

## Boundary Making and ‘Good’ Stem Cell Research (SCR) in Mainland China: Including Bioethics, Excluding Debate

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**Abstract** This study probes into what public Chinese stem cell scientists involve in defining what is ‘good research practice’. Thomas Gieryn in 1983 argued that scientists draw up boundaries between the realm of ‘real science’ and that of ‘pseudoscience’ in order to claim and defend their own territory. The aim was to protect the autonomy of scientific research and to elicit financial support and political backup (Gieryn, *American Sociological Review*, 48(6), 781–795, 1983). This article builds on, redefines and extends Gieryn’s concept of ‘boundary-work’ to apply to and include boundaries between ethical and non-ethical science, while emphasising the global scope of boundary work. It shows how scientists use both ‘science’ and ‘bioethics’ boundaries to demarcate their own territory and to exclude certain publics from debate in the field. By elaborating Gieryn’s concept of boundary work in the new and different context of bioethical science regulation, the article shows how Chinese stem cell scientists, by using both kinds of boundaries—between science and pseudoscience and between ethical and non-ethical science—at the same time welcome and abhor bioethical research regulation. This article also indicates the need to understand this extended form of boundary making in terms of global science collaboration and competition. It shows how the self-awareness of scientists as global actors in stem cell science has led to a moral economy of science and ethics involving global boundaries rather than local conditions. Such boundary making does not just function to strengthen group identity and to elicit political support; it is also mobilised to direct and, in many cases, to ward off discussion with bioethicists and the public.

**Keywords** China · Stem cell research · Boundary making · Research regulation · Bioethics · Public discussion

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## 1 Introduction: Boundary Making—Differentiating Science from Science<sup>1</sup>

Though science ideally is formed of a neutral body of activities bringing us closer to the truth (e.g. Popper 1970), it is hard to find academic literature arguing that the enterprise of science is not part of a social practise that is fundamentally contested. Most approaches, including instrumentalist and pragmatist ones, treat science as a constituent part of society, capable of steering society, and in fact influencing people's health, thinking and environment just as science itself is being influenced by society (Jasanoff 2005; Brown & Webster 2004). The science community is also recognised to have its own culture, which interacts with other cultures in society (e.g. 'Science as Culture'). It is actually hard to find works on the new biosciences and technologies that do not represent these innovations as socially influential, be it as a source of financial investment, an instrument of medical and scientific advancement or a potential danger to the environment, morality and corruption.

Although much has been written on the socio-economic development of technologies and their regulation, few studies exist on the ways in which Chinese scientists regard their particular field of work in a social and global context. In Europe, however, the views of scientists on the relation between their work and society have increasingly become the object of research since the 1980s (e.g. Gieryn 1983; MacKenzie 1990; Franklin 2003; Wainwright et al., 2006). Scientists' interpretations of their work are crucial to the ways in which new applications of science are translated from laboratory into society (Fujimura & Fortun 1996; Hacking 1992). This article builds on Thomas Gieryn's concept of boundary making (1983; 1999). Gieryn showed how, through boundary making, scientists' tried to expand their authority to other knowledge fields, monopolise professional authority and protect their autonomy over professional activities. However, with the development of bioethical research regulation, at first in European countries, a new situation came about in which the public mandate and science activities are seen to encroach onto each others' fields in the creation of bioethical research regulation (see Wainwright et al. 2006). This article aims to give an account of how this confrontation is occurring in China where there has been little public debate on the bioethics of stem cell research.

The article sets out to show how Chinese stem cell researchers create and manipulate boundaries at various socio-political levels to advance their interests in the field, justify resource allocation and build confidence in their field of expertise. Although it is impossible to say to what extent they succeed in this, these forms of boundary making do shed light on how the aims, interests and needs of scientists are packed in various culturally specific strategic forms. Culture here is used in a broad sense, indicating the ways in which science practises are given meaning through scientists' strategic performances drawing on norms and values (Baumann 2002) that vary across geographical localities and socio-political interest groups. In his 'Boundary-Work and the Demarcation of Science from Non-Science' (Gieryn 1983), Gieryn speculated on the strategic value of the reputation of non-scientific

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thinking to scientists. Gieryn argued that scientists draw up boundaries between the realm of science and non-science in order to claim and defend their own territory:

Construction of a boundary between science and varieties of non-science is useful for scientists' pursuit of professional goals: acquisition of intellectual authority and career opportunities; denial of these resources to 'pseudoscientists'; and protection of the autonomy of scientific research from political interference (Gieryn 1983: 781).

In other words, to attract public resources a distinction is made between worthwhile scientific work and fake science. According to Gieryn:

Boundary-work' describes an ideological style found in scientists' attempts to create a public image for science by contrasting it favourably to non-scientific intellectual or technical activities (Gieryn 1983: 781).

This article, however, shows how, apart from the distinction between science and pseudoscience, the distinction between ethical and non-ethical is important to boundary making in the realm of stem cell research. Global discussions on science and policy making have generated awareness in China of the need to elicit cooperation of society, and a need for science to be ethical and culturally appropriate. Human embryonic stem cell research (hESR) is a case in point. Although for some time bioethical scruples regarding stem cell research (SCR), in particular hESR, were seen as the domain of wealthy Western cultures (Sleeboom-Faulkner & Patra 2008), this analysis of boundary making by Chinese scientists shows the importance of conducting bioethical science in the valuation of what is regarded as 'good science'. The claim of performing 'good science' is especially highly charged in a country where regulatory authority is disputed, funding resources are scarce and a political connection and an international academic network are regarded as crucial to the continuity of research. The introduction of bioethics regulation in hESR involves much more than the safety of the donors, the protection of the researcher and the legitimisation of research. In fact, a myriad of often entwined factors play a role in scientists' need to produce what is regarded as 'good science', including the acquisition of government funding, which is increasingly linked to the requirement of bioethical review, the publication in international peer-reviewed journals, the facilitation of international science collaborations and the increasing need for a good image, both internationally and at home.<sup>2</sup>

The reputation of hESR in China has been an important issue to Chinese scientists, especially when the People's Republic of China (PRC) started to support hESR generously after President Bush's decision to no longer fund hESR federally in 2001. The great enthusiasm with which developing countries such as India and the PRC applied themselves to this field has been referred to as filling in the 'bioethical vacuum' (Sleeboom-Faulkner & Patra 2008). Although such description is misleading, as in the US hESR private corporations have continued to be funded abundantly, and elsewhere in the industrialised world hESR also took off and

<sup>2</sup> This need for kosher research is not distributed evenly over all stem cell researchers and their institutes (see Sleeboom-Faulkner 2008).

