

A vision of the future for non-profit technology transfer

Research institutions are expected to bring benefit to the public, while their technology transfer offices seek to generate financial returns. The future of non-profit technology transfer depends on finding ways to reconcile these two often conflicting goals

By Pamela L Cox

Traditionally, non-profit institutions (universities, hospitals, research institutes, governmental entities and foundations) have transferred knowledge through teaching, publication and service. Over the last 30-plus years, fuelled in large part by the Bayh-Dole Act providing institutions with the ability to retain title in inventions developed with government funding, non-profit institutions have increasingly used patents and commercialisation as an additional vehicle for knowledge transfer.

In response, these research-intensive institutions have established technology transfer (TT) offices and charged them with protecting, marketing and transferring innovations created at the institutions with the mixed, and sometimes conflicting, goals of bringing benefit to the public and financial return to the institution. While many have hailed TT as a resounding success and a key driver of economic growth and national competitiveness, others have decried the current system as flawed. In the context of this debate over what TT is, we thought it would be interesting to instead consider what it should be.

With that in mind, I asked our panel of national experts and thought leaders in TT

to share their vision of the future of non-profit technology transfer (NPTT).

Lita Nelsen is director of Massachusetts Institute of Technology's (MIT) Technology Licensing Office; Elias Caro is vice president of technology development for the Wallace H Coulter Foundation; Robin Rasor is director of licensing for the University of Michigan; and Connie Armentrout is director of Academic Technology Licensing for Monsanto Company.

What is your vision of what the world of NPTT should look like 10 years from now?

Lita Nelsen (LN): 'Should' and 'will' are two different questions. What I would like to see are established companies with a longer time horizon investing in early-stage (university stage) technology and possessing the R&D capacity to bring it to market. I also hope to see an environment where fewer university administrations are clamouring for the 'big win', and where Congress stops attacking the strength of patents, what can be patented and the penalties for infringement. Without strong patents, we cannot provide an incentive to companies and venture investors to invest in early-stage technology.

Elias Caro (EC): NPTT must be a strategic asset for the country and not just a cost centre with little support from the universities or government-funded institutions. They should run as businesses where patents are just the beginning and the end goal is to have sufficiently de-risked assets that become an important funding source for the institutions. As higher education becomes democratised by open online courses, universities will need to find new funding mechanisms besides tuition. The universities' biggest assets are their

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professors, who have the ability to develop new technologies with sufficient market appeal to attract funding.

Robin Rasor (RR): In 10 years, I see NPTT as continuing to be broader than 'just doing licensing agreements'. In my view, it will include:

- Education of students and faculty in innovation and entrepreneurship.
- Assistance of local communities with start-up activities.
- Collaboration with regional universities for economic zones.
- Marshalling changes in how we do research with industry, as industry continues to come to universities for R&D such as negotiating continued flexible IP terms in research contracts, which requires both sides to be flexible.
- Programme management of projects.
- Management of translational funds or even seed funds for further development of early-stage research and/or actual funding of office staff due to cuts in overall university budgets.
- Use of internet and social media for marketing and database/contact management.

Universities have already started to establish joint institutes with universities in other countries, but we are suffering growing pains because IP terms are generally the last thing that anyone thinks about in the agreements, often postponing those discussions until it is too late. Hopefully, in 10 years there might be more harmony among policies internationally, especially with the East Asian countries and India.

Connie Armentrout (CA): I envision that NPTT will continue to experience growth fuelled by creative TT officers finding new avenues to get early-stage inventions on their way to commercialisation. The offices will have to continue to use traditional licensing mechanisms (established company licensing in new technology from the academic setting) and start-ups, both university and community-supported small companies, while creating new ways to secure the money necessary for inventors to develop inventions beyond what typical (federal) research funding can do. I expect that universities, in connection with small and large companies, will come up with additional sources of support to develop inventions within the university setting.



