

## Democratising science? The politics of promoting biomedicine in Singapore's developmental state

Kerry Holden, David Demeritt

Department of Geography, King's College London, Strand, London WC2R 2LS, England;  
e-mail: kerry.holden@kcl.ac.uk, david.demeritt@kcl.ac.uk

Received 14 November 2006; in revised form 18 January 2007

**Abstract.** Drawing on Jasanoff's concept of coproduction [2004 *States of Knowledge: The Co-production of Science and Social Order* (Routledge, London) and Ong's notion of 'graduated' sovereignty [2000 *Theory, Culture and Society* 17(4) 55–75], we analyse Singapore's promotion of the biomedical industry. To secure its place in the knowledge-based economy, Singapore's developmental state is determined to change the mind-set of its population and inculcate the individual creativity and entrepreneurialism needed for scientific innovation. It is also rolling out an internationally accepted framework of bioethics regulation. We explore the liberal values implicit in these two projects for promoting biomedicine and their implications both for the civic norms of Singapore's developmental state and for the wider relationships between science and liberal democracy.

In the Buona Vista area of Singapore, transportation between the Biopolis science park and National University Hospital (NUH) is provided by a shuttle bus, which is often seen roaring down the highways as nothing but a smudge of colour. When it is momentarily stationed at the traffic lights the words 'Biopolis: beyond infinity' stretch out along its side in large white letters that, in contrast to its tinted windows, appear almost to radiate a glow. The tilt of the typeface makes it seem as if the words had just rushed in and do not intend to stay put for very long before dashing off again. Let the eye wander and the brightly coloured nodes of molecular structures wind their way around the exterior as does a luminous double helix, along with other familiar icons of biomedical science (see figure 1).



**Figure 1.** Biopolis shuttle bus (reprinted with the permission of JTC Corporation. Copyright © JTC).

---

The shuttle bus promises so much more than a free lift, and people are not its only passengers. These are powerful visual motifs coating its exterior, invoking universal knowledge claims about the human body and its inner workings. The bus is also emblematic of knowledge transfer. Its route echoes the temporal passage of biomedical knowledge from bench to bedside. This process is represented both symbolically, by the composition of text and image to connote movement and pace, and literally, by carrying scientists between the place of basic research (Biopolis) and that of clinical investigations (NUH). Such decorative carriage adds a glossy veneer to the otherwise mundane practices of biomedical research in Singapore. Here the image is hard at work manufacturing dreams about white-clad scientists achieving spectacular feats of human invention in spotless laboratories with cutting-edge machines. Any hint of the actual drudgery of laboratory work or the tedium of administering consent forms would disrupt the image and lessen its glamour and advertising appeal. Yet, skills and paperwork, and getting them in order, are fundamental to modern scientific practice, as a generation of laboratory ethnographies has clearly documented. In an interview with the *Straits Times*, Singapore's only English-language broadsheet, Philip Yeo, Chair of A\*Star, the government Agency for Science, Technology and Research, and cochair of the Economic Development Board (EDB), was asked about the importance of original thinking to scientific innovation. In response, he said: "what original thinking? Science is Science. Science is not instantaneous inspiration at all. No, it is sweat. A lot of scientific discovery happens when you are working your butt out" (*Straits Times* 2005). That is not the impression we get from the Biopolis shuttle bus.

The shuttle bus is part of a much wider promotional campaign. There are entry point websites, billboard advertisements at the airport, and the actual science parks themselves. Official efforts to promote the biomedical sciences in Singapore are strategically outward facing. They make global projections endorsing a colonisation of 'life itself' and bank on an economy of expectation about its future promises. (Hence the airport and entry-point websites become key promotional vehicles, and the science park has the feel of a tourist attraction.) The imaginary scope of bioscience—or what Franklin (2000) has called the 'global genetic imaginary'—is put to good use in Singapore. It is done with high production values on a huge scale that is intended to induce a sense of awe.

Saturation of this sort suggests the importance of the biomedical industry to Singapore's future wealth and prosperity. This is a message regularly relayed to Singaporeans as though no viable alternative exists. A sense of urgency runs through both promotional material and official documents. As the government repeatedly emphasises, in a global economy Singapore cannot afford to be left behind. In his National Day Speech of 2005, Prime Minister Lee Hsien Loong reiterated the survival instinct Singapore has never completely shaken off:

"What will Singapore be like 40 years from now? I can't tell you. Nobody can. But I can tell you it must be a totally different Singapore because if it is the same Singapore as it is today, we're dead. We will be irrelevant, marginalised ... Therefore, we have to remake Singapore—our economy, our education, our mindsets, our city" (Lee 2005).

This sense of vulnerability is most apparent in the state's efforts to adapt to the demands of transnational corporations. In response to shifts in global capital, Singapore has implemented a tight labour control regime (Coe and Kelly, 2002), sustained by state control of unionised representation and prohibition of industrial action and public demonstrations, resulting in a comparatively compliant workforce and deferential public sphere (Ho et al, 2002; Perry et al, 1997). In this respect, Singapore has been called an 'adaptive' state (Ong, 2000; Wong, 2004), in which pursuit of economic

growth is legitimised as the only route to security. In Singapore's developmental state, nation building and economic growth are twin projects that go hand in hand (Castells, 1992).

The prime minister continued his speech by reinforcing the need to build innovative and creative industries to improve Singapore's international competitiveness in the knowledge-based economy (KBE). Singapore is envisaged as a "city which is full of life and energy and excitement, a place where people want to live, work and play, where they are stimulated to be active, to be creative and to enjoy life" (Lee, 2005). To that end, the government has made great efforts to establish Singapore as a global hub for the biomedical sciences. There are other sectors within the KBE which the government is also keen to develop, like the creative industries and information technology, but we focus here on the biomedical sciences for two reasons in particular.

First, the biomedical sciences have emerged as an important field of inquiry in the social sciences, which have explored the transformative effect of scientific knowledge on social order. For example, new reproductive and recombinant DNA technologies have opened up 'life itself' to manipulation and political dispute (Rose, 2001). Biomedicine, in this context, is constitutive of new ways of knowing ourselves and new modalities of governance, an approach to what Rose and Novas (2005) call 'biological citizenship' that derives from Foucault's (1976) notion of biopower. As a thinker, Foucault perhaps predates the exponential growth of the life sciences and their commercialisation, but social scientists have picked up his baton and proceeded to unpack the social implications of biomedical science (eg Braun, 2007; Franklin and Lock, 2003).

Secondly, we demonstrate how in a series of ways the promotion of biomedicine challenges previously dominant civic norms of Singapore's developmental state. Like many East Asian states, Singapore has pursued a path to economic growth based on technocratic state management, political stability, and a comparatively quiescent citizenry concerned more with economic prosperity and communitarian ethics than with individual liberty or an open, democratic public sphere. But, in the context of an emerging KBE, the government now finds its compliant citizenry somewhat wanting. Singaporeans are compelled to be more creative and entrepreneurial:

"We envisage each Singaporean being imbued with the necessary mindset, skills and competences to excel in the new environment; with resilient and entrepreneurial individuals creating wealth and ensuring the prosperity for our country" (MTI, 2002a, page 5).

