The role of technology transfer in biotechnology

Date received: 29th November, 2000

John Wilkinson

John Wilkinson
is a partner in the biosciences group of Bird & Bird, a technology focused law firm. John represents a number of biotechnology companies and technology transfer companies based in the UK, US and Europe on corporate and commercial matters specialising in the intellectual property issues. Prior to joining Bird & Bird, John was the Legal Counsel for Cancer Research Campaign Technology Limited and was involved in all aspects of technology transfer including in relation to spin out companies formed by CRCT.

Abstract Technology transfer is the lifeblood of building a sustainable biotechnology industry. This paper considers the development of the technology transfer industry, and particularly its influence on the role it has played in the growth biotechnology in the UK. It identifies some of the key skills necessary to exploit intellectual property successfully and how these were effected in the case of one start-up company. It identifies some of the challenges facing the industry, including the need to retain staff, to be able to invest in technology for the longer term and to have the space and other facilities to incubate fledgling companies.

Keywords: intellectual property, technology transfer, biotechnology, The Cancer Research Campaign, academic, funding, bioincubator

When I was asked to write this paper I was reminded of a quote I had seen from an annual report of Western Union in the late 1880s. The Chairman reported:

> Many of our stockholders have asked me about this new invention by Alexander Graham Bell called the telephone. While we think that it is an interesting curiosity, there is never going to be a market for that technology, and therefore we have declined the offer to take a license.

This for me encapsulates a number of the critical features of the technology transfer process. My immediate reaction is how could anyone be so conservative as to fail to see the potential of the telephone. What would the Chairman think now in the age of communication?

My second reaction is that the person responsible for trying to transfer that technology had failed in the most spectacular fashion. It is the role of technology transfer to sell the technology and to do that you need to be able to see, invest in and explain the potential of the technology.

The Arthur Anderson report entitled 'Technology Transfer in the UK Life Sciences Industry'[1] defines technology transfer as 'the series of linked activities by which intellectual capital and know how passes between organisations with a view to creating and developing viable products and services'. This definition is a wide-ranging one and, in this paper, the term 'technology transfer' is used to refer the process by which technology is identified within an academic institution and developed, marketed and exploited commercially. The commercial exploitation could be by licensing to a pharmaceutical or biotechnology company with the resources to invest in the potential products or by the incorporation of a start-up company.

Although, strictly speaking, the licensing of intellectual property by an institution to a big pharmaceutical company could be considered to fall outside the definition of biotechnology, for the purposes of this

John Wilkinson
Bird & Bird,
90 Fetter Lane,
London EC4A 1JP, UK

Tel: +44(0) 20 7415 6000
Fax: +44(0) 20 7415 6111
E-mail: John.Wilkinson@twobirds.com

paper the meaning of biotechnology is taken more widely to refer to the exploitation of cutting edge life sciences, regardless of the size or history of the potential licensee.

Technology transfer in the field of biotechnology (although it might not have been a recognised term at the time) was probably started in the UK by the formation of the National Research Development Corporation, which later became BTG. The NRDC was established by the UK Government in 1949 for the purposes of commercialising British publicly funded research. In the 1980s the NRDC was renamed the British Technology Group. In 1985 the government removed BTG's right of first refusal over publicly funded research and the ownership of intellectual property arising out of publicly funded research was vested in the originating institution. This was one of the predominant factors in the development of university technology transfer offices and gave the opportunity to a number of charities (such as The Cancer Research Campaign and the Imperial Cancer Research Fund) to set up their own technology transfer offices. BTG was privatised in 1992 and listed on the London Stock Exchange in 1995.

However, the USA had a very active academic sector well before BTG had been incorporated, which had realised the potential of research being undertaken in its laboratories and decided to exploit the same. This is one of the contributing factors to the current strength of the US biotechnology sector. The Bayh–Dole Act of 1980 gave great support to technology transfer of publicly funded technology in the US by allowing the universities to retain title to the intellectual property generated from federally funded research.