Lita Nelsen, director of Technology Licensing Office, Massachusetts Institute of Technology

"Without strong patents, we cannot provide an incentive to companies and venture investors to invest in early-stage technology"

Introducing the participants

The panellists joining Pamela Cox in this issue's roundtable discussion are as follows:

- Lita Nelsen is director of Massachusetts Institute of Technology's (MIT) Technology Licensing Office, which manages over 600 new inventions per year, negotiating over 100 licences annually. The office has helped kick-start 25 new start-ups. Prior to joining the MIT in 1986, she spent 20 years in industry, primarily in the fields of membrane separations, medical devices and biotechnology. She is a past president of the Association of University Technology Managers (AUTM) and a founding board member of the Centre for Management of Intellectual Property in Health Research and Development, an organisation concerned with the use of intellectual property in medical research for developing country diseases.
- Elias Caro is vice president of technology development for the Wallace H Coulter Foundation, where he oversees the biomedical research grant programme and translational research partnerships with 10 US universities. Mr Caro, who has over 25

years of technical and management-level experience in major multinational corporations, joined the Coulter Foundation in 2006. Previously, he served as vice president of diagnostic research and development, president of the biomedical research division and executive vice president in charge of international diagnostics commercial operations and worldwide life sciences for Beckman Coulter. He has extensive international experience in Venezuela, Puerto Rico, France, Belgium, Japan and United States.

- Robin Rasor is director of licensing for the University of Michigan, where she oversees staff handling all functions of the licensing process, from management and marketing of disclosures to developing and negotiating appropriate licensing terms for licence agreements, as well as maintaining and monitoring existing agreements. Previously, Ms Rasor was director of licensing at the Ohio State University, where her primary focus was on technologies arising from life sciences research from the Colleges of Food, Agriculture and Environmental

Sciences, Biological Sciences, Dentistry, Medicine, Pharmacy and Veterinary Sciences. She also spent 10 years with Battelle Columbus Laboratories, is a past president of AUTM and serves on the board of governors of the Certified Licensing Professional Programme.

- Connie Armentrout is the director of Academic Technology Licensing for Monsanto Company, where she and her team support the technology (discovery) segment of Monsanto by gaining access to university technologies through material transfers and option and licence agreements. Ms Armentrout's team also oversees transactions required to fund research at universities, both basic and applied, as well as agreements for university services, and negotiates consulting agreements with academics that participate in various Monsanto activities. Federal grants, cooperative research and development agreements, material transfers, confidentiality, land leases and field trial agreements are also part of the team's activities.



Elias Caro, vice president of technology development, Wallace H Coulter Foundation

“Universities’ biggest assets are their professors, who have the ability to develop new technologies with sufficient market appeal to attract funding”

How has the mission of the NPTT enterprise changed?

LN: There have been good and bad changes. I believe that we have come to a point where there is simply too much emphasis on going for the big win. At the same time, more universities and research institutions are focusing on translational research and there is also more emphasis on entrepreneurship, both as an educational mission and as a route to commercialisation. The emphasis on industrially funded research is also intensifying.

EC: As established companies have reduced or eliminated their research, they have become dependent on acquiring innovation from entrepreneurial start-ups that have sufficiently de-risked their products. Most innovation is coming from government-funded research, as there are very few risk capital resources. However, government is starting to demand more productivity from the research dollars that it funds, and universities and other government-funded institutions will have to prove worthy of the funding. Societal benefits and high-paying jobs will be used to measure the impact of taxpayers’ investment in government-funded research.

For this to work, NPTT should become like early-stage venture capitalists working to further de-risk and validate the technology/product/service as a prerequisite for licensing. As projects advance, and both commercial and technical risks are reduced, valuation will increase. This model should produce an evergreen fund to further support the enterprise.

RR: I think it depends on the university. Sadly, there is more interest in revenues across many universities. But there is also continued interest in training faculty and students in innovation and entrepreneurship. In fact, there is a bit too much emphasis on entrepreneurship itself over just innovation. Not every technology should be a start-up; nor is every faculty member or student suited to be an entrepreneur – they might innovate, but not necessarily work at a small company.

Is having TT part of promotion and tenure a good thing or does it lead to less-than-quality disclosures that then clog out the quality disclosures handled by an always understaffed TT office?

CA: The process is much more complex than in the past. The officers responsible

for these activities have many things that have to be considered and factored into the equation, such as potential conflicts of interest, venture capitalist involvement and regulatory requirements.

What is the role of the faculty in your future model, especially the faculty entrepreneur?

LN: Entrepreneurial faculty is critical for getting early-stage technology commercialised. Existing companies are reluctant to license high-risk technology and start-ups are necessary to bridge the gap in many fields. They are also instrumental in involving graduate students and post-doctoral staff in entrepreneurship.

EC: For the most part, we do not think that faculty want to be – or would be – good entrepreneurs. We think that the right model is one in which faculty are serial innovators. This will require that NPTT provide the business support to transform the basic research into innovations that can be licensed at valuation points that produce an important and stable base of income for the institution. The money should be used to fund the additional cost of creating an entrepreneurial ecosystem in the institution. This ecosystem must provide the business support for the enterprise to be able to recruit the qualified cadre of businesspeople and CEOs to support the model.