continued to be generously funded,<sup>3</sup> the reputation of stem cell research in China suffered in the eyes of stem cell researchers themselves. All countries involved in hESR have paid attention to bioethical research regulation and the demarcation between the acceptable and the non-acceptable science. This is also the case in the PRC, where ethical guidelines were created in 2002 and where the Ministry of Health (MoH) published formal guidelines for hESR in 2003.<sup>4</sup> But because there is little transparency about the implementation of the regulation, and as many regard the regulation as ‘permissive’ or ‘loose’, Chinese stem cell scientists have done their best to protect the reputation of both the scientific and bioethical nature of their work. A redefinition of boundary making to include bioethics, therefore, is of high relevance to the ways in which Chinese scientists define ‘good’ hESR practise and to their efforts to impress their audiences. This redefinition of boundary work will shed light on the, now, global nature of the main referents of PRC stem cell scientists, and reveals that ‘the public’ mentioned by Gieryn as a main audience to scientists’ boundary work, is salient by its absence as an audience to the boundary work of stem cell scientists in China.

### 1.1 Method

hESR is controversial in many countries due to its use of human embryos and oocytes, i.e. unfertilised eggs. Bioethical accounts of this biosourcing—methods used to obtain oocytes and embryos—are often based on de-contextualised reviews of the ethical and legal literature. But although international-oriented bioethical regulation is increasingly adopted in Asian countries, styles of governance (Jasanoff 2005), implementation and daily practises vary substantially. This essay, though a culturally embedded account of how stem cell scientists’ boundaries between science and pseudoscience and ethical and unethical do not only define their research field fend of science competition, but also is mobilised to ward off undesired debate and opinions from potential societal opponents. To explore these contexts of SCR, this study draws on over 60 semi-structured interviews, of which 44 with scientists involved in SCR and others with policy makers, medical doctors, nurses, regulators, monks and female workers. Interviews took place in a period of 10 weeks from March to May 2007 and another 9 weeks from October to December 2007. Most of the scientists interviewed belong to well-known science institutions, CAS, CAMS, PUMC, Beijing University, Fudan University, Zhongshan University (Shanghai),

<sup>3</sup> For instance, the UK, Sweden, Israel, Japan, Australia. For discussions on these, see the special issues of *Science as Culture*, Vol. 17, issues 1 & 4).

<sup>4</sup> On 6 October 2001, the ethics committee of the Southern hESR Centre published the ‘General Ethical Guidelines for hESR’ and in 2002, the expert committee of the Ministry of Health published the ‘Proposal for the Supervision of Ethical Principles for hESR’ (10: 175). Both say that research embryos may derive from spare embryos, aborted embryos and cloned embryos. Bioethical regulation for embryo donation include: donation of spare embryos only on a voluntary basis and with informed consent; research is allowed only within 14 days; no return of the blastocyst into the uterus; no use other than for medicine; the coordinator of embryo donation and the researchers may not be one and the same person and the identity of the donor must remain private. The regulation of somatic stem cell nuclear transfer requires oocyte donation to be on a voluntary basis with informed consent. It allows in vitro research within 14 days, prohibits reinsertion to the uterus and only allows the creation of hybrids for research under observation of formal requirements (see Doering 2003; MoH 2003).

Shanghai Jiaotong University, Zhongshan University (Changsha), Renmin University (Guangdong), Hainan Reproductive Medicine Centre and Huazhong Keji University, Wuhan and various hospitals, such as Ruijin Hospital in Shanghai, Zhongshan first and second affiliated hospitals. The stem cell scientists and physicians interviewed are affiliated with institutions of varying status and reputation. But as the image formation, discourse and boundary delineation in Mainland China is central to this article, I refrain from more detailed institutional descriptions.<sup>5</sup> Though I have 'hung around' (Franklin & Roberts 2006) various hospitals and laboratories only for a few days, and in one case nearly a week, opportunities for systematic participant observation were limited. Interviews were conducted in both Chinese and English—the language used being decided by the interviewee—and translations are indicated in the text. This paper also draws on data from the internet, newspapers, textbooks and hospital documentation to describe discussions on science regulation referred to by scientists during interviews.

I have avoided mentioning the names of stem cell scientists and research institutes, not because they need to be anonymised completely in all instances, but because the individual scientists and institutes are not the focus of this paper and therefore should not be drawn attention to. Instead, I refer to them as S0–S25.

This paper is further divided into six sections. Section 2 defines the settings in which scientists were approached for interviews and delineates the initial findings that raised questions about boundary work and its audiences. Section 3 provides an overview of the research results of this study regarding the criteria used most for demarcating other scientists from the interviewee: science/pseudoscience and ethical/not ethical. It also provides the responses to the question as to whether the public should have a say in what is good research practise. These results raise the issue of who, according to Chinese stem cell scientists, should be involved in defining what is 'good research practice'. Sections 4 to 5 illustrate the ways in which scientists demarcate their work from that of others within China and in the West using their views of what is good research practise. Section 6 shows the consequences of these views for 'public debate' and for what constitutes their audience, and section 7 summarises the main arguments.

## 2 Approaching Scientists

My contacting and approaching scientists in the PRC should be viewed as part of a global trend of concern with an interest in stem cell research in Asia, and as a part of this paper's analysis. The number of international researchers, committees, bioethicists and social scientists visiting well-known human embryonic stem cell laboratories in China has increased rapidly over the last few years and has become part of the research reality that scientists are confronted with. When this study commenced, in 2006, scientists were only just beginning to realise the significance of being approachable by non-scientists. This, no doubt, affected the author's ability to contact scientists, which I now briefly comment upon.

<sup>5</sup> For a more detailed analysis of stem cell institutions in China, see Sleeboom-Faulkner 2008.

One scientist I contacted at the beginning of this study, S19 warned me about approaching scientists, after one of his (Chinese) researchers had tried to interview stem cell scientists on bioethics with little success:

They would not like to talk with you. I know my colleagues: they really will not talk with you. You first need to become friends. Then they will say ‘we just follow the rules’. I can guarantee that 95% of the bioscientists do not want to talk about bioethical issue.

Fortunately, I had not as much trouble as my Chinese colleagues, who might have been regarded as more of a bioethical threat.<sup>6</sup> Various factors affect the researcher’s ability to contact scientists in China. They include:

- The treatment of visitors by research institutes and hospitals in general. State research centres are more closed to visitors than are private companies and institutes with assured funding; and military SCR centres require applications for visits, including the screening of visitors.
- Lower level researchers always have to take into account the views of colleagues on their speaking about work with a stranger. Some research institutes require their personnel to report back to superiors for political and bureaucratic reasons (Sleeboom-Faulkner 2008).