In the 1980s The Cancer Research Campaign identified the need to find some way to increase the extent which research which had been funded was taken up by industry and developed for the benefit of cancer patients. As part of this process the Campaign saw the opportunity to plough back any return on its technology transfer activity into the research it funded. To date, Cancer Research Campaign Technology Limited (CRCT) has generated several million pounds for the Campaign and the research community and incorporated or participated in a number of start-up companies including Cancer Research Ventures, Cyclacel, KuDOS Pharmaceuticals, Photo Therapeutics and EPTTCO. The Imperial Cancer Research Fund set up Imperial Cancer Research Technology (ICRT), to undertake technology transfer. ICRT has also been active in the field of cancer-related technology transfer and, for example, played a significant part in the development of Antisoma.

During the last ten years universities have set up technology transfer offices. Imperial College has incorporated two companies, Imperial College Innovations to undertake technology transfer and Imperial College Company Maker as a mentoring and incubation company. Oxford University has been particularly successful, setting up ISIS Innovations and spinning out several companies, its first being Oxford Instruments in 1959 and several others including Oxford Biomedica, Oxford Glycosciences, Powderject, Oxford Asymetry and Oxford Molecular, in the last 15 years.

Clearly the technology transfer sector has played a significant role in the development of the biotechnology sector in the UK and the aim of this paper is to consider some of the skills and qualities technology transfer companies have brought to the sector. In the space allowed it would be impossible to be exhaustive: some of the more important aspects of the technology transfer role are drawn out below.

Academic liaison

The ability of technology transfer executives to work together with scientists who have spent a large proportion of their working lives doing very innovative and cutting edge research is critical to the successful development of that technology and the technology transfer process. A genuine rapport between the scientist and the technology transfer executive significantly facilitates the process. Such a rapport is not easily built up in a short period of time. One of the key strengths of CRCT was its ability to liaise with the scientists who received funding from the Campaign and to work with them to develop their ideas in a way that enhanced their commercial potential without imposing on the scientist the formality or rigidity of a commercial organisation. This sort of regular contact between the scientist and the project manager builds up a team relationship where the scientist participates in the commercial decision making and in doing so enhances the marketability of the project. From time to time the direction of the research, while not being dictated by the commercial process, does need to be informed by it and guided by some of the real needs of the potential industrial partner. For example, it is necessary to provide adequate information about the clinical or diagnostic potential of a product or device in order to determine and obtain a proper value for the technology. Such an understanding can also be important in identifying appropriate potential customers for the technology.

The process of licensing technology, and even more so in starting up a company, can be daunting, and the assistance of a project manager who has done the same thing a number of times makes the process significantly more comfortable.

Knowledge of the market

The experience of relevant markets gained by technology transfer executives is invaluable to an academic researcher who has made an important invention or discovery. This is another aspect of the partnering role played by technology transfer offices. Such an office will have personnel with the time and the experience to undertake the market research that is necessary, to write a business plan and to contact relevant individuals in companies if the licensing route is the one chosen or in venture capital houses for start-up companies. In some ways the charity-based technology transfer offices have the advantage of specialising in the relevant market (eg cancer) and having many contacts in their sector of the biotechnology industry.

There is a considerable and growing network of interim managers and advisors for start-up companies. The technology transfer industry is close to these people and develops working relationships with them. The participation of a talented CEO can make an enormous difference to the perception and potential of a start-up company. Being able to identify key individuals and facilitate the way they work with the academic scientists is part of the role of the technology transfer executive.

An important aspect of understanding the market is the ability to benchmark deals; to be able to determine how much to ask for in milestones or in terms of cash, and based on what valuation, for the start-up company. Obviously to ask for too little undervalues the intellectual property in question but to ask for too much may deny the proposal the opportunity to be taken further. A knowledge of the market, and particularly the financing market, can be of major benefit to the start-up company.

