Introduction
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It has become common parlance to describe innovation as taking place within a system. That is to say, innovation is thought to be a product of a system of integrated causes and effects, and the right way to analyse innovation is by thinking about a system. Gone from informed discourse about innovation is the caricature of the linear chain of events starting with the scientist-recluse and ending with the monopolizing capitalist. The more sophisticated view of innovation systems does not, however, mean that we have answered all of the questions about how innovation works. Far from it in fact, as the chapters in this part reveal. Take, for example, the point that if innovation is a system-level phenomenon, it would be useful to know exactly how intellectual property rights contribute to the system. Yet as the contributions in this part point out, this question is not normally taken up directly, or at least not until now. Each of the chapters in this part finds its own way to this question, a fact which illustrates that IPRs play multiple roles in innovation systems, each of which can serve as an analytical starting point. In the first chapter, IPRs are the ‘quanta’ for the valuation of inventions, in the second chapter IPRs are policy tools for national and regional innovation system management, and in the third chapter IPRs are the source of tension about access to research tools and the impact on the development of genetic diagnostics and therapeutics.

Adam Holbrook’s chapter begins with an account of what he calls the ‘national system of innovation (NSI)’ perspective on innovation systems and the role therein of intellectual property rights (IPRs). Holbrook’s central premise is that one’s view of innovation changes considerably if one abandons the Schumpeter conception of IPRs that restricts them to economic contexts. Holbrook’s view, by contrast, is that IPRs can be understood in a broader social context of innovation in which economic factors feature among other drivers of innovation. By looking at innovation through social and economic lenses, one can see, first of all, that firms are networked into private and public sector institutions which interact in a multitude of ways to diffuse, or block diffusion, of knowledge. From the standpoint of NSI theory, the central issue is to understand the formal and
informal linkages are created between institutions, and how in turn those linkages modulate directly the flows of knowledge between institutions. Second, Holbrook points out that if one takes a systems approach to thinking about IPRs in highly networked systems of innovation, it casts a different light on how we think about intellectual property. A strictly economic analysis of innovation would study the flow of capital in a national system. Holbrook, by contrast, suggests that if we think that IPRs embody economic and other social factors of innovation, then tracking their flow, as one would money, in an innovation system can be enlightening. Holbrook draws an analogy with data packet flows in the internet to suggest that IPRs are traceable packets of social and economic data in an NSI. IPRs may be characterized as the measureable ‘quanta’ of an innovation system because they are the basic aggregations of social and economic data exchanged in an NSI. Paradoxically, Holbrook argues, very well-defined IPRs are good for trading and stand out as ‘units’ of innovation because they are easily counted. But often the most valuable knowledge created in IPRs is the tacit knowledge – of what works and what does not work – that defies measurement in traded IPRs. The role of the NSI approach is to try to understand how knowledge flows from contexts in which there is somewhat diffusely defined invention to rigidly described IPRs.

Bjørn Asheim and his colleagues begin by noting that there are two large, but mostly independent, literatures on IPRs and innovation systems. Like Holbrook, they think that a national innovation systems perspective will bring to light the role of IPRs in innovation systems. Asheim et al. argue that an innovation systems approach is an important starting point for the discussion because one of the main reasons for supporting a national system of innovation is that it can bring the agencies of knowledge creation in close contact with private and public sector enterprise that will expand economic activity based on the knowledge. IPRs play an important role in generating the artificial scarcity necessary to drive the value of knowledge up, and to differentiate the value of different innovations that feed into a market system. IPRs, as Asheim and his colleagues point out, solve the knowledge valuation problem for markets. But IPRs do not themselves resolve issues about how different innovation systems ought to use the IPRs in pursuit of wealth creation, because the use of knowledge within different systems of capitalism defies a one-size-fits-all approach to integrating rules and practices about IPRs into an innovation system. Consequently, system-specific legislation, such as the Bayh-Dole Act, is unlikely to be usefully transferred to other innovation systems.

Within both the European Union and the United States there has been explosive growth in patenting activity in the last two decades for almost
all industries. The biotechnology industry’s growth spurt roughly corresponds to this period. The effects of biotechnology IPRs on the underlying science base and the production of applied science have been significant. Asheim et al. point out that the private receptor capacity in an innovation system is dependent on many things, but chief among them is being able to control the channelling of knowledge from public research institutions and keeping control of the valuation of that knowledge. An interesting dynamic between public and private institutions is created and maintained by IPRs insofar as they are part of the architecture for privately extracting value from otherwise public or ‘open’ science. Universities, having been at the centre of this social coordination of knowledge flows, have adapted their institutional mission along the way. Nowhere is this more obvious than in the changing role of US universities before and after the Bayh-Dole Act where university assignees on patents increased. In the European Union, where the assignees have tended to be industry even if the university is the inventor, there are initiatives afoot to change national laws more closely to resemble the Bayh-Dole Act. Asheim et al. consider the effects of Bayh-Dole on three countries (Germany, Switzerland and Denmark) within the broader European context. They conclude that the increase in patenting activity is largely a result of economic and institutional changes, rather than a sign of significant innovative activity in the biotechnology sector, and that the changes to rules about patent ownership that reflect the Bayh-Dole Act do not always have corresponding positive effects, as was the case in Denmark. In this respect, Asheim et al. end on the same theme as Holbrook regarding the highly context-dependent role of IPRs to innovations systems.

