# OpenPlant Intellectual Property Working Group Meeting Report

**University of Cambridge, Cambridge, United Kingdom**

Sponsored by the OpenPlant Initiative of the University of Cambridge, the John Innes Centre and the Sainsbury Laboratory in Norwich

Co-hosted by the Department of Plant Sciences, University of Cambridge and the BioBricks Foundation

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## Executive Summary

OpenPlant is a collaborative initiative between the University of Cambridge, the John Innes Centre and the Sainsbury Laboratory in Norwich, focused on the development of open technologies for plant synthetic biology. As part of this initiative, the OpenPlant Intellectual Property (IP) Working Group was formed to find pragmatic solutions to current intellectual property norms and policies that impede innovation in plant synthetic biology. These solutions should promote the scaling and commercialisation of novel advanced technologies but allow IP-free sharing of foundational technologies such as DNA parts and tools.

The initial meeting for the OpenPlant IP Working Group was held at the University of Cambridge on 30 July 2015, immediately following the OpenPlant Forum. The intention of the meeting was (1) to solicit input on the design specifications for an open materials transfer agreement (OMTA), a legal tool that complements the BioBrick® Public Agreement and supports the sharing of DNA components as tangible materials, and (2) to gather and prioritize actionable goals for creating and sustaining an international platform of open technologies for plant synthetic biology.

This meeting report provides context for the OpenPlant IP Working Group and summarizes the observations of the 23 participants, a diverse group of researchers, technical experts, and legal practitioners from academic, industry, and non-profit organizations. The OpenPlant IP Working Group plans to continue discussions via the OpenPlant website and through monthly calls to which all are welcome. The organizers of the OpenPlant IP Working Group welcome feedback on this initial report and invite additional suggestions for concrete actions that can enable the creation and maintenance of platforms for sharing open biotechnologies.

# 1. The OpenPlant and Synthetic Biology Research Initiative

## 1.1 Background

Synthetic Biology can be described as the design and construction of new biological entities such as enzymes, genetic circuits, and cells or the redesign of existing biological systems. This approach offers the prospect of reprogrammed biological systems for improved and sustainable bioproduction. While early efforts in the field have been directed at microbes, the engineering of plant systems offers the even greater potential benefits of complex metabolism, huge scale, and low costs.

OpenPlant is a UK Synthetic Biology Research Centre across over twenty groups at the University of Cambridge, John Innes Centre and The Sainsbury Laboratory, Norwich. We aim to promote innovation and social impact by accelerating the development and exchange of underpinning tools and techniques in plant synthetic biology, and to facilitate outreach, policy discussion and international development.

OpenPlant incorporates several projects in trait engineering to produce applications of high value and societal benefit. These include improving the quality and yield of biofuels, animal feed, food and high value products through carbohydrate engineering. Other projects seek to engineer plant natural products with applications in drugs, agrochemicals, food and drink, cosmetics and other products.

OpenPlant work packages focus on shared foundational technologies and their use for trait development. We promote a two-tier approach to managing intellectual property. Potentially valuable applications can still be patent protected in the conventional manner. There will be no change in practices at the top level. However we are exploring less restrictive models for distributing low-level tools and components for plant biotechnology.

As the scale of commercial biosystems are rapidly increasing, patent “thickets” and proliferating cross-licensing arrangements are becoming problematic, even for large pharma and agrochemical companies, and can be crippling for small companies. Innovation in a young field like synthetic biology requires freedom to operate. We believe steps to facilitate free exchange of DNA parts and tools will substantially speed the take-up of new technologies in plant synthetic biology, and foster innovation and entrepreneurship in the UK.

