possible to patent compounds that act on the target without disclosing the sequence. Although an academic inventor will no doubt still be under pressure to publish the sequence, he or she might still be tempted to sell the information to a commercial partner in return for delaying publication to give the commercial partner a head-start. The availability of patent protection for the isolated DNA, therefore, enables the sequence (and information on its function and use) to be published while, at the same time, protecting the inventor's commercial interests.

Gene patents encourage scientific progress

The simultaneous completion in June 2000 of a draft sequence for the human genome by the international Human Genome Project (HGP) and Celera Genomics Corporation was a landmark achievement in science. Genomes from various other organisms have also been sequenced in the past few years. This has resulted in a phenomenal amount of genomic information being made available to the scientific community.

In both Europe and the USA, academic researchers are effectively free to use patented drug targets for non-commercial research because, in practice, patents are rarely used to prevent such research. However, commercial entities can still use the ever-increasing amounts of publicly and commercially available genomic data to identify alternative targets. They might be able to discover drugs for the same target by using techniques that do not require use of the patent, perhaps using molecular modelling combined with screening techniques that use the target in its natural environment. Finally, they might be able to negotiate a licence to use the patent in fields and applications that the patentee does not wish to exploit. In any event, after expiry of the patent, the drug target will be free for anyone to use.

We have progressed a long way in genomic research. Many would argue that strong patent protection has been, and continues to be, instrumental in encouraging commercial efforts to conduct research and to develop and exploit its results. In the absence of these efforts, one has to consider whether genomic research would have been publicly funded to the same scale and made such progress. From 1990 until as late as 1998, the HGP was still estimating that the human genome would not be completed before 2005 and was not planning to produce a draft sequence before completion. Without the demonstration by the early biotechnology companies that concrete medical and economic benefits could arise from gene technology, would the political will and public funding have been available to begin the HGP in 1990 and finish it in 15 years? And even if the answer to that question is yes, without commercial competition, would the HGP have been accelerated to the position it is in now?

Reference

1 Williamson, A.R. (2001) Gene patents: are they socially acceptable monopolies, essential for drug discovery? *Drug Discov. Today* 6, 1092–1093

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Gene patents: are they socially acceptable monopolies, essential for drug discovery? – reply ▲

Initial letter: Williamson, A.R. (2001) *Drug Discov. Today* 6, 1092–1093
Response from Patrick Nef

Gene patenting: maintaining competitiveness in the EU

A recent letter by Alan Williamson [1] expresses the view that withholding patents on genes in the European Union (EU) will encourage the expansion of pharmaceutical R&D and that, ideally, genes should be patent free. Although I fully agree that full and free access to genome sequence data without the hindrance of patents is essential for the pursuit of scientific research (e.g. target and pathway identification and validation), I doubt that refraining from patenting in the EU is the appropriate solution for R&D companies.

A harmonized regulatory system within the EU admitting gene patents under defined circumstances protects inventions and improvements to existing inventions, promotes transparency and creates the needed legal and ethical environment for scientific advances. Thus, gene patents are viewed as value generators by academia, the biotech industry, the investors, and now also by pharmaceutical companies. Patenting is a meaningful way to protect and recover the huge investment in R&D, and to ensure freedom of operation, although an alternative is prior-art publication or greater use of secrecy. However, it is generally accepted that the broad use of secrecy would have a chilling effect on scientific progress and health research.

The basic requirements for obtaining a patent are: inventive step, novelty and industrial applicability ('utility' in the USA). The inventor provides information in exchange for obtaining a limited time period of exclusivity (~20 years from date of filing). Both the patent holder and society benefit from shared information which, in turn, stimulates innovation. The patent description must sufficiently disclose the invention, and the claims have to be clear and supported by the description. Many biotechnology patents suffer from 'enablement' problems, that is, the specification really doesn't enable an independent party to recreate the processes described in the patent. Therefore, multiple but costly strategies exist to challenge those patents.

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The US Patent and Trademark Office (PTO) has argued, however, that the patent system is robust and works efficiently. The US PTO has traditionally granted several gene patents with broad claims, but has recently issued new guidelines on utility that are similar to the EU Directive 98/44. A DNA sequence without indication of a function, the simple discovery of a sequence, or a partial sequence of a gene cannot be patented under the EU Directive [adopted by four of 15 member states (Finland, Denmark, Ireland and the UK), as well as the European Patent Organization composed of 20 members]. Indeed, recitals 23 and 24 of the EU Directive state that 'a mere DNA sequence without indication of a function does not contain any technical information and is, therefore, not a patentable invention', and that 'it is necessary in cases where a gene sequence is used to produce a protein to specify which protein is produced or what function it performs'.

In the USA, in addition to the utility tests of 'specific and credible', the patent applicant must now address a third criterion, 'substantial', which excludes 'throwaway', 'unsubstantial' and 'non-specific' utilities such as using a gene or a portion of a gene as a perfume additive. The new US guidelines, however, still allow claims based on sequence homology in other species, and do not prevent 'reach-through' claims.

It is, therefore, essential for all of those involved in R&D to adjust to the changing environment and to file patents in the EU and the USA based solely on concrete data reporting new research tools, mechanisms of actions, gene or protein functions, and not merely based on (partial) gene or cDNA sequences without an associated function. Developing drugs is so difficult that it is also in the public interest to make sure that companies with exclusive rights on a particular gene target are ready to make them available to others for a reasonable fee (e.g. by compulsory licensing or collaboration?).

The positive impact of innovation on R&D and on global public health can be easily measured in terms of novel products and intellectual property (IP, that is, the number of issued and pending patents in a given field). Therefore, patents or IP rights on invention represent an essential driving force for R&D organizations. Europe should remain competitive, and create the appropriate legal environment, for example, by totally implementing the EU Directive 98/44, for the development of innovative products that society demands.

Reference

1 Williamson, A.R. (2001) Gene patents: are they socially acceptable monopolies, essential for drug discovery? *Drug Discov. Today* 6, 1092–1093

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