



ARTICLE

Social bodies and social justice

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Abstract

This paper identifies and engages with the *social bodies* emerging by virtue of the social turn in the life sciences and recent embodied approaches to social justice. Across these diverse domains, bodies are being narrated as shaped by and dependent on their environments. To explore this potentially important and productive convergence, we bring Martha Fineman's vulnerability theory into conversation with neuroscience and environmental epigenetics. We foreground significant intersecting concerns and argue that vulnerability theory – and other embodied models of social justice – is strengthened by taking embodiment seriously, including attending to the social turn in the life sciences. This can enhance the potential traction of these progressive theories. These in turn provide an alternative theoretical framework to the neoliberal lens through which neuroscience and epigenetics have hitherto been translated into policy and practice. We nevertheless acknowledge the potential limitations and dangers of the current biopolitical landscape.

Keywords: socio-legal studies; neuroscience; epigenetics; vulnerability theory; child and family policy

1 Introduction

The relationship between our bodily place in the world and social justice has long preoccupied feminist, critical race and disability theorists.¹ It has also provoked and shaped particular fields of study, such as epidemiology and public health.² More recently, and the focus of this paper, this relationship has become a more pervasive concern across the humanities, social and life sciences. In the humanities and social sciences, for example, the body features prominently in an increasing number of approaches to social justice. From the discourses of precariousness (Butler, 2005) and vulnerability (Fineman, 2010; 2014; 2015; 2017a; 2017b) to the capabilities approach (Nussbaum, 2011; Sen, 1980), social flesh (Beasley and Bacchi, 2007) and depletion (Goldblatt and Rai, 2017), the body has been positioned as a site for understanding and responding to our common humanity. Within such models, the embedded fleshiness of the human condition is foregrounded with the hope of leveraging a more responsive state (Fineman, 2010): one that recognises not only common rights and state obligations, but also our specificity and ethical individualism (Sen, 1980).

As these approaches to social justice have gained ground in the humanities and social sciences, there has been a contemporaneous turn to the social in the life sciences. Here, what were once imagined as immutable facts of existence – hardwired biological codes, systems and processes – have lost their indifference to the social world. In particular, bodies have become porous to and shaped by environments of abuse and disadvantage. Neuroscience and epigenetics have been at the forefront of this profound shift in

¹While feminist and critical race scholars (e.g. Haraway, 2004; Roberts, 2010) have done much to explore this terrain, it is perhaps disability scholars who have most acutely illustrated the social-justice implications of the relationship between the body and the social context it is conceived within and moves through. This is reflected in the social model of disability that has shaped both disability studies and international civil society discourse (see Oliver, 1981; 1983; 2013).

²The social-justice concerns in these disciplines are most apparent in the work since the early 1980s that has focused on the social determinants of health (e.g. Marmott, 2005; Wilkinson and Pickett, 2011).

scientific thinking. As Maurizio Meloni writes, our understanding of the brain has been reimagined from an ‘isolated data processor to the ultrasocial and multiply connected social brain’ (Meloni, 2014). At the same time, epigenetics – the investigation of changes in gene expression that are not driven by alterations to the underlying DNA sequence – has delivered us to a post-genetic world where genes are no longer ‘absolutely sovereign’ but are ‘contextually dependent (and elusive) entities that cooperate extensively with a large variety of postgenomic’ environmental and social factors (Meloni, 2014, p. 601). Importantly, both epigenetics and neuroscience have been identified as offering new ways to understand and address inequalities and disadvantage (Loi *et al.*, 2013; Hair *et al.*, 2015).

Long-standing interest in the relationship between the body and the social is therefore being articulated in new ways at multiple disciplinary locations. Across these contexts, *social bodies* are emerging that may be implicated in overlapping social-justice concerns. Discussion across these disciplines has the potential to strengthen intersecting agendas that seek to understand and address inequalities that become embedded in, or understood through, the body. In this paper, we argue that bringing the social bodies invoked within embodied approaches to social justice and the new ‘social biologies’ (Pickersgill, 2014) into conversation has the potential to invest social-justice projects with new urgency, and greater political purchase, as we understand in new ways how opportunities and life chances may be limited by adversity and deprivation. This recognises the political and legal traction of the ‘hard’ sciences and thus the potential leverage afforded by this ‘new molecular landscape’ (Pickersgill *et al.*, 2013).

