

The UK Stem Cell Bank as Performative Architecture

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Introduction

In September 2006 the UK Stem Cell Bank made its first human embryonic stem cell (hESC) material available for wider distribution (Sample 2006). It was a significant moment. As the first publicly funded stem cell bank of its type – with both a practical distribution and regulatory function – its release of cellular material symbolised the coming of age of a new regulatory force in the international movement of hESC lines. It represented a further step forward in the co-development of innovative science and innovative governance procedures. This act of ‘institutional biosociality’ (Brown & Michael 2004) was the culmination of a project promoted by the House of Lords Stem Cell Research Select Committee in 2002 intended to put the UK at the forefront of international stem cell science and ensure an ethically vigorous and quality assured hESC science. Furthermore, the UK Stem Cell Bank is globally important in the performance of a particular vision of socially legitimate stem cell science (Authors forthcoming).

This paper reflects upon the ‘performative architecture’ of the UK Stem Cell Bank – the pathways and flows constituting the very physicality of the building. We unpack the symbolism and practice of the space in relation to the pursuit of a socially legitimate and quality assured science. The study of the performativity of localised geographical spaces in bio-science is not new. Nigel Thrift (2006) has used the concept in relation to buildings such as the Centre for Life at the University of Newcastle and the Wellcome Trust Biocentre at the University of Dundee. He uses the concept to explicate how the architectural shaping of these purpose-built structures enacts their role as “innovation incubators” (p.292) as “gleaming temples to interdisciplinary bioscience” (p.292). Thrift identifies five features common to these buildings that facilitate this performance – their interdisciplinary mixing of office and lab space; their porous through-flows of information and personnel; their creative sociability in a buzz generating café culture; their physical transparency; and their frequent explicit representation of ‘life’ in their structuring. The localised geography

and architecture of such buildings create spaces of bio-scientific innovation and invention.

However in this paper we want to focus upon a different type of performativity at the UK Stem Cell Bank. Instead of innovate spaces, we will illustrate how the geographical structuring of the Bank produces a metaphorical vision of sterility. The paper will provide a much more closely inspected empirical analysis of the space than Thrifts comparable work, detailing the physical and symbolic boundaries an individual must cross while journeying from a publicly available space into the privileged space of the hESC material in the Bank's laboratory space.

Our analysis differs to Thrifts in another way, reflecting the differences between the physicality of the UK Stem Cell Bank and the types of large scale facilities Thrift is discussing. Although both are modern purpose built structures, the Bank is not, externally at least, an ostentatious building. The Bank is currently housed in a small temporary building – often described as a porta-cabin - attached to a wider biological standards institution. It houses a small number of the Banks staff and three sophisticated laboratories¹.

The geographical shaping of the Bank has associated technologies of clothing and environment that mediate the individual's journey into the heart of the Bank. The empirical section of this paper details how, at each stage of entrance into the Banks sterile laboratory space, the ritualistic treatment of technologies and geographies act as accrediting artefacts of the Bank's legitimacy within a diversity of social networks and affiliations.

The paper is in three sections. This first introduces the UK Stem Cell Bank and locates its activities in a wider regulatory and political context. The second section describes the empirical content of the paper. It provides an account of the journey into the UK Stem Cell Bank's laboratory space detailing the boundaries that are crossed and their associated rituals of clothing and environment. Following Hirschauer (1991) we to unpack the lived experience of a sterile setting. The wider embodiment of, and connections to, networks of social legitimacy are made explicit at each stage of the journey. The third section reflects upon this description by

¹ A larger two story permanent building for the Bank on the same site is currently at the planning stage and is due to open in 2009. The symbolic reading of the 'temporary building' by those associated with the Bank is interesting. It is never interpreted as a sign of the Banks potential transience or lack of future orientated vision. Instead it is proudly presented as a symbol of the Bank's world leading status and efficient organisation through reference to the speed with which a temporary building can be made operable in comparison to a permanent build (Stacey 2004).

considering how pollution beliefs, ritualistic practice, and wider symbolic significance enable the UK Stem Cell Banks work².

