RESEARCH PAPER

Regenerative Medicine and New Labour life science policy: rhetorics of success, narratives of sustainability and survival

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Advances in stem cell science and tissue engineering are being turned into applications and products through a novel medical paradigm known as regenerative medicine. This paper begins by examining the vulnerabilities and risks encountered by the regenerative medicine industry during a pivotal moment in its scientific infancy: the 2000s. Under the auspices of New Labour, British medical scientists and life science innovation firms associated with regenerative medicine, received demonstrative rhetorical pledges of support, aligned with the publication of a number of government initiated reports presaged by Bioscience 2015: Improving National Health, Increasing National Wealth. The Department of Health and the Department of Trade and Industry (and its successors) held industry consultations to determine the best means by which innovative bioscience cultures might be promoted and sustained in Britain. Bioscience 2015 encapsulates the first chapter of this sustainability narrative. By 2009, the tone of this storyline had changed to one of survivability. In the second part of the paper, we explore the ministerial interpretation of the 'bioscience discussion cycle' that embodies this narrative of expectation, using a computer-aided content analysis programme. Our analysis notes that the ministerial interpretation of these reports has continued to place key emphasis upon the distinctive and exceptional characteristics of the life science industries, such as their ability to perpetuate innovations in regenerative medicine and the optimism this portends - even though many of the economic expectations associated with this industry have remained unfulfilled.

Introduction

'Regenerative medicine' (RM) has become the most significant conduit through which advances in stem cell science and tissue engineering are being turned into applications and products (Weissman, 2005; Hunziker *et al.*, 2006; Kemp, 2006; Gardner, 2007; Mason and Dunhill, 2008a, 2008b). As an industry led by the United States (see Lysaght and Reyes, 2001; Lysaght and Hazlehurst, 2003, 2004; Lysaght *et al.*, 2008), the majority of firms involved in manufacturing these medicinal commodities operate within the jurisdiction of the Wall Street NASDAQ technology exchange, yet it is also the case that a small cluster of British firms, mostly listed in London, have staked a claim in this industry over the past 10–12 years.

Under the auspices of New Labour, who governed Britain between May 1997 and May 2010, British medical scientists and life science innovation firms

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associated with genetics, genomics, tissue engineering and RM, received demonstrative rhetorical pledges of support from Whitehall (c. 2003–2010). The commissioning of the *Pattison Report* (UK Stem Cell Initiative, 2005) by Chancellor of the Exchequer, Gordon Brown, typified New Labour's resolve to maximise the UK's presence in RM worldwide (see Hope and Highfield, 2007). The 2005 budget stipulated that RM, and stem cell science *per se*, were to be singled out for public investment in recognition of their unique innovation capacity-building potential. The government response to Pattison's recommendations was to earmark an annual endowment of £10 million per year, ostensibly to assist with the development of a UK RM research-focused private–public partnership (UK Stem Cell Initiative, 2005; Hope and Highfield, 2007). Subsequent press reports suggest that New Labour's verbal commitment to back RM with public money ultimately went unfulfilled by the Treasury (Hope and Highfield, 2007).

New Labour pledges of support for stem cell science and RM were aligned to the publication of a number of government initiated reports about the future of the life sciences, presaged by Bioscience 2015: Improving National Health, Increasing National Wealth, also known as the Cooksev Report [Department for Trade and Industry (DTI), 2003]. Pattison drew public attention to the cause of RM, raising its profile on the Whitehall public relations agenda, yet it is within the context of Bioscience 2015, and the dialogue it engendered between 2003 and 2009, that the history of British policy commitments to stem cell innovation should arguably be evaluated. Bioscience 2015 was heralded by government as a unique partnership for delegated policy making among bioscience, bio-industry, ministers of the crown, and public servants that promised to enfranchise stem cell science entrepreneurship among other novel life science disciplines (see DTI, 2003). As part of this exercise in delegation, the Department of Health and the DTI, with its successors (the Department for Business, Enterprise and Regulatory Reform or BERR, and the Department for Business, Information and Skills or BIS), held consultations with the BioIndustry Association, life science venture capital groups, and pharmaceutical companies to determine the best means by which innovative science cultures, and specifically 'Dolly's revolution',¹ might be promoted and sustained in Britain. Bioscience 2015 encapsulates the first chapter of this sustainability narrative which, by 2008/9 had adopted a modified storyline that emphasised survivability.

