Science fiction, cultural knowledge and rationality: How stem cell researchers talk about reproductive cloning

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Chapter 8
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Nicola J. Marks

Introduction

In 1996, a sheep code-named 6LL3 was born in Roslin, just outside Edinburgh, UK. She was later named Dolly and became possibly the most famous sheep in the world. She was the first mammal created from an adult cell — not from the union of a sperm and an egg, not from an embryonic cell; she was created through reproductive cloning.¹

Dolly grabbed the headlines for a number of reasons. Firstly, she shattered an important biological dogma according to which cells, once fully differentiated, can only ever be that one kind of cell. Indeed, Dolly was generated from an udder cell from a fully grown ewe; the nucleus of this cell was put into an enucleated egg (a technique called somatic cell nuclear transfer or SCNT) and tricked into thinking it was a fertilized egg. It started dividing, until an embryo was formed, implanted into a surrogate ewe and brought to term. So the cells in Dolly’s body have the same nuclear DNA as the original udder cell and that one original udder cell contains all the necessary information to give rise to a whole new sheep.

Secondly, Dolly was seen as newsworthy because people at once drew the connection with potential human reproductive cloning, despite Ian Wilmut, her creator, downplaying this.² Human cloning, or at least the creation of human-like beings without the need for sexual intercourse, had been foreshadowed in

science fiction for decades.\textsuperscript{3} It was mentioned indirectly in \textit{Brave New World}\textsuperscript{4} and \textit{Frankenstein} or, The Modern Prometheus\textsuperscript{5}; and more directly in \textit{The Boys from Brazil}\textsuperscript{6} and Woody Allen’s film \textit{Sleeper}.\textsuperscript{7} With Dolly, human reproductive cloning was leaving the realm of fiction and entering that of scientific possibility.

Thirdly, Dolly opened up the possibility of ‘therapeutic cloning’, potentially an extremely powerful medical technology. This involves taking a cell from a patient, transferring its nucleus into an enucleated egg (again using somatic cell nuclear transfer), starting the process of cell division until a two- to three-day-old embryo is obtained. Then, instead of implanting the embryo into a surrogate, as was the case with Dolly, it would be transformed into a cell line (an embryonic stem cell line) with the potential to give rise to all cells in the body. Since these cells would contain the same nuclear DNA as the patient, they would be immunologically compatible with him or her, thus theoretically providing an endless supply of cells for therapy. Supporters of stem cell research and cloning have been keen to highlight this exciting medical possibility. However, many tried to distance ‘therapeutic cloning’ from the less palatable ‘reproductive cloning’; this was not easy given their similar technical origins.\textsuperscript{8}

Immediately after the announcement of Dolly’s birth, scientists, journalists, politicians, intellectuals of all sorts and members of the public started voicing their opinions. A mixture of awe and fear was evident.\textsuperscript{9} Clones (including human ones) were imagined and discussed in multiple ways. For some, Dolly was ‘one of the most significant scientific breakthroughs of the decade’\textsuperscript{10} but for others she conjured up images of ‘“photocopied” individuals and automated production lines or artificial incubators producing multiple adult clones’.\textsuperscript{11} Calls were made for rationality and calm,\textsuperscript{12} but also for emergency legislation banning reproductive cloning.\textsuperscript{13} The public and the media were accused of being misguided by absurd fears that were blamed on science fiction.\textsuperscript{14}

Although many expressed concerns about lay people confusing science ‘fiction’ and science ‘fact’, this chapter will show that this distinction is not as simple as it may appear. Indeed, when talking about these cutting-edge areas of research, people – including scientists – imagine particular futures for these areas in order to make sense of them in the present. They draw on existing cultural tropes to do so, including those from the science fictional genre. Some imagined futures will be described as fact, others as fantasy; some will come into being, others will not. Importantly though, these future-oriented discourses are not neutral. They may \textit{enable} particular futures to come into being – they are ‘performative’. They may also shore up the authority of particular groups, individuals or types of intellectual inquiry – they can be strategic.

The aim of this chapter then is to explore reproductive cloning by examining the futures that scientists imagine for this technology. I analyse whether they attempt to locate these imagined futures within the realms of fact or fantasy, and what discursive strategies they employ to do this. The chapter opens with a brief overview of the scholarship showing that science is not simply fact or (science) fiction simply fantasy. After describing the data collection, it discusses the literature that shows scientists use science fiction-derived imagery to discredit those who criticize embryo research and cloning. Drawing on interview data, it then focuses on stem cell researchers’ discourses about reproductive cloning. These scientists express multiple views about the area; this contrasts with the dominant discourse of ‘reproductive cloning bad, therapeutic cloning good’ found by others.\textsuperscript{15} In addition, stem cell researchers here not only attempt to discredit people’s fears about stem cell research and cloning by associating these with science fiction, but also draw on science fiction to express their own concerns. The chapter examines scientists’ focus on appearing ‘rational’; therefore the ways in which fiction-based accounts and ‘gut reactions’ are elided in favour of ‘technical’ explanations are also highlighted. In conclusion, I argue that fears and concerns, be they expressed by scientists or members of the public, should not be dismissed simply because they draw on fictional cultural tropes. Instead fiction – including science fiction and speculative fiction, utopian and dystopian visions – should be seen as an important vehicle to express our

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\textsuperscript{4} Aldous Huxley, \textit{Brave New World} (London, 1950 [1932]).

\textsuperscript{5} Mary Shelley, \textit{Frankenstein} or, the Modern Prometheus (Oxford and New York, 1980 [1818]).

\textsuperscript{6} Ira Levin, \textit{The Boys from Brazil} (London, 1976).

\textsuperscript{7} \textit{Sleeper}, directed by Woody Allen (1973).


\textsuperscript{10} BBC News, 1997: \textit{Dolly the Sheep Is Cloned} (22 February 1997).


\textsuperscript{12} THES Editorial, \textit{Dolly Is Just Cloning Around} (Times Higher Education Supplement, 28 February 1997).

\textsuperscript{13} Such legislation was implemented in the UK shortly after the announcement of Dolly’s birth, \textit{Human Reproductive Cloning Act} (London, 2001).