The UK Stem Cell Bank: Political and Regulatory Context

The UK Stem Cell Bank is a repository for adult/somatic and hESC lines (Stacey 2004), although to date has only handled hESC material. It was officially opened in May 2004 and is located at the National Institute for Biological Standards and Control at Potters Bar, north of London. Funded by the government's Medical Research Council (MRC) (75%) and the Biotechnology and Biological Sciences Research Council (BBSRC) (25%), both government-funded research councils, it has a regulatory capacity concerning the movement of hESC material in and out of the UK.

This regulatory capacity is set in a landscape of wider shifting regulatory boundaries (Brown, Faulkner, Kent & Michael 2006) and moral controversy. The ethical issues are well documented elsewhere³, but we should note that the most prevalent issues in the discourse are the inherent destruction of the embryo in hESC derivation, the informed consent of the donor, and the risks to women of undergoing egg donation. Further complexity is added through the vastly varying international regulatory positions on the issue, with the UK towards the permissive and liberal, yet tightly administered, end of the scale while others, such as Italy, ban hESC work outright (The UK Stem Cell Initiative 2005). Decisions at the Bank relating to these social and global issues are taken by the 'Steering Committee for the UK Stem Cell Bank and for the Use of Stem Cell Lines' - an interdisciplinary group of stem-cell scientists, social scientists, ethicists, clinicians and 'lay-members'. They develop codes of practice for the use of hESC lines in the UK and pass judgement on which donations to the Bank are ethically acceptable and which requests to access banked hESC lines are scientifically worthwhile and socially sound.

However, here we focus upon the UK Stem Cell Banks' laboratory space itself. It is an important instrument of international governance, subjecting all hESC donations to the Bank to a thorough quality assurance and characterisation regime that – should a hESC line fail – would prohibit its further distribution via the Bank. And it

² The paper draws upon two wider projects conducted by the authors using ethnographic fieldwork at the UK Stem Cell Bank. Author 1 has been working as an embedded researcher at the UK Stem Cell Bank since July 2005, conducting observations and in-depth interviews with the Bank Staff and wider supporting agencies.

³ See Holm (2002), Bok et al (2004), Holland et al (2001) & Lanza (2006) for a discussion of ethical issues relating to hESCs and stem cell banking.

is exactly this process – of securing a socially legitimate space of quality assurance – that we unpack in this paper.

*From Public Spaces to Sterile Laboratory Space: Technologies of clothing & environment at the UK Stem Cell Bank*⁴

The UK Stem Cell Bank is situated at the National Institute for Biological Standards and Control (NIBSC) next to a Cancer Research UK building on a narrow leafy lane adjacent to the small picture-postcard English village of Ridge. This lane is the final publicly available space before entering NIBSC, and is the final space an individual experiences on their journey into the Bank's laboratories that is not subject to specific regulation relating to cutting edge bioscience. As well as the UK Stem Cell Bank, NIBSC also houses researchers working as world leaders on a range of biological issues, and with these settings come necessary security procedures.

These security measures introduce the first barrier on the journey into the UK Stem Cell Bank's laboratory space. Upon approaching the NIBSC drive-way the individual's pathway is blocked by a lowered bar and security lodge. Staff at NIBSC have personal ID cards that grant them access. Others must be checked by security guards against a list of scheduled visitors. If present, they are given a visitors card that they attach to their clothing. The cards have magnetic strips that are necessary to enter the NIBSC main entrance at the other end of the driveway. Once past this and in reception visitors are again logged in, signed in, and must await their designated contact before being escorted around the building. Throughout the building doors are found with magnetic swipe card readers that only allow entrance to those deemed suitable. One such door blocks the pathway from reception into the UK Stem Cell Bank. Only a handful of NIBSC staff possess a card that allows them access through this physically imposing boundary between public space and the Banks laboratory space.

Wearing these cards in the carefully organised geographical layout of NIBSC is an important clothing ritual with both symbolic and technical function. For NIBSC they embody the institutions adherence with wider security commitments. For NIBSC staff they represent their legitimacy to enter the NIBSC space. For the visitor, it embodies their location within a social network of relative trust with the NIBSC

⁴ As we discuss later in the paper, the specifics of each boundary crossed on the journey into the Banks space have changed over time. The account here details the journey in early 2006.

staff. Whoever the wearer, the cards embody the holder's specific location within a hierarchical social network. The ability of some wearers card to allow them access, and the inability of others card to do so, confers privilege to the Bank's space.