Considerations when contacting stem cell scientists and physicians include:

- the busy schedules of scientists (though that is the case, too, in other countries)
- the connection network, reputation and trustworthiness of the researcher; Any topic linked to bioethical issues is sensitive, as relations with bioethicists in China have been difficult, resulting in bad press, and possibly of influence on their career and the name of their affiliations (Sleeboom-Faulkner 2008).<sup>7</sup>
- the perceived advantages and benefits to scientists of speaking with a foreign researcher regarding research publicity, collaboration possibilities and reputation

The question of why busy and ambitious stem cell scientists should speak to a foreign social scientist about the purpose, the circumstances and the history of their research is a relevant one. Interviewing Chinese scientists as a white European female may elicit responses that aim to please (or provoke!) the interviewer. Realising this, the author concentrated on the ways interviewees present their work as worthy of research funding, suitable for international collaboration, as scientifically promising, and beneficial to patients—that is, the way in which politically correct behaviour is presented ideally.

## 2.1 Scientists, their Referents and their Audiences

The question of boundary making occurred first when I realised that stem cell scientists interviewed were keen to delineate their work from ‘Other’ scientists, the kinds of scientists that fabricate data, that are hidden in rural laboratories or the rogue scientist

<sup>6</sup> An observation corroborated by the experience of a Chinese colleague in the UK.

<sup>7</sup> The collaboration between some bioethicists and journalists led to the organisation of satellite conferences for bioethicists to train journalists in ‘fair’ reporting on science.

that do not apply ethical standards in their work. Scientists seemed to delineate themselves from main referents, such as Western scientists, Western bioethics, Chinese bioethicists, the public, the South Korean scientist Hwang Woo-suk—known for the fabrication of research data and low ethical standards, Chinese scientists Huang Hongyun—known for his lucrative but dubious foetal stem cell therapy and Xu Rongxiang—known for claiming the ability to create organs from a superior kind of stem cell therapy (Mann 2003; Cyranoski 2005). All stem cell scientists interviewed (44), but one, distanced themselves from traditional Chinese medicine, associated with the practises of Xu; all claimed to apply international bioethical standards, though seven scientists believed that Chinese bioethics should formulate its own Chinese guidelines. In spite of this emphasis on bioethics, 40 scientists thought it was not necessary to involve the public (other than intellectuals) in a discussion on the bioethics of stem cell research, half of the scientists claimed that Chinese bioethicists did not understand their work sufficiently to be involved in the creation of bioethics guidelines, while all scientists claimed that their research would pass any international standard of bioethical review. In fact, it became clear that in the PRC stem cell scientists do not treat the public or 'the people' (*laobaixing*) as their main audience, but look to the international science community and the Chinese state for recognition. This may be one of the reasons that the author had less problems contacting stem cell scientists compared to some of her Chinese colleagues: the former being associated with an international platform of debate on science and bioethics, while the latter are generalised as potentially stirring up trouble for them on the internet or in Chinese language publications. To better understand the international dynamics of the creation of recommendations and guidelines for international collaborations in the life sciences, the analysis of boundary work by stem cell scientists may shed light on how they relate to bioethicists, the state and the public when it comes to the regulation of stem cell research in the PRC.

### 3 Boundaries Within the Scientific Community

One of the functions of boundary making in science is to enhance the authority of science (Gieryn 1983; 1999). Boundary making makes use of a range of methods of differentiation between science and pseudoscience. In China, these methods are as common as elsewhere and over the last decade various differentiation methods between ethical and unethical science have developed as well. Asking stem cell scientists about 'good' stem cell science yielded not only distinctions between 'real' and 'fake' stem cell science, but also delineations of ethical from unethical science. Below I show how stem cell scientists give contents to the norms and values associated with science practises.

#### 3.1 Science and Pseudoscience

One example of what most stem cell scientists regard as 'fake' science is Traditional Chinese Medicine (TCM). Scientists frequently refer to the boundary between science and TCM. All stem cell scientists but one that I interviewed relegated TCM to the status of pseudoscience. A leading stem cell scientist and regulator in Beijing,



S11, referred to the work of S18 as ‘TCM’, indicating that his work should not be confused with ‘real’ stem cell science. S18 is a financially successful medical doctor and TCM specialist, who in 2006 acquired capital through his patent on therapy for the management of burns. S18, however, describes his academic principle as ‘based on the powerful and vigorous integration of Chinese traditional and modern medicine’ with which he explores and utilises the ‘second life of organs’. S18 claims in both interview and on his website that his method of the adult stem cell cloning of organs is superior by far to methods of hESR used anywhere in the world, demonstrating Chinese scientific creativity and its ability to bring stem cell science to clinical application. Regarding himself as the ‘inventor of in situ and in vitro cell cloning of human organs’, S18 explains how his invention makes use of both TCM and science, criticising science for not understanding the difference between life and death:

Science is factual. But we also need creativity and imagination. But a horse is a horse and a cow is a cow. We should not mistake a horse for a cow. There is also a difference between a thing that is dead and a thing that is alive. Science should reflect upon this enormous difference (transl. by author, S18).

S18 explained how he made use of the ‘second life of cells’, or Potential Regenerative Cell (PRC<sup>+</sup>). When studying skin burns he discovered that the skin was still regenerating. This he attributes to PRC<sup>+</sup>. The ‘second life of cells’, S18 explains, refers to cell regeneration. When cells divide they make a spare copy, a source that can be addressed after an organ is damaged. The life of a cell is about 300 years, but a human life lasts usually no longer than a hundred years. Thus, S18 concludes, at the time of death, two thirds of the cell’s lifespan have not been used up. PRC<sup>+</sup>s then need to be regenerated and empowered, just as stem cells are regenerated through stem cell cloning.

S18 believes that his Chinese colleagues are too much Westernised: ‘it restrains their freedom of research!’ Western science S18 regards as artificial; it is about control and is non-holistic. S18 believes his colleagues criticise him because they are jealous. But S18 himself points an accusing finger to scientific fabricators: ‘After S6 came back from America, he was given money to set up a SCR centre. He was to create foetal membrane, but then he asked his brother to bring it [the membrane] [from America]’ (S18, transl. author). Another fabrication took place in Shanghai. S0 had sewn a human ear, made from cartilage, onto the back of the mouse, pretending it was real. He had learnt this trick in America doing SCR, which S0 claims to have heard through his Shanghai branch. S18 criticises pouring large sums of grant money into science: ‘No matter how good your science, if it does not yield results, then you are a cheat’ (S18, transl. author). Similar arguments appeared on websites in March 2007, when web articles attacked well-known stem cell scientists Li Lingsong and Sheng Huizhen for wasting millions of government money (Chen 2007). They were contrasted with scientific pioneers and ‘real’ scientists that work on practical applications for the needy.