RR: This is the current struggle. There is a sense at some places that all faculty should be entrepreneurs. At the same time, there is a parallel concern about conflicts of interest (in particular with medical faculty – note the Sunshine Act). Many faculty feel whipsawed by conflicting messages from their employers. In my opinion, there is a lack of understanding about innovation versus entrepreneurship. If we want all faculty to be entrepreneurs, who will be left to teach and do research? And we ‘teach’ our faculty to be entrepreneurs, but very few really will leave their jobs or put their own money into an endeavour; even worse, they will be pushed into being entrepreneurs with technology that has no business being in a start-up.

I believe we want faculty innovators: faculty that understand markets and can sense early on whether their research is leading to something that might be marketable and warrants calling TT.

CA: The faculty inventor is (and will remain) critical to the TT effort. Some need to be involved with the technology from cradle to grave, while others invent and hand the invention over. Some are at the scientific helm of the start-up, while others want to stay in their laboratories and continue basic research. Often, technologies would not get off the ground without the drive of the inventor(s). In any event, the inventor(s) will continue to be crucial in the hand-over of the technology at whatever point that takes place.

Describe the expertise of the TT professionals in this future model.

LN: I see these professionals as being effectively ‘bilingual’ between academia and industry. They will have good scientific backgrounds and, preferably, industrial experience in product development and marketing. Some entrepreneurial experience, especially with investors, will be helpful, as will a working knowledge of the academic mission and value system. Good communication skills (oral, written and active listening) will be critical, as will familiarity with intellectual property and the ability to handle ambiguity, to problem solve and to deal with a wide range of personalities. Good networking skills will also be key.

EC: I will not cover the expertise needed for back-office functions such as administration and patenting, which are not very entrepreneurially focused. The business development function will require professionals with deep expertise in the areas of technology and markets, in which the core technical competencies of an institution will give it a competitive advantage. I do not think that institutions should or could have strategic advantages in every area of technology and business. A core competency/strategic advantage analysis should be performed with input from experts in those areas initially considered. It is only in these areas that the early-stage venture capital model should be considered. Other areas could use a more traditional model or could even consider partnerships where the intellectual property is transferred at no cost for sponsored research moneys.

RR: TT professionals will have to continue to be broad in their science knowledge and, depending on structure of the office, some may need to know more about programme management and entrepreneurship. TT needs more people who understand software development and who are multinational or

understand international policies (we have licensing staff who are fluent in Chinese, Japanese and French).

CA: I envision that TT offices will build teams that encompass a wide range of skills, all of which will be necessary to move new inventions to the right kinds of company that can take them through to commercialisation. There will be a need for staff that can combine start-ups with venture capital, seed funding with federal funding, start-ups with large companies and so on.

How are synergies between non-profit TT offices utilised?

LN: Multi-disciplinary research and large programmes often require multi-institutional collaboration. TT offices are critical in the negotiation of such research agreements. Flexibility, responsiveness and the ability to compromise are critical for such agreements. Similar skills are needed for jointly owned patents and in material transfer agreements.

EC: This model probably would not be applicable other than for a few large institutions and for a limited number of areas. It seems logical that consortia of institutions can be developed by strategic competency areas to achieve a sustainable model that enlarges the pie and gains negotiation power.

RR: I’m not sure I have an answer for this. We have been doing inter-institutional agreements for years, but if our offices/universities are not aligned in terms of our overall goals (service versus revenue), it can make for difficult relationships. It is still pretty rare to see offices working together, unless they have a regional reason to do so.

CA: I see this happening through training programmes offered by the LES and AUTM, but I am far enough removed from the day-to-day activity of these offices to be a good judge of synergy utilisation.

Will the predominant assets transferred in the future model be patent rights, copyrights, trade secrets, trademarks, unpatented know-how and/or tangible materials (eg, biological materials, animal models, germplasm, software) – and why?

LN: For universities, trade secrets are antithetical to our mission of publication and other dissemination of knowledge.



Robin Rasor, director of licensing, University of Michigan

“Not every technology should be a start-up; nor is every faculty member or student suited to be an entrepreneur”

For similar reasons, unpatented know-how is seldom a source of revenue for the university. Trademark licensing is valuable for universities with nationally ranked football and basketball teams (not us). They may also be important for hospital services and associated branded products, but can be very dangerous if not properly used.