Once through the final swipe card operated door into the UK Stem Cell Bank the individual encounters a very different type of boundary. About one metre into the Bank's purpose built building there is a blue line on the floor. This demarks a space the UK Stem Cell Bank staff knows as 'Change One'. This is a significant moment in the journey from public spaces into the Bank's laboratory space because this is the first barrier designed not to restrict the movement of people but instead to restrict the movement of microbiological contaminants. 'Change One' relates to footwear. Shoes worn elsewhere are not allowed to touch the floor beyond this line. Bank staff who work beyond this line keep a set of shoes at the 'Change One' point which are only ever worn across the line in the Bank's space. Visitors are required to place bright blue plastic shoe covers over their footwear which are disposed of after use. These technologies of spatial differentiation are symbolic of the Bank's location within a wider regulatory value system prioritising sterility and cleanliness. Compliance with these technologies grants the individual access to the Bank's first corridor; the office space; the room with the back-up energy supplies, liquid nitrogen and the mechanics of the air handling system; and the door with the three freezers that are intended to actually house the pre-master, master, and distribution stocks of cell lines. The wearer can also enter the next room with an equally distinct spatial demarcation – the space known as 'Change Two'.

Change Two is a small room only big enough for one person at a time. It links the outer areas to the Banks laboratory beyond, and is where the most significant gowning rituals are performed. But Change Two also contains two distinct geographical spaces that are divided by a physical barrier approximately a foot high that the individual must step over to pass through the room. The very timing and form of the 'step over' is at the essence of the incorporation of wider regulatory commitments into the daily operating and structuring of the Bank.

Upon entering Change Two the individual puts on first a face mask and shower cap. Then they pick up the Tyvek suit – a GMP certified full body outfit – to put it on. At this moment, while putting their first leg into the Tyvek suit, the individual steps over the foot high barrier, so their footwear that is suitable for Change One areas never touches the floor across the barrier in Change Two, and,

equally, the Tyvek Suit never touches the floor prior to the foot high barrier. Once both legs are over the barrier, and in the suit, it is zipped up and the hood pulled over the head. The individual must then reach back over to the first side of barrier to get a set of gloves stored in sealed sterile packs. They are then ready to open the door to the joining corridor.

However there remains another symbolically and practically significant technology of demarcation between Change Two and the laboratory space - the air handling system and the various airlock doors that maintain the laboratories “aseptic integrity” (UK Stem Cell Bank 2005). Upon leaving Change Two the individual enters what is known as a Grade ‘C’ corridor that leads to the laboratories. A Grade C area is defined as a space where the maximum permitted number of particles per m³ equal to or above the size specified is 350,000,000 at 0.5µm (Department of Health 2001). Essentially this means a space with filtered air that is significantly more sterile air than that found in normal environments. However the air is not as contaminant free as the air found in each laboratory – known as Grade B with 350,000 permitted at 0.5µm – or the air in the contained bench area – which is known as Grade A with 3,500 permitted at 0.5µm (Department of Health 2001). The air in the Grade B environment is entirely replaced 50 times an hour, almost once every minute. These rooms house the highly sterile Grade A cabinets where the physical manipulation of hESC culture is actually conducted. The final barrier on the journey – the cabinets glass protective cover - prevents all but the covered human hand from entering the privileged space reserved for the curation of hESC lines. Each of these barriers - the protective cover, the airlock doors, and all those detailed before them – constitute a set of practical and symbolic boundaries that enact the Banks socially legitimate sterility procedures.

In analysing this passageway we want to draw upon four themes – pollution beliefs and sterility, ritualistic practice, wider symbolic importance, and standardisation of practice.