\textsuperscript{15} Haran et al., \textit{Human Cloning in the Media}, p. 31.
unease and excitement about the future of science and medicine. In particular, it highlights a common concern about the integrity of human bodies and what should/not be done to them.

Science, Literature and Struggles for Authority

A rich scholarship in science studies has shown that the ‘facts’ of science are not simple reflections of nature or reality. What scientists consider to be the problem at hand (the one that is worth investigating and that is ‘investigatable’) depends on the material world, but also on scientists’ particular interests and on the theories that they have already accepted. When a hypothesis is tested experimentally, there are always multiple potential ways of interpreting the results. The matter is not settled solely by further reference to nature or further experimentation, but also by social factors. The kinds of hypotheses that are put forward and accepted will reflect the material world, but also the local culture. They may serve the purpose of those with the most political power. So science and scientific facts do not exist outside of society, even though they rely heavily on the materiality of the objects of study: ‘science matters, culture matters’.


If an experiment seems to contradict someone’s theory, this person may not necessarily be convinced to throw their theory out, instead they might critique the way in which the experiment has been conducted or the equipment and skill of the experimenter. This is the ‘experimenter’s regress’ according to Harry M. Collins, Changing Order: Replication and Induction in Scientific Practice (London and Beverly Hills, 1985), pp. 83–4. It is through social negotiations that the validity of knowledge claims are accepted, Harry M. Collins and Trevor J. Pinch, The Golem: What Everyone Should Know About Science (Cambridge, 1993). For instance, negotiations determine who might be the right kind of person, or ‘modest witness’, to make particular claims, see Steven Shapin and Simon Schaffer, Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life (Princeton, 1985), Donna J. Haraway, Modest_Witness@Second_Millenium.FemaleMan©Meets_OncoMouse™: Feminism and Technoscience (New York, 1997).


Similarly, discourses found in literary texts and popular culture are not ‘just fiction’. Dominant images in the media, films or books provide us with ways of seeing and interpreting the world, and with language to express our concerns. Fictional accounts can help make sense of, normalize or, on the contrary, problematize behaviours, technologies and objects; they have ‘epistemological power’. Literature for instance, because it is ‘between knowledge and unawareness’ opens a unique location for scholarly inquiry. Therefore ‘popular culture matters’ too.

Science fiction, or speculative fiction, is particularly important given that science and medicine are so embedded in our everyday lives: how we see ourselves and our bodies is increasingly shaped by biomedical research. Our genetic makeup – our DNA – in particular has come to be synonymous with who we are; genetic determinism and essentialism abound in discourses about our identity. Science fiction enables us to explore, explicitly and ‘in graphic ways’, the different futures (both utopian and dystopian) that science opens for us.

Fiction provides a set of culture tropes, especially metaphors, which we draw on. These metaphors ‘structure our understanding of events, convey emotions and attitudes, and allow us to place public issues and events in a shared context of
common belief. Gamson and Modigliani introduce the concept of ‘interpretive packages’ which are clusters of elements such as ‘metaphors, catchphrases, visual images, moral appeals and other symbolic devices’ that characterize a temporarily dynamic discourse which provides people with ‘interpretation and meaning for relevant events’. There are a variety of competing packages available for people to draw upon in order to make sense of the world, but these packages are also themselves shaped by shared cultural meanings. These packages are signalled by ‘condensing symbols’ which often correspond to strong images from particular works of fiction. So science and (science) fiction cannot simply be set up in contrast to each other. Instead, they both are shaped by and shape the culture in which they are embedded. However, scientists are often at great pains to distance what they do from science fiction; they contrast science as provider of objective facts with fiction as provider of subjective fantasies. They set up a ‘hierarchy of genres’: they exclude events and people (such as maverick scientists or concerned publics) from the realms of good science by describing them with terms indicative of the fictional genre. Scientists paint themselves as rational and objective whilst others are dismissed as irrational, subjective and emotional.

Nevertheless, scientists do not only deal in ‘facts’. They regularly project themselves into the future where they imagine their hypotheses confirmed by others’ work or possible cures becoming widely used. These projections are very important in showing policy-makers, funders and members of the public the potential of particular areas of research. They may even be vital in creating a future for particular technologies and areas of research; as such these expectations are ‘performative’.

Scientists draw on what Waldby has called the ‘biomedical imaginary’, the cultural references and mythologies (like the genesis story) which guide and shape biomedical thought and interpretations but often remain unacknowledged. As Squier, drawing on Waldby, argues:

> The very fact that imagery and metaphor are thought to be sites extraneous to science suggests the investment science has in the marginality and obscurity enabled by those discursive modes. Thus we can look to imagery and metaphor for the expressions of excess fantasy and desire, finding therein those sites of unresolved tension, cultural paradox, and stubborn ambiguity that are crucial, if generally overlooked, aspects of biomedicine. (emphasis added)

There are therefore a number of factors that shape how scientists make sense of science; these need further examination. Members of the public draw on four different types of knowledge to make sense of science: ‘technical’ knowledge; ‘methodological’ knowledge, such as knowledge of the limitations of genetic testing; ‘institutional’ knowledge, such as the links between research and funding or commercialization; and ‘cultural’ knowledge, about the social and cultural contexts in which knowledge is produced. It seems likely that scientists do the same.

In summary then, science and fiction are not easily disentangled, and the study of how scientists deploy fictional references (either to promote particular futures or to criticize others’ concerns) is an important location for sociological analysis. In particular, it may highlight how science maintains its authority, as well as reveal some of the ‘excess fantasy and desire’ or fears scientists have in relation to human clones.