Some tangible research materials (targets, vectors, single genes) have become less important since new technology allows them to be so readily replicated from publications. Other materials such as animal models and tissue samples continue to have research value, but ethical obligations demanding that they be made widely available limit commercial potential to relatively small value.

Software falls roughly in two categories: patentable algorithms and 'just copyright'. The latter usually has significantly less value because it can be designed around, the code at university stage needs to be rewritten and the fundamental value is in the know-how and vision of the authors. Such 'copyright only' software is an important part of student (and faculty) entrepreneurship, but not as important in formal technology licensing. So patents will likely continue to be our bread and butter.

EC: All of these could form the asset value that an early-stage funded company can assemble.

RR: I doubt that trade secrets and know-how will ever be a major asset, because universities will always have to publish and it is way too difficult to define and protect know-how in a university setting (at least that is my opinion). Copyrights will continue to increase as information technology continues to be important, particularly with the health IT push. Tangible materials will always be important, but more for sharing than for revenue. Trademarks (other than university logos) have limited value except in certain areas – in particular agriculture. I'm not sure that many universities will gain value from trademarks.

Copyrights will continue to be a struggle, because most universities have very unclear copyright policies – leaving the copyright ownership to the faculty. The lack of clarity in these policies makes it very difficult to ensure that valuable copyrights can be licensed (not all valuable property is software – we have licensed websites, educational tools and other content). Inconsistent treatment of ownership of 'copyrights' creates a lot of confusion at

universities; but little interest in changing these policies, except by TT offices, renders them static. This is a big issue for many of us, I suspect.

CA: Companies use a variety of IP protection to secure their investments in the commercialisation of products. Different companies may rely on one type of IP protection more than others. For example, biotechnology may rely heavily on patents, trademarks and trade secrets, while software will rely more on copyright and trademarks.

How will the budget to protect these assets change?

LN: The increasing costs of patents undoubtedly lead to higher barriers to patenting and are very restrictive for those universities with small budgets. And it is not clear at all how much provisional patents protect disclosure or whether they just offer a false sense of security.

EC: An initial investment from the institution(s) is required to provide the resources to create this model. Obviously, the funding should be a commitment of between about US\$1 million per strategic area, and a minimum of US\$2 million to US\$5 million for biotech, for a sufficient period to create the evergreen fund. Some of the de-risking of projects can also be achieved from moneys from Small Business Administration programmes.

RR: The main sources of budget stress will continue to be patent and labour costs. Universities will continue to need to be creative in reining in patent costs (different deals with firms, having in-house patent attorneys (see Emory) and other ideas). Universities may need to be more aggressive about reimbursement from licensees and need to get additional funding from departments.

TT offices will continue to be understaffed; we simply have not done a good enough job explaining that understaffing results in money being left on the table.

CA: I would expect budget needs to increase.

Where will the funding come from for the future TT office?

LN: That is tough to answer. Some offices will be able to support themselves from income, while others may need university support (which will be difficult to come by).

There do not appear to be other sources on the horizon. Some universities have historical arrangements that allow them to include the cost of US patenting for federally supported inventions in their indirect cost pool; there might be some consideration of extending this more widely to other schools.

EC: Initially, the institution(s) will have to fund the venture; as the successes pile up, the enterprise should become self-sufficient and produce high multiple return on investment to the institution(s). Of course, this will require an important investment of millions of dollars annually for the first seven to 10 years in the biotechnology or medical device fields, and shorter in other areas of technology.

RR: I agree with Lita – this is a toughie. It all depends on the politics of the university and how valuable it judges the endeavour. At the University of Michigan, most of the new money is going to support upstream activities – innovation – not the downstream of marketing, protection and licensing. Our concern is that we will become the ‘plug.’ There is tremendous angst over how to fund the tech transfer endeavour. Some universities (eg, Arizona) have even gone back to how we did things 15 to 20 years ago, by having individual TT officers paid for and located in individual departments and colleges. Satellite offices return because the only way to get funding is through decentralised versus central budgets. In my opinion, this is a bad trend. Few offices will ever be able to support their offices solely on revenue.

CA: Universities have been creative in this regard for many years. I would expect that they will have to use more of their revenue to cover expenses as time goes on. For many years, universities have relied on industry to cover IP expenses as part of the compensation for an option or licence, and I would expect that to continue.

What are your thoughts on how to bring about the external changes – legislative or otherwise – that would need to occur to transition the current model of NPTT into your vision of the future of TT?