To develop this argument, we focus on Martha Fineman’s response to vulnerability as ‘*the primal human condition*’ (2017b, p. 142, emphasis in original). Fineman’s vulnerability theory is built on the twin pillars of our bodily place in the world and our embeddedness in social and institutional relationships. These foundations mirror the analytical focus of the new social biologies and Fineman’s attention to institutional structures makes it particularly relevant for the analysis and development of law and policy. Arguing for greater attention to what it means to talk of embodiment at this point in the development of the life sciences, we illustrate how these knowledge claims strengthen vulnerability theory’s significant potential as an analytical framework and deliberative space for the formation of socially just law and policy. Further, while developments in the life sciences have quickly become associated with stigmatising and punitive social policies, we posit vulnerability theory as a means of wresting these scientific models from neoliberal frameworks, enabling the science to be used to scaffold more progressive agendas. We contend that, through this, vulnerability theory helps to reveal and challenge the narrow conception of the ‘social’ that inhabits – and limits – contemporary science and policy.

The paper begins by articulating Fineman’s theory of universal vulnerability. We then set out the fundamental propositions of neuroscience and epigenetics, focusing on how intergenerational processes have become an important locus for these two fields and the point at which they meet. Having acknowledged the *social bodies* that populate these projects, we address how scientific claims from these fields have been mobilised in policy. The final section returns to vulnerability theory and demonstrates how the ‘new biosocial terrain’ (Meloni, 2014, p. 595) may provide further weight to a vulnerability analysis of government interventions and help to formulate alternative policy that is potentially both more effective and just.

2 Vulnerability theory

The last two decades have seen the emergence of a new humanist discourse that centres embodiment – entwining ethics and ontology – to challenge and realign existing ethical and political models of responsibility (Murphy, 2011, p. 577). While our argument has relevance across this rich and diverse field of embodied approaches, here we focus on the analytical framework that Martha Fineman has built upon the ontological fact of our embodied vulnerability. In this section, we set out Fineman’s analytical proposition, which deploys embodied vulnerability to articulate a ‘more inclusive and realistic legal subject – one that makes it clear that injury and injustice does inevitably arise when the state remains unresponsive to human vulnerability and dependency’ (2017b, p. 149).

For Fineman, embodied vulnerability is the defining human condition: it is part of our shared humanity that we all age and may be struck down by illness and natural or man-made disaster. While embodied vulnerability is universal, it is also particular, reflecting our different forms of embodiment and our positioning within webs of economic and institutional relationships. Thus, Fineman brings together our embodied vulnerability and our social embeddedness to argue that vulnerability is ‘both universal and particular; it is experienced uniquely by each of us’ (2010, p. 269). Fineman’s understanding is therefore distinct from the stigmatising vulnerability of social policy, which characterises individuals and groups who, by virtue of their circumstances, are more susceptible to harm than others. Fineman regards the ascription of vulnerability to some people and not others as ‘misleading’ and ‘inaccurate’. It is also pernicious, as grouping individuals into ‘vulnerable populations’ may overstate their likeness according to a small number of shared characteristics, while understating their likeness to members of the majority population, which may precipitate their stigmatisation (Fineman, 2013, p. 16).

From this ‘descriptive or empirical’ starting point, Fineman develops a theoretical framework for deliberating ‘the just allocation of responsibility for individual and societal wellbeing’ (2017b, p. 141). The universal vulnerable subject who sits at the heart of the theory is an alternative to the unencumbered liberal subject of contemporary law and policy: ‘an illusion of invulnerability and independence made possible by an unequal distribution of resources’ (Karpin, 2018, p. 1118). Acknowledging universal vulnerability – and the universal vulnerable subject it implies – the focus becomes resilience and the duty of the state is to provide us with the assets or tools to be resilient when our vulnerability is made manifest.

