The first IVF baby was born in the 1970s. Less than twenty years later, cloning and GM food were popular talking-points, and information and communication technologies had transformed everyday life. In 2000, the first map of the human genome was sequenced. More recently there has been much discussion of the economic and social benefits of nanotechnology. This book contributes to increasing calls for regulation — or better regulation — of these and other new technologies. Drawing on an international team of legal scholars, it reviews and develops the role of human rights in the regulation of new technologies. Three controversies at the intersection between human rights and new technologies are given particular attention. First, are human rights contributing to a brave new world of choice, where human dignity is fundamentally compromised? Second, are new technologies a threat to human rights? Finally, can human rights contribute to better regulation of these technologies?

The prevalence of successful biotechnology firms has long been associated with the existence of national or regional agglomerations of the biotechnology firms themselves and partners such as large corporations, universities, research institutes, and venture capital firms. It is, however, acknowledged that such agglomeration trends may
be most closely associated with medical biotechnology. This chapter examines ninety-three firms that may be classified as biotechnology-related firms in Norway. While there is indeed a great preoccupation with medical biotechnology in Norway, the survey shows that two other distinct traits are present: a concentration of firms focused on diagnostics and related fields, and a focus on marine biotechnology. In a path dependency perspective, these foci may be explained at least in part by the existence of knowledge bases and market opportunities within chemistry based reagents and fish oils respectively, which were present from the times prior to the advent of modern biotechnology. The chapter contributes to the theories on capabilities of individual firms and agglomeration of different firms and other organizations, and suggests that foci on such niches as those which are prevalent in Norway may function with more disperse geographical distribution patterns as compared to cases described in existing literature.

Constructing Capabilities in Entrepreneurial Technology Firms: A Comparative Institutional Analysis of Germany, Sweden, and the UK
Richard Whitley and Steven Casper

in Business Systems and Organizational Capabilities: The Institutional Structuring of Competitive Competences

This chapter explores the mechanisms linking dominant institutions to distinctive business competences in Germany, Sweden, and the UK, and looks at the relative success of these mechanisms in some detail by focusing on the characteristics of different subsectors. Specifically, it compares how the institutional frameworks in these countries have affected strategies for dealing with two major kinds of organizational problems that firms have to manage in developing new technologies in the biotechnology and software industries. It focuses on the role of different kinds of skill formation systems and labour market institutions in encouraging the development of contrasting kinds of organizational capabilities. While the predominantly arm's length institutions in countries such as the USA or UK are conducive to the development of project-based entrepreneurial technology start-ups focusing on discontinuous radical innovations, there are other subsectors of these industries where more complex and stable organizations are effective. Success in such segments is strongly advantaged by institutional
structures that encourage competence enhancing human resource strategies.

**Darwinian Agriculture**

R. Ford Denison

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As human populations grow and resources are depleted, agriculture will need to use land, water, and other resources more efficiently and without sacrificing long-term sustainability. This book presents an entirely new approach to these challenges, one that draws on the principles of evolution and natural selection. It shows how both biotechnology and traditional plant breeding can use Darwinian insights to identify promising routes for crop genetic improvement and avoid costly dead ends. It explains why plant traits that have been genetically optimized by individual selection—such as photosynthesis and drought tolerance—are bad candidates for genetic improvement. Traits like plant height and leaf angle, which determine the collective performance of plant communities, offer more room for improvement. Agriculturalists can also benefit from more sophisticated comparisons among natural communities and from the study of wild species in the landscapes where they evolved. The book reveals why it is sometimes better to slow or even reverse evolutionary trends when they are inconsistent with our present goals, and how we can glean new ideas from natural selection's marvelous innovations in wild species.

**The Emergence of Organizations and Markets**

John F. Padgett and Walter W. Powell

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The social sciences have sophisticated models of choice and equilibrium but little understanding of the emergence of novelty. Where do new alternatives, new organizational forms, and new types of people come from? Combining biochemical insights about the origin of life with innovative and historically oriented social network analyses, this book develops a theory about the emergence of organizational, market, and biographical novelty from the coevolution of multiple social networks. The book demonstrates that novelty arises from spillovers across intertwined networks in different domains. In the short run actors make
relations, but in the long run relations make actors. This theory of novelty emerging from intersecting production and biographical flows is developed through formal deductive modeling and through a wide range of original historical case studies. The book builds on the biochemical concept of autocatalysis—the chemical definition of life—and then extends this autocatalytic reasoning to social processes of production and communication. The chapters analyze a wide range of cases of emergence. They look at the emergence of organizational novelty in early capitalism and state formation; they examine the transformation of communism; and they analyze with detailed network data contemporary science-based capitalism: the biotechnology industry, regional high-tech clusters, and the open source community.