Thus, the boundary between real and fake science, according to stem cell scientist interviewees, lies between scientific theory and successful application. This boundary can be seen as one of the most powerful in current China, as ‘science’ in itself has become the main signifier of progress, wealth and world



power (see Sung 2009). In itself, however, this equation of science with effective applicability and progress is ambiguous. Often investment in stem cell science is justified and legitimised by reference to science as universal knowledge developed in 'the West'. But as stem cell science has not yielded the expected applications and therapeutic breakthrough, according to the criteria used above, it would have to be regarded as 'fake'. However, rather than 'fake', proponents of hESR regard the failure of science to produce results in the form of therapeutic applications and drugs as a matter of delay. But critics of hESR regard such science as unethical.

### 3.2 Bioethically Correct and Incorrect Science

All stem cell scientists I spoke with condemned the clinical application of untested stem cell therapies for large sums of money, such as the stem cell practise of Huang Hongyun, who applies olfactory sheathing cells from foetuses to patients. Scientist S3 from Hainan Province commented:

According to our moral values, we could not allow it. For, scientifically, it has not been shown to have therapeutic effect. [S3] [transl author]

Also, the interviewed scientists that would allow experimentation in desperate cases clearly rejected the exorbitant prices.

Scientists S17 from Guangzhou opposed the use of mesenchymal or derived neural stem cells to rescue people with spinal cord problems in Shanghai and Beijing, simply because he thought it was a bad method. S17 looked for another method: 'It is very difficult to establish a whole organ. Until now it is impossible. We want to make a chimera. We want to use an animal as a human organ incubator.' Here, S17 made a distinction between Hwang's method of 'blind cats catching mice' and sound organ generating methods developed in various forms of mice and other rodents.

Other hESR scientists criticised colleagues for advocating therapeutic cloning. One scientist from Hainan province regarded the wish to use embryos for curing a disease as a bioethical problem, a problem of virtue, ridiculing the idea that common diseases could be treated by such method: the high number of required eggs could never be met. He regarded other forms of hESR, such as cell fusion and basic research, as bioethically superior and of greater scientific value.

The practise of bona fide science is usually contrasted with the practises of small clinics in the country or clandestine research centres. These centres are considered to engage in illegal embryo and oocyte trade, unlike the large hospitals and SCR centres in the metropolises. Thus, embryologist S5 in Guangzhou says:

Recruitment for oocytes is not allowed. Perhaps smaller clandestine centres engage in this kind of work. If the Ministry of Health closes them, they may not care about it. But the larger hospitals have their own resources, and cannot afford to do this. [S5] (trsl author)

Stem cell researchers clearly use government vetting and their affiliation with large university hospitals in the metropolis to justify their own research as ethically correct.

Other ways of delineating ‘good’ stem cell research from ‘inferior’ types of stem cell research is the distinction between scientists that have been abroad and those that have not. It is presumed here that students that have experience in an internationally well-known laboratory acquire a proper scientific training and learn about the norms and standards that make science successful. Success, here, is often equated with having publications in international peer-reviewed high-quality science journals. All researchers that have enjoyed education abroad use this boundary between themselves and those educated in China to indicate their ethical awareness and capacity to work in an ethically sound way. Some criticise other researchers for a lack of international publications, which now has become a regular way of judging scientific results by research funding agencies. The possession of stem cell lines that are compatible internationally is another criterion for indicating the scientific success of one’s laboratory. In SCR, criticism of each others’ stem cell lines or boasting of the creation of extraordinary numbers of stem cell lines is another way of delineating one’s lab and those of collaborators from others. However, claims about the actual publication of stable (characterised) stem cell lines were conspicuously absent, a fact commented upon by S7, a leading life science scientist from the Shanghai Academy of Biological Sciences.

Naturally, scientists that have been abroad are not necessarily good scientists, and having international publications does not guarantee the bioethicity of a scientist. Researchers working under demanding, but little successful PIs, also argue the reverse, that experience abroad makes researchers bioethically savvy and having their names on international publications might lead them to drive their labs too harshly. In fact, nearly half of the PIs involved in somatic SCR partly blame the government for not controlling scientific malpractise in hESR and wasting money. Opponent S19 of hESR blamed the government: ‘you can arrest one million political dissidents in one night, but you cannot control this...!’ (S19)

Among Chinese stem cell scientists notions of ‘bad science’ exist that refer to China’s history of pseudoscience during and after the cultural revolution, including Lysenkoism and TCM (Sleeboom-Faulkner 2008b), but notions of unethical science also build on practises associated with notions of backwardness and lacking in experience in scientifically advanced countries. Within China scientists use both the traditional distinction between ‘real’ science and ‘pseudoscience’ and the more recent distinction between ‘bioethical’ science and ‘bad’ science to delineate themselves from ‘other’ scientists that threaten the field. The concept of science without due bioethical review in interviews signified science that lacks in good research method. Examples included the use of an exorbitant number of eggs and embryos and experimental science applications based on misty procedures in hidden labs in the country. Furthermore, scientists that have not been abroad or do not have international collaborative networks are not expected to produce ‘good’ science. On the other hand, criticism also exists of foreign-educated scientists, whose scientific and bioethical training had led them to promises of scientific results without realising them. Although interviewees made no clear distinction between good science and ethical science, the concepts of ‘bad science’ and ‘fabricated science’ was clearly delineated from ‘unethical science’. This asymmetric use led to the realisation that the fabrication of research data is always considered as ‘bad science’, but that the flexible use of bioethical measures is not necessarily considered as such.

#### 4 Science: Thin Boundaries Between China and the West

Stem cell scientists on the whole do not feel the need to create a boundary between their scientific practise and 'Western' science; in fact, most stem cell scientists claim that there is just one universal science. In this sense there are no boundaries between the two. And, although scientists put more faith in Western science, regard foreign-educated scientists as having more potential than domestic-educated scientists, and although the scientists were unanimous in their view that bioethics should be part of science, they did not view China's scientific future potential in any way as less promising compared to science in the West. This section explains how boundary work underpins this seeming contradiction between regarding science as universal and view Chinese bioethics as particular to China. After showing that great variety of views exists towards the embryo, I argue that boundary work does not just serve the protection of the field of stem cell research, but also is used to accommodate various notions of bioethics to facilitate variable practises of stem cell research.