To improve Singapore's position in this new global economy the state has reimagined its role as enabling rather than prescriptively controlling development of the KBE. To attract international investors and talent Singapore now promotes itself as a centre for scientific excellence by offering research facilities, funding, career opportunities, and a regulatory climate unavailable elsewhere. Scientists can sleep easy knowing they are free from animal rights or right-to-life protestors.

In her studies of economic development in Southeast Asia, Ong (2000; 2004) presents a theory of graduated sovereignty to explain how the developmental state, so characteristic of Southeast Asia, has managed the demands of the global economy by encouraging spatial fragmentation of citizenship and governance. Citizenship, she argues, is variegated geographically in accordance with its economic value. As producers in the KBE, scientists are accorded more privileges and freedoms when at work in, say, the Biopolis science park, than citizens elsewhere. This method of weighing up the economic value of citizenship is very much in keeping with the legacy of the developmental state, which has adapted economically to global forces, whilst still exerting authority over its labour force. We draw on Ong's theory of graduated sovereignty when

---

discussing the Singapore government's promotion of entrepreneurial subjectivity as vital to the success of the KBE. However, biomedical science also requires a host of regulatory protocols that surpass the state's spatialised management of the KBE and are not as overt in their entry into Singaporean society.

Though not involved in the initial formulation of the International Conference on Harmonisation Guidelines for Good Clinical Practice (ICH-GCP), Singapore quickly adopted its template for internationally standardised regulation to protect the rights and autonomy of clinical research subjects. Accordingly, Singapore has reorganised its bureaucratic mechanisms for governing biomedical research so as to be consistent with the broadly liberal and individualistic principles of bioethics stipulated by the ICH-GCP. It seems strange that a developmental state should promote a series of liberal, individualist values otherwise so at odds with its traditional project of nation building. Singapore's enthusiasm for the biomedical sciences also raises issues about the relationship between certain civic values and scientific ones. If, as historians of science (eg Ezrahi, 1990; Shapin and Schaffer, 1985) suggest, the emergence of modern science has gone hand in hand with liberal democracy, to what extent will the promotion of biomedicine in Singapore pose critical challenges for Singapore's political culture as much as for its political economy?

The construction and practice of laboratory science are mainstays of academic science studies, but our focus here is on the wider effect of science and the economic, political, and social structures required to produce scientific knowledge of a particular kind. As we illustrate using the Singapore case, biomedical science, especially in this highly commercialised form, does not simply happen: it depends upon a multinational and capital intensive industry that is governed by a globalised regulatory structure, and produces life-enhancing drugs, sold on an international market, and coveted by a range of political and lay actors whose campaigns have penetrated research agendas and outcomes.

To explore Singapore's burgeoning biomedical science industry against the backdrop of its political culture, we turn to the theory of coproduction, which has been developed most prominently by Jasanoff (2004; 2005). Jasanoff builds on a legacy of science and technology studies (STS) of the mutual constitution of scientific and political orders (Ezrahi, 1990; Latour, 2004; Shapin and Schaffer, 1985). The assumption that science and society are coevolutionary provides an almost natural starting point for STS scholars, who insist that attempts to separate the two are part and parcel of the myth-making machinery that has lent science its appearance of god-like universality.

If science implies a particular social order then what kind of society, and indeed what kind of science, is implicated in the promotion of the biosciences? This is the kind of question Jasanoff and other proponents of the coproduction model (eg Latour, 2004; Wynne, 2001) have been seeking to answer, largely by referencing Anglo-American examples. In this way, they have successfully demonstrated that the values implicit in science and technology resonate with those circulating in liberal democracies. But what about Singapore and other countries that practice science but not liberalism? In addition to extending the coproduction framework to uncharted territory, the Singapore case puts into sharp relief the prevailing assumptions of STS about the symbiotic relationship between science and democracy. By instituting internationally decreed 'best practices' of liberal bioethics to facilitate its science industry, has the former 'Asian Tiger' inadvertently opened the door to liberal democracy? Or, just as prior to the 1997 financial crisis when a kind of 'Asian' capitalism seemed a real possibility, is there also the possibility for a new form of science, unchecked by a democratic public sphere, emerging from the East?

## Methods

To answer these questions we apply the methodological traditions of interpretative social science to a variety of primary sources and materials including policy documents, committee reports, official speeches, press releases, and media texts. In July 2005, Holden also conducted a series of interviews with senior scientists, administrators, and government bioethical advisors in Singapore. Six of our informants were scientists; five were working in the private sector and one in the Office for Life Science at National University of Singapore. Three informants were working in different areas of medical-bioethical governance: one was an administrator and two were doctors who managed the ethical review process across one half of Singapore's health system. One informant managed public affairs, marketing, and education at Johns Hopkins Singapore Division of Biomedical Sciences. The remaining two were laboratory researchers in developmental biology and cell biology. This interview sample was designed to look specifically at the discourses surrounding the state's promotion of the biomedical industry. Our informants therefore represent the professional field in which the discourse of entrepreneurialism and the politics of bioethics emerge and conflict with the political culture of the Singaporean state. We make no claims about how these official discourses circulate amongst and are consumed by Singapore's diverse, multiethnic and multilingual population.

## Nourishing a nascent industry

"Singapore sweetens the pills" was the headline of an article in *The Guardian* (Tomlinson, 2004, page 30) newspaper when GlaxoSmithKline (GSK) announced plans to establish a new research and development facility in Singapore. The byline—"formula that lures British scientists: no animal rights protests, minimal red tape and ample cash incentives"—was a thinly veiled criticism of the research climate in Britain, and the article went on to describe the great efforts made by the Singapore government to attract and accommodate the biomedical industry. GSK moved into Singapore's Biopolis science park in September 2004, one month after *The Guardian* ran its article. This meant nearly everything was already in place to begin customisation of its laboratory suite. Essentially, all GSK had to do was bring in the experts.

In February 2006 the Singapore government launched the fourth of its five-year plans for future growth in science and technology. The new *Science and Technology Plan 2010 (STP2010)* (MTI, 2006) is the culmination of a strategy begun in 1991. With a budget of \$2 billion,<sup>(1)</sup> the initial plan laid the foundations for Singapore's move up the biomedical value chain. Under the leadership of then Prime Minister Goh Chok Tong, the National Science and Technology Board was established to implement science policy and oversee economic development. Renamed A\*Star following a 2000 restructuring, its role is now focused on attracting and developing talent and on deepening Singapore's research and development capacity through the work of its two research councils, the Biomedical Research Council and the Science and Engineering Research Council, and its oversight of Singapore's twelve public research institutes variously dedicated to biomedical science, information technology, and engineering.

Public expenditure on research and development has almost doubled with each new plan. The designated budget for the current plan stands at \$6 billion, with \$13.5 billion earmarked for future investment in four areas: developing highly specialised niche areas of research and development; encouraging private sector growth; improving technology transfer and increasing translational research to bridge the gap between public and private sectors; and, finally, the recruitment and retention of home-grown

<sup>(1)</sup> This report does not indicate whether this figure is Singaporean or US dollars.

and foreign expertise (MTI, 2006). Achieving these goals, however, means investing in and devising policy across a spectrum of government departments: urban regeneration and renewal to construct new science parks; educational policies to develop a scientific labour force; health policy to facilitate more translational and clinical research; and immigration policy to encourage the influx of foreign scientists, technicians, and researchers.