Creating Silicon Valley in Europe

Steven Casper

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Through the 1990s and early 2000s, a strength of the United States economy has been its ability to foster large numbers of small innovative technology companies, a few of which have grown to dominate new industries, such as Microsoft, Genentech, or Google. US technology clusters such as Silicon Valley have become engines of innovation and wealth creation, and the envy of governments around the world. This book examines trajectories by which new technology industries emerge and become sustainable across different types of economies. Governments around the world have poured vast sums of money into policies designed to foster clusters of similar start-up firms in their economies. The book employs empirical studies of the biotechnology and software industries in the US and several European economies to examine the relative success of policies aimed at cultivating the “Silicon Valley Model” of organizing and financing companies in Europe. Research associated with the “varieties of capitalism” literature has argued that countries with liberal market orientations, such as the US and the UK, can more easily design policies to cultivate success in new technology industries compared to countries associated with organized economies, such as Germany and Sweden. The book's empirical findings support the view that national institutional factors strongly condition the success of new technology policies. However, the study also identifies important cases in which radically innovative new technology firms have thrived within organized economy. Through examining cases of both success and failure, this book helps identify constellations of market and governmental activities that can lead to the emergence of sustainable
clusters of new technology firms across both organized and liberal market economies.

Innovation in Local Economies
Colin Crouch and Helmut Voelzkow (eds)

The study of varieties of capitalism is moving on from the analysis of static national types to embrace local and sectoral diversity and the study of systems in the process of major change. This book addresses the issue by examining four localised sectors, comparing a German case with one in another European country. The general changes taking place in Germany itself and the other countries (Hungary, Sweden, and the UK) form the context of the studies. The case studies concern the following: furniture making in North-Rhine Westphalia and southern Sweden; automotive manufacture in east Germany and northern Hungary; biotechnology around Munich and Cambridge; and TV programme and film-making in Cologne and central London. The studies find a complex pattern of conformity with, and deviation from, national types, but only occasional examples of where divergence takes the form of a direct confrontation with a national model. This is partly because national models are themselves changing; partly because they are often capable of accommodating more diversity than is often assumed by national studies; and partly because firms are increasingly able to reach outside their national boundaries for institutional resources.

Varieties of capitalism and innovation: the Silicon Valley model
Steven Casper

in Creating Silicon Valley in Europe: Public Policy Towards New Technology Industries

What is the relationship between institutional frameworks, public policy, and the governance of innovative competencies by firms? This chapter extends the varieties of capitalism theory to examine how different types of economy impede the governance of new technology firms. It argues that most new technologies attempt to create radical innovations by developing competencies along a widely diffused “Silicon Valley Model”
surrounding the financing, staffing, and creation of employee incentives within firms. Liberal market economies, such as those found in the US and UK, provide strong institutional supports for the Silicon Valley Model, while coordinated market economies, such as Germany or Sweden, provide a series of constraints. A theoretical framework is developed to explore this argument. How public policy might impact competitiveness within new technology industries across the two types of economies is discussed.

How an American technology cluster emerged and became sustainable: San Diego biotechnology

Steven Casper

in Creating Silicon Valley in Europe: Public Policy Towards New Technology Industries

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The ability of the US economy to generate new technology industries, such as biotechnology, provides support to the contention that liberal market economies (LMEs) have a comparative institutional advantage in generating radically innovative firms. However, the link between varieties of capitalism and innovation within LMEs has not been systematically explored. This chapter explores the link between institutions and the management of innovative competencies within a successful US biotechnology cluster — San Diego, California. It empirically examines whether national institutional frameworks within the US generate patterns of economic coordination in the areas of finance, employee incentive structures, and labor market organization that benefit firms, and are consistent with predictions of the varieties of capitalism approach. The policy context surrounding the US biotechnology industry is also discussed.