This political and ethical project can therefore be understood as one that aims to secure a more responsive state (Fineman, 2010): one obligated to address the differences in resilience that differentials in socio-economic, educational, environmental and other factors can create. For Fineman, the state is ‘the legitimate governing entity and is tasked with a responsibility to establish and monitor social institutions and relationships that facilitate the acquisition of individual and social resilience’ (2017b, p. 134). This is essential, as our position within this complex network of relationships ‘profoundly affects our destinies and fortunes, structuring individual options and creating or impeding opportunities’ (Fineman, 2017b, p. 145). For Fineman, then, a state ‘is responsive when it acts to monitor and adjust institutions and relationships when they do not function in a just manner’ (Fineman, 2017a, p. 4). We return to the question of an appropriately responsive state in the final section of this paper.

Our ‘embodied and embedded’ (Fineman, 2015, p. 2091) place in the world therefore provides the foundations for this humanist ethic (Murphy, 2011, p. 578). In this, as we shall articulate, there are clear similarities with the preoccupations of the new social biologies, as the environment shapes health outcomes, resilience and opportunities. For Fineman, however, embodied vulnerability is something of a term of art – a ‘provocation to express an alternative way of structuring law’ (Karpin, 2018, p. 1120). Her primary concern is our embeddedness – that is, our place in relation to the informal and formal structures and institutions of social life that enable us to be resilient: ‘A vulnerability approach is primarily focused on exploring the differences and dependencies that arise from the fact that we are embedded within society and its institutions’ (Fineman, 2014, p. 318) and ensuring that the state is responsive to those differences.

Our work here is not directed at detracting from Fineman’s twin pillars of our ‘embodied and embedded’ experience (2015, p. 291). Rather, our project is to return to the foundational concern with embodiment, recuperating it as something more than a means to get to the structural preoccupations of the theory. In this, we seek recognition of embodied differences as more than just the ‘bodily differences that are manifest across various members of society at any given time’ and variations due to the inevitable corporeal changes that occur as we ‘mature and grow, as well as age and decline’ (Fineman, 2017b, p. 144), which Fineman terms the ‘horizontal and vertical dimensions of difference’ (p. 148). Here, we seek a rebalancing – an understanding that our embodiment and our social embeddedness are intertwined in ways that potentially impact intergenerationally. We demonstrate that

vulnerability theorists need to take embodiment seriously and engage with emergent evidence of the somatic effects of social and environmental embeddedness.

Our argument, then, is that, as Fineman's theory of universal vulnerability is directed at securing a more responsive state – defining 'a robust sense of state responsibility for social institutions and relationships' (2017b, p. 143) – the life sciences are articulating a body that may very directly animate this project. As Jörg Niewöhner observes:

'It is almost ironic that the deeper biologists delve into the human body and the more fine-grained and molecularised their analysis becomes, the less they are able to ignore the many ties that link the individual body and its molecules to the spatio-temporal contexts within which it dwells. The emerging embedded body is a body ... open to the world.' (Niewöhner, 2011, p. 290)

The new social bodies of the life sciences may therefore help to compel the state obligations that vulnerability theory mandates as we understand the body as porous to the social world in which it is embedded. This porosity can biologically entrench inequalities and disadvantage, limiting our resilience and that of future generations. Thus, we wish to marshal this very overlap: fusing the recognition of our bodily place in the world that underpins embodied approaches to social justice and the knowledge claims of the new social biologies.