Pollution Beliefs and sterility:

We can analyse the empirical work set out above in terms of Mary Douglas’ concept of ‘pollution beliefs’ – enactments of secular and religious rituals that deploy categorisations of purity and danger to identify that which is clean and safe and that

which is unclean and problematic (Douglas 1966). Douglas notes that such pollutions beliefs are frequently aligned to geographical organisation, as is observable in the case of the UK Stem Cell Bank – the boundaries and borders between the publicly accessible space and the privileged space of the human embryonic stem cell line are orientated towards the exclusion of individuals and micro-biological contamination. To Douglas, such beliefs reveal values central to the daily operation of the location. In the analysis presented here we choose to further unpack these values, not just in their mobilisations within the Bank, but in wider social spaces.

The journey detailed above is partly constitutive of a specific nuanced metaphorical vision of sterile practice. The nuance comes through two mechanisms, one we discuss here, one we address later in the paper. The first becomes obvious once it is realised that the journey we have outlined into the bank is only one of two human trajectories into the same space – the two trajectories are that of the human being – detailed above – and that of the human material – the hESC line itself. Revealingly, there are asymmetrical treatments of these two trajectories. If, for example, a scientist at the Bank had a flu virus, the virus would be contained behind their facemask, ventilated out of the room by the air-handling system, and shielded from the hESC line by the Grade A cabinet. However, it is possible, indeed quite likely, that a flu virus would be present, and openly available to the air, in the hESC line itself – this material is of course derived from a human source and with it carries a wide variety of human contaminants. The same is true of the HIV virus. Each hESC line is tested for hepatitis B, C and HIV, among other viruses. Should these be found this would not undermine the social legitimacy of the Bank – indeed it would be a success of their quality assurance system. This points to a complex understanding of what a sterile space should be.

Franklin (2006) has unpacked the earliest stages of the second trajectory – that of the human material – in her work on a recently built co-located IVF surgery and hESC derivation laboratory in the UK. Successful hESC line derivations conducted at this site will, as part of their Human Fertilisation and Embryology Authority licence, be donated to the UK Stem Cell Bank for subsequent distribution. Franklin's commentary considers the primacy of Quality Assurance practices in the facility and socio-ethical complexity of the hatch linking the two units, the passageway through which embryos are passed. It is apparent from her account that the asymmetrical application of pollution beliefs between human beings and human materials are in

operation there as they are in the Bank. And, just as Quality Assurance pervades the Banks practices and architecture, so does it Franklin's derivation/IVF facility. To Franklin:

“Quality Assurance, not just technical assurance, is now the element that must be added to biology to make it as good as nature – as good as the real thing – so that new made-in-the-lab biologicals, such as pancreatic islets, heart valves or skin, will function normally. But quality control is not added to *biology itself*. Quality is about *taking away* the dirt, the noise, the pollution, the pathology and the ‘junk’ that detract from the reliability of biological function.” (Franklin 2006, p172 original emphasis)

This ‘taking away’ of dirt is performed both functionally and symbolically through the geographical organisation of both the UK Stem Cell Bank and Franklin's IVF/derivation laboratory. It is embodied in the architecture and associated ritual of the very buildings.

Yet we should also acknowledge the relativity of this specific vision of sterility. Here we can usefully reflect upon Hirschauer's (1991) analysis of sterility rituals in surgical operations. He argues that:

“the symbolic function of sterility procedures is primarily related not to the boundaries of the operating theatre but to those of the patient. So, although blood is not free from bacteria, blood-stained instruments are treated as ‘sterile’ because ‘being clean’ is to be understood *relative* to the patient-body.” (p. 306 original emphasis).

This has equivalence at the UK Stem Cell Bank where the pollution beliefs are operationalised relative to the hESC material. However there is a significant difference, as in the Bank the biological material is being protected from the living human being – a reversal of sterility settings such as the hospital, dirty-bomb scares or sewage works. At the Bank, and in Franklins IVF/hESC derivation unit, it is the human being that is restricted and made subservient to the needs of the biological material - the human biological vitality that is sacred, and the human being – and their inherent dirt – that is profane.