Seed funding

An element of technology transfer that has become increasingly important in recent years is the ability of the technology transfer offices to provide seed funding to start-up companies and projects. The University Challenge Fund, while not without problems, has provided a very significant boost to the ability of the recipients of University Challenge Awards to fund the seed phase of their companies. The University Challenge is a DTI-sponsored scheme which was funded jointly by the DTI (the UK Department of Trade and Industry), the Wellcome Trust and the Gatsby Charitable Foundation with a view to allowing universities to fund research in the short term, increasing the potential value of the technology and hence any business ventures based on the technology. Universities either alone or in consortia have to raise 25 per cent of the total value of the fund and compete for a contribution of the remaining 75 per cent from the University Challenge Fund. The investment criterion, set at a maximum investment to a company of £250,000, means that a very significant number of companies will be created. The total University Challenge Fund was £45m which, when matched with the 25 per cent from the universities, allows for 240 companies to be set up (if each receives the maximum funding permissible). Whether these will find their way to secondary funding remains to be seen. Arthur Anderson estimates that a University Challenge Fund will need to invest in an average of £40,000 in 32 licensing projects and an average of £150,000 in four start-up companies at 35 and 25 per cent success rates, respectively, to achieve a 350 per cent return on investment.

A number of universities and other technology transfer offices have also been able to raise independent funds. The Medical Research Council's technology transfer office was instrumental in the raising of a £40m fund, UK Medical Ventures which has funded at least six companies. It is significant funding potential such as this which will give technology transfer offices considerable opportunities to develop technology further along the development pathway with a view to maximising the return to the funders of the research, the institutes and the inventors.

Seed funding is an increasingly important part of the process by which start-up companies are developed. Start-up funding is becoming more difficult to secure and, when it comes from venture capitalists the valuations are low. In this way the funding gap between concept and a saleable technology is becoming more difficult to bridge. Once the principle of a concept has been proved a company is much more likely to be successfully financed but the work needs to be funded and seed funds are an ideal way to do this.

Intellectual property protection

The underlying asset in any biotechnology company is the intellectual property protecting the technology or inventions being exploited. One difference between technology transfer of publicly funded technology and research undertaken by private companies is that there is a strong need in the academic environment to publish results. This is driven not only by the desire of the scientists but, with an increasing amount to science being funded by charities, by the requirement that the advances made with charity funding be disseminated for the benefit of the public.

In a competitive field of science, it is necessary to maximise the potential for patent protection by filing an application as early as possible but the costs involved can be significant. For example, CRCT in the year 1998/99 reported that its direct investment in its patent portfolio was almost £693,000. This is a very significant investment in the technology transfer process and, in CRCT's case, is funded from the income generated through its business. The investment in the patenting process is not simply financial. It is necessary to adopt an appropriate strategy and, in certain circumstances, to try to predict where the real commercial value of an invention may lie. This involves time and understanding on the part of the technology transfer executive. Ideally, the process starts when the scientist has made an interesting discovery which he thinks may have commercial potential. From this point onwards the work and publications of the scientist can have a dramatic effect on the scope of protection and hence the value of the intellectual property. The participation of the technology transfer executives in this process can enhance the value of the technology at each stage from assisting in the development of an exemplification and patenting strategy through to the prediction of what may or may not be commercially useful.

EPTTCO

The incorporation of EPTTCO Limited by CRCT does demonstrate how the skills in technology transfer can be put into practice. CRCT, working with Dr Trevor Twose, an experienced independent consultant, formulated a strategy to maximise the potential for exploitation and return from a significant intellectual property portfolio, including over 20 patent families, in the field of enzyme prodrug therapy based on two enzyme systems. EPTTCO was founded by CRCT, the Institute of Cancer Research and Auckland UniServices Limited (the technology transfer subsidiary of the University of Auckland) and Dr Twose was appointed as its CEO. The Auckland Division of the New Zealand Cancer Society, and subsequently the University of Auckland, had focused its research and development effort in one enzyme system relating to nitroreductase and the Institute of Cancer Research in the other, relating to carboxypeptidase G2. CRCT had acted for some years for the Institute of Cancer Research and on certain projects for the Auckland Division of the New Zealand Cancer Society. It, together with its co-founders, had considered various options for the exploitation of the increasing body of intellectual property protecting the enzyme systems and the prodrugs and decided in the autumn of 1998 to incorporate a company. Key considerations in the decision to incorporate a company were that it would be a leader in the enzyme prodrug therapy field working with two world class research teams that already had experience of putting products into the development process with large pharmaceutical companies.