The paper begins by presenting a brief history of an RM industry that began to internationalise strongly in the 2000s. Much was anticipated of the UK contribution to RM at this time, creating fervour and enthusiasm in government circles. The remainder of the paper consequently explores the ministerial interpretation of a bioscience discussion cycle that embodies this parable of expectation, setting out, as it did, to create a road map through which RM and its sister technologies might achieve commercial fruition (Wainwright et al., 2006; Pollock and Williams, 2010). The paper focuses specifically on a rhetorical exchange of salutations between the primary author of the discussion cycle (David Cooksey) and government ministers, responding in kind, to his recommendations. An estimation is made of the word emphasis placement ascribed to by these actors, using the application of the computer-aided content analysis programme DICTION 5 (Hart and Childers, 2005). The DICTION analysis we have performed primarily focuses upon a comparison of scene-setting textual fragments from the discussion cycle, that is to say introductions and forewords provided by David Cooksey to the reports he collated, including Bioscience 2015 (DTI, 2003) and The Review and Refresh of Bioscience 2015

(Bioscience Innovation and Growth Team, 2008) in parallel with two formative rejoinders from government – *The Government Response to Bioscience 2015* (Warner and Sainsbury, 2004) and *Government Response to The Review and Refresh of Bioscience 2015* (BERR, 2009a). Our content analysis of these responses indicates that, *inter alia*, ministerial interpretation placed key emphasis, at this time, upon the distinctive and exceptional characteristics of the life science industries, such as their ability to perpetuate RM innovations. In our view, this amounts to a ministerial appropriation of the politics of expectation that has primarily arisen in parallel with the commercialisation of the genetic sciences and tissue engineering (Wainwright *et al.*, 2006; Pollock and Williams, 2010).

Capitalising on pluripotency

The discovery, and intricate profiling of the stem cell's near infinite capacity for molecular immortality has opened the twenty-first century chapter in a chronology of the genetic sciences that spans a paradigmatic behemoth, tracing its origins to Darwin and Wallace's 1858 declaration of a natural selection hypothesis, and Mendel's 1866 studies of plant heredity (Lane, 1994). Contemporary stem cell medical therapeutics is the *gestalt* of Darwin and Mendel's legacy and the era of DNA signature characterisation work it prompted between 1900 and 1944 via Avery, Macleod and McCarty; Chargraff; Franklin; Chase and Hershey; Crick and Watson; Meselson and Stahl; and Kornberg (Lane, 1994). The stranger-than-fiction innovations emanating from modern-day cellular biology, tissue engineering, reproductive medicine, and genomics capitalise extensively on the breakthroughs performed by these scientists and their inheritors, who went on to found an entrepreneurial, venture capital-led, bio-industrial complex of recombinant genetics in the 1970s and 1980s (Cooke, 2001).

In economic terms, the recombinant genetics industry was thought, at the time of its initiation (the mid-1970s), to represent a potential progenitor for a next industrial divide anchored in biosciences (see Piore and Sabel, 1984) to rival that of the silicon chip (Henderson, 1989). Like Fordism before it, silicon-based semiconductor production did alter industrial life dramatically, enabling the information age, accentuating globalisation and intensifying the spread of Taylorist work cultures internationally (Henderson, 1989). Whilst securing a worldwide footprint, the genomics and genetics industries of the 1970s, 1980s and 1990s achieved modest gains when compared with the expectations that accompanied their instigation [for the USA, see Lysaght and Reyes (2001), Lysaght and Hazlehurst (2003, 2004) and Lysaght *et al.* (2008); and for the UK, see Cooke (2001, 2004), Hopkins *et al.* (2007), Tait (2007) and Martin *et al.* (2009a, 2009b)].

A generational leap in scientific capability is said to have occurred in 1998 (Kemp, 2006; Lysaght *et al.*, 2008), with the peripheral decoding of stem cell pluripotency by James Thompson in Wisconsin (Wadam, 2009). This discovery helped to reassert optimistic claims that genetics might, as yet, sustain a new kind of industrial renaissance (see specifically Lysaght and Reyes, 2001; Lysaght and Hazlehurst, 2003, 2004; Lysaght *et al.*, 2008). Stem cells occur in all aspects of corporeal aetiology and are widely espoused as trenchant progenitor components of life (Weissman, 2005; Kemp, 2006; Hunziker *et al.*, 2006; Gardner, 2007; Mason and Dunhill, 2008a, 2008b), equipped with the ability to switch on and switch off regeneration and repair, transmogrify into multiple cellular forms (hence the plurip-

otent prefix) and reproduce infinitesimally (Reya *et al.*, 2001; Sato *et al.*, 2004). The commencement of a stem cell industry in the early 2000s aimed to exploit this capacity for therapeutic and profitable purposes (Lysaght and Reyes, 2001; Lysaght and Hazlehurst, 2003, 2004; Kemp, 2006; Lysaght *et al.*, 2008; Check-Hayden, 2011).

Since stem cell research and RM entered the genetics lexicon, both sobriquets have acquired hefty millstones of expectation (Wainwright *et al.*, 2006). RM has consequently attained the status of a universal panacea in waiting, despite the persistence of considerable scientific, manufacturing and venture capital barriers to the achievement of Darwin's apotheosis (Reya *et al.*, 2001; Fuchs *et al.*, 2004; Sato *et al.*, 2004; Mason and Manzotti, 2010; Nerem, 2010; Prescott, 2010; Check-Hayden, 2011). Knowledge of these vicissitudes has not, it seems, deterred speculative industries of hope – exemplified in the cord blood banking sector – from arising in response to predictions that stem cell science will one day precipitate a new industrial divide, as well as a genetic medical revolution (Brown and Kraft, 2007).