Having introduced vulnerability theory, the next section outlines the social bodies emerging within the biosocial landscape, focusing on developmental neuroscience and environmental epigenetics and, in particular, where these overlap with neuro-epigenetics. We approach the life sciences acknowledging that, while bodies are 'produced through networks that fold and cut across science and other fields' (Roberts, 2002, p. 21), biomedicine is a particularly privileged site at which bodies are constituted and experienced. Further, as Bruno Latour (1987) argues, propositions are not simply claims or statements: they also articulate the body into new sets of arrangements or relations. These can be very concrete and structural arrangements, for example with the institutions of the state as illustrated below. But they also have more diffuse and potentially profound effects. Biological facts are 'technophenomena' that constitute one part of our individual and shared reality but also shape 'how the self is made "real"' (Lock and Nguyen, 2010, pp. 109, 284). In the context of neuroscience, we see this in the emergence of new brain-based identities ('cerebral subjects' (Ortega, 2009)) within medicine and policy, as well as in the support groups that embrace neuroscientific language to better articulate and legitimise understandings and experiences of diagnosis ('neurochemical selves' (Rose, 2005)). At the same time, claims from neuroscience and epigenetics are also easily embedded in the responsabilising discourses of neoliberalism. Indeed, plasticity and the (unrealistic) belief that sufficient work on the self can improve the epigenome to the benefit of current and future generations can deflect attention from profound structural inequalities, resonating with Lauren Berlant's 'cruel optimism' (2011). Further, plasticity and the focus on transforming the self reinforce the existing political order and make 'normative particular ways of being' (Gillies *et al.*, 2016, p. 233), particularly around obligations to optimise the self and parenting. While our engagement with these rich understandings of embodiment is necessarily limited here, the naturalisation of contextual and contingent understandings of the body makes engagement with socio-political embodiment all the more pressing (Fox and Thomson, 2017; Dietz, 2018).

3 The life sciences and the new social body

In the twentieth and twenty-first centuries, neuroscience and epigenetics have been part of an 'epistemic transformation in the life-sciences' (Meloni, 2014, p. 597) where there is growing acceptance that humans are shaped by both biological and social forces. In these fields, and elsewhere, we see the 'molecularisation of biography' (Niewöhner, 2011), where early disadvantage can shape the brain's early development and, in our post-genomic world, the 'social life of an organism comes to be

implicated in phenotypic expression' (Pickersgill, 2014, p. 481). In other words, the socially unjust distribution of resources, precarity and resilience can have immediate somatic affects that are then (potentially) experienced for generations. In this section, we introduce neuroscience and epigenetics. However, the aim is not to provide a comprehensive account of these fields. Both terms encompass a wide range of specialisms and sub-specialisms at different stages of emergence that are often contested and sometimes in conflict. Rather, the aim is to introduce foundational propositions, acknowledging the limits of current knowledge, before proceeding to discuss the translation of neuroscience into public policy. Whilst we appreciate that all knowledge production is social, we recognise that some knowledge is more social than others, and are acutely aware of the almost endemic 'brain over-claim syndrome' (Morse, 2006) and 'translation fever' (Rose and Abi-Rached, 2014) that surround these fields.

3.1 Neuroscience

Since the 1990s, the brain has become the focus for unprecedented research funding and attention. A series of national and international collaborative 'big science' projects have sought to map and understand our neural selves. By the start of this century, there existed 'a truly global infrastructure for neuroscience research' and, by the beginning of the current decade, 'neuroscience acquired the characteristics of expertise' (Rose and Abi-Rached, 2014, p. 6). Rose and Abi-Rached distinguish four pathways along which neuroscience 'became entangled with the government of the living': psychopharmacology, brain imaging, neuroplasticity and genomics (Rose and Abi-Rached, 2014, p. 6). Whilst we focus on the latter two – reflecting our subsequent concern with governing through children and families – it is worth briefly noting that the birth of neuropharmacology and its almost exponential development since the 1960s enabled a neuromolecular vision of the brain to emerge. All mental states, events and processes became articulated at the molecular level. Shortly thereafter, brain-imaging technologies were deployed to make visible – and thus more intelligible – pathological and normal mental states and processes. Mediagenic visual representations, whilst shaped by the technologies and human choices that generated them, were taken to be unmediated snapshots of the truth and were a 'key element underpinning the growing power of neuroscience in the everyday world' (Rose and Abi-Rached, 2014, p. 10) including the public policy we will address. Yet, it is the advent of the plastic brain that perhaps best demonstrates how knowledge of the brain has been recalibrated and come to permeate popular, policy and legal cultures.