The complexity and relativity of meanings for sterility is present in the juxtaposition and negotiation of definitions used by the Bank. General terms include culture that is ‘mono-septic’ - meaning only a single viable entity is present; practices of ‘aseptic processing’ - meaning nothing external is added to the material; and a more normal sense of sterility meaning no organisms are detectable down to a certain level of measurement. However the staff recognise these definitions can be differentially interpreted being shaped in practice by sensitivity levels and methodological specifics. Yet however they are operationalised, they always privilege the human material above the human being – maintaining the asymmetry between the two human trajectories. This metaphorical vision of sterility is embodied both in the Banks practice and architecture, and has both symbolic and functional impact.

Ritualistic Practice:

Following Douglas, we argue that these pollution beliefs are enacted and reinforced through careful ritualistic practice. The gowning procedures and the passage across boundaries are tightly observed and repeated. The ritualism of following strict yet relatively simplistic sterility rules allows an individual to get on with their day-to-day work without continually thinking through the complex rationales that frame them (Rawlings 1989). Although potentially complex to learn initially (Mody 2001), once understood the rituals can become second nature and facilitate the unproblematic performance of the Banks space.

Such secular rituals can be found in other scientific and medical settings – Lynch (1988) unpacks the practices surrounding the sacrifice of research animals, Sims (2005) explores safety procedures in physics laboratories, and most similar to our use here, Mody (2001)⁵ analyses laboratory dirt in materials sciences⁶. Lynch

⁵ Mody (2001) uses Mary Douglas to explore both ‘matter out of place’ and ‘matter in place’ – both that which is pure and that which is dirt. He develops beyond Douglas’ framework to explore how pollution and contamination are used with epistemic outcomes by scientists to expand and shape knowledge. Success and failure can be interpreted and accounted for by reference to both matter ‘in’ and ‘out’ of place.

(1988) argues that the sacrifice of laboratory animals by experimental biologists is a particularly constituted ritualistic practice orientated towards the transition from the commonsense ‘naturalistic animal’ to the production of a mathematically organised ‘analytical animal’. Central to this shift is the re-representation of the animal away from the commonsense form where they are imbued with emotional and ethical significance.

This has parallels with Wainwright et al (2006) and Sleeboom-Faulkner’s (2007) research on hESC laboratory staff who demonstrate nuanced responses to the ethical framing of their science. Wainwright et al expand Gieryn (1999) to develop the concept of ‘ethical boundary work’ – the practices, resistances and associations made in the UK hESC laboratories they studied to instantiate the correctness of their work and respect for the material. Sleeboom-Faulkner details ritualistic practices – such as bowing to the material – that are differentially followed in Japanese hESC laboratories. Although Wainwright et al and Sleeboom-Faulkner do not use the terminology, all three examples detail conditions involved in the ordering of the sacred and profane in the laboratory setting – a topic we return to in relation to the UK Stem Cell Bank later in this paper. The attempt to establish ethical and social legitimacy in a time when science can no longer assume such authority fundamentally shapes how the UK Stem Cell Bank has been operationalised (Authors, forthcoming). Although only one part of a wider network of interactions and values, the establishment of a sterile and quality assured space is important to this.

Wider symbolic importance

However, the performativity of the UK Stem Cell Bank architecture has further symbolic resonance beyond the daily ordering of working life within its physical constraints. Normative assumptions about the sterility of the Banks space and the resultant biological materials handled therein are essential to the sustained social legitimacy of the Bank. For the wider public, the vague conceptualisation that modern British bioscience is clean – and thus safe – is welcomed, and symbolically

⁶ The use of ‘ritual’ to account for scientific activity is not without its detractors. See Collins’ (1994a) commentary on Hirschauer (1991) and subsequent exchange (Collins 1994b, Hirschauer 1994) and comment by Mody (2001).

represented in images of stem cell scientists in tyvek suits, reminiscent in the popular imagination of those worn by scientists guarding E.T. or the anti-terrorist agencies preparing for chemical attack, and are found on the cover of Bank's first annual report (Stacey 2004).