New Labour science policy, financialisation and regenerated hope

Commercial RM entrepreneurship has encountered myriad challenges since its inception, including product efficacy failures, and a period of forestalling during the dotcom bubble of 2001 and its aftermath (Lysaght *et al.*, 2008). The recombinant genetics industries, including early forms of RM, benefited extensively from a confluence of bull markets that helped fill the pockets of US venture capitalists in particular, and gave rise, in some instances, to over-investment and fraudulent activity (Hunziker *et al.*, 2006). The entrepreneurial segments of the RM sector remain limited, as a consequence, to a small number of probably fewer than 50 companies worldwide, many of whom survived the capricious tides of the early 2000s by sharing associations with US university life science clusters (Kewell *et al.*, 2009). Biotechnology companies in Europe and the Far East (primarily China, South Korea and India) have also become closely involved in RM product development activities and clinical trials in recent times, particularly when this has blended old and new forms of tissue engineering with stem cell therapies (Lysaght *et al.*, 2008; Martin *et al.*, 2009b).

The worldwide growth of RM as a medical biotechnology sector is indelibly engrained with that of financialised capital and financialisation in general – as a science and industry it owes much to cash-rich bull market cycles (Taylor, n.d.) that meant, for illustration, that US, European and UK governments could invest prodigiously in university life science projects during the late 1990s and early to mid-2000s (Cooke, 2001, 2009; Peston, 2008). Prior to the disintegration of the new economy in 2008 (Froud *et al.*, 2004; Froud and Williams, 2007), successive New Labour administrations channelled wealth gained from a rising financial services economy into the funding of the Strategy Technology Board, Regional Development Agencies, and latterly the stem cell, were escalating commodities for New Labour to imagine, in its rhetoric at least, as a twenty-first century UK Innovation PLC (Hope and Highfield, 2007).

The detailed architectural blueprint for this transition was initially provided in 2003 via the deliberations of a government/bio-industry working group, known as

the Bioscience Innovation and Growth Team (chaired by David Cooksey of Advent Venture Partners) [see Foreword to DTI (2003)]. The bioscience discussion cycle they co-produced consists of four main documents. Authored at different intervals by changing coalitions of corporate and state interests, this reportage comprises several polemical shifts in ministerial interpretation that we document in some detail in this paper. In 2003, when the series begins with Bioscience 2015, a dialogue is being sought with industry in terms of the best means by which novel scientific gains, such as those being augmented in genetics and the new discipline of RM, might ascertain British pre-eminence 'as a global leader in bioscience' (DTI, 2003, p.8). The year 2015 represents an auspicious date for the culmination of this vision for which a sandclock was already ticking since 'the UK must take steps now to secure its current threatened position as Europe's leading bioscience centre and number two in the world' (DTI, 2003, p.8). BIGT made initial sets of proposals for capitalising on the renewed knowledge liquidity of the life sciences that emphasised measures to bolster industry-health sector relations and the profile of UK clinical trials, addressing inter alia the negative consequences for firms of regulatory intensification. The report continued by recommending that venture capital incentives should be magnified in lieu of an 'immediate and severe funding crisis', and that infrastructural deficits might be attended to through the construction of 'four bioprocessing Centres of Excellence' and the expansion of 'interdisciplinary education essential to the bioscience sector' (DTI, 2003, pp.28-34, 69).

Informed by the proposals of the Bioscience Innovation and Growth Team, Warner and Sainsbury (2004, p.3) set out a series of long-term planning and investment commitments, which begin by 'initially focusing on research in the treatment and cure of four major diseases – Alzheimer's, stroke, diabetes and mental health as well as developing new medicines for children'; as part of an overall promise from the Chancellor of the Exchequer to provide 'an additional £25 million in each of the next four years ... to secure the necessary development of medical research here in the country' (Gordon Brown as quoted in Warner and Sainsbury, 2004, p.3).² Of the recommendations by the Bioscience Innovation and Growth Team, those involving detailed changes to corporate financing and the leveraging of liabilities within the UK tax system received the least favourable response. By contrast, commitments to excellence creation in bio-processing, the formation of a European bioscience stock exchange, and investment in specialist education and training initiatives were wholeheartedly embraced in rhetoric (Warner and Sainsbury, 2004, pp.5–19).