When asked about China's science prospects in the area of hESR, I received the following variety of responses:

- China is more scientific than the West, because of Confucianism: its leaders are engineers, not lawyers or actors (S22).
- China has no religious ceremony and rites, it does not need to have tokens of respect for embryos (S3).
- In China the animal and human embryo can be seen as a person (S5).
- China is not religious (S1; S3; S10).
- In China views of spirits/soul (*linghun*) are ambivalent. Though it can enter the embryo, the embryo is not treated as having a spirit (S8).
- As China is not religious, it has a good supply of embryos and fetuses. This is different from the US, where scientists are scared to be shot by anti-abortionists (S4, S20, S19).

Despite the relative advantage China is thought to have in hESR, due to the presumed indifference of the Chinese towards embryo research, all large laboratories and hospitals I visited expressed the wish to participate in international research and to adopt international bioethical institutions. Thus, the majority of the stem cell scientists criticised the government for not stopping commercial stem cell/foetal research practises by Huang Hongyun and others, as they feel that they spoil the reputation of bona fide stem cell researchers.<sup>8</sup> Various research institutes also ask leading international scientists to become part of their IRBs (S16, S17, S23, S1, S25). The expensive and labour-intensive efforts of creating IRBs, including the design of informed consent forms and taking time to speak with patients, cause much havoc in hospitals and research institutes. But these institutes hope to be

<sup>8</sup> In fact, their appeal has been successful, as on 1 May 2009 regulation came into effect that characterise all stem cell therapies as 'Category 3', which are defined as ethically problematic and taken direct responsibility for by the Ministry of Health (Cyranoski 2009: 146–147).

rewarded by international acknowledgement. A prestigious stem cell scientist (S2) from Guangzhou said:

We don't care about the embryo, but the West cares. Therefore we need international regulation' (S2).

At least four other scientists expressed similar points of view (S25, S10, S4, S26).

Considering the tremendous efforts put into creating bioethics institutions, it is not surprising that most Chinese scientists get upset when discussing, in their view, the lack of bioethical regulation in the US private SCR sector, and the comparatively large sums invested in hESR by the Californian government (S4, S1): 'But the US has the least strict regulation!' says S23: 'Stanford Ladies eggs are advertised for 500 US\$!' The American example frequently invokes sneers about 'strong individualism', 'the lack of protection for the poor and ignorant', and the 'anarchic situation in the private stem cell research sector,' and it is certainly not regarded as a model for emulation. All scientists interviewed claim that China has a strong need for bioethics, both to gain international acceptance and to protect the poor and those who are vulnerable at home. A problem is, however, that the bioethics imported by Chinese scientists often is adopted from the USA, while bioethicists seem to be influenced by the detailed bioethical regulation for stem cell research in the UK. The different attitude towards regulation may be partly responsible for the great variety in views among scientists on the need for importing 'Western' bioethics institutions. Although most scientists say their hospital/research centre needs Western bioethics, one scientist (S10) was not alone in voicing the opinion that China, with its own concept of life, should not copy bioethical rules:

Strong nations with their concept of soul push around weaker nations without.  
(S10)

This scientist argued that 'China should be able to compensate women for the donation of embryos'. However, another scientist fiercely argued for respecting the dignity of man, accusing Western capitalism of commodifying embryos (S19). Again, another scientist said he could not be bothered about creating ethics, arguing that 'donating oocytes is the same as donating blood for experiments' (S2), while still another felt that 'Animals are in greater need of bioethics than are humans' (S17), while yet another scientist argued that 'More research ethics needs to be taught in hospitals rather than in society' (S3).

Views on what kind of bioethical institutions are needed and for what purpose, then, vary enormously. Although each scientist's 'Chinese' view of hESR is embedded in Chinese society, all scientists concluded that international bioethics institutions are needed as a part of the progress of science. Another example illustrating how views of scientists on life are overshadowed by what is considered to be international bioethics is that of 'life as a continuous flow', a view also commonly held internationally among developmental biologists. One of the most important 'cultural' justifications for using embryos and oocytes in SCR in China is the 'Buddhist' view that 'life is continuous': no particular boundaries can be drawn between life and death and between species. In this view, it makes no sense to ask about the beginning of life or when a human shape becomes a person, as life is a continuous process. Whether this is a particular Asian way of thinking about life or

not, Chinese researchers quote it to legitimate the use of embryos and oocytes in hESR. Interestingly, the only researcher among the interviewees that pointed out the importance of saying whether something is dead or alive was the scientist that claims to use TMC in his work on 'stem cells' (S18). Though he regards the embryo as a live human being, he added not without cynicism: 'we need to kill the lives of a few to save the lives of the many in the name of The Way' (*Da Dao*), implying science. But despite the doubts about the discontinuity of life, all researchers insisted that they (would) use international bioethical standards, claiming that research on cloned embryos can continue for 14 days, after they have to be discarded (S1). Although such ideological flexibility is not unique to China, the way it is expressed in boundary making no doubt is.

Although it is clear that most scientists agree that science is universal, and that bioethics institutions should be part of it, Chinese stem cell scientists refer to the religious, ethical and socio-political advantages China has over the West as characterising Chinese bioethics. Again, although all stem cell scientists express their support for adopting international bioethical guidelines, the ways in which these guidelines should be interpreted and the context in which they are Sinified, make scientists also believe that bioethics makes it possible for Chinese science to develop an edge over scientific development abroad. Still, great discrepancies of views exist as to the kind of bioethics that should be adopted. Scientists consider the international bioethics they have adopted as more than adequate, while they regard the ethics that Chinese bioethicists want to adopt as relatively strict. Rather than adopting a translation of Western bioethics, various stem cell researchers have expressed the wish for a bioethics with Chinese characteristics. In short, boundary making includes the definition of the ethical in such a way that it is perceived to be advantageous to the development of 'scientific' stem cell practises in China.

## 5 Boundary Making: Including Bioethics, Excluding the Public

Boundary making in science does not just aim to enhance the authority of science (Gieryn 1983; 1999), it also incorporates non-science parts of society through bioethical discussion, including science policy making, public discussion and bioethics regulation (Wainwright et al. 2006). The incorporation of non-science elements into the process of boundary making, such as bioethics committees, could enhance the position of scientists internationally and at home if such boundaries are perceived to correspond to reality. Bioethics then can be regarded as a new source used to mediate between the 'uncomfortable' boundaries between the scientific and the social in a global and a local context. Some of the boundaries bioethics mediates are common to many societies, including decision making around embryo and oocyte donation and the public discussion about it. The ways in which the boundaries are discussed, however, vary per society as a result of discursive differences and because of the divergent circumstances in which SCR takes place in China as a developing country, as a socialist country, and as a country with its own cultural and political history. For instance, the concept of public involvement has been in constant flux even in Chinese recent history. Mao's so-called 'mass line' required policy making to be based on the participation of the masses. But this, in

the 1960s, also meant that the alleged science of the masses resulted in crude political interference with the life sciences (Sleeboom-Faulkner 2008). Partly as a result of this traumatic experience, life scientists are wary of any external interference. On the other hand, life scientists put efforts into gaining the cooperation and participation of the public when it comes to the provision of tissue samples, participation in medical trials and trust in their expertise and integrity when it comes to blood banking, safety and security. Exceptional scientists, such as Pei Xuetao, have also started engaging in public discussion by writing popular books on stem cell science with public participation in mind (Pei 2002). Nevertheless, the general view on public engagement among scientists was negative.