### Political culture in Singapore

In *Designs on Nature*, Jasanoff (2005) makes great use of the idea of ‘political culture’. At its simplest, the term refers to processes and norms of governance. She argues that national variations in political culture shape the practice of science and production of scientific knowledge. Rather than being uniform and universal, science is produced by the political and economic life of a nation. This may sound a little one-sided, as though political culture has agency whereas science and technology have none, but Jasanoff insists not. Instead, she argues that technological and scientific change creates new political cultures. Biotechnology is her example. Scientific innovations like recombinant DNA techniques challenge our ways of life and lead to new forms of governance whose development, Jasanoff (2005) argues, is influenced by national political cultures. In this way, both science and politics are coproduced at the national level.

To understand how coproduction might work in the Singaporean context, we can begin by considering its institutional history and political culture. Singapore is widely extolled as a so-called developmental state. This model for economic growth first emerged in Southeast Asia, where the speed of industrialisation and strength of the state defied the orthodox growth paradigm, which advocated laissez-faire policy and free markets as the optimum growth route to prosperity (Thompson, 1996). In opposition to that dominant growth paradigm so aggressively promoted by the World Bank and International Monetary Fund (IMF), Singapore’s industrialisation was achieved under a strong, state-led programme of economic planning and investment.

We identify five interlocking features of Singapore’s political culture that distinguish it as a developmental state. First, Singapore’s ruling People’s Action Party has held power since the first general election in 1959, thanks, in no small measure, to official suppression of any organised opposition. This was highlighted during September 2006, when Singapore hosted the World Bank and IMF Board of Governors Annual Meeting. The meeting was an important showcase for Singapore. As part of its campaign to welcome the 16 000 delegates, the government draped the highway from the airport with a mile-long mural of four million smiling faces, one from each Singaporean citizen, presumably.<sup>(2)</sup> Public demonstrations have accompanied previous IMF meetings but, in Singapore, public rallies are banned and political gatherings require a licence. In 1999, Chee Soon Juan, leader of the Singapore Democratic Party, was arrested for addressing a crowd without a licence. This incident was widely reported internationally and put the Singapore government on the back foot over its civil rights record (Aglionby, 2002). To avoid such international opprobrium, the government eventually succumbed to pressure over its initial ban on protests during the meetings. Selected demonstrators were given entry to the conference centre and directed towards a small, enclosed space from which to campaign. But smiles may well have turned to frowns when, instead of making the usual complaints about the IMF and World Bank, protesters instead wore gags with the words “no voice” written on them, attacking the Singapore government more than those notorious international organisations.<sup>(3)</sup>

<sup>(2)</sup> See <http://www.smiles2006.com> for the mural.

<sup>(3)</sup> See the radical political website <http://www.thinkcentre.org> for an alternate write up of the WTO/IMF general meeting and pictures of the event.

---

Secondly, state institutions operate without much external scrutiny or regard for popular political opinion. State autonomy has remained intact because, as Castells (1992) notes, economic development is seen as central to national survival. State institutions are charged, above all else, with protecting the prospects for economic growth, a responsibility they jealously guard. The resulting bureaucratic instinct to defensiveness and secrecy made it difficult to obtain official permission to interview scientists working within A\*Star's public research institutes. One British scientist was very happy to talk informally, but a clause in his contract forbade him from speaking publicly about the institute or his job without prior consent from A\*Star, which A\*Star refused to grant despite numerous requests. Initially, A\*Star refused because no list of interview questions had been provided for the Corporate Communications office to vet. Having received a list of questions, it then responded saying that all A\*Star scientists would be out of town and thus unavailable for interview during the entire four-week period of fieldwork. Journalists face similar hurdles. Charles Piller, a journalist from the *Los Angeles Times*, explained that when he approached A\*Star to talk with foreign scientists who had moved to Singapore he was confronted with a hierarchical bureaucracy which meant that all his questions were vetted and a chaperone accompanied him to interviews (personal communication, July 2005). These efforts are symptomatic of a political culture in which state policy is not regularly subject to public scrutiny or debate.

Thirdly, public policy is synonymous with economic policy. Whereas urban renewal during the 1960s swept away the cramped ghettos of the old city to make room for government-owned high-rises, highways, and other infrastructure needed to support Singapore's emergence as an export-oriented manufacturing platform, the government's ongoing promotion of the KBE also sees state policy coordinated across government departments to support its economic agenda. Biopolis is located in a corner of a much larger urban regeneration scheme, called 'one north' (written in lower case as it appears), which involves converting old Housing Development Board blocks into more contemporary 'loft-style' condominiums for expatriot and other scientists recruited to work there (Wong and Bunnell, 2006).

Fourthly, the Singapore government has traditionally imported business know-how rather than develop home-grown innovations. Its early success was achieved by providing an export production platform for foreign multinationals. In the current transition the same pattern of importing knowledge can be traced. Singapore has been quick to tap into international currents of expertise. The need for human capital is the central theme of the *STP2010* report. It sets out policies for recruiting leading scientists from around the world to work in Singapore. The idea is to introduce a topsoil of talent whose skills and experience will filter down to a layer of bright young graduates, who will then be encouraged to stay and so reverse Singapore's long-standing brain drain (Ong, 2005). A number of established scientists have been poached from abroad to work in Singapore's public research institutes, such as Edison Liu, former director of the National Cancer Institute in the US and now director of the Genome Institute Singapore, and Sir David Lane, discoverer of the tumour suppressor gene p53, who in 2004 was appointed executive director of the Institute of Molecular and Cell Biology. According to the chief scientific officer at Cordlife, this filtering effect has allowed Singapore:

"to gain ten, twenty years experience in a matter of three to five years, and use these people that come in as catalysts to bring in-house talent on a par with global development in a very short time frame." (interview).

Finally, the developmental state should not simply be understood as an economic model for growth; it is also indicative of a particular cultural value system. The government is mandated to implement policies as long as economic development is

realised. As Perry et al state, this legitimating process has had a particular effect on social relationships:

“As part of its sacrifice for Singapore’s economic achievements the population has accepted extensive curbs on individual freedoms Western society tends to emphasise” (1997, page 6).

The strength of the developmental state encouraged the idea that capitalism could assume a different form in Asia. Part of its distinctiveness was said to derive from a set of cultural attitudes, beliefs, and values rooted in the region’s histories and traditions, more widely known as ‘Asian values’. According to Said (1978), the newly industrialised Asian states moulded their national identity in the image of the ‘oriental’ Other that infused colonial narratives. The polemical rift between East and West was reified through a moral framework that constructed Western (capitalist) cultures as highly individualised, materialistic, and morally dissolute. In opposition, Asian identity was said to embody a communitarian ethos that put obligations to family and community first (Ang and Stratton, 1995). Being Asian in Singapore has been reinforced by government campaigns that admonish, famously, chewing gum, littering, and bad personal and public hygiene whilst promoting courtesy, respect, and submission (Perry et al, 1997).