The infrastructural weaknesses identified within Cooksey's extensive, yet optimistic and ambitious, sectoral audit undertaken in 2003 were revisited as part of *Review and Refresh of Bioscience 2015* (Bioscience Innovation and Growth Team, 2008). *Review and Refresh* acquiesces to a less buoyant mood than its forerunner, highlighting progress in the form of 'reinforcing the funding of research, with a special emphasis on translational research', but also noting that other milestones had either fallen by the wayside or been lost sight of in a diffident 'economic climate [wherein] the flow of finance to emerging biotechnology companies from institutional investors has virtually ceased' (Bioscience Innovation and Growth Team, 2008, p.1). As a result, bioscience is seen as having entered into a period of disaggregation and shrinkage marked by prolific takeovers and bankruptcies, the concomitant decline of blockbusters; innovation bottlenecks created by the slow pace of National Health Service (NHS) product testing and adoption cycles, multifarious regulation, the diminution of UK clinical trials; and unfavourable NHS drug charging practices (Bioscience Innovation and Growth Team, 2008, pp.3–4).

The government's response to the plethora of recommendations put forward by Review and Refresh 2015 was to emphasise marketing and tax inducements as potential salves, promising reforms to NHS innovation decision systems in line with the outcomes of the Darzi Report (Darzi, 2008), and pocketed funding for new horizon initiatives, such as RM, through the Technology Strategy Board (BERR, 2009a; see also Office for Life Sciences, 2009, p.7, 2010). Most notably, however, New Labour's 2009 rejoinder to the Cooksey Report sought to manifest better business to government relations with the life sciences. Ostensibly, in its last months, New Labour proposed this solution as a way of assailing problems of entrepreneurial entropy by creating symmetries with bureaucracy to overcome market dysfunctions. Building upon this desire, the need for the sector to be led by a life sciences super cluster was signalled by the Office for Life Sciences (OLS) policy stipulations of 2009 and 2010, alongside a hope that greater private-public partnership arrangements could be fostered between life scientists and their NHS counterparts (Office for Life Sciences, 2010, pp.13-14). Investment in regenerative medicine was to be further prioritised as part of this new momentum (Office for Life Sciences, 2010, pp.42-43).

Methodology and sources

In political terms, ministerial interpretations count; they are signifiers of extant value. Linguistic analyses of ministerial interpretations convey a sense of the gravitas in which a report is held, in parallel with trenchant opinion of its worth, esteem and the legitimacy of its findings (Hart and Childers, 2005; Rogers et al., 2005; Short and Palmer, 2008). The following analysis of the bioscience discussion cycle we have described thus far (comprising four key documents in total) takes these observations into consideration. DICTION 5 has a number of attractive features in relation to the examination of unique elements of language in texts related to policy and management documents (Short and Palmer, 2008). Specifically, DICTION has been applied in a number of contexts where researchers have sought to assess the verbal tone of statements made in policy settings (Bligh et al., 2004a, 2004b; Hart and Childers, 2005; Rogers et al., 2005; Short and Palmer, 2008) and, in particular, where it was deemed desirable to conduct comparisons among such statements (Rogers et al., 2005). In comparison with other qualitative-textual software packages, DICTION was created for the differentiated analysis of specific types of texts, such as presidential speeches, public policy speeches, political debates, corporate annual reports, corporate public relations statements, legal documents, and magazine and TV advertisements; relying, in each of these categories, on a unique set of dictionaries allowing for the comparative assessment of textual documents (Short and Palmer, 2008). Research using DICTION has been published in a number of journals, such as American Behavioural Scientist, the Journal of Applied Psychology, the Journal of Business Ethics and Leadership Quarterly, wherein it has been used to examine the extant modalities of policy change, charismatic leadership, organisational image and organisational identity (Short and Palmer, 2008).

Using lexicographic theory, DICTION employs 33 different dictionaries, containing over 10,000 search words, to analyse a text passage. These dictionaries are

both context-specific to the type of speech or written reference material in question. This means that the software is sensitive to the deixic contours of dialogue. DIC-TION is meta-synergistic, allowing the user to specify the analysis of a text in DIC-TION's repertory of terms, such as 'politics', 'business' and 'scholarship', with further subcategories, such as 'corporate financial reports', 'corporate public relations' and others for 'business' or 'campaign speeches', 'public policy speeches' and 'political debates' in the 'politics' setting. DICTION's vocabularies contain individual words whereby homographs are explicitly treated by the programme through statistical weighting procedures, which partially correct for context (Hart, 2000; Bligh et al., 2004a). By comparing a verbatim text passage with a specified repertory, DICTION generates scores for word passages (of a minimum of 500 words) for a set of each of its pre-set variables. As an outcome, DICTION generates a relatively straightforward measurement of the levels of certainty which underpin a textual passage of a speaker or author by combining totals from dictionaries signalling assuredness (i.e. words that imply a modality of confidence; uses of the verb 'to be' and so on); and subtracting from them vocabularies connoting tentativeness (i.e. modalities of ambivalence, hesitation and hedging) and by making comparison across passages (Bligh et al., 2004a). While DICTION could be criticised for imposing a significant set of assumptions in deriving its output scores on account of the pre-supplied repertories of text with which imported text passages are compared, this problem is significantly reduced by comparing thematically categorised imported text passages derived in similar settings with each other (Rogers et al., 2005).

