Introduction
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Patents are often the first thing that comes to mind when thinking about how to protect intellectual property rights and encourage innovation. But policy options exist for stimulating innovation other than lengthening the duration of patents to generate larger rewards. A broader perspective that explores other means of increasing innovation is needed in order for one to know what options are available. This part is organized to encourage discussion of how to stimulate biotechnology innovation by means beyond patent length. Our hope is that these chapters will help encourage thought and study about using less conventional means of boosting innovation.

With much attention focused on harmonizing patent length across countries, gains from other policy options could be overlooked. While promoting innovation is a key goal, other objectives such as improving diffusion of technologies and access to new technologies are also important. Using a wider range of instruments achieves a larger number of goals. With more policy levers, a faster rate of innovation could be achieved for any specified level of another goal. Expanded policy options might achieve a better outcome in terms of multiple policy goals.

Industries have differing characteristics that influence how best to promote innovation. What stimulates innovation in one industry may have little impact in another. Some industries patent frequently; others almost never. Increasing patent length will not succeed in stimulating innovation in industries that do not patent. A wider mix of policy options may also generate a better distribution of innovation across industries.

This part covers a disparate set of approaches: international economics, international political economy, and comparative institutional economics and legal perspectives. Economics, politics, institutions and the law all interact in determining intellectual property (IP) systems and the impact of IP systems on innovation. Thus, we sought viewpoints from each of these perspectives on the common theme of how to stimulate biotechnology innovation.

From an international economics perspective, in the first chapter, Alan Isaac and Walter Park examine whether an open source approach could be used to stimulate innovation in biotechnology. To assess the
likely strengths and weaknesses of an open source approach in biotechnology as a means of stimulating innovation, they begin by considering the existing IP system to determine what failures of the current system we might hope to improve upon. Critiques of the current IP policy applied to biotechnology argue that it may actually deter innovation through patent thickets, fragmented rights and transaction costs, given the sequential and cumulative nature of the research and innovation process in the sector. The critiques also point out that the proprietary system places a disproportionate burden on developing countries by denying them access to biotechnologies that can address some of the most pressing issues in the developing world including pharmaceuticals, food security and concerns about biopiracy. However, the alternatives that have been proposed to the current IP policy (like plant breeders’ rights and *sui generis* modalities of protection) do not address the fundamental characteristic of the system, namely, a proprietary mechanism based on exclusion. Isaac and Park ask if a non-proprietary approach, such as the open development system, could improve upon the current IP system by fostering innovation and by promoting diffusion of technology to poor countries.

They discuss three varieties of open development possibilities and then explore the relevance of those strategies to modern biotechnology by comparing similarities and differences between the software and the biotechnology industries. They examine some of the underlying principles that could make open source work for biotechnology. They also highlight some concerns associated with the application of those strategies in some areas of biotechnology.

Open development has proven to be quite successful in the software industry, and Isaac and Park argue that there exist multiple similarities between biotechnology and the software sectors. Both sectors are characterized by cumulative and sequential innovations that are mostly research tools. In both sectors, it is quite difficult to distinguish pure from applied R&D, which in some cases has led to the risk that protecting basic research could stifle future innovations.

The authors also warn that there are differences between the two sectors that may render the open development mode (what they call ‘open bio’) inappropriate for biotechnology. For example, software is protected by copyrights while biotechnology is protected by patents, which are shorter and more expensive than copyrights. The authors warn that there is some reason to believe that the case of software may be particular, and that an open development system could actually reduce innovation in other industries.

The application of open bio in developing countries requires special attention, especially issues relating to neglected diseases and biopiracy.
Park and Isaac differentiate between possibly increased access to data and research tools and (less likely) increased development of targeted biopharmaceutical innovations needed in those countries. The open bio alternative could allow developing countries to obtain access technologies needed to create a body of basic R&D that would make development of commercial innovations like tropical medicines profitable. Moreover, the open bio alternative could address the complaints of biopiracy that developing countries have against developed countries by allowing developing countries to enhance their capabilities for indigenous innovation and research, and to level the playing field against firms from the developed world.

The open development system could allow developing countries to jumpstart their own indigenous innovation efforts. However, Isaac and Park emphasize that an open bio mode is a complement, not a substitute, for government supported research programs. As for innovation incentives, the conclusions are even less certain. It is not that clear whether open bio would be an improvement over the proprietary system in fostering innovation.

From an international political economy perspective, in the second chapter Chris May addresses the implications of increasing protection of intellectual property in the biotechnology industry. He argues that political power, economic interests and philosophical uncertainty make the development of policies of intellectual property more political and less technical than the traditional analysis of innovation versus market power acknowledges. He makes the case that the trend to expand patent scope will continue due to industry lobbies at the national and international levels. He argues that the TRIPs agreement is only the beginning of an effort which intends to harmonize and globalize a patent regime which will benefit private interests over the common good.