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29 Nelkin and Lindee, The DNA Mystique, p. 16.
31 Ibid., p. 3.
33 Haran et al., Human Cloning in the Media, pp. 131–5.
37 Squier, Liminal Lives, p. 15.
Data Collection in Context

Interview Data and Discourse Analysis

Research for this chapter was part of a broader project examining stem cell scientists' discourses about their work and about public engagement. The data here are from interviews with scientists from either the UK or Australia. These two countries were chosen as they both are English-speaking, have heavily invested in stem cell research and have similar systems of governance. Interviews lasted between 40 and 105 minutes (most lasting 60 minutes). To access a range of voices, I spoke to junior and senior, academic and commercial scientists working with adult and/or embryonic stem cells (in humans and/or animals) or in areas relating to stem cell science (such as immunology). I conducted 37 one-to-one in-depth semi-structured interviews and three group interviews, interviewing a total of 48 scientists. The focus here is on how they talked about 'reproductive' rather than 'therapeutic' cloning and 28 scientists specifically talked about this technology. Qualitative methods were used since the aim was to explore scientists' accounts to gain an in-depth understanding of, for example, discursive strategies, not obtain the percentage of scientists strongly opposed to cloning.

These discourses were analysed following Gilbert and Mulkay's approach, and Potter and Wetherell's development of this work. That is the analysis of discourse as a 'topic' – for instance the study of interpretative regularities or of discursive repertoires – is seen as 'methodologically prior' to that of discourse as a 'resource' – where what interviewees say is taken to reflect how things 'really are'. Discourse is not restricted to particular utterances, and discourse analysis:

In addition, I organized two multi-disciplinary discussions bringing together stem cell researchers, social scientists, lawyers and ethicists. In total, the discourses of 54 stem cell researchers were accessed. These data were complemented by attending conferences and by an examination of publicly available material including media coverage and parliamentary transcripts; these will not be discussed here.


So the analysis also investigates how authority is given to particular truth claims and examines discourse in its institutional, cultural and historical settings.

Although interviews are not the same as naturally occurring talk, they are not 'culturally unique' and provide an interesting insight into what scientists say in this context which is perhaps less confrontational than parliamentary debates. Here, respondents were given pseudonyms to help protect their anonymity. All emphases in quotes were added by the author. In places, long interview excerpts are reproduced to highlight some of the complexities and intricacies of respondents' discourses.

Discursive Contexts

The interview data were collected in 2004–2005, which corresponds to a unique set of circumstances. Shortly after Dolly's birth, the first human embryonic stem cell line was created. It was this combination of cloning and stem cell technologies that made therapeutic cloning seem an exciting possibility.

In 1998 and then in 2001, some scientists claimed to be working on reproductive cloning; these were Richard Seed (a physicist), Panos Michael Zavos, Severino Antinori (two fertility specialists) and Brigitte Boiselier (a biochemist, head of a human cloning company and member of the Raelian Sect). No evidence ever surfaced to confirm any success in their endeavours. Nevertheless, clear legislative and regulatory frameworks were called for in many countries to address cloning as well as stem cell-based developments in embryo research.

In the UK, research on embryos for improving infertility treatments was already regulated under the 1990 *Human Fertilisation and Embryology Act*. Is concerned with talk and texts as social practices ... has a triple concern with action, construction and variability ... [and has a] concern with the rhetorical or argumentative organization of talks and texts.
This was extended in 2002 to allow the creation (whether by cloning – SCNT – or fertilization)59 and use of embryos for research into ‘serious conditions’ under licence from the Human Fertilisation and Embryology Authority.60 In parallel, as mentioned in the introduction, reproductive cloning was banned through emergency legislation the same year.

In Australia the use (not the creation) of embryos was legalized and regulated in a nationally consistent manner from 200261 but cloning, both reproductive and therapeutic, had been put under moratorium the same year.62 In 2006, Australian legislation was updated to allow the creation of embryos through cloning technologies for research.

In 2004, during my data collection, a ground-breaking paper was published by Korean scientists led by Woo Suk Hwang and collaborating with American colleagues; they claimed to have created a human stem cell line through cloning (SCNT).63 This demonstrated that therapeutic cloning was possible. Then in 2005, another paper was published by the same group, this time claiming to have produced over 10 patient-specific cloned stem cell lines, signalling that therapeutic cloning could be efficient enough to be used in a clinical setting.64 However, after some ethical concerns were raised, both papers were eventually shown to be deliberate frauds.65

So when my interviews took place, therapeutic cloning was legal in the UK but its moratorium was about to be reviewed in Australia. In addition, the claims by reproductive cloners had not led to any evidence of human reproductive cloning. Therapeutic cloning still seemed promising as one of the Korean papers had come out, but the fraud had not yet been brought to light. However, Dolly’s premature death in early 200366 indicated the potential limitations of cloning technologies.57

49 The Prolife Alliance had argued that cloned embryos did not come under the auspices of the HFEA, thus leaving a legal loophole, R v. Secretary of State for Health, Ex Parte Bruno Quintavalle on Behalf of Pro-Life Alliance (2001). The case was successful in the High Court but overturned on appeal.


51 Research Involving Human Embryos Act (Canberra, 2002).

52 Prohibition of Human Cloning Act (Canberra, 2002).


57 To date, no stem cell lines have been successfully created from cloned human embryos.


were ‘expelled’ by other scientists from bona fide science.\textsuperscript{61} They were also criticized in the media, which is rather unusual since medical scientists normally enjoy public support there.\textsuperscript{62}

A variety of science fiction stories and characters were drawn upon to talk about cloning, including \emph{The Boys from Brazil}, \textit{Frankenstein} and \textit{Brave New World}. Soon after Dolly’s birth, they were utilized by the public\textsuperscript{63} and in the media\textsuperscript{64} to express concerns about reproductive cloning and the ‘imminent threat’ of mass-produced clones lacking proper human identity. This makes sense, since this area of research was in its infancy. The same was true of IVF in the 1990s when embryo research was discussed at length in the lead-up to the legislation being voted on in the UK and when similar discourses inspired by science fiction were used: ‘What could be more natural than to fill the missing parts of the test-tube story along Frankenstein lines?’\textsuperscript{65} In addition, anyone who claimed to want to clone humans was labelled ‘mad scientist’ or ‘Dr Frankenstein’\textsuperscript{66} by the media.

However, fictional characters and references to irrationality were more commonly used by those in favour of stem cell research and cloning: they projected fictional accounts onto their opponents (those who disagreed with destroying embryos for instance)\textsuperscript{67}. Again, as in the 1990 debates over IVF:

\begin{quote}
When Frankenstein appeared within the context of pro-research discourse, he was made to speak, not of the dangers of science, but of the credulity, ignorance, and dogmatism of those who were unwilling to endorse the advance of science knowledge.\textsuperscript{68}
\end{quote}


\textsuperscript{62} Ibid., pp. 83–4.


