at no cost, for-profit licensees are anyway charged with maintenance fees which are due to access the BiOS platform, as it is expressly claimed that "it is costly to maintain an exchange of materials and improvements, and to develop […] an information technology commons so that licensees can share biosafety and improvement data and collaborate on working around barriers to innovation. Thus, BiOS licenses are associated with a Technology Support Agreement, in which we ask for-profit licensees to pay some of these costs, at rates related to size of the enterprise […]. Other than cost recovery for material handling non-profits are not asked to contribute".[690] This statement appears quite inconsistent with the otherwise at first glance widely advertised "free access" to the technologies at issue and it seems to apply different measures to the higher costs associated with the patenting, on the one hand, and to the claimed service delivery costs, which are certainly lower, on the other hand, resulting in the exclusive unjustified sacrifice of the former.

Ultimately, a great deal of confusion seems to have been misleadingly introduced as far as the use of the term "open access" is concerned. Indeed, "open" and "free" access are not necessarily synonyms,[691] as licenses may well be open to all interested parties, for instance under fair and non-discriminatory (RAND) terms, without therefore having to be definitely royalty-free. Both business types can in fact co-

686 For details, see: CAMBIA BiOS Initiative - Proposal, Implementation Phase 2006 - 2008, January 2006, available at: http://www.bios.net/daisy/bios/2029/version/1/part/4/data

687 CAMBIA BiOS Initiative - Proposal, Implementation Phase 2006 - 2008, January 2006, p. 4, available at: http://www.bios.net/daisy/bios/2029/version/1/part/4/data

688 Bearing otherwise the risk of so-called "free-riders" misappropriating your invention.

689 For more information, see: http://www-128.ibm.com/developerworks/ibm/library/i-osource1

690 For the reference, see: http://www.bios.net/daisy/bios/licenses/398/2535.html

691 For more details, see the definition of free software, as opposed to mere open source software, available at: http://www.gnu.org/philosophy/free-sw.html

exist in a competitive environment, and the condition of being "open" is certainly not a prerogative of the free model only.

Finally, a few words still need to be said regarding the fundamental differences between such a peculiar mechanism - hereby assimilated to an open source clearing-house - and a patent pool. In this regard, BiOS promoters contend that while patent pools are usually open only to a selected group of players who already own enough technology to trade it against others for privileged access, thus purportedly being inaccessible to any player or industry that does not have any leverage, the BiOS patent portfolio, by contrast, shall be available for anyone agreeing on the BiOS licensing terms.[692]

In fact, this assumption seems to be strongly misleading because it appears to put technology contributors (i.e. pool members) and third parties (i.e. licensees) on the same plan. Indeed if, on the one hand (i.e. as far as pool members are concerned), it is true that a patent pool needs to target only defined market players in order to ideally include only essential, complementary technologies, thereby avoiding anti-trust issues, on the other hand (i.e. as far as licensees are concerned), it is not equally true that a patent pool makes any difference as to the third parties with whom it eventually enters into routine bilateral licensing agreements, where fair and non-discriminatory (RAND) terms are typically implemented to comply with competitive conditions.

In this respect, the most apparent difference between a patent pool and a BiOS-alike platform is that, in the latter, there is no real distinction of treatment between initial contributors and interested licensees: as soon as you wish to get access the so called "protected commons", you are asked to subscribe to the same participation terms of its contributors: namely, in exchange for according you the right to view, use and eventually modify the technologies at issue - instead of charging you with royalty fees - they ask you to endorse the obligation of granting back to the Community all improvements deriving from the BiOS technologies under the same conditions.[693]

On the other hand, in a patent pool, so called "grant back" clauses, if at all, apply exclusively to the patent pool's members and are typically limited to essential, complementary technologies that directly relate to the pooled package; third party licensees, instead, are not concerned with such obligations, as their only commitment consists in complying with the negotiated royalties according to the standards terms of the bilateral agreement. In this perspective, the BiOS platform appears as a sort of "floating pool", encompassing all derivative improvements based on the originally contributed applications, therefore progressively expanding its "technological mass".

692 CAMBIA BiOS Initiative - Proposal, Implementation Phase 2006 - 2008, January 2006, p. 29, available at: http://www.bios.net/daisy/bios/2029/version/1/part/4/data

693 CAMBIA BiOS Initiative - Proposal, Implementation Phase 2006 - 2008, January 2006, p. 28 *et seq.*, available at: http://www.bios.net/daisy/bios/2029/version/1/part/4/data

In this respect, the view is taken that a collaborative consortium, as a patent pool, proposing affordable and non-discriminatory licensing terms, may well achieve objectives at least partly comparable to those of an open source clearinghouse, i.e. ensuring wide (i.e. "open", but not necessarily also "free") access to the relevant technologies for the benefit of interested third parties. However, at the same time, patent consortia other than the examined open source model are also employing autofinancing mechanisms to recoup the costs undergone independently, through their own generated royalty flow, without having to rely on some alternative forms of public funding to subsidize their own existence in the first place.