At a discursive level stem cell scientists mobilised various kinds of argument to persuade the author (a foreigner) of ‘the Chinese stance’ on stem cell research. Stem cell scientist, generally, do not favour the inclusion of the public, as it draws attention to ‘uncomfortable’ disputes about oocyte and embryo donation. Asked about the need for public discussion on the donation of embryos and oocytes, over 90% of the stem cell scientists interviewed said that China would be ill advised to start one. The various reasons scientists provided for this can be summarised as follows:

- i. As China is an atheist country, there is no need for public discussion.

According to this widely found view among scientists, China is not a religious country, but an atheist, socialist country: The Chinese do not believe in God. Therefore embryos have no special status and abortion is no problem. A public discussion is not needed. Peasants think that life starts after birth (e.g. S3, S10, S11). These scientists express the belief that, unlike the Christian West, atheist China does not need to have a discussion on the bioethical aspects of embryo donation as life before birth is not a religious issue in China.

- ii. Superstitious people would veto donation in public discussion.

A second view regards superstition among the rural population as problematic. According to this view, educated people donate oocytes and embryos, but not the country-people. They regard blood, semen, organs, bone marrow and other bodily tissues as precious. This belief has roots in Taoism and Confucianism (e.g. S22, S5, S8). Such people would make any donation impossible, so they should not have a say in the discussion.

- iii. Due to a lack of education, the people are not fit to participate in public debate.

A third view regards the people unfit as partners in discussion and comprises the following opinions: If you talk about oocyte donation, people think about cohabitation. How can you have a debate with them? (e.g. S3, S9, S22). People are superstitious and pragmatic at the same time: they pray to Guan Yin when they want a baby. They do not really want to discuss things [see, Fig. 1: Guan Yin in the IVF department in a fertility cum stem cell research centre] (e.g. S9, S3, S5, S8, S14). We need to teach the people bioethics so that they can protect themselves. After that we can have a debate (e.g. S9, S3, S16, S5, S8).

- iv. Due to the backwardness of the countryside, inadequate discussion could thwart the position of vulnerable women.



**Fig. 1** A photograph of Guan Yin in the IVF department in a fertility cum stem cell research centre. People pray to Guan Yin when they want a baby

According to a fourth view, Chinese rural areas are so backward that a public discussion could endanger the vulnerable position of women. According to this argument, in China women should not be asked to donate oocytes to science. For in the backward countryside, it is important for women to be a virgin when they marry. If in the countryside women were forced to donate oocytes, this would thwart their position. For this reason, it is argued, regulation is preferable to public discussion (S23, S9).

- v. Due to their materialist attitudes, the people could not be expected to participate in public discussion on embryo or oocyte donation.

According to a fifth view, public discussion would be meaningless, as it requires people to be interested in the topic. In this view, people only care about house prices and buying things (S23). People may be able to understand science, but they need to care about it in order to discuss it (e.g. S10, S11, S23).

In short, reasons scientists provide for not holding public discussion are contradictory, as some scientists regard China too atheist to have a public discussion while others regard China as too superstitious and backward to have one. Those belonging to the first group believe that IVF patients should be able to donate against a reduction of the fees. Stem cell research here is pictured as promising treatment for widespread diseases in China, including thalassemia, muscular dystrophy, Alzheimer's disease and liver cancer (e.g. S25, S23, S17, S18). Little mention, however, is made of the abominable state of the healthcare system (Yang 2008; Liu & Rao 2006; Wang et al. 2007), making it unlikely that the average



patient will ever benefit from those therapies during their lifetime. This situation suggests that patients could benefit from a voice in the discussion.

Scientists sharing the second view of China being too backward and superstitious for public discussion, at the same time, regard IVF treatment as important exactly due to the alleged superstition of people in the countryside. One scientist argued that precisely for this reason, the need to help infertile women in the 'backward' Chinese countryside is great (S9). Others argued that Chinese families (especially in rural regions) need to have children to continue the family line and to honour the ancestors and perform rites: without children a woman means nothing; and without sons she risks divorce (S8, S5, S3).

In short, stem cell scientists' views on the ability of the Chinese public to participate in public debate on the donation of reproductive materials indicate that the majority find the Chinese people incapable, unsuitable or uninterested to do so. Stated reasons involve lack of education, materialism, superstition, backwardness and poverty. Although scientists regard bioethics as a boundary value of science, they do not use it to incorporate their home audience into their research field.

## **6 How Bioethical Boundary Work for an International Audience Saves Scientists from Public Discussion at Home**

This section shows how, in China, due to a shortage of healthcare coverage and a demand for IVF treatment clandestine practises that violate bioethical regulation are encouraged. Though public discussion on embryo and oocyte donation could provide awareness of the danger and unethicity of some practises, it is not in the interest of scientists employed in both the high level hospitals and laboratories with ample funding or other hospitals and laboratories to initiate a public discussion, as it has the potency to tarnish their reputation and hamper any attempt at engaging in international collaboration. Additionally, to save or earn money, exchanges of reproductive materials between patients and hospitals and hospitals and research centres are routinely practised and regarded as beneficial for all parties involved, even when they involve bioethical issues.

In China, since the late 1970s, the healthcare system in rural areas was virtually dismantled; only a small minority of the rural population has (limited) healthcare coverage, while a minority in urban regions has health insurance (Wang et al. 2007; Liu & Rao 2006). As a result, the need for medical treatment can mean the bankruptcy of the entire family household. Similarly, infertility often leads to the spending of a fortune for IVF treatment, which is offered in certified hospitals of which there are over 80 and which are run commercially (Yang 2008; Special Issue of *The Lancet*, 20 October 2008). As the treatment is forbiddingly expensive for many families, cheaper clandestine practises have spread. Without effective supervision of all reproductive hospitals, it is hard to control the trade and barter in embryos, fetuses and oocytes between hospitals and research centres. Although large high-class hospitals are unlikely to take the risk of engaging in serious illegal practises, hospitals that are making losses and private clinics are hard to control.