## 1.2 Developing Open Technologies for Plant Synthetic Biology

Synthetic biology requires a range of foundational technologies enabling engineering design principles to be applied to biological systems. These include computer modeling capabilities, libraries of characterised standard parts, and automation of lab protocols to enable high-throughput experimentation. OpenPlant aims to develop such tools and technologies in the liverwort Marchantia as a highly tractable plant 'chassis' for synthetic biology and then release these tools and technologies openly to promote innovation. We will also produce systematic collections of experimental protocols and shared DNA parts in cyanobacteria, *Synechococcus elongata* and other plant and algal models. These parts will include novel markers, regulatory promoters, RNA-based gene regulation mechanisms

and functional enzymes such as metabolic pathway components. Tools for efficient transformation, gene editing and shuttle systems will also be publicly released along with cell lines and strains of several organisms.

In addition to biological technologies, we plan to seed multiple small-scale collaborations for the use of the most recent miniaturised devices and software control for biological instrumentation. In particular, Cambridge has proved a fertile ground for the marriage of microelectronics, optics and biology in the past, seeing the birth of hybrid products like laser scanning confocal microscopy and Solexa/Illumina next generation DNA sequencing. OpenPlant will develop software for generating models, automating DNA assembly and quantification of gene expression as part of its core work packages and the initiative is additionally supporting over 100 small OpenPlant Fund grants over the next five years. These projects will yield a diverse range of open outputs that include low-cost and open source lab hardware prototypes, educational resources and more.

## 1.3 Harmonizing Open and Proprietary Technologies for Plant Synthetic Biology

The intention of OpenPlant is to promote innovation using a two-tier system for IP management. While freedom to operate is necessary for foundational technologies, the commercial applications and products that will be built upon these foundational technologies require investment in development, production and distribution for which IP protection is usually necessary. This two-tier model for IP management involves a decision about which route is most appropriate for a given technology to achieve its desired impact. Low-level technologies with little commercial value in isolation or with high potential to spur innovation are made available openly while high-value applications may be patented or otherwise protected.

Maximising uptake of OpenPlant outputs requires several legal, technical, and social components to complement the core technologies and DNA parts. As a good illustrative example, many OpenPlant researchers recently co-authored a common syntax for DNA part assembly (Patron et al., 2015) to increase interoperability of parts, thus complementing the freedom to operate provided by open or IP-free provision of the sequences and physical DNA. Technical solutions to storing and distributing part information are part of OpenPlant work packages, with registries based on the open source JBEI-ICE project to be provided at each OpenPlant partner site and linked to a network of other global registries.

Providing researchers with the legal tools to disseminate their technologies openly in a way that ownership and usage rights are clear is also key. This involves training researchers on existing legal solutions as well as engaging IP and technology transfer professionals in developing new approaches and legal tools where none exist.

# 2. Proposal for an Open Materials Transfer Agreement (OMTA)

## 2.1 Current practice in biological materials transfer

The transaction costs involved in acquiring and obtaining permission to use biomaterials present a significant logistical and legal barrier for academic research and for commercial development of biotechnologies (Walsh, Cho & Cohen, 2005; Ku & Henderson, 2007; Kahl, 2015). Although centralized repositories such as Addgene have helped streamline the distribution of biomaterials among researchers at academic institutions (Kamens, 2014), access to biomaterials remains problematic for researchers at for-profit institutions and for those wishing to develop commercial applications. The contractual obligations imposed by standard material transfer agreements (MTAs) in use by many academic institutions and centralized repositories allow access only by researchers at academic or non-profit institutions and do not allow sharing of biomaterials outside the identified laboratories or use of biomaterials for commercial purposes. Moreover, any variance from these standard terms must be negotiated on a case-by-case basis.

From a technical perspective, MTAs and the transaction costs they entail for access and use of biomaterials has had a negative impact on research. Researchers in both academic and commercial institutions have reported delays in their research, abandonment of ongoing projects, and the inability to embark on new projects due to difficulties in negotiating terms for access and use of biomaterials (SB6 State-of-the-Art Survey).