For the purpose of this paper, excerpts from four textual documents representing the bioscience discussion cycle were subjected to a comparative analysis. The earliest of these reports, *Bioscience 2015* (DTI, 2003), was commissioned in January 2003 by Lord Sainsbury, parliamentary under-secretary of state for science and innovation, and Lord Hunt, then a minister at the Department of Health. The report also lists, as authors, the Bioscience Innovation and Growth Team in partnership with the BioIndustry Association (BIA). *Bioscience 2015* includes an introduction by the prime minister, Tony Blair, and David Cooksey, chairman of Adventure Venture Partners and chairman of the Bioscience Innovation and Growth Team (DTI, 2003, p.5).³

The 2004 Government Response to Bioscience 2015 (Warner and Sainsbury, 2004) is much shorter than the earlier document to which it responds (*Bioscience 2015*). Being addressed to David Cooksey, the response lists as authors parliamentary under-secretary of state of the Department of Health, Norman Warner, and parliamentary under-secretary of state for science and innovation at the Department of Trade and Industry, David Sainsbury (who commissioned the earlier report). *Review and Refresh of Bioscience 2015* is prefaced by David Cooksey, but does not include an additional introduction by a senior government official. Interestingly, David Cooksey is now listed as chairman of the Eurasian Natural Resources Corporation,⁴ and the report draws on a much smaller number of contributors.⁵ The final document in the series (BERR, 2009a), entitled *Government Response to Review and Refresh of Bioscience 2015*, is prefaced by Lord Mandelson 'on behalf of BERR' and highlights the link between this initiative and an earlier report entitled *Building Britain's Future: New Industries, New Jobs* (BERR, 2009b).

In order to ensure compatibility between the four reports, initially all illustrations, captions and footnotes were removed. These measures, however, did not result in the desired typological homogeneity of the four text documents because both *Bioscience 2015* (DTI, 2003) and the *Review and Refresh of Bioscience 2015* (Bioscience Innovation and Growth Team, 2008) contain far more technical detail than the respective government responses. In order to compensate for this problem, the consecutive DICTION analysis was conducted with abbreviated versions of all documents, which included the political introductions of these documents only. Fortuitously, this focus on introductory political statements resulted in documents which were similar in word count, ranging from 947 words for the 2009 government response to 1061 for the 2004 government response, as well as in terms of word usage (see Table 2). The documents were consecutively analysed under the DICTION setting 'politics' with the sub-setting 'public policy speeches'.⁶

Results

Table 1 depicts a comparative assessment of word utilisation frequencies for the non-technical aspects of all four reports. When taken as a whole, the relative frequency of keyword tabulations shown in Table 1 indicates a pattern of change in the thematic focus of the four documents. Thus, *Bioscience 2015* (shown in column a) shows 'bioscience' as the most recurrently instantiated keyword, followed by 'industry', 'companies', 'health' and 'clinical'. As might be expected, the non-technical excerpt of the 2004 *Government Response* (column c) to *Bioscience 2015* lists the self-referral term 'government' as the most frequent keyword, followed by 'clinical', 'NHS' and 'health' and 'bioscience' in joint fourth place. The analysis of keyword frequencies between the excerpt from *Review and Refresh of Bioscience 2015* (column b) and the original *Bioscience 2015* report (column a) shows that both reports cite 'bioscience' as the most frequently attributed keyword. This is followed by 'clinical' as the second most frequently cited keyword (0.48% versus 0.56% in terms of usage). Deployment of the word 'bioscience' notably diminishes between *Bioscience 2015* and *Review and Refresh of Bioscience 2015* (in usage terms the

Report	<i>Bioscience</i> 2015 (2003) a	Review and Refresh of Bioscience 2015 (2008) b	Government Response to Bioscience 2015 (2004) c	Government Response to Review and Refresh of Bioscience 2015 (2009) d				
Word count	2500	5500	4500	7000				
Keyword count (%)								
bioscience	1.64 (1)	0.89(1)	0.27 (4)	0.19 (5)				
clinical	0.48 (5)	0.56(2)	0.62(2)	0.20 (4)				
companies	0.64 (3)	0.13	0.22(5)	0.04				
government	0.36	0.29 (5)	0.93 (1)	0.49(1)				
health	0.52 (4)	0.27	0.27(4)	0.22(3)				
industry	0.84(2)	0.53 (3)	0.11	0.27(2)				
NHS	0.12	0.24	0.51 (3)	0.10				
regulatory/ regulation	0.16	0.18	0.07	0.04				
support	0.28	0.40 (4)	0.11	0.10				
technology	0.12	0.15	0.16	0.08				

 Table 1. Keywords as percentage of words analysed (key non-technical sections, including introductory political statements)

drop is from 1.64% to 0.89%). 'Companies', 'health', 'industry' show similar patterns of diminishment. Notwithstanding, other frequently occurring keywords, including 'support' and 'government', appear to remain relatively stable in terms of their utilisation (encompassing a percentage change of 0.28-0.40% for 'support' and 0.39-0.29% for 'government'). Both the 2004 and 2009 responses to David Cooksey's recommendation use 'government', if at a diminishing rate (falling from a rate of 0.93% in 2004 to 0.49% in 2009). Deployment of the terms 'clinical' and 'health' also declined between 2004 and 2009. In contrast, 'industry' appears to have become an increasingly important term by the end of the discussion cycle (rising from a utilisation rate of 0.11% in column c to one of 0.27% in column d).