\textsuperscript{65} Mulkay, ‘Frankenstein and the Debate over Embryo Research’, p. 158.


\textsuperscript{67} For instance, Mulkay, ‘Frankenstein and the Debate over Embryo Research’; Williams et al., ‘Envisaging the Embryo in Stem Cell Research’; Haran et al., \textit{Human Cloning in the Media}, p. 61.

\textsuperscript{68} Mulkay, ‘Frankenstein and the Debate over Embryo Research’, p. 169.

So supporters of stem cell research and therapeutic cloning used science fiction as a ‘rhetorical weapon’.\textsuperscript{69} Drawing on Gamson and Modigliani, the condensing symbol here is ‘Frankenstein’ which has ‘cultural resonance’\textsuperscript{70} with shared popular culture and can convey a dystopian image of science. However, by being projected onto opponents of embryo research, it indicates these people are silly to believe in science fiction and that their fears are unfounded.

Proponents of IVF and embryo research in the 1990s had also drawn on fictional narratives to support this research. Indeed they needed to project themselves into the future and imagine the possibilities of IVF. However, these projections were always utopian and, as there were no well-known and readily available utopian fictions with which to associate these imaginings, these were never labelled as fantasies. Therefore, the people articulating them could maintain their cognitive authority by not being associated with science fiction.\textsuperscript{71}

I now turn to my data which confirms some of the above findings but contrasts with others. In particular, scientists not only project fictional imagery onto others to dismiss their fears, but also themselves draw on fictional cultural tropes (including science fiction like \textit{The Boys from Brazil}) to express their own concerns.

\begin{center}
\textbf{Multiple Views on Reproductive Cloning}
\end{center}

I found more variety in my informants’ discourses about reproductive cloning than those discussed above – this could be due to the larger sample size and to the private setting compared to those of the media and parliament. Approximately half expressed some level of concern for human reproductive cloning, whilst half expressed some level of support for it, especially as an infertility treatment (only eight respondents totally rejected it). Most respondents had not considered this latter use, so their initial reaction was often interesting. They then thought through this during the interview, sometimes ending up rejecting this idea more, sometimes less, as I will discuss below.

Another difference with the above discourses is that my informants did not mention any of the ‘mad scientists’ attempting human reproductive cloning. This is most likely due to the timing of my research: when the above data were collected, reproductive cloners had the attention of the media. However, by the time I was interviewing, these claims had been dismissed and stem cell research had retained its aura of ‘good science’.

The discourse of some scientists reflected the dominant discourse above: reproductive cloning was described as unacceptable, but therapeutic cloning as useful. For instance a stem cell scientist from Australia states:

\textsuperscript{69} Kitzinger and Williams, ‘Forecasting Science Futures’, p. 737.

\textsuperscript{70} Gamson and Modigliani, ‘Media Discourse and Public Opinion on Nuclear Power’, p. 5.

\textsuperscript{71} Mulkay, ‘Rhetorics of Hope and Fear in the Great Embryo Debate’; Mulkay, ‘Frankenstein and the Debate over Embryo Research’.
Martin imagines a possible future in which SCNT can help organ regeneration, but advocates a ban on reproductive cloning which he describes in pejorative terms as ‘freaky’. Not all scientists however were as enthusiastic about the future promise of therapeutic cloning. This is discussed elsewhere.72

Some stem cell researchers said they felt uncomfortable about the idea of reproductive cloning, but were not sure why. The following was the response by an Austrahan PhD student working on adult stem cells to a question about the acceptability of reproductive cloning for treating infertility:

Caroline: [shakes head] Yeah, no, I would, I mean it’s hard because you’re dealing with people that really want children. Yeah, I would tend to not agree with that.

Interviewer: Can you understand why you don’t agree with that?

Caroline: Um [hesitation] No! [hesitation] It might simply be because you’re using the term reproductive cloning.

Caroline was one of the scientists who had not already thought in depth about her view on reproductive cloning as a treatment for infertility. Many scientists raised safety issues as the reason not to let reproductive cloning go forward: ‘it’s quite clear that it’s completely unsafe and you shouldn’t think of doing it.’ Others put forward another hurdle: the need for DNA mixing, which happens in fertilization, but would be by-passed by cloning:

Philip: I think I’ll give you an even better argument against it that’s strictly a biological argument: evolution has gone to a lot of trouble to make sexual reproduction, we waste an awful lot of energy on it, it must be there for good reason.

Heidi: So, at this point I would never say that one should start developing cloning technology for infertility treatment in a clinical setting at this point, because it’s not safe. But if you took that argument out and people found that cloning was a safe technology, or it became a safe technology, then I don’t see what the argument against it is.

Another argued:

Danielle: I guess personally I don’t have a personal ethical or moral conflict with reproductive cloning, I don’t know why that is, I don’t know if that’s because I’m a scientist or that’s because you know I personally know someone that’s struggled with infertility, I’m not sure why that is, or, but I think that if it was safe .. I don’t see the future as being everyone’s going to be cloned or anything like that, I don’t really see a problem with it, I have a realistic I think view of what it could be applied for.

Danielle was suggesting that her accepting view of reproductive cloning could be due to her being a scientist; this implies that she is not swayed by unfounded fears and has an educated opinion based on ‘technical’ knowledge. Alternately, her view could be shaped by her personal experience with friends who are infertile, suggesting a role for ‘cultural knowledge’ in shaping her views.

This diversity of views shows that the same science ‘facts’ lead to scientists expressing different opinions about what areas of research can and should go forward. Their views then seem to be shaped by something beyond the detail of the science.

Science Fiction as a ‘Rhetorical Weapon’

Despite the variety of views just discussed, many scientists expressed their personal view as if it were the obvious one to hold. As did many of the scientists investigated by others, they attempted to discredit people’s concerns by placing these in the realm of fiction. Some informants criticized members of the public for drawing on science fiction to make sense of cloning. In the following quote, an

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Australian adult stem cell researcher condemns both the media and the press for associating scientists with Dr Frankenstein:

Clara: There’s a lot of [hesitation] bad press you know, Dr Frankenstein, so that’s the other thing. I find that really annoying, this whole, like with the cloning debate, and the public issue was because you know a scientist is going to go away and clone something just because they can ... We all have better things to do!