LN: I would urge legislators not to weaken patents any further and to provide tax credits that would reward truly long-term investments (not a year, but long enough to truly develop products and companies). Could we reform Wall Street and get rid

of stock speculation and dependence on quarterly earnings such that public companies had greater incentive to invest long range?

EC: The Small Business Innovation Research (SBIR) programme could be an avenue to enact change. In reality, the SBIR funding is big enough to serve as a model for proof of concept. The money is already allocated in the budget and the goal is to further develop US enterprise. Managing the funds as venture capital instead of academic funds should improve the number and level of successes.

One of the National Institutes of Health (NIH) – the National Heart Lung and Blood Institute – launched an experiment allocating an important amount of funds to consortiums of institutions that had to provide matching funds for five years. The goal was to develop solutions for unmet medical needs within their areas of interest. I am proposing a similar model here. SBIR moneys could be used in a similar way.

RR: We have always talked about the federal government mandating that some portion of federal dollars go to support TT, but this idea will continue to stall because TT remains a small part of the overall picture for universities. They want to control how they use the overhead (and I don’t necessarily blame them for that). Can TT offices ever do a better job of explaining what we do? Fighting off all the sexy new ideas such as iCORP, entrepreneurship training and the like for the ‘boring’ job of marketing and licensing? This is a real challenge for understaffed and overworked offices. One has to be visionary and I’m not sure there are a ton of truly visionary TT offices (sad but true).

CA: I think that the universities and non-profit labs that are research units are set up now to handle the TT function. The sharing of best practices will remain a great resource for the continued education of the workforce.

“ Non-profit technology transfer must be a strategic asset for the country and not just a cost centre with little support from the universities or government-funded institutions ”

Action plan



Continued funding is essential to invest in protecting intellectual property, to provide legal support for high-stakes IP transactions and strong template agreements, and to retain experienced staff with valuable networks and relationships. NPTT is critical to a vibrant innovation ecosystem.

- The technology transfer profession has become more defined over the past two decades as the need for such services has increased.
- Sustained investment and efficient allocation of resources is critical to the future of non-profit technology transfer.

And how would you bring about the internal changes – financial or otherwise – that would need to occur to transition the current model of NPTT to your vision of the future of TT?

LN: We need to educate university boards and senior administrators about the value and benefits of the tech transfer process, and to dispel the perception that it's all about bringing in large income. We need to educate each other that 'it's not primarily about the money', and bring about more collaborative approaches to joint inventions and shared research resources. Intellectual property should not be a barrier to collaboration. We need to educate companies better about the difference in mission between the non-profit and for-profit sectors, so that they are more cognisant of the bright lines (eg, publication) that cannot be crossed and so we can spend less time 'negotiating' items that we simply can't negotiate.

EC: Our goal is to do it with the NIH, the National Science Foundation and other governmental institutions. We are starting to work with one of the NIH institutes to allocate SBIR funding in a more business-like fashion. The NHLBI U-54 experiment will open doors to other institutes that want to wait and see. Government-funded initiatives such as the M-Track programme in Michigan and the New York State Energy Research and Development Authority will allow universities to experiment without committing their own funds. However, adoption will require that university presidents decide to allocate important funds to the NPTTs for them to be able to hire the right people and start the transformation.

RR: We need to continue to educate university leaders (eg, department, college, provost) that the innovation and entrepreneurship process incorporates TT – it is not separate from TT. I also think that we need to do a better job of explaining the difference between innovation and entrepreneurship. Many of us (including faculty) worry that we are giving our students the wrong message – it is not always 'bad' to go and work for an existing company; not everyone makes US\$1 billion on their start-up and so on.

CA: Universities will have to adapt their programmes to allow for creative negotiations with industry and venture capital groups. There is a current trend

of developing exceptions to policies, which is designed to increase industry research funding at universities. Innovative thought leaders will need to expand on these practices and continue to find new ways to develop inventions to the point where another mechanism can promote commercialisation. At the same time, universities, non-profit research organisations and industry cannot lose sight of the fact that the teaching and training of students, so that those students can step into roles in industry, is still a very important feature of their TT efforts.

Vision of the future

Two attributes stand out from our experts' vision of NPTT.

First, the panel sees a future where NPTT will continue to exist. Over the 18 years that I have been in TT, the profession has become much more defined. The value and expertise provided by TT officers in service to inventors, institutional stakeholders, funding partners, licensees and the public have not gone unrecognised. There is the implicit expectation that this service should continue.

Second, the experts see resource allocation playing a large role in shaping the future of NPTT. The panellists agree that investment is needed to support those TT programmes that are not self-sustaining. **iam**

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