The quality and derivation of material and knowledge resources in stem cell research centres vary greatly. A number of core university hospitals are eligible for

state research funding (Hong 2008), though others manage to acquire local municipal or provincial state funding or grant funding from the Priority R&D Programmes 973 and 863. A stem cell scientist with good national and international contacts, S4, expressed the spirit:

In China, 50 out of 100 Yuan funding from the central government will go to Beijing because they are government ranking officials, and also the government does everything first for Beijing; 25 will go to Shanghai. Nationwide the remaining 25 goes to the remaining cities, to Hangzhou, Guangzhou, these coastal cities. Then the local governments give you a one to one match. But here when we get one dollar we only get 80 cents, because the local government, the hospital and the university, will try to get these 20 cents.

Many research centres have arrangements with hospitals that partner them when applying for state grants. In this way, stem cell researchers can be assured of a regular supply of bioresources, while hospitals receive extra research funding. Stem cell researchers without hospital ties have to look elsewhere for resources to continue their research, although this would violate official guidelines. Stem cell research centres and hospitals are regulated by two different ministries (Zhai 2004). The MoH checks the artificial reproductive technologies and its regulatory supervision is regarded as stricter than is the regulatory supervision for SCR in research centres, which is overseen by Ministry of Science and Technology.<sup>9</sup> Stem cell researchers in prestigious research centres usually make sure that there is an institutional review board (IRB) in place. It is the task of IRBs to discuss whether medical interventions and research practises involving human biological materials occur in agreement with medical protocol and bioethical regulation. Some institutes try to involve prestigious international figures to ensure their reputation necessary for acquiring international collaborative partnerships and for publishing in internationally peer-reviewed journals. Success in research requires that the international science community is persuaded of the ethical and safety of their research practises: the conformation to bioethical regulation is a condition for international recognition and publication in international peer-reviewed journals.

The following conversation with well-known Chinese scientists may provide an idea of the problems related to the functioning of IRBs in the eyes of at least some scholars:

S13: Nowadays IRBs are also important.

S19: No. These are set up mainly to fool foreigners.

S13: Yes, it is to fool them, but...

S19: It is like this.

MSF: Do most hospitals have an IRB or not?

S19: No, they don't. They should be formulating clear guidelines and supervising them.

<sup>9</sup> The MoH was responsible for the Moh Ethical Principles of Human Assisted Reproductive Technologies (2003) and the MoH Guidelines on Human Assisted Reproductive Technologies (2003), while MoST and MoH issues the Ethical Guidance on Human Embryonic Stem Cell Research (2004) (Zhai 2004). The MoST, however, oversees stem cell research.

- MSF: How about hospitals? Are there bioethics committees in hospitals?
- S19: Any progress we have to welcome. It is better to have an IRB than not. I am a member of the *Expert Committee for the National Office on Regulations of XX*.<sup>10</sup> It is in the official documents that any application has to be approved by the IRB. Then they set up an IRB in three minutes and ask the professors sign. Then they have an IRB. I think half a dozen at least are like that. If you ask ‘Do you really have an IRB by law’, then.... The only way [forward] is to discuss with them why we need an IRB and what it should do.
- MSF: What do you think are the functions of an IRB?
- S19: First it must be a group of multidisciplinary people. Then they have to discuss and say to people what is right and wrong. Then we can say ‘no’ sometimes, remind scientists or clinicians that we cannot do anything we like. People should know there is something like a reliable IRB and like bioethics.
- MSF: Is there no state overview?
- S19: It is also cultural. If nobody complains, then they would not actively... If the people do not report to the authorities, then they will not investigate [Min bu gao, guan bu zhao] [transl. author]

The openness of the discussion with S19 and S13 is a rarity, but made blatantly clear what was already apparent observing the struggles some scientists explaining the functions of the IRB and its history in their institution. The explanation for the lack of state supervision by S19 is striking, as in S19’s view no bioethical problems exist in practise as long as the people do not report it. Not surprisingly, in this scientists’ view, public discussion would mean an improvement in the functioning of IRBs though he recognised areas of science, including his own, in which this would not be necessary.

It is in a situation of unequal access to healthcare and different quality levels of stem cell research centres that bioethics institutions of different quality have evolved. In combination with the lack of effective supervisory bodies this makes for a patchy control and review of research practise. Although scientists recognise that patients and vulnerable groups, especially rural women, need protection, the use of public discussion and education among lay people is usually denied. It is therefore ironic that the international science community is the audience involved in bioethics discussions on stem cell research practises in China, rather than the Chinese population and its patient.

## 7 Conclusion

In this article, Gieryn’s concept of boundary making was redefined, extended and applied to SCR in China, and Wainwright et al.’s claim that scientists incorporate bioethics into boundary making (Wainwright et al. 2006) was shown to be applicable to Chinese scientists’ views on good SCR. But, although bioethics turned out to be of great importance to Chinese scientists, this is a result of international competition rather than of involving domestic views on hESR. In the current Chinese science community, belonging to the international science community is of crucial importance to stem cell scientists. Most stem cell scientists regard science as

<sup>10</sup> The name of the location of the office is anonymised.

universal, and many scientists try to distance themselves from what they regard as 'backward Chinese science in rural areas', Chinese Traditional Medicine and research that ignores bioethical procedures. But due to the funding shortage and diversity in research quality in China, only a few stem cell centres can afford the expenses associated with good laboratory practise and internationally acknowledged standards for bioethical review. This diversity is also expressed by scientists that recognise a great discrepancy between the levels of 'good science' within China. Through boundary work then scientists try to elicit financial support and legitimise the role of particular scientific practises, creating boundaries within the scientific communities and within society.

As far as the scientists' current scientific research is concerned, boundaries between science in China and the West are hardly recognised; but when future prospects of stem cell research between China as a whole are compared with those in the West, interviewees believe that religious and socio-political factors favour China. Ideological boundary work, then, goes beyond the delineation of science from pseudoscience: Society, bioethics and international politics are increasingly included into scientists' views of good science, showing a growing awareness of the social relevance of research and the dependence of research support and publications on an international public. Nevertheless, the majority of Chinese stem cell scientists regarded inviting the Chinese non-academic public to voice its views on stem cell research as a futile and unnecessary exercise. Although stem cell scientists regard bioethics as a necessary element of good research, it is not the domestic public that is adopted as scientists' natural audience, but the international science community and the growing bioethics movement within China.