The strategy adopted by EPTTCO was to collaborate with companies that were developing vectors with a view to arming the vectors with its enzyme systems. CRCT's ability to fund intellectual property protection had allowed it to build up a patent portfolio protecting the technology and running to 21 patent families. CRCT was also able to make use of its seed fund to underwrite the research necessary for the early stages of the company's existence. The founders, through the contacts of CRCT, were able to attract Dr Twose, to assist in the formulation of the strategy that led to the formation of the company and to act as its CEO. By the end of its first year of operation the technology had been the beneficiary of nearly £1m in direct finance and indirect support, including pre-incorporation investment. The skills and experience CRCT had built up allowed it to support a number of the company's functions in-house, including financial, company secretarial and legal functions. Within a month of its incorporation EPTTCO had completed its first collaboration agreement, agreeing to work with Vion Pharmaceuticals Inc. to arm Vion's TAPET bacterial vector. Within nine months, Vion and EPTTCO had jointly granted an option over the armed vector resulting from their collaboration to AstraZeneca.

The company also entered into an agreement to work with Onyx Pharmaceuticals Inc. to identify a suitable system to arm its viral vectors and to provide a range of prodrugs for further clinical development by Onyx. The agreements with Vion Pharmaceuticals, AstraZeneca and Onyx were independent validation of the EPTTCO prodrug systems and its ability to do deals.

In addition to the enzyme prodrug systems EPTTCO retained rights to other potential therapeutic systems which it would be able to develop on its own account. It was viewed as a strength to have the potential to develop a revenue-generating business in conjunction with a drug development programme which would, in the longer term, create valuable products for the company.

The ability of CRCT, the Institute of Cancer Research and Auckland UniServices to identify and attract high-quality management, to fund the company in its early stages, to liaise with the academic inventors and to support in the management and business administration function and to convince third parties to invest in its prodrug systems which resulted in the successful transfer of the technology to EPTTCO.

The future

Although the technology transfer industry has developed enormously in the last decade there are still a number of challenges facing the industry. As with the biotechnology industry, the ability to attract and retain high-calibre staff and management is a challenge. In all but the very large and successful technology transfer companies it is difficult to match the potential rewards that are available to employees of higher-risk biotechnology companies. The technology transfer industry should address the way it remunerates its executives with a view to allowing the industry to attract high-quality management and to allow its employees to share in the success of the companies spun out of the technology transfer offices.

Although the UK government has made money available, such as the University Challenge Fund, the Biotechnology Exploitation Platform Challenge, the Business Mentoring and Incubation Challenge, LINK, CASE and SMART awards and the Teaching Company Scheme, the amounts of money available are relatively small and the investment criteria are limiting. One of the real advantages of the University Challenge Fund is that it has given the recipients the ability to take a longer-term view and fund a series of projects and companies. This allows them to plan an investment strategy. However, there needs to be a growth in the availability of early stage finance to maximise the potential for successful development of the biotechnology industry.

The availability of laboratory space and other facilities for early stage companies has been a challenge. The development of bioincubators has helped, but the problem remains, particularly in London where the costs can be exorbitant. There have been several bioincubators set up with public and private money and the successful features of these should be used as models to encourage further public and private investment in bioincubators and the space necessary to allow the biotechnology industry to flourish.

Summary

In summary the UK technology transfer industry has had some notable successes over the past ten years, but in order to continue with this success it needs to continue to invest in its people and facilities and to have access to sufficient money to invest in early stage projects. It will be through the investment in people and an understanding of the science and business that, unlike the Chairman of Western Union, the industry will not miss the next telephone call.

Reference

1. Arthur Anderson (1998), 'Technology Transfer in the UK Life Science Industry', Arthur Anderson, London.