Yet we argue a further constituency – that of the bioscience sector – ascribe more resonance to these symbolic productions than the public at large. There is agreement across the sector that human derived material – such as hESC lines – is inherently dirty at a microbiological level with a range of possible contaminants (Franklin 2006). It is part of the UK Stem Cell Banks role to ensure that the hESC lines they distribute pass rigorous quality assurance tests (Stacey 2004) making them legitimate for international transfer (Authors forthcoming). We develop Waldby and Mitchell's (2006) parallel argument also concerning the UK Stem Cell Bank in this regard. To Waldby and Mitchell, drawing upon Michel Callon (1998), the Bank – through its apparatus of the steering committee and the central storage hub - is the last stage in the 'disentangling' of the hESC material from the networks of kinship and familial ties associated with the IVF clinic and paternity. Furthermore this apparatus is central to the 're-entanglement' of the biological material into networks of disembodied exchangeability, ripe for international movement in the tissue economy. Applying an equivalent logic we see the performativity of the UK Stem Cell Bank's architecture as an essential component in the disentangling of hESC material from the networks of inherent microbiological contamination within the symbolic associations of wider bioscience, and their re-entanglement as quality assured units of aseptic integrity. This re-entanglement into microbiological sterility is surely as important as the re-entanglement into kinship sterility for facilitating the hESC materials mobility within Waldby and Mitchells tissue economy. Negative pollution beliefs in the bioscience sector about the material held by the Bank would undermine the fluidity with which it could circulate.

Documentation and the standardisation of practice

The journey described in the empirical section of this paper at all points undergoes various mechanisms for translation into, and out of, documentary format. The security practices involve recording details of the individual into an electronic database and a handwritten log. Furthermore this documentation is ascribed into the clothing rituals through the issuing of staff and visitor ID cards. The step-by-step

mechanics of the microbiological controls – gowning, environmental monitoring and the air handling system - are documented in Standard Operating Procedures (SOPs). Rawlings (1989) notes the importance of sterility as an ‘accomplished display’ that’s demonstrated in written records in hospital surgical settings. Elsewhere we have written about the importance of these translations between what is *doable* and what is *documentable* for the alignment between the Bank’s day-by-day working practices and their regulatory commitments. Such documents constitute the Banks legitimate practice in a bureaucratically accountable form (Authors forthcoming) that are themselves performative of that legitimacy (Prior 2003).

However here we will focus upon what these documents mean for the standardisation of practice, and with it unpack our second mechanism forming the nuanced metaphorical vision of sterility. How, within the particular set of pollution beliefs operationalised at the UK Stem Cell Bank, the performativity of the space combined with its ongoing alignment and re-alignment with its associated documentary practices maintain stability and standardisation while facilitating change and fluidity.

The use of the Standard Operating Procedures (SOPs) detailing the practices to be followed in environmental monitoring and gowning reveal the precise form taken by the notion of ‘standard’ embedded within the Banks pollution beliefs. SOPs imply the accordance with a benchmark. They are a visualisation of the Bank’s interpretation of a wider regulatory or guideline based statements of minimum required performance in terms of sterility. However they do not imply temporal stability in the Banks practices. They do not necessarily mean that what is done at the Bank one month is the same as will be done the following month.

The SOPs can be re-written, and their performances as instantiated practice altered accordingly, on a frequent basis. This results from the Banks ongoing learning and development process that is inherent at an innovative institution of this kind. In this context the documentary rigour of the SOP is to align the fluid and creative interpretation of sterility guidelines with the stringent requirements for a recorded and visible practice. They demonstrate that at any time the Bank are meeting a minimum benchmark. Yet, the mechanisms through which this is achieved can alter. For example, the account above describes a blue line – change one – where the individual is required to change their shoes as they cross a particular spatial boundary in the Banks organisation. However, over time this blue line has been replaced by several

other mechanisms for performing this boundary, moved to different locations, and removed altogether. Such creative re-configuration is common in scientific practice (Lynch 1985, Knorr-Cetina 1999, Latour & Woolgar 1979). Each stage of the journey at the Bank has been developed and re-configured as the staff at the Bank experiment with new ideas to optimise their working patterns.