From a legal perspective, MTAs are problematic in that their terms may expand the rights of an institution well beyond those granted under formal intellectual property laws (Bubela et al, 2015). For example, MTAs may impose obligations that limit the use of materials that are not eligible for patent protection or for which patent protection has expired. MTAs also may limit the use of materials in countries where the inventors or owners have not sought or been granted patent protection. And most worrisome are terms within MTAs that attempt to “reach through” a patent to lay claim on anything developed using the materials.

In the field of synthetic biology, many researchers rely on registries of biological parts as a community resource for sharing biomaterials and associated data (Kahl & Endy, 2013). The idea is that contribution, use, and re-contribution of genetically encoded functions will create a positive network effect that will enhance the value and sustainability of these common registries. To enable the synthetic biology research community to realize the positive network effects inherent in the engineering of biology, a new standard material transfer agreement is needed that will provide access to biomaterials for all researchers and will encourage commercial development of foundational biotechnologies.

## 2.2 Design specifications for an OMTA

The Open Materials Transfer Agreement (OMTA) is a simple, standardized legal tool that enables individuals and organizations to share their materials on an open basis. The primary purpose of the OMTA is to eliminate or reduce transaction costs associated with access, use, modification, and redistribution of materials. This in turn will help minimize waste and redundancy in the scientific research process and promote access to materials for researchers in less privileged institutions and world regions.

The principle goals of the OMTA are to:

- eliminate or reduce transaction costs associated with access, use, modification, and redistribution of materials;
- minimize waste and redundancy in the scientific research process; and
- promote access to materials for researchers in less privileged institutions and world regions.

Features of the OMTA include:

- Access – Materials available under the OMTA are free of any royalty or fees, other than appropriate and nominal fees for preparation and distribution.
- Attribution – Contributors may request attribution for materials distributed under the OMTA.
- Reuse – Materials available under the OMTA may be modified or used to create new substances.
- Redistribution – The OMTA does not restrict any party from selling or giving away the Materials, either as received or as part of a collection or derivative work.
- Non-discrimination / Inclusivity – The OMTA supports the transfer of material between researchers at all types of institutions, including those at academic, industry, government, and community laboratories.

## 3. Output from the OpenPlant IP Working Group Exercise

## Need for an OMTA

Early discussions addressed the current state of patent protection of DNA parts and the need for an OMTA. One participant asked if a patent landscape analysis had been completed - is there clear precedent for composition of matter claims for DNA parts in the patent literature and a clear need to make them more openly accessible? This was flagged as a potential study to take forward, although as presented in the introductory material there is anecdotal need documented from synthetic biology researchers.

The example of mobile phone components was raised as a space where standards and liberal licensing were viewed as essential to allow interoperability and technological innovation. Synthetic biology was thought to be in a similar situation given the sheer scale of parts. As one participant put it, we may now be talking about 10-20k parts but how will the legal and social system cope with 2 million parts - what will happen to people's willingness to share if we see a linear or exponential growth in parts and their monetary value increases? One synthetic biologist suggested that there will be a non-linear explosion of parts but these will be segregated by organism and limited by the finite number of genetic elements available, but no participants responded to the question of shifting incentives and community buy-in given this trajectory. It was suggested that we may be able to learn from other communities that have developed an ethic of openness and sharing, for example in software or hardware, with the specific example of 3D printing files raised.

Others participants were interested in the current scope of the OMTA and whether the intention was to provide a legal tool for synthetic biology and DNA parts specifically or for biological materials more generally. They were also interested in the extent to which OMTA was the only option on the table and

whether other suggestions could be discussed. The following alternatives to the OMTA were then raised by the group during the course of the meeting:

1. No legal mechanism - focus on technical solutions to remove barriers to reuse of materials
2. Set up a system of bio-engineers' rights akin to plant breeders' rights
3. Give all IP rights away.