Throughout the 1980s and early 1990s, the Singapore government championed ‘Asian values’ as an ideological counter to the centrifugal forces of neoliberal capitalism. This construction of ‘Asian values’ is epitomised by the 1991 government white paper *Shared Values* (Chua, 1998). It was an explicit attempt by the government to cultivate a cohesive and biddable labour force by consolidating the shared histories and traditions of its otherwise diverse population.

In the wake of the 1997 financial crisis, the Singapore government quickly abandoned its ‘Asian values’ rhetoric. In a reversal of fortune, ‘Asian values’ are now considered an obstacle to success in the KBE. Instead, in a gesture very much in keeping with the top-down approach of a developmental state, the government is now urging its citizens to change their ‘mind-set’ and embrace entrepreneurialism and world citizenship to accommodate structural changes in the global economy. To that end, Ong (2000; 2004) argues that states in Southeast Asia are now embarking on a new strategy of differentiating their various populations spatially to meet the demands of capital. She develops this theory of graduated or variegated sovereignty in relation to special economic zones in China and Malaysia, where state power is delegated to international corporations and investors, but she has also extended it to Singapore and its approach to foreign experts in the exemplarily variegated space of the science park (Ong, 2005).

Returning to Jasanoff’s coproduction framework, we might ask about the wider implications of this way of promoting the biomedical industry in Singapore. In what follows we argue that the state’s concern with human capital has been translated into an ideal form of citizenship that is spatially variegated: restlessly creative and individually entrepreneurial in the workplace but not in other spheres of life. At the same time, however, Singapore’s participation in the global biomedical industry also depends on rolling out an international bioethical framework to protect the individual rights of human subjects. An ethical scandal involving a foreign scientist and Singaporean clinical trial subjects suggests some of the tensions between these two features of promoting biomedicine: variegated entrepreneurialism and bioethics.

### **Ethical misconduct at the National Neuroscience Institute**

In December 2000 the Singapore government announced the appointment of eminent British neurologist, Professor Simon Shorvon, as new director of the National Neuroscience Institute (NNI). Apart from running the NNI, he was also to oversee a S\$10 million research project into the causes of Parkinson’s disease. He was to have free rein,

essentially, to pursue innovative lines of investigation and full charge over a health-care centre from which to run clinical trials. Shorvon was a world-renowned expert and his appointment was a big coup for Singapore. Here, an esteemed scientist relocated himself along with members of his research team to Singapore to work in a promising field of research. If successful the research had the potential to generate groundbreaking therapies and an extremely competitive intellectual property position of global significance.

In January 2003, Shorvon was accused of having acted unethically. Clinical trial patients had raised concerns over some of his research practices. After hearing of patients' complaints, the deputy director demanded an investigation. Shorvon was charged with changing the medication of trial patients and taking blood samples without consent. He was also accused of breaking confidentiality by accessing patient files and contacting them directly rather than through their own doctor. In March 2003, Shorvon was very publicly sacked. Returning to the UK, he counterattacked, insisting he was caught in the middle of political infighting at the NNI. To restore his reputation, he rallied some of his friends, all eminent doctors and scientists, to make character statements on his behalf and warned fellow scientists about the dangers of moving to Singapore, where, he insinuated, cronyism would hamper proper scientific work (*Financial Times* 2004).

In response to the scandal, the *Straits Times* (2003) ran an article warning that Singapore was turning into a "cowboy town for scientists", an accusation aimed squarely at the rising number of foreign scientists. Professor Lim Pin, Chair of the Bioethics Advisory Committee (BAC), was quoted in *Science* (2003) as saying that the incident showed Singapore was tough on those who thought they could break the rules. The Singapore Medical Association (2003), in a different vein, reflected on the experience as representative of cultural values and asked "is it because of our Asian subservient mentality that our senior is always right?" (*Singapore Medical Association News* 2003).

### **Eastern cowboys and entrepreneurial subjects**

"To succeed talent will be key. Singapore must become a global talent hub, attracting talent here by providing a vibrant environment and an open society that offer opportunities for communities of creative and talented people."

MTI (2006, page 4)

Whatever the truth of these charges and countercharges, the NNI scandal exposes a tension between the explicit promotion of entrepreneurial subjectivity and the tacit politics of bioethical regulation. According to Ong's (2005) theory of graduated sovereignty, entrepreneurial citizenship is constitutive of the spaces in which it is calculated as an economic good. In the Singaporean context, entrepreneurial subjectivity emerges in the conceptualisation of the science parks as spaces where the unrestricted pursuit of scientific knowledge is actively encouraged. The NNI scandal also shows that in these variegated spaces of entrepreneurialism scientists come into regular contact with the Singaporean populace through clinical research, and that the continuation of such research relies on patients volunteering to become human research subjects. Put simply, progress in biomedicine can be said to rely, in part, on a union between savvy scientists and rational, reflexive research subjects. Science in Singapore requires the construction not only of an entrepreneurial subject but also of an individuated bio-political subject willing to offer itself as the raw material for scientific research. The first half of this union has been explicitly promoted by the state, and in this section we will look at Singapore's attractiveness to international investment and talent and how

---

the discourse of entrepreneurialism is perpetuated at the expense of Singaporean citizenry. The other half of this union, the ethical or biopolitical subject, has not been encouraged, or, indeed, even acknowledged, publicly, and in the following section we look at the history of bioethics and its purchase in Singapore.

Singapore advertises itself as an oasis for biomedical researchers. The caption under a photograph of Biopolis in *STP2010* boasts of “a plug and play environment” (MTI, 2006, page 13). Singapore has traditionally suffered brain drain, with its brightest graduates completing their studies and embarking on careers in countries that offer better opportunities (Ong, 2005). One of the ways to retain their expertise is to create the kind of atmosphere they want to live and work in: make it big, highly aesthetic, and call it “one north”: the futuristic urban redevelopment scheme within which Biopolis is located. Lifestyle choice is an increasingly important feature of the recruitment campaign. Thus, Biopolis feels more like a tourist attraction than a science park, an assumption the psychedelic shuttle bus does nothing to dispel. Within ‘one north’ there are shops and restaurants (apparently one of best food courts on the island) amidst bohemian art galleries, sanitised laboratories, leisure facilities, and loft-style apartments. ‘one north’ is thus much more than a science park. It is a place to work, play, and live. It is envisioned as a hub of hybridity and creativity for the KBE, a city within a city that Singapore’s scientists and other knowledge-based workers need never leave (Wong and Bunnell, 2006).

Thus, in the process of selling science, national identity is also getting a makeover, as Singapore promotes itself as a “vibrant environment and an open society” (MTI, 2006, page 4). The rationale is simple. The primary labour force of the KBE—enterprising scientists, IT professionals, and other knowledge-based workers—are seen to carry with them not only highly prized technical skills but also a distinct set of cultural values, which, according to *STP2010*, are nearly nonexistent in Singaporean society.