In the final chapter in this part, Koichi Sumikura considers the effects of IPRs, especially patents on disease genes, with respect to the development of molecular diagnostics and potential drug targets. Sumikura argues that there is a difficult balancing act that needs to be achieved to support the public’s interest in having new gene-based diagnostics and therapeutics. On the one hand, public disclosure of research results increases access, while providing leading biotechnology and pharmaceutical firms with traditional intellectual property rights protection that will enable them to undertake potentially risky projects. The problematic situations where the balance is not struck are well known – access to diagnostics, as in the case of Myriad’s BRCA tests, and licensing restrictions on research tools, particularly in cases where the intent is not to develop further commercializable technologies. Sumikura observes that Japanese university researchers have not been concerned until recently about the potential for IPRs to restrict their research activity. In a series of interviews of research scientists conducted by Sumikura a number of issues and events came to light that
are eroding researcher confidence in there being a strict line demarcating research from commercial use of licensed technologies. For these researchers, the threat of IPR incursion into basic science is seen as a real problem that threatens their institutions, academic freedom and their individual research programs. Researchers, sensing the tide change in their own institutions and abroad, may become increasingly reluctant to take on new research projects intensively based on licensed technologies.

Sumikura considers the policy options that may address the concerns that have arisen in the literature about the negative impact of IPRs on research, and the concerns voiced by his study group. These include anti-monopoly provisions such as reach-through clauses and compulsory licences, but he notes that measures such as these can have the effect of destabilizing a patent system because they target a key provision – short-term monopoly rights. Other policy options, may be more attractive. For example, gene patents could be recognized in an IP system, but research exemptions would be made for genetic diagnostics or for research tools: a view upheld by many of the scientists Sumikura interviewed. Another option is narrowly to limit the effects of patent rights on genes, thereby keeping the scope of the patent rights narrowed to the claims made at the time of application. Again, these approaches may not enhance confidence in the patent system, and so Sumikura considers a coordinated solution involving integrated management of intellectual property, the development of research tool consortia, reciprocal access to research tools with individually held patents, and university institutional ownership policies that provide free access to research tools within the institution. Only through a careful balancing act between researcher interests, state laws, and the demanding realities of innovation systems can the public interest in timely diagnostics and therapeutics be met. For Sumikura, simple remedies to the problem do not seem to be possible. The implication is that a satisfactory solution will likely be a complex negotiation that reflects the intricate web of interests that sustain IPRs in biotechnology.

What is immediately striking about the three chapters in this part is that, despite being written from very different perspectives from industrialized countries that are not easily compared, there are important common themes running throughout. Notice, for instance, that in each chapter the place of IPRs in innovation systems is regarded as an important but under-studied issue. It is as if the descriptive project of saying what IPRs do for innovation systems had eluded the attention of the research community in general, and the authors of these chapters feel that they have to break new ground as they start to probe the question. Equally striking, however, is that each of the chapters takes on the issue by locating IPRs in national systems of innovation in order to be able to describe, within
the boundaries of national research funding agencies, university systems, laws and culture. This strategy for tackling the problem generates equal suspicion among all of the authors of these chapters that generalizations stating the role of IPRs in innovation systems are not very likely to rise above the level of platitudes. For example, everyone knows that IPRs have a coordinating role between research universities and the private sector. But to go beyond the surface of this statement and answer, for example, a very complicated but relevant question about the impact of laws styled on the Bayh-Dole Act in other jurisdictions is quite difficult. Similarly, calling for reform in some generic conception of an IP system is an easy thing to do, but actually to see how reform would work in a specific country is quite different. Reform to the allowable scope of claims in a patent system might be feasible in Germany, but the same reform might not be feasible in Japan.

This part of the book attempts to answer the difficult question about the role of IPRs in innovation systems. No doubt the results are constrained by the countries considered and perspectives offered. Does that suggest that the responses are simply idiosyncratic? One way to broach this question is to look at the other option. Perhaps there is one true-for-all-of-time theoretical account of the role of IPRs in innovation systems that transcend the particular details of any one national innovation system. Perhaps there are even general principles one can observe in single cases. The lesson from this part, however, is that the details of how IPRs are implemented in an innovation system, the institutions and practices they foster and legitimate, and the character and depth of the innovation system give rise to context-sensitive detail that puts into doubt the prospects of a general theory of IPR–innovation system interaction. That is not to say that the general descriptive project is hopeless, but it is to emphasize that much more descriptive work needs to be done before much credence is given to normative projects calling for changes and reform in innovation systems and IP laws.