Here, Clara is implying that scientists are responsible people who would not waste their time on something as unsavoury as human reproductive cloning. Similarly, a British embryonic stem cell scientist bemoans science fiction’s perceived influence on the low public opinion of scientists:

Anthony: But once something starts becoming a bit controversial ... you’ve got you know all this Frankenstein cloning, then people start to get suspicious, ‘this is scientists just playing around’.

Neither Clara nor Anthony portrayed these imagined uses of Dr Frankenstein as ways of expressing concerns over the potential of science to run away and lead to unintended consequences. They steeped criticisms of scientists in science fiction, and could thus dismiss them as irrational. Neither of these respondents suggested that some of their (well-respected) colleagues may not oppose reproductive cloning in such unequivocal terms.

Another informant from Australia downplayed concerns about scientists attempting human reproductive cloning. To do this he drew on science fiction imagery but also highlighted that if scientists had wanted to clone humans, they already could have done this by using technologies other than somatic cell nuclear transfer:

Victor: If you really set your mind to actually doing something destructive, you could, The Boys from Brazil, that’s something that comes up all the time, you know in the field, but the fact is that embryo splitting has been around for a long time, so if you wanted to, you can split an embryo ... I’m sure it would work, although I don’t know if anyone’s tried it ... since the 1980s, embryos splitting’s been around, no one’s ever done it, the whole point is, OK fine you might just want to do it for the hell of it, if you don’t have a reason, people won’t do it, there’s a lot of the stuff you can do in different ways, but no-one’s ever bothered to do it.

In The Boys from Brazil Joseph Mengele survives the end of the war and flees to Sao Paulo where he produces clones out of tissue he took from the late Adolf Hitler.73 Victor indicates that the image fiction projects of scientists is distorted as these people are not megalomaniacs bent on world destruction or re-creating Hitler. Evidence for this is the fact that scientists have not ‘bothered’ to use another available technology to create clones (embryo splitting). So concerns about reproductive cloning are not well founded according to Victor.

A different stem cell researcher, this time from the UK, also criticized members of the public for basing their views on science fiction, after I mentioned that some people may fear clones would not have their own identity:

Ted: I think [clones] would have their own identity, because, I come back to identical twins, in practice, I think we’re being kind of skewed by ... The Boys from Brazil kind of scenario, of creating mini-Hitlers, you’re probably too young to remember a film by Woody Allen, called Sleeper, have you seen that? It’s probably worth watching that, because [the] grandmaster’s nose [is] to be cloned to form a new one. It’s ridiculous obviously but in practice, when we have identical twins, we might say, oh, they look very similar, but we don’t somehow think they are the same person, or they have the same identity, we treat them as separate people, so we are completely capable of distinguishing between genetic identity and psycho-social identity.

Ted is highlighting the idea that a person’s genetic makeup does not determine their ‘psycho-social’ identity. In other words, he condemns genetic determinism and highlights the role of nurture as well as nature in identity formation. According to Ted, clones would be unique individuals. Ted is partly blaming science fiction such as The Boys from Brazil or Sleeper for this focus on genetic determinism. For him these scenarios are ‘ridiculous obviously’: they will not occur in practice and only serve to worry and confuse people. However, as will be shown below, not everyone disbelieves these scenarios which also do not clearly rest on genetic deterministic understandings of human identity.

Scientists here project science fiction imagery onto publics, whose fears then no longer have to be taken seriously and can be dismissed.

Science Fiction as a Means of Expression

Some of my informants expressed their own concerns using science fiction images, rather than projecting these onto others. For instance, I had asked a UK adult stem cell researcher what he thought about his country being one of the only ones to have legalized human SCNT (the first steps towards therapeutic and reproductive cloning). In the following quotes, he answers by criticizing other countries’ bans

for being based on emotions rather than facts. He then describes his own concerns about reproductive cloning, and draws on imagined futures derived from science fiction to express them:

John: Yes, I think, well you have to ask why the other countries have made it illegal, you know, and it's mostly these sorts of semi-religious or emotional things about, about them being human embryos or human cells ... I don't really see that you know we should take a different view about these cells to any other cells, unless people are proposing to grow them up into, into live human beings, where there's a whole set of different issues that come up, but, so no, I think our legislation is sensible.

Interviewer: So what issues concern you about reproductive cloning then? Is it the safety issues?

John: ... I mean I think the first thing is safety, and unless it's absolutely safe, you shouldn't do it. There are issues of more sort of widespread issues of public health ... Sexual reproduction actually has a function of mixing up the gene pool and if reproductive cloning became common place you could end up with a really rather restricted gene pool. Um, I don't terribly like the idea of having one hundred copies of some of the world's dictators, [laugh] [hesitation] which could easily happen.

Interviewer: Do you think that? That that could happen? I mean in terms of environmental factors being important, for example, I mean I don't necessarily, I mean Dolly was different to her mum for example ...

John: Well we don't know actually. Um, but I think it's quite possible that a dear leader would make one hundred copies of himself [laugh].

By highlighting his approval of UK legislation, John indicates that 'semi-religious or emotional things' should not guide science policy, thus presumably suggesting instead a role for scientific facts. He expresses his approval for the banning of reproductive cloning and gives three reasons. The first relates to safety and, as mentioned above, is often used as grounds not to reproductively clone human beings. The second was also given by several informants and highlights the importance of having a varied gene pool for species adaptation in case of environmental changes. The third is the most remarkable here. John suggests that allowing reproductive cloning could lead to the creation of 'one hundred copies of some of the world's dictators'.

This last scenario is, in my view, clearly inspired by The Boys from Brazil in which 94 clones are produced from Hitler's tissue. John does not see this as fantasy, and argues that it is quite possible and 'could easily happen'. When I quiz him about the role of nurture in shaping identity, he indicates that there is no clear evidence that environment would play a large role: 'Well we don't know actually'. Although John may acknowledge the cultural reference to science fiction, he does not portray his concerns about reproductive cloning as based on irrational fears; rather the idea that a leader would want to use cloning to make 100 copies of himself is presented as quite reasonable. However his laugh may indicate he realizes other people may not take these concerns seriously.