Lifestyle is but one draw. The more persuasive draw is the research climate, which also benefits from the picture of Singapore as an open and vibrant society, because it entails minimum fuss and maximum efficiency. “A candy store for scientists”, was how one newspaper headline described it (Piller, 2004). There is a visible absence of activism of any sort in Singapore and to the advantage of pharmaceutical companies and biomedical scientists there are no animal rights or pro-life activists to placate. Indeed, there is little scope for the public to influence biomedical research in Singapore. Discussion of the societal dimensions of science is narrowly focused on the economic. The government has backed its rhetoric with considerable government funding. Four of the five private sector scientists interviewed for this research mentioned that the EDB had been a founding investor in their Singapore arm. Three companies were physically based in the Biopolis and benefited hugely from the integrated facilities there. As the director of research at one firm put it,

“Biopolis was the obvious one to go for because you’ve got this integrated system here. You’ve got all this infrastructure, it’s all provided, and as a company you don’t have to put your hand in your pocket to start from scratch setting something up” (interview).

When asked why their companies had chosen Singapore, informants consistently pointed to the favourable research climate:

“Singapore offered a stable infrastructure and the promise of good honest non-corrupt regulation and a good cost base by virtue of incentives and grants and also from the regulation point of view the access to being able to do clinical research would be predictable and timely opposed to having uncertain time frames and other issues in other countries” (interview).

Singapore has much the same appeal for academic researchers. In interviews, informants consistently mentioned money, both for salaries and research grants, as a particular draw:

“The thing is that as a researcher, particularly in academia, you have to always write grants. The success rates for grants in the US, and in the UK I suppose, are usually not very high. Research funding is quite restricted. Salaries are restricted. That’s different here, and research money is much more easily available” (interview).

In this push to recruit talent for the KBE, there is the tendency for values inscribed upon foreign scientists to become conflated with those of worthy citizenship (Ong, 2005). The values of compliance and diligence, which once appealed to manufacturers, are being replaced by a new emphasis on technical skills and individual creativity now thought necessary for competing in the most promising areas of technological and scientific innovation. A recent report by the government’s Economic Review Committee put the problem starkly:

“The biggest challenge for Singapore to develop a vibrant enterprise sector is to change the mindset of Singaporeans. This means that Singaporeans must have the instincts to sense opportunities and take calculated risk, and have the desire to build something out of nothing .... To mould a nation’s culture is a tremendous and long term effort, because these are societal behaviours which are embedded in its history” (MTI, 2002b, page 4).

There is a dual construction taking shape here. One is a positive construction of ‘global talent’: the innovative, entrepreneurial producer who is networked into the global economy—in the 72-page *STP2010* report the term ‘global talent’ is invoked twelve times. The other is a negative construction of the Singaporean citizenry, which is represented as somehow lacking the right stuff.

This geography of deficiency cuts against a concomitant rhetoric about the universality of science. Asked by the *Straits Times* about retaining such global scientific talent and about the loyalty of foreign experts to Singapore, Philip Yeo, Chair of A\*Star, replied: “scientists know no nationality, their loyalty is only to their science” (2005). Glancing through the report, however, reveals that the majority of foreign experts currently working in Singapore originated from developed English speaking countries, in particular the United States (MTI, 2006, pages 10–11). The prize scientists, the big catches that titillate the national media, are held aloft as role models. In the absence of any identifying details, the term ‘global talent’ simultaneously uproots scientists from their national origins and assigns Singapore a heritage to be forgotten. As a discourse, ‘global talent’ has a recognisable function in national policy making. It perpetuates a myth about the movement of labour and prospects for economic growth in the KBE (Olds and Thrift, 2005). This rhetoric is often juxtaposed against the traditional values that once defined Singaporean culture, which are now conceived of as insular, outmoded, and, most compelling of all, irrelevant to a burgeoning KBE.

In this context, native Singaporeans might have every reason to be concerned about the influx of foreign experts and their elevated status as entrepreneurial subjects. As Ong (2005) notes, the presence of so many foreigners, all vying for well-paid positions and opportunities, has created a “‘high-tension zone’ of constant cross-referral between the recent past and the projected future, between rigidity and flexibility, between insiders and outsiders” (2005, page 345).

None of the foreign scientists interviewed for this research laboured under any misapprehension about their presence in Singapore. They understood their role as one of tutelage. Their expertise is in high demand. That much is clear. Amid phrases in government discourse, like “such talent will be needed to fuel” (MTI, 2006, page 36), scientists are fetishised as an essential factor of production in the KBE, whose skills will

---

“seed local talent” (page 38) and ensure the “strong pipeline of high quality graduates” (page 5) needed to compete in the KBE. This kind of rhetoric transforms foreign scientists into a kind of human capital needed to make the local labour force more productive; and the Singapore government has calibrated its policy to this differentiated labour force in accordance with its relevant market value. This is typically postdevelopmental activity, as Ong (2000) would phrase it, which has created a form of graduated sovereignty whereby those with higher market value enjoy greater freedoms and privileges from the state.

To return to the NNI scandal, it is probable that Professor Shorvon performed the appointed role of enterprising, innovative scientist. As director of NNI, with a sizeable grant and the freedom to direct his own research agenda, he was, for all intents and purposes, plugging in and playing away. However, his research, as with all biomedical research, involved research subjects: Singaporean citizens, who may, through the principles underwriting bioethics come to understand themselves as a collective of individuals with an active part to play in the development of biomedical research.

### **The limits of plug and play**

The NNI scandal marred the otherwise unblemished face of biomedical research in Singapore. The government and representatives of its health-care system acted quickly to extinguish any doubts about the reliability of Singapore’s ethical regulation. Shorvon was dismissed without reprove and a media campaign quickly set about repairing the image of biomedical research—there is, after all, global competitiveness to think of. In November 2004, the BAC published its *Guidelines for Institutional Reviews Boards*, setting out ethical governance of research on human subjects (BAC, 2004). It stipulated that “all proposals for pharmaceutical trials are required to undergo an independent ethics review process and to comply with the ‘Singapore Guideline for Good Clinical Practice’, which is based on the ICH-GCP Guideline” (page 1). The *Straits Times* ran a supporting article in which Professor Lim Pin, Chair of the BAC, stated: “In the drive to achieve excellence in biomedical sciences, it is critical that Singapore must be seen doing good science” (24 November 2004).

Luring foreign scientists is not sufficient to guarantee the growth and success of Singapore’s biomedical industry. ‘Good science’ now also depends on being seen to observe certain ethical terms and conditions. Underpinning the practice of biomedical science is the regulatory infrastructure of bioethics, whose liberal principles are at odds with the civic norms of Singapore’s developmental state.

Singapore adopted the ICH-GCP in 1998 without much explicit consideration of the political values implicit to bioethics or the wider implications for Singapore’s political culture of affording patients more individual rights and autonomy. National implementation of good clinical practice was overseen by the Centre for Drug Administration (CDA), which forms part of the Health Sciences Authority (HSA), the statutory body that regulates pharmaceutical and medical products on the Singaporean market and monitors the quality of health care and its delivery. At the recommendation of the BAC, the HSA now has the added responsibility of licensing clinical investigations in Singapore.