Table 2 depicts the results of a DICTION-based analysis of shorter fragments of introductory text. As indicated by the keyword count, both the 2003 *Bioscience 2015* report and the 2009 government response make frequent use of the words 'government' and/or 'industry', as they place key emphasis on these two groups as principal actors in the bioscience landscape. This emphasis on 'industry' is particularly pronounced in the introduction to the 2003 *Cooksey Report*, where this word accounted for 1.48% of all analysed words (appearing approximately 1.5 times within every 100 word text block). Later reports (including the 2004 *Government Response* and the 2008 *Review and Refresh*) show a far less pronounced usage of 'industry', with the exception of a dual emphasis which is placed upon 'government' and 'industry' within *Government Response to Bioscience 2015* (2009) – wherein both words yield a relative frequency count in excess of 1%.

In terms of DICTION scores derived from this analysis, it is interesting to note that the 2003 *Bioscience 2015* shows significant negative scores for Ambivalence and Hardship. Taken together, these scores are indicative of a confident and upbeat tone which characterises, in particular, ministerial interpretations of the earliest report in this series. The mood of general optimism that accompanies political endorsement of the 2003 report does not seem, however, to translate into concomitant positive scores for Praise, Satisfaction or Accomplishment. The expectation is primarily of future gains based on past and present innovations. It is notable that this report excerpt, together with all other texts investigated here, scores negatively on Levelling terms that seek to establish equivalence, suggesting that these reports place bioscience within a textual context of distinctiveness and exceptionality.

There was a notable change in perception, however, between the ministerial foreword accompanying the publication of the DTI's *Government Response to Bioscience 2015* in 2004 and that which precluded the release of *Bioscience 2015*. The 2004 report yields significant positive values for Accomplishment and Inspiration when compared with significant negative scores for Ambivalence and Hardship, already observed for the 2003 report. This suggests that the 2004 government response promoted a position where the status of bioscience was more pronouncedly cast in positive terms. This is mirrored by significant positive scores for the composite variables Activity and Optimism, which are indicative of a confident attitude towards the then current orientation of government policy.

This verbal framing of bioscience in terms of accomplishment is replicated to some degree by the 2008 *Review and Refresh of Bioscience 2015*, which, in terms of key DICTION scores, mirrors the tone of the earlier 2004 government response in relation to the attribution of a significant positive score for Accomplishment. However, it is interesting to observe that this textual excerpt does not yield significant negative scores on Ambivalence and Hardship (as the previous two reports

Report	<i>Bioscience</i> 2015 (2003)	Review and Refresh of Bioscience 2015 (2008)	Government Response to Bioscience 2015 (2004)	Government Response to Review and Refresh of Bioscience 2015 (2009)
Word count	1011	949	1061	947
Keyword count (%) government industry) 0.99 1.48	0.63 0.32	1.23 0.38	1.80 1.37
DICTION scores (Ambivalence ¹ Self Reference ² Levelling Terms ³ Praise ⁴ Satisfaction ⁵ Inspiration ⁶ Hardship ⁷ Accomplishment ⁸ Cooperation ⁹	$\begin{array}{c} \text{standard score} \\ -1.19^{*} \\ -0.63 \\ -1.47^{*} \\ -0.81 \\ -0.43 \\ -0.39 \\ -1.27^{*} \\ 0.50 \\ -0.71 \end{array}$	$\begin{array}{c} -0.51 \\ -0.87 \\ -1.51^{*} \\ -0.08 \\ 0.90 \\ -0.40 \\ 0.01 \\ 1.90^{*} \\ 0.55 \end{array}$	-1.69^{*} -0.81 -1.78^{*} -1.10 -0.43 1.80^{*} -1.27^{*} 3.04^{*} -0.90	-1.80^* -0.75 -1.44^* -0.07 -0.33 -0.10 -0.42 2.57^* 0.77
DICTION variable Activity ¹⁰ Optimism ¹¹ Certainty ¹²	s (significance 0 0 0	2++) 0 0 0	+ + 0	0 + +

 Table 2. DICTION analysis of key bioscience discussion cycle documents (introductory political statements only)