This conception of a standard as a benchmark, but not ‘sameness over time’, brings further nuance to our understanding of the Banks pollution beliefs. As well as the asymmetrical treatment of the human being and the human material, we see that the Bank’s space is differentially performed over time. In accordance with this the metaphorical vision of sterility is also differentially constructed as the practices change. The pollution beliefs are mobile⁷.

And so too must be the ritualistic practices discussed above, which lends further shading to our understanding of what ritualistic practice is. Inherent in the notion of both religious and secular ritual is the continual repetition of practice in the orientation towards specific symbolic and functional ends. Yet here we have described an instance of changeable, mobile rituals. So we must ask, at their core, what here is being repeated, what is deemed sacred and what profane? Our argument is that the pollution beliefs operationalised at the UK Stem Cell Bank through repetitious ritualistic practice make sacrosanct the alignment and constitution of practice and document. Although the physical practices may alter over time, the commitment to the production of a sterile environment – be it with an asymmetrical treatment of human being and material at its heart – and the marriage between these practices and their documentary accountability, are central to the pollution beliefs mobilised at the UK Stem Cell Bank.

The Bank operates in an environment of external accountability and organizational logic (Strathern 2000) that pervades the construction of sacred and profane in the laboratory. As witnessed through these pollution beliefs, the Bank prioritises not the location of matter in, or matter out, of place, but instead values matter that’s place is documented. The asymmetrical flows of human and human material into the UK Stem Cell Bank laboratory space are not deemed problematic so long as their movement within the space is governed by a bureaucratic system of recording. This system is inherently linked to passage ways through the physical

⁷ Mody (2001) provides another example of mobile pollution beliefs.

building of the Bank, each space and each boundary is intimately tied in to the performance of a particular metaphorical vision of socially legitimate sterile practice.

Discussion

The performative architecture of the UK Stem Cell Bank and its associated practices clearly parallel many other ceremonials and performances. As we have seen, cells and persons describe circuits of separation and seclusion. These are pragmatic and functional, in that they separate cells and their custodians from contamination. They are also performative, in that they provide *enactments of purity*. The physical and symbolic boundaries that surround the Bank and the observances that are attached to them construct a series of *rites de passage* that persons and cells go through. The performative architecture we have described reflects the ideal type described by Van Gennep (1960) and his successors.

The successive barriers and boundaries create a series of *liminal* conditions, progressively defining ever more 'pure' or 'sacred' spaces (Turner 1967). Physically, such barriers must not only be traversed, but also *approached*. The initiate or postulant must approach the ceremonial site in a suitable manner, and be admitted formally to the process of progressive separation. Ceremonies of segregation progressively separate the person from the mundane or profane world, successively admitting her or him to the sacred spaces and performances associated with the esoteric spaces and the esoteric experiences that are associated with it. The scenic arrangements of such spaces and performances are often associated with rituals of purification and of specialised clothing. These rituals of separation establish the 'sacredness' of the secluded or secret space. The arrangements also surround and enclose the core space in such a way as to define a *progression* of increasingly esoteric places, things and actions. The space is typically *layered* and defines a journey of revelation, enlightenment or purification.

Institutions that inscribe these practices and ceremonials have common characteristics. They include bounded spaces, ceremonies of separation, elements of rites of passage, scenic and performative rituals. They have the common function of rendering persons and objects *pure*. In a way that parallels Goffman's (1961) notion of the *total institution*, or Coser's (1974) closely related idea of the *greedy institution*, we propose to refer to this general class of social arrangement as *moral refineries*.

This recognises their common property: the progressive refinement and purification of both persons and material objects through a ceremonial order of progressive segregation from the mundane order. These practices also correspond to the *circuits of hygiene* to be found in healthcare settings, that practically involve barrier nursing, sterile technique and measures against contamination.

As a *moral refinery* the UK Stem Cell Bank, enacted in part through its performative architecture, stands visibly as a location on international legitimacy for hESC science. In this paper we have made explicit the role of the micro-sociological organisation of geography at the bank in shaping this. The flows through the Bank of people and material, and the reach into the Bank of wider regulatory factors, co-produce with the local organisation of space as enshrined in the Banks very building a metaphorical vision of sterility. Such visions have symbolic power. Without this the Banks task of guardianship would surely be tougher.

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