Holden interviewed two doctors who had moved into managerial roles within the office for research and development in one major health-care cluster in Singapore. They were responsible for supporting the conduct of clinical trial investigations by centralising the administrative processes and advising investigators about best practice, grant applications, and data-collection methods. This involved standardising the paperwork, and making all forms and documents centrally available (often in downloadable formats). It also entailed institutionalising a distinction between ethical and unethical conduct. Having been operational only since 2004, their office was still in the process

of realising its managerial scope. In that time, however, it had already implemented good clinical practice as recommended by the CDA, which, as both informants pointed out, observed the principles of bioethics dominant in the US:

“We conform to international guidelines and we have focused very much on a US centric type of approach and we have made sure that we have conformed to other basic structures like that. In fact we have plans to go in the near future with some sort of accreditation for our research ethics, so in that sense we hope to aspire to the highest international standards” (interview).

Asked about ethical assurance procedures, informants typically referred to other boards and advisory panels:

“Our boards report to this board called the Research Ethics Committee and this board is the one that writes down the policies. We also have international advisors who are really top people in the ethics field, who tell us what is ethical and what is not. What can be done and what shouldn't be done” (interview).

This kind of response led to questions about why the national ethics committee had been established in the first place and what its objectives were. Here, again, responses tended to refer to international standards rather than to domestic concerns:

“When the government decided to look at bioscience as one of the next industries to focus its efforts on, the government always acts on the advice of experts from other countries and I think that one of the pieces of advice that it was given was you need a bioethics committee. So based on that, the advisory committee was set up” (interview).

In this way the practice of ethical review was not driven by much consideration for the ethical concerns that the Singaporean people may have about biomedical research. Rather, it was largely about complying with international bureaucratic standards and procedures, so that the resulting data could be used in drug licensing applications in the major markets of the US and Europe.

Despite persistent probing, professionals responsible for medical ethics said nothing substantive about any ethical concerns raised by research in Singapore. Rather, they made great efforts to show deference to the standards set by international advisory committees. The reference to an international advisory board displays a need to be seen to institute international best practices at the expense, perhaps, of considering the implicit political and social dimensions of those practices and their congruence with Singaporean society. The Biomedical Sciences International Advisory Council (IAC), which is the primary advisory council endorsing much of the government's science policy, is composed of fifteen members, seven of whom are from the USA, three from the UK, and one each from Germany, Australia, Sweden, France, and Canada. Clearly, there is some bias towards Europe and North America. Why are China and India not represented since both countries have developed ambitious biomedical industries?

Members of the IAC are leaders in their field who direct major research institutes in their respective countries of residence. Undeniably, the IAC is made up of eminent scientists, but what gives them authority to judge ethical matters in Singapore? Notably, there is not a single social scientist present to problematise why international guidelines, such as the ICH-GCP, appear neutral in the face of multiracial, multicultural, and multiethnic societies, or what these guidelines do for science and how they improve it (surely they must make some difference; otherwise what is the point?). Unfortunately, the authority of the IAC to determine good ethical conduct in Singapore became something of a regular feature of interviews. For instance, one scientist, who worked closely with patients during clinical trial investigations, emphasised that “highest international standards are met”, but failed to articulate who or what they were designed

---

to protect, apart from the international marketability of research results obtained in Singapore:

“We work to essentially the highest international standard here. All of our studies are reviewed by an external ethics committee including our draft of a pretty substantial informed consent document for the patients to review. The review board process is pretty robust. We have had the FDA (US Food and Drug Administration) audit us here” (interview).

Our research did not set out to scrutinise their ethical codes of conduct. But questions about ethics and scientific practice seemed to provoke a preemptive response from informants. This pattern prompted us to wonder why Singaporean officials should turn to foreign agencies to assure the ethical soundness of research with human subjects in Singapore.

Taking coproduction seriously permits thinking about how a kind of biopolitical subjectivity is being produced through the institution in Singapore of bioethics regulation to meet the economic imperatives of globalised biomedical research. In response to the NNI scandal and the launch of the BAC report, Professor Lim Pin’s public statements were a reassuring nod to an international research community and its investors, rather than to an agitated Singaporean public concerned about the proper and dignified use of their bodies in biomedicine. The three interviewees working for ethical review committees all framed ethical guidance as what could be done to the subject without causing harm, and they looked to regulatory guidance at the international level to set that standard. ICH-GCP defines good biomedical research as that which meets a standardised set of criteria, the central tenet of which is protection of the individual research subject by respecting his or her autonomy. In Singapore, these guidelines do very much what they say on the tin, but the individual subject being protected is deafeningly silent.

What, then, is an ethical regime of that sort doing in Singapore? There is an obvious genealogical link between the major rights-based doctrines of the 20th century and the development of bioethics. Bad memories of Nazi doctors and liberal eugenicists stalk scientific research involving human subjects. The Nuremberg Trials held between 1945 and 1949 condemned the inhumanity of experiments conducted in Nazi concentration camps. Horrific in their detail, experiments were performed on prisoners against their will, causing suffering and death. The resulting Nuremberg Code decreed that “voluntary consent of the human subject is absolutely essential” to medical research (*British Medical Journal* 1996). In 1964, the World Medical Association (WMA) gathered in Helsinki, Finland, to sign a document etching the Nuremberg Code into medical research ethics. While it acknowledged the commitment of medical research to ensuring the health of populations and the pursuit of knowledge, it pronounced the rights of the individual research subject paramount to the needs of both society and science (WMA, 1964). These two events directly informed the moral principles foundational to modern bioethics, which can be listed as respect for individual autonomy, beneficence, non-maleficence, and justice. Respect for individual autonomy is by far the most important guiding principle and it is captured in the legal requirement to obtain informed consent from the research subject (Dyer, 2005). ICH-GCP stems directly from these historical developments in medical ethics, which reflect historically and geographically specific national experiences.

Nevertheless, bioethics is premised on the idea that moral problems are by their nature universal and can be resolved through the application of logical reasoning. If this were true then the rights-bearing individual would also be a universal subject unaffected by place, time, and culture. Bioethics inscribes a certain subject position: enterprising, self-regulating, and self-knowing. The bioethical model strives to operate

beyond the state through norms and practices made immanent through globally distributed biomedical research and development. However, as with any rights-based doctrine, bioethical guidelines are enforced through state institutions. This produces something of paradox in Singapore. A bioethical model has been imported and rolled out across the Singapore health-care system. It relies on the presence of individuated subjects who, when signing the consent form, know exactly what their individual rights are. Such individual subjects can withdraw, complain, and appeal. They have rights. They can refuse treatment or form patient activist groups to lobby government and influence the design of research. They can campaign for adequate representation.

The bioethical model being put into practice in Singapore anticipates a certain state–society relationship in which the populace is invested with a series of rights, both individual and participatory, such that it can give active assent to new and novel forms of science and technology being developed. Scientific knowledge is no longer strictly a matter for the scientific community and its system of peer review, publication, and awards. Instead, Jasanoff contends, science is validated in accordance with an active public sphere:

“The challenge, rather, is to constitute in tandem with global advances in technology the institutional capacity that will permit citizens to participate meaningfully in debating the implications of the new technologies” (2006, page 292).