For almost a century, the prevailing wisdom was that the adult brain is transmutable and fixed. This 'hardwired' brain was incapable of restoring neurons or neural networks lost or damaged through illness or injury (Lowenstein and Parent, 1999, p. 1126). Understandings of brain plasticity emerged from experiments on the rehabilitation of humans following brain injury and stroke. These demonstrated that the damaged brain could remap itself and this could be accelerated by rehabilitation practices informed by neurobiology. Such experiments transformed our understanding of the brain from a 'self-contained, decontextualized entity' (Papadopoulos, 2011, p. 432) to the brain 'as plastic, mutable, open to transformation ... throughout life in response to external inputs' (Rose and Abi-Rached, 2014, p. 6). Plasticity was matched by the discovery of neurogenesis – the growth of new nerve cells in the brain. Research by Elizabeth Gould and colleagues (1999) challenged the belief that neuron development only occurs early in life and suggested that it may be stimulated or prevented by social and environmental factors. This links neuroscience and epigenetics – as Dimitris Papadopoulos writes: '[p]lasticity appears when epigenetics is at work: the worldly making and remaking of the totality of an organism in the process of its development' (2011, p. 433).

3.2 Environmental epigenetics

Epigenetics denotes the potentially heritable alterations 'in gene expressions that occur in the absence of changes to the DNA sequence itself' (Doliny and Jirtle, 2008, p. 4). Crudely, epigenetics concerns the mechanisms that switch genes on and off, or otherwise regulate gene expression. These changes

can be characterised as ‘developmental plasticity’ – a means by which the static or fixed genome can respond more flexibly to a dynamic environment (Meloni, 2014, p. 602). Within the diverse field of epigenetics, environmental epigenetics focuses on the impact of environmental factors on the epigenome, and therefore their impact on physiology – including brain form and function. In focusing on environmental impact, environmental epigenetics has its genealogical roots in the normative, scientific and theoretical foundations of epidemiology, although this is now pursued at the scale of the molecular (Pickersgill *et al.*, 2013, p. 430).

Several key studies underpin much epigenetic commentary and are taken to provide proof of principle. These studies track changes in methylation that result from nutritional or environmental factors, with chronic stress a concept that drives the field and provides a focus for experimental design (Niewöhner, 2011, p. 281).³ Methylation enables the activation and deactivation of genes and their associated proteins. If the genome is now best described as a ‘vast reactive system’ (Keller, 2012), then methylation is part of this, ‘regulating the production of specific proteins in response to the constantly changing signals it receives from its environment’ (Keller, 2014, p. 2427). The impact of methylation on phenotypic expression can be seen clearly in nature. With honey bees, for example, feeding genetically identical larvae differently produces different adult phenotypes, as larvae fed on royal jelly become fertile queens, whilst those fed less nutritious food become sterile workers (Kucharski *et al.*, 2008).

In this context, recourse is frequently made to key epidemiological observations, for example changes resulting from periods of famine. Studies of the Dutch Hunger Winter of 1944–45 during German occupation and the experience of malnutrition in Overkalix in Northern Sweden are taken to establish a connection between malnutrition *in utero* and early-life and subsequent metabolic disorders. These disorders persist for up to six decades, include the second generation, and are transmitted via the epigenome (Painter *et al.*, 2008). McGowan’s (2009) study of the level of methylation in post-mortem hippocampal tissue from two groups of suicide victims, one of which had a known history of abuse, is also notable. McGowan’s work found a different methylation pattern in the abused group compared to the non-abused group. This has been interpreted as evidence of trauma becoming part of the genetic ‘memory’, which may then (potentially) be transmitted intergenerationally (Meloni, 2014, p. 602).

In terms of laboratory science, the work of Michael Meaney, Moshe Szyf and colleagues on how variations in the maternal behaviour of rats created epigenetic alterations in affected pups is central (Meaney, 2001). These and similar studies are taken to show that early-life experiences (most often associated with maternal behaviour) can affect neural development, shape maternal behaviour in offspring and hence affect gene expression in a third generation. Significantly, interpretation of the evidence moves seamlessly from animal experiments to lessons for human behaviour where we must now attend to ‘shaping and reshaping our plastic brains’ (Rose and Abi-Rached, 2014, p. 12).