Thus, John contrasts unsatisfactory legislation or decision-making around science, which he describes as based on emotions and religion, with sound decisions based on evidence and risk assessments — even if these risks are re-interpretations of science fiction scenarios. He avoids sounding contradictory by portraying the storyline of politicians wanting to clone themselves as realistic. He bases these claims on the evaluation of available data (such as the status of current scientific knowledge or the character of current leaders) and by implication, then, is not displaying emotion-based judgements. So being able to present one's views as 'rational' is important. I will come back to this in the next section.

John's is a very genetically deterministic view. He imagines clones as 'copies' with the same characteristics as the original dictator. This contrasts with Ted's view above. Other informants, this time from Australia, also expressed a belief in determinism:

Barry: In terms of reproduction I see no real merit in having a cloned individual because it's really only a facsimile of, genetically, of someone who's already there.

By using the label 'facsimile', Barry is using 'metaphors' of clones as 'photocopies'\(^ {74}\) to dismiss reproductive cloning. Thus, similarly to publics and media,\(^ {75}\) he is drawing on cultural imagery and projects an image of clones as mere copies of the original.

One scientist working in immunology in Australia was unusual in that he expressed the following very specific concern about therapeutic cloning sliding into reproductive cloning:

David: There's only one way to make a complex organ: that is do reproductive cloning and abort the foetus and take the organs, that's the only way to do it. So people haven't thought that next step through. That's the real reason that I'm against cloning, reproductive cloning ... So you could say I need a kidney to live,

\(^ {74}\) Nerlich and Clarke, 'Anatomy of a Media Event', pp. 51, 53.

\(^ {75}\) Wellcome Trust, Public Perspectives on Human Cloning; Nerlich et al., 'Fictions, Fantasies, and Fears'; Nerlich and Clarke, 'Anatomy of a Media Event'; Haran et al., Human Cloning in the Media.
David is imagining an undesirable future in which human clones (foetuses that are aborted) are created for immunologically compatible body parts. This contrasts with more common utopian futures found in the media and described by other scientists (see above) in which therapeutic cloning is used to create compatible body parts from cell lines. Similar to John above, David invokes a specific cultural trope from science fiction (Frankenstein), but does not indicate that this association is irrational or that his views are therefore mere fantasies. He describes a very detailed scenario in which complex organs are found to be impossible to make from cell lines and in which the initial promises of therapeutic cloning are not realized, leading to a reproductive cloning/organ harvesting dystopian situation.

This storyline is in fact very similar to that of *The Island,*76 which came out several months later. In this film, organs for rich people were initially going to come from cell cultures, but greed and technical problems led to the need to create full (adult) human clones. Although describing an imagined future that could easily be a science fiction plot, David does not portray his views as unrealistic. In fact, his use of the Frankenstein trope could be a way of signalling his awareness that his scenario may seem fantastical, and his rejection of this point of view; he is pre-empting criticisms of his imagined future. David here expresses concern about the commodification of clones’ bodies and their use as spare parts. Although these cloned foetuses are genetically identical to the donors, they should still be afforded some kind of dignity.

Scientists do not only draw on science fiction to express dystopian futures for reproductive cloning. For example, an Australian adult stem cell scientist discusses a friend’s experiment:

Pierce: I’ve just had a mate of mine who cloned a mouse from an olfactory receptor in the nose … it’s what Woody Allen did in *Sleeper.*

Pierce directly associates his friend’s work with the storyline of a fictional movie. The plot of *Sleeper* was raised by another scientist above and labelled as unrealistic (‘ridiculous obviously’). Here however, an experiment that has taken place is described by analogy with fiction. In fact, Pierce then goes on to explain that his friend contacted Allen to tell him about his experiment. This indicates the friend knew of this fictional storyline and highlights the ‘biological imaginaries’ that shape the experiments that scientists undertake. Of course, here, the clone in question is that of a mouse; it is not clear that the same sort of language would be used if the cloning was of a human. It is quite possible that human bodies are seen as more special, or sacred, than that of animals.

I have argued that fictional scenarios created in the entertainment industry and scientists’ imagined futures are not so distant. Scientists do not only draw on fictional imagery to discredit others, but also to express their visions of future scientific developments, which make sense of their current positions on cloning. These imagined futures however are not portrayed as irrational or fictional, but as realistic.

*Reconstructing ‘Rational’ Reasoning*

In this section, I explore how scientists make sense of the views they express about reproductive cloning, stem cell research and regulation. Some researchers are happy to paint their views as grounded in values and other cultural factors. Others work hard to ‘rationalize’ them and present them as objective and factual.

In the following quotes, I discuss stem cell regulation with a researcher in Australia:

Peter: … But to ban [embryonic stem cell research], because a certain sub-population of the community has a strong feeling that no one should have access to this because they don’t believe in it themselves, *I think that’s wrong,* I think that’s ethically wrong …

Interviewer: If say embryonic stem cell research went forward and somatic cell nuclear transfer was, became more safe and reproductive cloning became safe, what would you say to that? …

Peter: I don’t think that’s acceptable.

Interviewer: OK. Why do you not think that’s acceptable?

Peter: […] [hesitation] Because you’re making, well because, even though we think it’s safe, if something. There’s a couple of reasons. First of all, I can’t see any point in making a new human for the sake of you know making a new person that’s going to grow up as a person, you know, I don’t see any medical, necessarily any medical benefit that couldn’t be achieved in another way. There’s something, *maybe I have some religion in there somewhere deep down,* there’s something wrong about that, *it just doesn’t feel right to me,* I don’t see the need for it and it doesn’t feel right.

Interviewer: So do you then think it should be banned?