In Singapore, however, this sense of a ‘civic epistemology’—Jasanoff’s term for how the public tests, validates, and assents to acts of scientific knowledge creation—is largely absent. The individual mode of subjectivity implied by bioethical regulation is inconsistent with the prevailing norms of citizenship. When this apparent contradiction was broached with an interviewee working for a national ethics committee, this was the response:

“I think the committee does realize that there is a difference between the Western cultures and how Asians perceive bioethics. We do understand that autonomy is a concept that was drawn up by the Western countries and if you look through our reports we seldom use the word autonomy, but rather, most of the time, we say respect for the individual” (interview).

It is true: autonomy of the individual is absent in their reports. Initially, we were slightly flummoxed by this reply—the guiding principle of bioethics, missing? But on further reflection it makes some sense. The mapping of ICH guidelines onto Singaporean society defies the very logic of those guidelines. We do not think our interviewee had given much thought to the question of individual autonomy or what it entailed, and we doubt that the Singaporean state has either. Bioethics is simply paperwork. As long as the consent forms are signed and the paper trail is clear, there should be no qualms about what it all means.

This is where the administrative power of the ICH is most felt. Its aim is simply to standardise the licensing procedure for new medicinal products across different countries. This involves national regulatory bodies cooperating to harmonise their administrative procedures and paperwork. If justification were ever needed, the ICH can rely on an ever-pressing need to get pills to patients in more efficient time frames. Harmonisation has allowed pharmaceutical companies to slash the administrative costs of compiling a new application dossier each time they want to market their products in a different country; all the technical requirements are inching toward uniformity. One knock-on effect of increased regulatory requirements, in place at both the laboratory bench and patient bedside, is that it is now impossible to imagine doing science any other way. Trust in the objectivity of research is guaranteed by a series of administrative protocols rather than by personal relationships, of which ethical guidelines are one component. The impersonal nature of ICH administration

---

lends its good practice guidelines the appearance of political neutrality. The ICH represents a particularly effective form of standardisation that allows scientific research to travel significant distances and still be relevant to dominant markets of the US and Europe.

Imagine if Singapore refused to accept these ethical guidelines, on the grounds that its liberal individualism was inconsistent with ‘Asian values’, and ignored culturally embedded ways of identifying and resolving moral problems. We doubt GSK and other large multinational drug companies would be so forgiving in making their investment decisions. As the prime minister said in his National Day Speech, “You may want to be the same, but you can’t be the same. Therefore, we have to remake Singapore—our economy, our education, our mindsets, our city” (Lee, 2005).

### **What kind of science for what kind of society?**

This question is central to the work of coproduction theorists, and to Jasanoff (2004; 2005) in particular. In addition to its substantive import for academic science studies, it goes to the heart of a wider political project of democratising science and opening it up to wider public deliberation and debate. A first step in that process is breaking down the ideological apparatus designed to keep society and science at arm’s length by “expos[ing] to public scrutiny the assumptions, values, and visions that drive science” (Wilsdon and Willis, 2004, cover page). Once science is recognised for the socially and historically situated practice it is (Haraway, 1997), more meaningful public participation and the deepening of liberal democracy are said soon to follow (Leach and Scoones, 2005; Wynne, 2001).

The issues in Singapore are somewhat different. The idea of science as a force for social good is largely unquestioned: the good it is supposed to deliver is economic growth and thus national security. In a developmental state vaunted for its ability to mould its citizenry to adapt to industry’s shifting labour force requirements, it is not at all clear what these liberal ideas about public engagement and opening up science might mean, since there is no public as such to engage and thereby democratise science. In this context, the question is the inverse of that posed by STS scholars and activists in the US and Europe: to what extent is science a force for democratising the public sphere?

The growth of biomedicine and the importation of regulatory controls to support it bring with them the potential to reshape the Singaporean polity. In this analysis, we have looked at the discourse of entrepreneurialism and the implementation of bioethics as potential challenges to the established political culture of a developmental state. Despite attempts by the government to spatially manage entrepreneurial subjectivity and assign it to the science parks, there remains the issue of how much longer it can tell citizens to be creative, challenging, and entrepreneurial at work without the risk of those attributes spilling over into other spheres of civic life. The tacit liberalism of international bioethical guidance for the conduct of clinical trials has not been acknowledged because of the appearance of political neutrality lent to it by international organisations. Bioethics regulations to protect the individual rights of trial subjects were quickly rolled out across Singapore with little thought given to their historical and geographical provenance or ethicopolitical significance.

Tensions between Singapore’s established political culture and these liberalising effects of promoting biomedicine are still latent, and it is not yet clear what the future will hold. Will the public sphere in Singapore be influenced by the internationalised campaigning of patient activist groups or animal rights advocates? Ho et al (2002) suggest that the growth of the Internet in Singapore is leading to the emergence of alternate public spheres where Singaporeans challenge dominant political views. Similarly, in the specific context of

biomedicine, Rose and Novas (2005) look to the Internet for evidence of new forms of ‘biological citizenship’ and political organisation emerging, often transnationally, around certain diseases and forms of clinical research to cope with them. Are Singaporeans ever likely to realise their individual bio-value and act upon it in such public ways?

If increased democratic engagement and biological activism are one possible outcome of promoting biomedicine in Singapore, there are considerably darker possibilities as well. Drawing on the dystopian tradition of science fiction, with its stories of runaway science and Frankenstein futures, we might ask what kind of science will emerge from East Asia, unchecked by the kind of liberal, democratic public sphere that Jasanoff and other STS scholars often take for granted? This question returns us to the theory of coproduction, in which science is a national project, coconstituted by political culture and scientific innovation.

In the west of Singapore, near the Tuas Industrial estate, home of pharmaceutical manufacturing plants, there is a feeder bus that takes students between Nanyang Technological University and the Boon Lay Interchange. The pharmaceutical company Pfizer has placed an advert inside the bus encouraging healthy volunteers to participate in clinical trial investigations. The slogan reads “it takes more than good health to be a volunteer, it takes a big heart” (see figure 2)<sup>(4)</sup>. There is no denying that Pfizer’s marketing department has done its homework. The advert is targeted specifically at students whose youth and good health make them ideal subjects for type-I clinical trials.



**Figure 2.** The Pfizer advertisement, taken from inside the bus, the insert shows a close-up (reprinted with the kind permission of Brandon Lee).

<sup>(4)</sup> See <http://www.flickr.com/photos/sangsara/55362288/> Internet blog for further images: in particular, an image taken from inside the bus shows the extent of the Pfizer campaign. The blog also has postings by Singaporeans who expressed disgust at being recruited for pharmaceutical trials in such a way.

The reference to having a good heart echoes the Heartlander/Cosmopolitan discourse used by the government in the 1980s to promote Asian Values and used here to imply that national duty now involves volunteering as a healthy trial subject. Thus, the advert plays on a communitarian ethos and brings home the understanding that making an economic contribution such as this one is an act of good citizenry. It appears as though Pfizer has tapped right into the Singaporean 'mind-set', and exploited it for commercial ends. Perhaps the slogan should instead read "clinical trials NEED YOU", with Lee Kuan Yew pointing at his audience in the manner of Lord Kitchener.