In discussing the need for new legal tools in this space, several synthetic biologists pointed out that OMTA is just formalising a practise that already exists as many labs use materials either without going through an MTA process or not strictly adhering to the agreement. There was also a feeling that some of the technical solutions beyond the OMTA might be more valuable, for instance a better DNA part repository infrastructure. Others felt strongly that innovation and investment requires demonstrable proof of freedom to operate, which can be restricted by MTAs and therefore requires additional steps obtain. With OMTA you have this upfront and it provides a lightweight mechanism to assist in releasing materials into the public domain without administrative requirements.

Several participants felt that a legal tool was an important solution, but that existing frameworks could be co-opted from within plant science, particularly if the focus was on plant synthetic biology. Plant Breeder's Rights (PBRs) provide a two-tier system like OMTA, whereby breeder's have exclusive control over the propagating and harvested material of a new, stable plant variety for a number of years, but academics are free to work with the material. It was suggested we might therefore borrow from this model to set up a system of bio-engineer's rights that protect the material as an alternative to patents, which plant breeders already recognise an unsuitable. One benefit is that PBRs already have backing and proponents within a mature industry, which is where we anticipate synthetic biology is heading with the current economic activity. A large international system of practitioners have already had similar conversations to this working group and have implemented legislation which allows for innovation and variety outside of the patent system. Legally, as long as the biological part or material is a living thing that has to be maintained it can be analogous with plants in terms of breeding rights, although it is unclear the extent to which DNA falls into this category. It was suggested that as PBRs are already used in a non-institutional context, they may also more easily translate to sharing outside of academic institutes e.g. between biohackers.

Those who advocated during the meeting for giving all rights away felt that the OMTA does not go far enough in dedicating the materials to the public domain in perpetuity. For this to happen, a non-assert clause is required which obligates those originally making the material available not to assert IP rights over it. Such a clause is not usually included in an MTA and it was suggested that linking to the BioBrick® Public Agreement (BPA) would be an option that could be built in to the emerging framework. The BPA is a bilateral agreement or promise that the part provider will not assert their IP rights in return for the recipient providing attribution and taking responsibility for their use of the part. This is still legally separate from agreements covering the physical material. Integrating a clause into the OMTA stating that neither the creator nor recipient will file or assert patent claims as compositions of matter was also raised as an option. Connecting the release of DNA sequences and parts into the public domain in a way that links directly to DNA sequence pre-screening systems in patent offices would be an alternative mechanism to protect against another party patenting parts that have been released into the public domain. There was no consensus on which of these mechanisms to recommend or integrate into OMTA plans.

In order to surface further ideas around the OMTA as presented and explore other solutions, a non-exhaustive list of ideas for creating and sustaining an international platform for sharing open biotechnologies was solicited from the meeting participants. This list includes inputs for the design specifications of the OMTA as well as potential technical solutions and social considerations that address the broader legal, technical, and community aspects of creating and sustaining open biotechnologies. A range of themes emerged during the construction of this list, which are discussed below.

## 3.1 Identifying and prioritizing ideas

The list of ideas provided by participants is shown in Table 1 and is rank-ordered based on the type of idea (legal, community, or technical) and the priorities assigned by meeting participants. In creating this list, meeting participants first articulated their ideas to the group and then wrote these ideas onto large flip charts. Participants then used up to five post-it notes to designate the ideas they considered high priority and to specify why they considered those particular ideas important. Several observations are of note:

1. Some participants felt strongly that there should be a mechanism to give away all rights in the materials in perpetuity (one person cast three votes, another person cast all five votes, and four people cast one vote). One participant commented that “this point should continued to be made and asked”, suggesting that even those who may not feel it is a viable or preferred solution appreciate it as a benchmark or comparator for other options that retain some rights. The point raised questions within the meeting about what public domain means, the extent to which it is possible for materials to enter it and the basis of design decisions for the OMTA.