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76 *The Island,* directed by Michael Bay (2005).
Peter presents concerns based on religious or emotive grounds as inappropriate reasons to put breaks on science. Then he expresses concerns about reproductive cloning. I ask him if it should therefore be banned. His initial ‘gut-reaction’ against reproductive cloning is not used as a justification to ban this technology either. Peter finally says that reproductive cloning should not be allowed, but only after he has found and voiced concerns which relate to public health—he imagines a dystopian scenario in which people with unknowable and undetected mutations are created. So concerns about the health and safety of potential clones and future populations are put forward as better (more appropriate and convincing) reasons to ban a practice than ones based on the perceived inherent wrongness of this practice.

According to Gilbert and Mulhany, scientists draw on different repertoires in different contexts in order to present particular versions of events. Specifically, the ‘contingent repertoire’ is deployed when actions are depicted ‘as the activities and judgements of specific individuals acting on the basis of their personal inclinations and particular social positions’. This contrasts to the ‘empiricist repertoire’ which ‘portrays scientists’ actions and beliefs as following unproblematically and inescapably from the empirical characteristics of an impersonal natural world’. The former is usually drawn on to explain why people (including scientists) make erroneous judgements, whilst the latter is used to explain the correctness of one’s own decisions, which flowed inevitably from the ‘proper’ interpretation of nature. This is called the ‘asymmetrical’ ‘accounting for error’.

Utilizing these analytical tools, it can be argued that Peter is attempting to explain the error in others’ views that stem cell research should be banned by drawing on the contingent repertoire—the ‘personal inclinations’ of these others is that they are religious. At the same time he uses the empiricist repertoire to explain his position on reproductive cloning—he portrays the need to ban it as following from safety concerns based on Dolly’s early ageing and the risk of passing diseases to future generations. Peter’s own personal inclinations are mentioned (‘maybe I have some religion in there somewhere deep down’) but not put forward as reasons for a ban. A similar analysis of John’s discourse above can be done. He describes others’ views using the contingent repertoire—‘these sorts of semi-religious or emotional things’—and challenges their role in guiding policy, whilst describing his view using a more empiricist repertoire—for instance talking about the ‘really rather restricted gene pool’. Similarly Philip was keen to give me ‘strictly a biological argument’ to explain his stance on reproductive cloning. So many scientists describe the reasons for their views using the empiricist repertoire, even if they are describing imagined futures that may or may not eventuate.

Other researchers by contrast are more comfortable discussing their views using the contingent repertoire. For example, Zach working on adult stem cells in Australia says the following:

Zach: I can’t see any productive reason for [reproductive cloning] and I, I suppose I’m sort of contradicting myself in saying that if there’s no obvious benefit why should you do it, when I’ve said there’s other things that have been banned that shouldn’t have been banned because of the possibility of stuff. For that one, I just can’t, I can’t understand why you would need that sort of an aspect, it seems, and in that case, it’s not actually for research, it’s for people to have children along other pathways so, I don’t know if it needs to be banned I suppose. I’m not really big on banning stuff, so [laugh] I just can’t see the necessity for it ... I see a very extreme way, you know, I’m just not really comfortable with the idea of people basically raising themselves, and I know it’s not the same and nurture comes into it but I probably just see too much science-fiction to [laugh] to separate from my way of thinking.

80 Ibid., pp. 79-82.
acknowledge his views as being contradictory and socially located. He reflects on the difficulty in separating one’s views from broader cultural influences. In particular, although he can draw on ‘technical’ knowledge to highlight the role of nurture, he retains a view of human clones as photocopies of the original cell donors, with the same identity (‘raising themselves’). His ‘biological imaginary’ is here, rather unusually, acknowledged and shown to shape his thinking and explain his concern about genetic determinism.

Many scientists draw mainly on the empiricist repertoire and ‘technical’ knowledge to express their views and put them forward as rational facts untainted by culture. However, there is space for explicitly contingent and cultural knowledge to be expressed too.

Discussion and Conclusions: Rhetorical Strategies, Cloned Bodies and the ‘Imagination Deficit’

This chapter has examined scientists’ discourses about reproductive cloning. It has shown that fact and fiction merge and separate in interesting ways. Scientists present different futures for cloning and imagine clones and their bodies in different ways.

Reproductive cloning is at the cutting edge of research. Although the birth of Dolly is an indication that the creation of cloned humans may be possible, there is still much work to be done if this is ever to happen. This ‘work’ includes ‘imaginative work’, whereby future-oriented discourses imagine, promote and construct a future in which cloning is a possibility, as well as material work for instance to refine the technology. It is of course possible that the creation of human clones may not occur. This latter future will be facilitated if the materiality of human cells prevents their successful cloning, or if imaginative work that casts a negative image of cloning is successful enough to end interest in this area.

There were various ways in which scientists interviewed here talked about human cloning. Some imagined a future in which it was a treatment for infertility. Others described it as ‘freaky’ or imagined a future in which genetic diversity was under threat due to too many people using it. For many, there were hurdles to overcome before human cloning should be considered; these often related to the health and safety of future clones. In addition, several scientists expressed some form of ‘gut reaction’ against this technology (e.g. Peter or Caroline) which may also prevent it from being developed.

Because human reproductive cloning has not been achieved in practice, the imaginative work that refers to it (whether to promote or demote it) is heavily influenced by popular culture, especially science fiction in which reproductive cloning has existed for a long time. Fictional imagery was here utilized in two key ways. Firstly it was used as a ‘rhetorical weapon’ to discredit others’ views. Stem cell researchers projected science fiction-based accounts into the mouths of members of the public for instance. In this way, concerns raised by these others were placed in the domain of fiction and did not merit careful consideration. This rhetorical strategy, which draws on a ‘hierarchy of genres’, is commonly adopted by those in favour of a controversial area of research in order to displace criticisms. This projects and imagines members of the public and others as credulous and irrational.

Secondly science fiction and other cultural tropes are part of scientists’ ‘biological imaginary’, they shape, implicitly or explicitly, how scientists speculate about their (proposed) research and that of others. For instance, Zach explicitly drew on science fiction to explain his concern about reproductive cloning, and Pierce’s colleague articulated his project about creating a mouse from nose cells by drawing a parallel with *Sleeper*. Similarly, John expressed his concerns about reproductive cloning by referring implicitly to the scenario of *The Boys from Brazil*. So science fiction here, in contrast to others’ findings, can be used by stem cell researchers overtly to express their views, not simply to dismiss what critics may argue.