Alternative pathways to competitiveness within CMEs: the subsector specialization argument

Steven Casper

in Creating Silicon Valley in Europe: Public Policy Towards New Technology Industries

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Coordinated market economies such as Germany or Sweden do not have appropriate institutional infrastructures to sustain large numbers of radically innovative firms. However, alternative strategies to develop competitiveness in new technology industries might exist. The biotechnology and software industries are each comprised of multiple sub-sectors. While important areas within each industry, such as therapeutics biotechnology or standard software, are associated with radical innovation, other large segments are characterized by incremental innovation. The chapter argues that companies within coordinated market economies could successfully specialize in such sub-segments, creating pockets of national competitiveness for their national industries. Descriptive statistics from the UK, Germany, and Sweden, and case studies from the platform biotechnology and enterprise software industries in Germany are used to empirically substantiate the argument.

Global value chains in the pharmaceutical industry
Jocelyn Probert

in Recovering from Success: Innovation and Technology Management in Japan
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This chapter looks at value chains in the Japanese pharmaceutical industry, which was, until recently, relatively isolated from global consolidation, value chain modularization, and indeed global markets. One reason was the institutional and regulatory environment — including governmental emphasis on safety over effectiveness — but corporate strategies also played a part, including a strong preference for organic growth and employment security. It is further noted that there was a limited contribution from university-based research activity, especially in biotechnology. But this industry is now in the throes of rapid change. The prospect is offered that leading pharmaceutical companies may well respond to their challenges while retaining cherished traditions through the pursuit of global niche strategies.

Elaine Romanelli and Maryann Feldman

in Cluster Genesis: Technology-Based Industrial Development
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This chapter examines the spatial and temporal dimension of a variety of forms of entrepreneurship across cities in the United States in the human biotherapeutics. The first finding is that clusters grow predominantly through the investments of local entrepreneurs, local firms, and local venture capitalists. Second, for three of the regions with the largest clusters — San Diego, Boston, and San Francisco — the critical spur to growth appears to be a tendency of entrepreneurs to leave local, established firms to found additional firms. Moreover, only those regions, however, that exhibited this secondary, or second-generation growth grew to substantial sizes relative to other clusters. The attraction of entrepreneurs and firms to a region is a tertiary influence on growth, occurring late in the history of the industry and the clusters.

Balancing on a Planet
David A. Cleveland

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We are in the middle of a major, long-term food crisis—how do we get out of it? The goal of Balancing on a Planet is to empower readers to analyze the challenges facing the agrifood system so they can ask better questions, find more useful answers, and participate in discussion and decision making more effectively in order to contribute to solving the food crisis. This book is an interdisciplinary primer on critical thinking and effective action for the future of our global agrifood system that integrates biophysical, social, economic, cultural, and philosophical components. It explains the fundamental concepts needed for understanding the history, current situation, and possible futures of our agrifood systems—from local to global—and analyzes opposing perspectives. It covers a range of topics, including population, the Neolithic and subsequent revolutions, sustainability, plant breeding and biotechnology, agroecosystems management, common property management, climate change, and localization. A key component of the book is a thorough analysis of the assumptions underlying different perspectives on problems related to food and agriculture around the world and a discussion of alternative solutions. For example, the author argues that combining selected aspects of small-scale traditional agriculture with modern scientific agriculture can help balance our biological need for food with its environmental impact—and it can continue to fulfill cultural, social, and psychological needs related to food.
Cloning by human hands can mean many things. It can refer to the intentional clonal propagation, via recombinant-DNA technologies, of small bits of a genome such as particular genes or regulatory DNA sequences. It can refer to the artificial stimulation of natural clonal processes, as for example by subjecting animals to treatments or research protocols that induce parthenogenesis, gynogenesis, hybridogenesis, or polyembryony, or that enforce intense inbreeding. Or, it can mean the purposeful manipulation of cells and whole genomes to generate genetically identical cell masses or even entire clonal individuals via mechanisms that may differ quite radically from those known in nature. This chapter reviews laboratory methods in biotechnology, and canvasses the resulting biological products that have emerged to date from each of these forms of human-mediated clonality.