Notes: DICTION measures the significance of a score by comparing the relative frequency of words expressing 'hesitation' or 'uncertainty' in the case of Ambivalence to a standard range of frequencies at which that specific score should be found for the specific type of text (i.e. public policy statements). If the relative frequency of these words exceeds a low threshold, the score is negatively significant (i.e. proportionately under-utilised). If it exceeds a high threshold, it is positively significant (i.e. proportionately over-utilised). As a rule of thumb, scores above +1 or below -1 are likely to be detected as statistically significant. In particular:

- 1. Ambivalence denotes modalities of uncertainty; for instance, words and phrases that express hesitation or doubt, implying unwillingness to commit (i.e. 'allegedly', 'almost', 'approximate', 'baffling', 'dilemma', 'guess', 'suppose');
- 2. Self Reference denotes first-person deixic positioning (such as 'I', 'myself', 'himself', 'herself');
- 3. Levelling Terms denote unanimity, belonging, confidence and certainty (such as 'everybody', 'anyone', 'consistently', 'unconditional', 'inevitable');
- 4. Praise denotes affirmations of some person, group or abstract entity (such as 'reasonable', 'successful', 'leading');
- 5. Satisfaction is associated with positive affective states (e.g. 'passionate', 'excited', 'auspicious', 'encouraging');
- Hardship refers to unsavoury or undesirable outcomes (e.g. 'error', 'cop-out', 'weakness', 'bankruptcy');
- 7. Inspiration refers to nouns associated with moral or personal qualities (such as 'virtue', 'courage', 'dedication');
- Accomplishment denotes words expressing task achievement (e.g. 'establish', 'finish', 'influence' 'proceed');
- 9. Cooperation denotes terms designating behavioural interactions (e.g. 'network', 'exchange' and 'share').

DICTION variables are composite scores and subject to a similar assessment of significance as DICTION scores. Specifically:

- 10. Activity refers to language denoting the implementation and the avoidance of inertia;
- Optimism denotes language endorsing a person or concept and highlighting their positive entailments;
- 12. Certainty indicates resoluteness, inflexibility and a tendency to speak ex cathedra. For further details see Hart (2000).

did). This can be interpreted as a change in verbal framing in relation to the 2003 report excerpt in the sense that the status of bioscience is now described with reference to diminishing levels of confidence, certainty and optimism when compared with the relevant segments of the original *Bioscience 2015* report. This is confirmed by the absence of significant scores for the composite variables Activity and Optimism, which were observed for the earlier 2004 *Government Response*. The final text segment of the series, the 2009 *Government Response to Review and Refresh of Bioscience 2015*, appears to combine a positive verbal framing of existing cooperation with the downplaying of Ambivalence and Hardship. This is exemplified by positive scores for Accomplishment and negative scores for Ambivalence that are significant. Positive scores for the composite variables Optimism and Certainty are likewise indicated.

Discussion and conclusions

The bioscience industry is a British success story. From the discovery of the double helix structure of DNA 50 years ago in Cambridge, Britain has been at the forefront of bioscience. Our academic and research scientists remain amongst the best in the world ... The UK bioscience industry faces an exciting future. (Tony Blair, Foreword to *Bioscience 2015*: DTI, 2003, p.3)

As the UK economy is rebalanced we need to build on our strengths and look to high-tech sectors as the new drivers of growth and prosperity: the medical biotechnology industry is one such sector with the key attributes to play a leading role in driving our economy in the future. (Lord Mandelson, Foreword to *Government Response to Review and Refresh of Bioscience 2015*: BERR, 2009a, p.3)

During their time in office. New Labour policy makers became ardent admirers of the medical life sciences. Indeed, it seems that by the 2000s, key ministers, including Peter Mandelson, Gordon Brown and Tony Blair, had been wholeheartedly captivated by the dream of a worldwide stem cell biotechnical renaissance. British bioscience firms were to stake a formative claim in this revolution, via the catalyst of a public-private partnership between government and industry that, it was hoped, would produce internationally competitive RM innovations (Cooke, 2001, 2004; DTI, 2003; Warner and Sainsbury, 2004; Bioscience Innovation and Growth Team, 2008; BERR, 2009b). Significant pledges of New Labour support for this initiative were forthcoming throughout the 2000s, symbolised by the commissioning of the Pattison Review in 2005 (UK Stem Cell Initiative, 2005). This review reflected the tenor of a much broader conversation being held at that time on a tripartite basis with representatives from the bioscience industries. In the beginning, this dialogue emphasised success, optimism, dynamic energised growth, expansionism and the exceptionality of stem cell innovations. Words such as 'bioscience' and 'industry' were enthusiastically embraced, particularly in relation the 'health' and 'clinical' applications of novel life science innovations. The textual analysis we have undertaken, allied to a synthesis of word counts, suggests that this optimistic conjecture altered over time, from one of securing sustainability for medical bioscience as it sought to capitalise on the new discipline of RM, to one of ensuring survivability as the economic outlook soured around about 2009. This was accompanied by changing patterns of verbal preferment (see Table 1).