May finds this expanded and globalized patent regime particularly troublesome for biotechnology because of the specific characteristics of the industry, namely, the difficulty in separating basic research from applied research. At the international level, a global policy regime would constrain nations, particularly developing countries, to choose policies that may not reflect their own preferences and needs. This, in turn, creates distributional consequences biased against developing countries that must adopt policies that may not be in their own best interest.

May views the patent system as not working to balance the public and the private interests and to protect the public realm. For example, there is a strong tendency to grant numerous patents and to assume that the judicial process is there to repair mistakes, without considering associated costs. He fears that patents are transforming scientific endeavors into technology and commercial industrialization, and that this transformation can create
problems like slowing down research and creating uncertainty related to risks of litigation. He explores areas of action to reform global IP such as improving patent quality, reducing uncertainty, controlling costs, setting up a pre-grant process of opposition, and establishing fair-use measures.

May argues that the current policy debate is centered on the technical discussion of balancing innovation and market power, which he believes to be inappropriate. He argues that the proper policy making approach should emphasize the political nature that permeates the debate on intellectual property. He proposes adopting an approach that stresses the multidimensionality of the policy debate, taking into account moral, distributional, technological, environmental issues simultaneously.

This policy making approach, May argues, is a viable alternative for developing countries as it would not force them to support the current patent system. Moreover, he argues that such a multidimensional approach also addresses the needs of developed countries, and, thus, it is an alternative to a global governance of the patent regime that truly looks after the global common good. May suggests that the issues related to biotech innovation and IP be put within the broader context of the organization of science in modern societies, and that the opposition between social forces and the commodification movement be addressed at national and the global levels.

From a comparative institutional economics and legal perspective, in the third chapter Scott Kieff examines a role of IP institutions too often neglected: coordination. He argues that intellectual property could help coordinate among users to ensure the best use of assets (with easier negotiation, improved diversity and socialization) but that it was often misused as an incentive mechanism or as a way to reduce transaction costs and problems related to monopolies. He explains how those latter problems are not always solved by IP but instead can give rise to liability rules and enhanced antitrust regulation. He then compares coordination with other IP goals, some related to externalities, rent dissipation and direct incentive, and also contrasts property rights’ coordination effects with those of alternative institutions. He then assesses the coordination role of IP with elements of general property theory. For example, he assesses the compatibility of the coordination function of IP with the commercialization theory, highlighting many similarities, for instance with regard to coordination of complementary and non-competing users. He also suggests some implications of this approach for further research, in particular for research tool innovations, and provides some preliminary thoughts on the implications that this coordination role could have on the development agenda of developing countries and for local institutions.

These chapters raise several important issues, not the least of which is
the appropriateness of using open source in the context of biotechnology. There are differences between the biotechnology industry and the software industry. In the software industry, open source is mostly used (and is particularly useful) for disclosing the underlying technology: the source code. The situation is different in the biotechnology sector where disclosure happens early on, at the time of applying for a patent. Open source would therefore mostly be used to increase access to already disclosed technology. This point emphasizes the different purposes of open source in different sectors and the need to distinguish between them.

Another issue is the importance of the public sector in research in relation to the open source movement. Indeed, it might be important and useful to get the public sector more involved in the open source movement. However, a concern can be raised that the growing tendency of public institutions to get involved in commercial endeavours and to license their technology to private enterprises could interfere with this purpose. Public institutions are less likely to advocate open source approaches if they are interested in pursuing payoffs from commercializing discoveries based on public R&D they funded. In this respect, the connection between the public sector and the open source movement should be explored further.

These chapters also raise important issues about the different modes to assess IP in biotechnology and the tension between the public and the private. One can note the many levels and types of information involved, highlighting the complexity of the different structures present. While representing one option amongst many others, property rights should be given proper consideration and assessed taking the other approaches into consideration. Along with the need to keep them as an option, property rights have a complex mix of costs and benefits relative to other structures.

The pattern of research output has a large random component. Often, one person discovers a research technique that turns out to be useful elsewhere. Property rights are needed to reduce the transaction costs. Otherwise, there is excess duplication of effort and insufficient gain from specialization according to talent and ability. If two steps are needed, and someone has already discovered the first step and someone else the second, the two need to be able to get together and contract without cost barriers. It would be great if one person discovered both steps, but it does not always happen that way. Transaction costs are everywhere, even related to status and other rewards to innovation such as publications. It is important to keep markets from getting too concentrated. Thick markets, with many buyers and sellers, typically operate more efficiently than thin markets: a greater number of potentially mutually beneficial exchanges are realized.

Finally, there remains the issue of what consideration should be awarded
to wealth distribution when assessing the patent system. Inequitable wealth distribution makes a patent system less appealing as a means of encouraging innovation. It can be pointed out that in reality there is no guarantee that people have enough resources to participate in transactions over patented products and that this fact puts pressure on the political system for alternatives. Concern over wealth distribution is stronger in Europe than in the United States for cultural reasons. However, due to the absence of criminal sanction in the US patent system, patentees often allow a vast amount of infringement, especially when the infringing parties lack the funds to pay or transaction costs are prohibitive. In either case, the transaction would not have occurred anyway so the infringement does not cause direct harm to the patentee’s profit.