Biotechnology, a promising and sophisticated science of the twenty-first century, has also been at the centre of controversies, with its varied applications and commercial uses raising legal concerns. The book discusses the latest developments and applications of biotechnology in the modern world. It is a comprehensive study of various legal issues pertinent to biotechnology, including but not limited to intellectual property, trade policy, environmental concerns, biodiversity issues, regulatory matters, and human rights connections. In addition to providing a global perspective to these concerns, covering the subject from the standpoints of the US, Europe, and India, the book also provides insights into the regulatory canopy on biotechnology in India.
In order to understand better the development of the therapeutic biotech firms in the Munich region, Germany's largest and most successful biotech cluster, this chapter contrasts the development of Munich firms with that in the Cambridge region in the UK. The chapter proceeds as follows. First, it discusses how the comparative case study will increase the understanding of the mechanisms through which entrepreneurs in a new industry are able to overcome pre-existing institutional barriers to their firms' development. Second, it outlines the main organizational challenges with which biotech entrepreneurs in Cambridge and Munich have been confronted in building up a biotech firm. Third, it analyzes how Munich's and Cambridge's therapeutic biotech firms have relied on their institutional environments differently to develop their firms' capabilities to deal with these organizational challenges. Fourth, it discusses how the different institutional paths which Cambridge's and Munich's biotech entrepreneurs have followed to deal with key organizational challenges have affected the development of these firms. Finally, the main findings are summarized and some implications of this study for broader debates in the comparative institutional literature are suggested.

Crops and Weeds
C. Neal Stewart

There is a trend towards embracing nature and the acceptance of natural products, even though humans have altered virtually everything. A case in point is food and food crops. No natural human food exists except wild game and a few undomesticated plants. There has never been natural corn or wheat, and many vegetable crops such as carrots and Brussel sprouts are recent inventions of crop domestication. Transgenic
crops seem transformative since they possess one or two genes from a different species. The process of gene introduction takes place in the lab using biotechnology, but traditional breeding and domestication drastically alter genomes of plants relative to biotechnology, since hundreds to thousands of genes are manipulated in hybridization. Like those of crops, genomes of weeds are also selected and adapted for growth in farmer’s fields. Human and natural selection are powerful forces.

Green and Greener

C. Neal Stewart

in Genetically Modified Planet: Environmental Impacts of Genetically Engineered Plants

Ironic in many ways is the opposition that environmental activists have shown toward transgenic crops. They oppose biotechnology in general: today's transgenic plants that have indirect environmental benefits and those transgenic plants of the future that are explicitly designed to have direct environmental benefits. It is also ironic that the modern environmental movement was largely started in response to overuse of agricultural chemicals as described in the seminal book Silent Spring. Transgenic plants that are insect-resistant have made the need for many chemical insecticides obsolete. Several prominent green groups are examined with regards to their positions on transgenic plants. Their blanket hostility towards biotechnology is ubiquitous, as is their equally enthusiastic embrace of organic agriculture. Paradoxically, mass organic farming would require far more energy and land to feed the world than utilizing the best technologies available, including biotechnology.

Conclusion

C. Neal Stewart

in Genetically Modified Planet: Environmental Impacts of Genetically Engineered Plants
Environmental risks must be viewed in context with benefits. Biotechnology must be compared with the current best alternative technologies, and not with idealistic but impractical farming practices. For example, Bt transgenic plants for insect control should be compared with conventional treatments using chemical insecticides. There is much idealism and romanticism surrounding farms and farming today, but idealism does not feed the world. Furthermore, idealism should not be allowed to obscure science, regulations, and the adoption of best technologies and practices — especially in the developing world, which does not have the luxury of tolerating poor harvests. Governmental regulations of transgenic plants are probably too stringent and conservative relative to known risks and should, in many cases, be relaxed. Biotechnology should not be treated as a cure-all for improvement, but viewed as merely one tool in the toolbox for sustainable agriculture. Large scale organic and subsistence farming are not reasonable to feed today’s population, and the best technologies must be adopted for humanitarian and environmental reasons.

The OECD as Ideas Diffuser: The Growth of the Global Biotechnology Industry

Monique Centrone


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Chapter 11 deals with the OECD and biotechnology. The OECD has taken a clear lead in the industry's development. It has done so by generating an industry discourse starting in 1980. The chapter addresses the role of the OECD in the historical construction of the concept of biotechnology. After having observed developments in biology in several western nations during the 1970s, the OECD started to promote a new vision of the industry as an enabling technology, one that had the power to create long-term economic growth. This was considered an important response to the problem of global economic decline during that period. In consideration of the political and scientific conversation surrounding the term biotechnology, this chapter evaluates the discursive work that provided a new biotechnology framework and how it legitimized national investments and policies that helped to build the industry.