Bioethics, international research standards and modern science facilities can distinguish one's institute positively above 'lacking' others. Stable stem cell lines (rather than uncharacterised ones), animal facilities (rather than farms), foreign research experience, international publications (rather than Chinese publications) and bioethics institutions are all used as signifiers of 'good science', contrasted with the scientific backwardness of competitors. To scientists, then, the 'international science community' rather than the 'ordinary Chinese people' (*laobaixing*) plays the main role as audience in the bioethics debate on hESR and SCR in China. The second main audience of scientists' boundary making is the growing movement of bioethics, which has its roots in the 1980s, grew in political clout in the late 1990s and became a force to reckon with in this century. With the exception of a few groups of stem cell scientists, the majority showed great reservations about discussions with bioethicists, claiming that Chinese bioethicists, unlike foreign bioethicists, are incapable of understanding their science, their needs and those of China. In the minds of the majority of stem cell scientists the domestic public in China is absent as a worthy partner of discussion. Although bioethics may be used in many countries to draw society within the boundaries of science, in China, the relationship between scientists and public remains hierarchic. Despite the fact that patients donate reproductive materials to hESR, and even though 'the people' are usually quoted as the ultimate benefactors of the future fruits of hESR, in the minds of the majority of scientists they are not ready to have views on this matter. As long as these boundaries are defended by a majority of stem cell scientists, conversation with either public or bioethics movement will remain trying.

## References

- Baumann, G. (2002). *Contesting culture. Discourses of identity in multi-ethnic London*. Cambridge: Cambridge Studies in Social and Cultural Anthropology.
- Brown, N., & Webster, A. (2004). *New medical technologies and society. Reordering life*. Cambridge: Polity Press.
- Chen, Wanduo (2007) Guojia Zhongdian Keyan Xiangmu 973, 863 jihua juran xuancuo shouxi kexuejia le? Yizhi shu qianwan yuan keyan jingfei da le shuipiao? [Have the Priority R&D Programmes 973 and 863 chosen the wrong scientific leaders? Have a few tens of million Yuan been wasted?], Qingnian Zhoumou [Weekend Youth], 15 March 2007.
- Cyranski, D. (2005). Fetal-cell therapy: Paper chase. *Nature*, 437, 810–811 (6 October 2005).
- Cyranski, D. (2009). Stem cell therapy faces more scrutiny in China. *Nature*, 459, 146–147.
- Doering, O. (2003). Chinese researchers promote biomedical regulations: What are the motives of the biopolitical dawn in China and where are they heading? *Kennedy Institute of Ethics Journal*, 14(1), 39–46.
- Franklin, S (2003) Ethical biocapital: New strategies of cell culture. In Franklin & Lock (2003) *Remaking life & death. Toward an anthropology of the biosciences*, (pp. 97–127). Oxford: James Currey; Santa Fe: School of American Research Press.
- Franklin, S., & Roberts, C. (2006). *Born and made. An ethnography of preimplantation genetic diagnosis*. Princeton: Princeton University Press.
- Fujimura, J. H., & Fortun, M. (1996). Constructing knowledge across social worlds. The case of DNA sequence databases in molecular biology. In L. Nader (Ed.), *Naked science. Anthropological inquiry into boundaries, power, and knowledge* (pp. 160–173). London: Routledge.
- Gieryn, T. F. (1983). Boundary-work and the demarcation of science from non-science: Strains and interests in professional ideologies of scientists. *American Sociological Review*, 48(6), 781–795.
- Gieryn, T. F. (1999). *Cultural boundaries of science: Credibility on the line*. Chicago: Chicago University Press.
- Hacking, I. (1992). The self-vidomation of the laboratory sciences. In A. Pickering (Ed.), *Science practice and ordinary action: Ethnomethodology and social studies of science* (pp. 29–64). Chicago: University of Chicago Press.
- Hong, W. (2008). Decline of the center: The decentralizing process of knowledge transfer of Chinese universities from 1985 to 2004. *Research Policy*, 37, 580–595.
- Jasanoff, S. (2005). *Designs on nature: Science and democracy in Europe and the United States*. Princeton: Princeton University Press.
- Liu, Y., & Rao K. (2006). Providing health insurance in rural china: from research to policy. *Journal of Health Politics, Policy and Law*, 31, 1, February 2006.
- MacKenzie, D. (1990). *Inventing accuracy: A historical sociology of nuclear missile guidance*. Cambridge: MIT Press.
- Mann, C. C. (2003). The first cloning superpower. *Wired Com*, 11 Jan., [online] Available at: [http://www.wired.com/wired/archive/11.01/cloning\\_pr.html](http://www.wired.com/wired/archive/11.01/cloning_pr.html).
- MoH. (2003) Ethical Guiding Principles on Human Embryonic Stem Cell Research (2003-460), (Promulgated by the Ministry of Science and Technology and the Ministry of Health, People's Republic of China on December 24, 2003. Available at: [http://www.chinaphs.org/bioethics/regulations\\_&\\_laws.htm#\\_Toc113106142](http://www.chinaphs.org/bioethics/regulations_&_laws.htm#_Toc113106142)).
- Pei, X. (main ed.) (2002). *Ganxibao Jishu* [Stem cell technology]. Beijing: Huaxue Gongye Chubanshe.
- Popper, KR (1970) Normal science and its dangers. In: Lakatos & Musgrave (Eds.), *Criticism and the growth of knowledge*, (pp. 51–9). New York: Columbia University Press.
- Sleeboom-Faulkner, M. (2008). The changing nature of ideology in the life sciences in the People's Republic of China (PRC). Case studies of human cloning and human embryonic stem cell research (hESR) in medical textbooks (1996–2005). *Biosocieties*, 3, 21–36.
- Sleeboom-Faulkner, M., & Patra, P. K. (2008). The bioethical vacuum: National policies on human embryonic stem cell research in India and China. *Journal of International Biotechnology Law [JIBL]*, 5(6), 221–234.
- Sung, W.-C. (2009). Within border: Risks and the development of biobanking in China. In M. Sleeboom-Faulkner (Ed.), *Human genetic biobanking in Asia* (pp. 178–198). London: Routledge.
- Wainwright, S. P., Williams, C., Michael, M., Farsides, B., & Cribb, A. (2006). Ethical boundary-work in the embryonic stem cell laboratory. *Sociology of Health & Illness*, 28(6), 732–748.
- Wang, M.-L., Zhang, S., & Wang, X.-W. (2007). *WTO, globalization and China's health care system*. Houndmills, Basingstoke & New York: Palgrave Macmillan.

- Yang, J. (2008). The power relationships between doctors, patients and the Party-state under the impact of red packets in the Chinese health-care system. Unpublished manuscript of *PhD dissertation, School of social sciences and International Studies, University of New South Wales*, August 2008.
- Zhai, X. (2004). ABA country report for China 2003. *Eubios Journal of Asian and International Bioethics*, 14(2004), 5–10.