2. There was a clustering of ideas around the importance of building and educating the community. For example, six votes were placed on the importance of building a community and five votes were cast for creating an educational resource and FAQs on MTAs. Participants highlighted the creation of  a “culture” and a “moral economy” and comments on education included the current lack of understanding of MTAs and a “mistrust” of agreements. Several votes were cast for ideas around branding of OMTA to make it recognisable and increase awareness and uptake.

3. There was also a clear desire for technical solutions that would make it relatively effortless for researchers to participate in contributing DNA parts to an open platform. One participant described ease of use as “paramount” and another linked the idea that if we are asking scientists to “give away” their work then this shouldn't involve work on their part. Others reiterated the transactional costs to institutions and the idea of reducing these, particularly as several participants predicted a large rise in biomaterial transactions occurring. Four votes were cast to implement a “one click” licensing solution and one participant stated “I don’t want to talk to anyone or fill out a form. I want it to be instant”.

A common thread through several conversations throughout the day was a recognition that

the OMTA is not suitable for all parts, purposes or parties at all times but it introduces choice into the technology transfer decision process. However, it also became clear that there was a great deal of confusion about the features of the OMTA and how the OMTA would work in the context of other legal, technical, and community initiatives. These concerns have been summarised in the thematic sections below.

### 3.1.1 Redistribution

The main concerns raised around redistribution focus on the ability for the recipient to:

1. Edit the part
2. Redistribute the part to any party
3. Allow commercialisation of the part.

To further clarify, the design of the OMTA enables recipients to duplicate and redistribute parts to commercial, academic or non-commercial recipients, thus allowing parts manufacture. The ability to modify a part and subsequently place restrictions on that novel part is also possible on the OMTA, making it non-restrictive for any party who wishes to sell or redistribute. Making commercial use explicit in the wording of the OMTA, rather than implicit in the description 'for any lawful purpose' was suggested by at least three participants and commenters.

Several concerns were raised about redistribution and associated mechanisms. One was that a practise may emerge by which someone put restrictions on a part that they had only modified slightly, which would be allowed by the OMTA. This was not viewed to be a problem by some in the room and indeed encouraged as the original part would still be available. Another participant suggested this could lead to “scams” if people were unaware of the existence of the free version. A distinct but related point was also raised around actors distributing material that was not as advertised or even dangerous. Liability for losses associated with this action could represent a problem for creators and intermediary distributors. No clear solution was raised to this but it was noted that such actions are already possible under the current system.

It was suggested that the two concerns above and broader issues of awareness of freedom to operate and quality control could be addressed in part by widely distributing information on the free parts via a public repository or registry, which potentially allows feedback on parts. This led to substantial discussion, including data protection implications of such a database. At this stage, it was important to reiterate the distinction between the information representing the part i.e. the DNA sequence, and the physical material i.e. the DNA itself contained in a vector or other distribution format. The OMTA focuses purely on the transfer of material, not information. This raised a concern over whether the cost of de novo synthesis of DNA would soon compete with the cost of redistributing physical DNA to the point where no-one transfers materials anymore but only the information. Will an OMTA be obsolete soon after it is created? Some synthetic biologists confirmed that they currently sometimes synthesise rather than request parts from other labs and see this practise increasing. However, other synthetic biologists highlighted that the field is becoming more ambitious in the length of the DNA parts they create, including building chromosome scale fragments, and it is unclear how well synthesis technologies will keep pace with this. Others pointed out that other materials such as chassis lines cannot be synthesised so MTAs will still be required.

The final concern raised on redistribution was the associated transaction cost of maintenance and postage of physical DNA stocks in addition to the cost of administering MTAs. Who will face these costs

and how much of problem do they represent to the recipient or redistributor? No one in the group was aware of any empirical data for how much time universities and individual labs currently spend negotiating MTAs and physically preparing DNA for redistribution. Several synthetic biologists in the group used third party distribution services such as Addgene, who currently redistribute material under the UBMTA. OpenPlant plans to use the Arabidopsis Research Centre, GARNet and other plant-specific repositories to assist in redistribution. This increases the range of organisations that could be persuaded to offer material under the OMTA. Repository agreements to use the OMTA were deemed to be important by some participants, with three votes for establishing them as a priority and comments that they were “important for uptake/dissemination of parts from academic communities” and that”OMTA should be functional without us establishing a repository”.