These scientists however seem aware that links with fiction could make their views seem merely fantastical. They tried to pre-empt this by laughing or stating something along the lines of ‘this may seems crazy, but it is true, and I have plausible evidence’ (e.g. ‘So that’s really Frankenstein stuff, but that’s totally and utterly doable’). Extending on this, although some scientists explicitly draw on fictional imagery, they are usually keen to highlight that their views are shaped by rational thought and experimentation. However, this contrast between those who are rational and those who are not needs to be ‘constructed’, it is not simply given in nature. As Haraway argues, ‘[t]he struggle is over who gets to count as a rational actor, as well as an author of knowledge, in the dramas and courts of technoscience’. Here we saw how scientists like John and Peter had difficulty during interviews to make sense of their ‘gut reactions’ and how they attempted to downplay the ‘cultural’ components of knowledge in favour of ‘technical’ ones. One strategy for this was to draw flexibly on the ‘contingent’ and ‘empiricist repertoires’.

When scientists draw on cultural tropes, these achieve specific effects (like displacing criticism or highlighting concerns) by signalling particular ‘interpretive

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82. Waldby, *The Visible Human Project*.

83. Kitzinger and Williams, ‘Forecasting Science Futures’.
84. Haran et al., *Human Cloning in the Media*.
85. Waldby, *The Visible Human Project*.
packages'.

One of these packages is 'the unacceptability of reproductive cloning'. In John's case, 'one hundred dictators' is a 'condensing symbol' which has a particular cultural resonance, through its association with the storyline of The Boys from Brazil and is thus likely to suggest similar meanings to various people who might hear it. Drawing on metaphors from The Boys from Brazil can be a short-cut way of projecting an image of reproductive cloning as unacceptable.

So stem cell researchers draw on science fiction imagery and particular interpretative packages to project visions of reproductive cloning or of members of the public. However, these reinterpretations of film or book storylines do not always do the original's justice. For example, there can be many ways of reading The Boys from Brazil. Here it was deployed as an example of genetic determinism, whereby armies of Hitler clones were generated (this interpretation was either accepted by the likes of John, or projected onto publics and dismissed by Victor). However, Levin's novel highlights the role of nurture in addition to that of genes in determining people's character.

There seems to be an 'imagination deficit' as Van Dijck calls it: 'Relevant and interesting literary works were systematically reduced to their seemingly unequivocal or unambiguous plots, without acknowledgement of their rich, multi-interpretable and educational content'.

Some of these impoverished re-deployments of cultural products lead to 'conventional, flattened concepts of the human body, its identity and individuality'. That is, clones are imagined as 'photocopies' of the original, pale imitations. Genes are given an all important role in the generation of psychological identity. These conceptions highlight the angst displayed by stem cell researchers like John or Barry towards the idea of creating clones that would not be 'proper' human beings. This indicates that for them genetics determine what cloned bodies will look like but also who clones will be, and human uniqueness should not be diluted or troubled by the creation of clones. In addition, the narcissistic idea of people 'raising themselves' becomes a concern if individuality comes solely from genes.

By contrast, conceptions of potential clones as unique individuals and reproductive cloning as part of tools for assisted reproductive technology reveals an understanding of identity stemming from a combination of nature and nurture. This more complex understanding is reproduced not only in The Boys from Brazil, but also in other multi-layered science fiction narratives such as Blueprint or Joshua, Son of None. For scientists who imagine clones in this way (such as Heidi or Ted), clones would be 'proper' people who deserve respect. Their well-being is of concern if cloning technologies do not improve. This understanding of clones as full human beings, despite their genetic identity (as in sameness) with donors, is also visible in David's concern about the commodification of clones' bodies (including that of foetuses) for use in stem cell treatments. Again, this complex issue is dealt with in a film, The Island.

All these scientists imagine clones and their bodies in different ways, sometimes utopian, sometimes dystopian. Despite the rejection by many of science fiction as a means of making sense of human reproductive cloning, I think the richness and diversity of fictional narratives may be very useful in unpicking exactly what it is that we fear or embrace in this technology.

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Chapter 9
Inventing the Healthy Body: The Use of Popular Medical Discourses in Public Anatomical Exhibitions
Elizabeth Stephens

Over the last decade, a large number of popular anatomical exhibitions—Body Worlds, The Amazing Human Body, Bodies: The Exhibition, Bodies Revealed, Our Body, a corps ouvert, Our Body: The Universe Within, Body Exploration and Mysteries of the Human Body—have toured across the UK, United States, Europe, Australia and Asia to great popular success. Advertised as ‘the anatomical display of real human bodies’, these exhibitions feature écorché figures (that is, bodies whose skin has been removed to reveal the internal anatomy), preserved through a process of plastination (in which the organic fluids are replaced with a clear synthetic polymer). Displays include whole bodies and dissected figures, as well as single organs, parts of the skeleton, the vascular system, and so on. All of these exhibitions owe their exhibitory styles and the availability of plastinated bodies on which they depend to the foundational work of Gunther von Hagens, the German anatomist who invented the process of plastination, and whose Body Worlds was both the first of these anatomical exhibitions and remains the best known.1 (Body Worlds claims to have received over 26 million visitors since its first show, in Tokyo, in 1995.)

The Amazing Human Body exhibition, which toured Australia in 2006 and 2007, exemplifies the curatorial style of these exhibitions. Designed, according to its organizer Dr Wayne Castle, to look ‘like a medical textbook’, each of the exhibits was surrounded by explanatory text intended to direct the viewers’ gaze to a particular part of the body and to provide an account of its function.2 At the Sydney show, Castle, dressed in a white coat that signified his status as a medical professional, delivered lectures on various aspects of human anatomy, using the exhibits as demonstration models. Publicity material reinforced the show’s

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1 Although none of these other exhibitions is formally affiliated with Body Worlds, they all use von Hagens’ patented plastination technology and may well source their exhibits from the same processing facilities. (Given the limited number of facilities, it is likely they are all associated with von Hagens to some degree, although von Hagens has also taken steps to distance himself from his competitors’ work.)