**Acknowledgements.** The authors would like to thank all those who participated in the research. Thanks also to Henry Yeung, Sarah Moser, and Tricia Seow in Singapore for their hospitality and support, to James Porter and Mariapaula Escobar for their support and encouragement with this project and to our three referees for their comments and recommendations.

### References

- Aglionby J, 2002, "Singapore's fine culture keeps people in line" *The Guardian* 2 November, page 7
- Ang I, Stratton J, 1995, "The Singapore way to multiculturalism: Western concepts/Asian cultures" *SOJOURN* 10(1) 65–69
- BAC, 2004 *Research Involving Human Subjects: Guidelines for Institutional Review Boards* (Bioethics Advisory Committee, Singapore)
- Braun B, 2007, "The biopolitics of molecular geographies" *Cultural Geographies* 14(1) 6–28
- British Medical Journal*, 1996, "Nuremberg Code" 313 1448
- Castells M, 1992, "Four Asian Tigers with a dragon head: a comparative analysis of the state, economy, and society in the Asian Pacific Rim", in *States and Development in the Asian Pacific Rim* Eds J Henderson, R P Appelbaum (Sage, London) pp 33–70
- Chua B H, 1998, "Asian values: restraining the logic of capitalism?" *Social Semiotics* 8(2/3) 215–226
- Coe N M, Kelly P F, 2002, "Languages of labour: representational strategies in Singapore's labour control regime" *Political Geography* 21 341–371
- Dyer S, 2005 *Applying Bioethics: Local Research Ethics Committees and the Ethical Regulation of Medical Research* PhD dissertation, Department of Geography, King's College London
- Ezrahi Y, 1990 *The Descent of Icarus: Science and the Transformation of Contemporary Democracy* (Harvard University Press, Cambridge, MA)
- Financial Times* 2004, "MPS is not against doctors working in Singapore", 27 July, page 16
- Foucault M, 1976 *History of Sexuality: Volume 1* (Penguin Books, Harmondsworth, Middx)
- Franklin S, 2000, "Life itself: global nature and the genetic imaginary", in *Global Nature, Global Culture* Eds S Franklin, C Lury, J Stacy (Sage, London) pp 188–227
- Franklin S, Lock M (Eds), 2003 *Remaking Life and Death: Toward an Anthropology of the Biosciences* (James Currey, Oxford)
- Haraway D J, 1997 *Modest\_Witness@Second\_Millennium. FemaleMan<sup>©</sup>\_Meets\_Oncomouse<sup>™</sup>: Feminism and Technoscience* (Routledge, London)
- Ho K C, Baber Z, Khondker H, 2002, "'Sites' of resistance: alternative websites and state–society relations" *British Journal of Sociology* 53(1) 127–148
- Jasanoff S, 2004, "The idiom of co-production", in *States of Knowledge: The Co-production of Science and Social Order* Ed. S Jasanoff (Routledge, London) pp 1–13
- Jasanoff S, 2005 *Designs on Nature: Science and Democracy in Europe and the United States* (Princeton University Press, Princeton, NJ)
- Jasanoff S, 2006, "Biotechnology and empire: the global power of seeds and science" *Osiris* 21 273–292
- Latour B, 2004 *Politics of Nature: How to Bring the Sciences into Democracy* translated by C Porter (Harvard University Press, Cambridge, MA)
- Leach M, Scoones I, 2005, "Science and citizenship in a global context", in *Science and Citizenship* Eds M. Leach, I Scoones, B Wynne (Zed Books, New York) pp 15–38
- Lee H L, 2005, "National Day Speech", 21 August, <http://www.sprinter.gov.sg>
- MTI, Ministry for Trade and Industry, Singapore, <http://www.mti.gov.sg>
- 2002a *Report of the Economic Review Committee Sub-Committee on Enhancing Human Capital: Realising Our Human Potential. Executive Summary*
- 2002b *Report of the Entrepreneurship and Internationalisation Subcommittee Economic Review Committee*
- 2006 *Science and Technology Plan 2010*

- Olds K, Thrift N, 2005, "Cultures on the brink: reengineering the soul of capitalism", in *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems* Eds A Ong, S J Collier (Blackwell, Oxford) pp 270–290
- Ong A, 2000, "Graduated sovereignty in South-East Asia" *Theory, Culture and Society* **17**(4) 55–75
- Ong A, 2004, "The Chinese axis: zoning technologies and variegated sovereignty" *Journal of East Asian Studies* **4** 69–96
- Ong A, 2005, "Ecologies of expertise: assembling flows, managing citizenship", in *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems* Eds A Ong, S J Collier (Blackwell, Oxford) pp 337–353
- Perry M, Kong L, Yeoh B, 1997, "Global processes and a developmental city state", in *Singapore: A Developmental City State* Eds M Perry, L Kong, B Yeoh (John Wiley, Chichester, Sussex) pp 1–24
- Piller C, 2004, "A candy store for scientists" *Los Angeles Times* 9 December, page A1
- Rose N, 2001, "The politics of life itself" *Theory, Culture and Society* **18**(6) 1–30
- Rose N, Novas C, 2005, "Biological citizenship", in *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems* Eds A Ong, S J Collier (Blackwell, Oxford) pp 439–463
- Said E, 1978 *Orientalism* (Penguin Books, Harmondsworth, Middx)
- Science* 2003, "Singapore trial halted, British scientist fired" **300** 233
- Shapin S, Schaffer S, 1985, *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton University Press, Princeton, NJ)
- Singapore Medical Association News* 2003, "Medical ethics—do no harm" **35** 7–8
- Straits Times* 2003, "S'pore must avoid becoming a cowboy town for scientists", 12 April
- Straits Times* 2004, "Ethics nod a must for Singapore", 24 November
- Straits Times* 2005, "Demystifying Biopolis: Singapore's top science talent scout", 13 August, pages S4–S5
- Thompson M R, 1996, "Late industrialisers, late democratisers: developmental states in the Asia Pacific" *Third World Quarterly* **17** 625–647
- Tomlinson H, 2004, "Singapore sweetens the pills: formula that lures British scientists: no animal rights protests, minimal red tape and ample cash incentives" *The Guardian* 26 August, page 30
- Wilsdon J, Willis R, 2004, *See-through Science: Why Public Engagement Needs to Move Upstream* (Demos, London)
- WMA, 1964 *Declaration of Helsinki* World Medical Association, <http://www.wma.net/e/policy/b3.htm>
- Wong J, 2004, "The adaptive developmental state in East Asia" *Journal of East Asian Studies* **4** 345–362
- Wong K W, Bunnell T, 2006, "'New economy' discourse and spaces in Singapore: a case study of one-north" *Environment and Planning A* **38** 69–83
- Wynne B, 2001, "Creating public alienation: expert cultures of risk and ethics on GMOs" *Science as Culture* **10** 445–481

**Conditions of use.** This article may be downloaded from the E&P website for personal research by members of subscribing organisations. This PDF may not be placed on any website (or other online distribution system) without permission of the publisher.