### 3.1.2 Attribution and Reuse

Discussions around reuse of materials under OMTA focused on concerns about provision and tracking of attribution, primarily in academic institutions and this was considered to be a key part of creating a community culture. Several participants suggested that this needs to be considered alongside the role of publications and patenting in institutional and national contexts. The incentive structures that exist for researchers can be very different across these parameters and several descriptions were given of less or more permissive technology transfer regimes in different institutions. Understanding the motivations for making things open and how different people want to be rewarded was raised – as one participant put it, “the sense of 'mine' drives a lot of work in general”. Solidifying trust and reputation was raised as a key driver and regulator of academic work, but may be less important to those operating outside academia.

Overall, participants suggested that consideration should be given to:

- Creating a system to allow attribution of the part to be awarded to the correct individual.
- Tracking of attribution, although the question of whether this should be mandated or left to scientific community norms had a mixed response and no clear preference emerged.
- Implementing a feedback mechanism enabling work to remain open after redistribution but enabling attribution to remain with the original contributor of the part.

Suggested solutions included an online maintained repository of parts with provenance information. The idea of unique identifiers for parts, individual creators and publications was raised, which would enable cross-linking of information without losing this provenance trail using a concept that is already widespread in the biosciences and familiar to researchers e.g. GenBank IDs for DNA and ORCIDs for individual researchers.

Concerns were also raised around quality control and its link to reputation. One idea focused on classifying work as private on the repository to indicate that it's in progress but the part is not yet ready for open distribution. This was suggested to fit well into the triage structure, whereby researchers make an active decision about whether to release openly that may come at various points in the part creation process. It also with existing practises in the iGEM registry, which contains theoretical parts. From a legal perspective, such a database could also address concerns that materials might have IP claims of which redistributors are unaware. It was suggested that removing some of this uncertainty may enable higher flux of materials. The database would also form a resource for patent examiners in

the course of searching for prior art and could therefore be opened up to material not under an OMTA with clear marking.

### 3.1.3 Non-Discriminatory Access

Some expressed confusion about what was meant by “Non-discriminatory Access” and wanted to be sure that the OMTA did not focus on big institutions but also would enable access by DIY labs, hackerspaces, etc. To clarify, the intention is for the OMTA to support material transfer for individuals at all at all types of institutions, including those at academic, industry, government, and community laboratories. Therefore, the OMTA does not include any provision that would require the recipient to be associated with a specific type of institution (e.g. a requirement that the receiving organization be an academic or non-profit institution). To avoid confusion in the future, it may be best to label this feature “inclusivity” rather than “non-discrimination”, although non-discrimination is the term used in other open licensing initiatives such as the Free Software Definition, Open Knowledge Definition and Creative Commons licensing scheme.

The group questioned the non-discriminatory clause, as previously mentioned in terms of discussing what rights could and should be given away.

### 3.1.4 Institutional Implementation

The OMTA is intended to work in existing institutions in a way that doesn’t cause disruption and makes MTA transactions easier for contract offices and material donors and recipients. Quantitative data is not available but our understanding through anecdotal evidence is that MTAs account for a substantial workload in the contracts offices that deal with them.  In particular, any negotiations with companies absorb a lot of time. Much of the due-diligence work takes place the first time a material is transferred, but under the current system each subsequent transfer requires individual signing of the agreement and negotiation if the UB-MTA is not used or the recipient is a company. We discussed the following ways to minimise the burden on institutions:

1. **‘One-click’ electronic agreements.** Electronic UB-MTAs are already implemented by Addgene and are likely to be acceptable as long as they fit into the administrative workflow. Participants commented that speed and ease of use is paramount and vital to the success of OMTA.
2. **Pre-agreement to OMTA terms.** OMTA will not require re-negotiation for companies and therefore in principle it should be possible for the institution to agree that something can be sent out under OMTA once and then provide a single-click license for recipients that still allows sufficient information for institutions to track usage for their own record-keeping. This will be a substantial departure from current practice and may be challenging to negotiate, particularly in institutions with a greater mandate to protect any potential future intellectual property rights in the materials. It is likely to be less challenging at Stanford and Cambridge where researchers have more autonomous control over the use of their research outputs.
3. **Providing software and links to allow tracking of parts.** For academic exchanges, institutions may use MTAs as a tracking mechanism as much as a legal tool and therefore other

ways of tracking reuse of parts and materials will aid in any transition to use of the OMTA, where there is potential for that ability to be lost given the recipient's right to redistribute. This was also emphasised in the discussion on research incentives and barriers to use of the OMTA.

## 3.2 Defining next steps

Leading on from the meeting, there will be further discussion and clarification for the legal document of the OMTA informed by the participants views and other input. This development will eventually take place on an editable website at openmta.org where ideas and concerns can be added anonymously or with attribution.

This website will provide a home for OMTA versions of record and potentially any future governance structure that emerge, as several participants suggested that a host institution would be required to maintain and revise the document. Several participants also suggested the idea of creating a brand and perhaps protecting that. Creative Commons was suggested to provide a model here as they have an international community which revise the licenses periodically via a mailing list . While these licence texts are open, the CC name and logo are trademarked to avoid misuse and maintain trust.

It was stated at the meeting that the short term goals of the OMTA are to create a mechanism for sharing of parts between the OpenPlant institutions in the first instance so this is the key next practical step once the wording of the legal document has been

# 4. Conclusion

There was a clear need and desire from the majority of working group participants  to provide a mechanism for exchange of DNA parts and other biomaterials that both minimises transaction costs and provides options for more open and permissive rights for the recipient. The design specifications for an open materials transfer agreement (OMTA), were largely deemed to be appropriate and the major challenges now lie in implementation and addressing the numerous texhnical, social and cultural barriers and opportunities surfaced by the group. The immediate actionable goals for creating and sustaining an international platform of open material exchange for plant synthetic biology are to implement a pilot transfer using the OMTA and set up a body to provide a home to the legal text and solicit further comments. Further work and information-gathering will include examining how the OMTA fits into insitutional workflows, further exploring the implications of international exchange and establishing the ancilliary tools which will ensure that parts remain open and incentivise producers to contribute open parts.

Table 1. Ideas generated and prioritized by participants of the OpenPlant IP Working Group

| Type | Idea / Reasons for high priority | Votes |
|---|---|---|
| Legal | Provide a way to give away all rights in the materials unconditionally to everyone, forever<br>● decision to place in public domain is a key upstream one<br>● this point should continue to be made/asked<br>● 100% (3 votes)<br>● Because PD is the only mechanism that is infinitely stable, moral and ethical. Building blocks of life (5 votes) | 12 |
| Legal | Repository agreements with institutions (like Addgene for UBMTA)<br>● important for uptake/dissemination of parts from academic communities<br>● Take the work off the producers, if they are letting it go they won't want to work at it<br>● Yes – OMTA should be functional without us establishing a repository | 3 |
| Legal | Trademark OMTA/other protection<br>● Important for recognition, trust and acceptance<br>● Reinforces integrity of the community – watch out for knockoffs<br>● Institution design, version control, version evolution and communication | 3 |
| Legal | Map patent landscape<br>● This helps people make informed decisions<br>● A necessary step in establishing FTO | 2 |
| Legal | Legal status synth bio. Post, mayo/myriad? | 0 |
| Legal | Viral agreement | 0 |
| Community | Community of users is important (cc)<br>● Very Important<br>● What is created should be useable and used<br>● This is a moral economy. It is a brutal place, not just a happy one<br>● Very Important<br>● Need critical mass to be near default<br>● Need to get a culture of use | 6 |
| Community | Create information & Educational resources/FAQs on MTAs. Why do they exist? Benefits/disadvantages of OMTA<br>● Engage<br>● OMTA case study, examples and different fields<br>● Unclear to many – different benefits to different users<br>● This point is vital for future knowledge and innovation in the communication between legal/academic/companies.<br>● Distrust of agreements so this may assist in understanding why the MTA is required | 5 |