Tables 1 and 2 depict a series of statistical word tabulations that draw attention to some important indexical patterns which occurred as this narrative renegotiated its course. Our research noted that the foreword to Bioscience 2015 (DTI, 2003) gives prior importance to 'bioscience', followed by 'industry', 'companies', 'health' and 'clinical'. Bioscience 2015 did so as part of a discourse of market efficacy and commercial actualisation. Our reading of this document and the ministerial rejoinder to which it relates (see Table 1) suggests that the New Labour administration was concerned with maximising the health and social impact of biotechnological entrepreneurialism at that time, as well as with improving the efficacy of UK innovation up-take by the NHS and private sector procurers. It is curious to note that our word tabulations did not identify 'finance' as a nomenclature, but rather observed oblique references to 'industry'. Such oblique perceptions of industry among ministers were garnered with demonstratively confident and positive aspersions of Accomplishment and Inspiration, and Activity and Optimism, prior to 2009. Positive scores for the composite variable Certainty were also highlighted. Whilst an attempt is made to continue this up-beat momentum in the Government Response to Review and Refresh of Bioscience 2015, it is also clear that, by this time, a strategy of bureaucratic substitution had been enlisted as a compensation for market failures that would seek to plug medical bioscience firms and RM enterprises directly into the supply-chain circuitry of the NHS.

New Labour made a verbal commitment to support medical bioscience and the development of a British RM through thick and thin, much as marriage partners. It honoured this commitment rhetorically by offering to safeguard the industry so that closer ties might be forged among the NHS supply chain, bioscience enterprises and medical research consortia. The strength of this conviction can be properly assessed only *post hoc*, through the measurement of comprehensive budgetary data relating to government spending on bioscience. Alas, only data relating to ministerial pledges are available at the current time (see Hope and Highfield, 2007; Allenye, 2010). This includes Coalition pledges of support for RM which continue to frame stem cells in a similar light to that cast by New Labour. The Coalition government, which comprises an alliance between Liberal Democrats and neoliberal Conservative politicians, pledged in the Spring of 2011 to reduce significantly the national science budget as part of its package of austerity measures; yet, their proposals promise to ring-fence funds for RM and stem cell science. There appear to be areas of significant repetition between Coalition and New Labour policy, perhaps old wine in new bottles. Correspondingly, the drivers for innovation stipulated in the Coalition's plan for growth seem to echo past initiatives championed by New Labour - and David Cooksey (Hope and Highfield, 2007; Allenve, 2010). Tax reform, the incentivisation of UK clinical trials, and the fast tracking of promising innovations within government-sponsored hubs are professed Coalition solutions to entrepreneurial sluggishness within the life sciences sector (Hope and Highfield, 2007; Allenye, 2010). New Labour also proposed these ideas, based on Cooksey's advice. Stem cells are viewed as a major strategic asset in this plan, for which New Labour promised much, but delivered relatively little before leaving office. New Labour's legacy, in this respect, has been to institutionalise an optimistic and expectant policy rhetoric within which the fate of UK stem cell science, and British RM entrepreneurship, appears increasingly embedded.

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Notes

- 1. The BBC announced "The first mammal to have been successfully cloned from an adult cell ... at the Roslin Institute in Edinburgh": Anon. (nd.) BBC On This Day: '1997: Dolly the sheep is cloned', available from http://news.bbc.co.uk/onthisday/hi/dates/sto-ries/february/22/newsid 4245000/4245877.stm [accessed 2010].
- 2. Citing the Right Honourable Gordon Brown PC, MP: Budget Speech of 17 March 2004, available from http://en.wikipedia.org/wiki/Gordon Brown [accessed 2010].
- 3. An Appendix to the document gives details of a steering group of 11 members; a biomanufacturing working group of 14 members; a European markets working group of 14 members; a finance and investment group of 18 members (the largest of all the working groups); and a group representing NHS/industry partnerships, consisting of 17 members. Overall, the report boasts 74 authors and/or contributors of whom about 33 hailed from the pharmaceutical industry or industries related to the life sciences, 17 from financial services, 15 from academia, and about nine from various government agencies and quangos.
- 4. ENRC is a mining, processing, power and logistics group which operates primarily in Kazakhstan (see www.enrc.com).
- 5. The Appendix lists a steering group of 13 members, a new ideas working group of 14 members and a finance and investment working group of 14 members. In total, the report draws upon the contributions of 41 individuals of whom about 17 hail from the pharmaceutical industry, nine from financial and legal services, eight from government agencies and seven from a mix of academic and non-profit organisations.
- 6. The introductory statement represents a policy statement in relation to a public policy issue. One of the authors has gathered some experience in the application of this DIC-TION facility through its utilisation in an NHS-sponsored research project on public private partnerships in primary care (Beck *et al.*, 2009).

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