| | | |
|---|---|---|
| Community | Host Institution for OMTA versions<br>● Crucial for implementation of new practices<br>● Need management<br>● Ensure consistency, version control, ability to update as events unfold (laws change, practices change)<br>● Agreement needs to be between legal entities – entity created for purpose<br>● Quality and community focus | 5 |
| Community | Sexy logo and T-shirt required<br>● Achieve popularity and used by attractiveness, make sure it's doodle-able<br>● If it becomes a positive brand, more people will use and share<br>● Relates to community (logo)<br>● Distinct logo and branding, likely to increase false up as it develops | 4 |
| Community | Ambitions of OpenPlant – Clearing house and broader ethics<br>● Important to keep in mind<br>● Helps establishing community ethos<br>● Helps articulate community aspirations and higher goals | 3 |
| Community | Bioengineer's Rights<br>● Could be interesting<br>● Brilliant idea, important to bear in mind<br>● A good model to think with and help to maintain across all biology | 3 |
| Community | PR & management of message and response required<br>● Need clear message to the world<br>● Prior art and standard; OMTA and different agreement/licensing; Guidelines for patenting and verify IP claims | 2 |
| Community | Outreach to institutions to sign on to the OMTA<br>● Enables more academics to have the option of disseminating their research in ways that promote translation<br>● You have plenty of biologists facing similar problems | 2 |
| Community | Educational materials for appropriate use of the OMTA<br>● Guidance on use of OMTA – just part of a well thought-out announcement/launch | 1 |
| Technical | One-click licensing (don't need to wait for the institution once they are signed up to OMTA)<br>● Important if OMTA is to be broadly useful tool and to increase ease of use for institutes<br>● Speed and therefore frequency and success of use<br>● Easy for users<br>● Ease of use is paramount. Makes process symmetric for holder and recipient<br>● Need to reduce transactional cost | 4 |

| | | |
|---|---|---|
| Technical | Information about part should be linked with attribution mechanism<br>● Important for incentivising use<br>● Allows credit to remain regardless of human nature (i.e. not crediting in publications)<br>● Should acknowledge accreditation. Will never be 100% it just has to be good enough. | 3 |
| Technical | Distributed public register with symbol e.g. ©<br>● Ease tech<br>● Links well with logo idea – a simpler symbol that I can recognise<br>● Start small, test and do first, good practices and guidelines, values and ethics | 3 |
| Technical | Predicted scale of OMTA? OpenPlant MTA, Open Biology MTA, Open SB MTA, OpenMTA?<br>● Transaction cost of "material" transfer should be as low as possible<br>● Implies no bilateral contract<br>● Identifiers, similar to biomarkers and varieties of Open | 3 |
| Technical | Use of unambiguous identifiers e.g. OrchID, GENBANK ID<br>● Facilitates database referencing, social links and establishing reliability<br>● Standards | 2 |
| Technical | Connect Sequences to patent office as prior art<br>● Very important to protect donated parts<br>● Is important but only if there is data/use otherwise it's alerting the patent office that someone has cloned a gene | 2 |
| Technical | Create a function that allows tracking of "parts in progress"<br>● This helps build anticipation and worthy as documentation after publication | 1 |

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