In the processes of translation, the focus on the epigenetic impact on children’s brains becomes gendered. Here, women can be framed as the ‘first environment for children, potentially activating and augmenting a range of moral discourses and subjecting them to (increased) scrutiny’ (Pickersgill *et al.*, 2013, p. 437). Yet this can be tracked backwards to Meaney’s rats, as the ‘pragmatic reductionism’ (Beck and Niewöhner, 2006) of the laboratory funnels us towards this particular experiment, which at this point and subsequently is freighted with common-sense and gendered understandings of parenting and responsibility. Returning to our earlier statement regarding the importance of attending to the processes of socio-political embodiment, and before considering how this is extended when science is translated into policy, it is worth briefly detailing how Meaney, Szyf and colleagues started their work on northern hooded rats, choosing these animals because of their identifiable ‘maternal’ behaviours of ‘arched-back nursing’ and ‘licking and grooming’ (Weaver *et al.*, 2004). Such behaviour is observable at different levels of intensity so that a ‘less

³While four mechanisms of epigenetic control have been identified, most of the environmental epigenetic studies focus on DNA methylation; see Romani *et al.* (2015).

maternal' group can be identified within any population. The experiments focused on the impact of these two types of behaviour on the methylation status of the stress-relevant receptor in the hippocampal tissue (Pickersgill, 2013, p. 432). Pups that had 'low nursing' mothers had significantly higher rates of methylation, taken to indicate a higher susceptibility to stress. As elsewhere in the life sciences, 'in epigenetics biomedical knowledge and the social structures of parenting, gender and family life mix in a range of ways' (Pickersgill, 2013, p. 437).

The epigenetic landscape remains defined by both hype and scepticism, with claims of intergenerational stability and transmission of epi-mutations proving particularly contentious. Environmental epigenetics – including neuro-epigenetics – is a field in the making. While some in the social sciences draw parallels between environmental epigenetics and the socio-biologies of the past that were shaped by race, gender and class prejudices (Gillies *et al.*, 2017), others express varying degrees of acceptance (Rose and Abi-Rached, 2013; Meloni, 2014). While we have significant reservations about the scientific processes, claims and their impact on policy-making, we share Meloni's view that epigenetic work in neuroscience and epidemiology in the last decade has 'undermined any residual dualism of nature and nurture, "biological" and "social" causes in developmental processes' (Meloni, 2014, p. 601). This necessitates grappling with the implications for social justice at the level of theory, policy and practice.

We would, however, make two further points about the science. First, the new claims bolster work that has long linked social, economic and environmental disadvantage to poor health and other outcomes. Environmental epigenetics has its genealogical origins in epidemiology, work on the social determinants of health and the developmental origins of health and disease. It addresses hypotheses accepted as legitimate within these fields but now at a molecular level. Second, even as we accept the degree to which the science is contested, these claims have a strategic value, able to underpin arguments for basic rights, welfare and redistribution. These claims do not need to languish within the gendered and punitive policy discourse they are currently associated with. At the same time, we acknowledge the concerns of Gillies *et al.* (2016, p. 228), who argue that the context within which these sciences have emerged is so politically loaded that it provides a 'somewhat ideologically sodden base upon which to pitch a big cross-disciplinary tent'. Nevertheless, we believe that it is worth exploring whether the 'deeply progressive implications' of the science (Fitzgerald *et al.*, 2014), when wrested from a neoliberal frame, can disrupt the narrow and gendered understanding of the 'social' that is mobilised in both the science and the policy to deliver positive outcomes for social justice.

Returning to vulnerability theory, neuroscientific and epigenetic claims can underscore the importance of attending to our 'embodied and embedded' human experience, and the indivisibility of these elements. Thus, there is merit in meaningfully exploring common ground. Whether this is provoked by a belief in the scientific validity of current claims or merely recognition of their strategic potential, scientific evidence can 'prompt a more decisive response' (Karpin, 2018, p. 116) in law and policy. As Karen O'Connell writes, when the brain is 'conceptualised as an organ of relationship and context' – rather than a singular computational device – 'social inequality is less easily overlooked' (O'Connell, 2016, p. 95). Similarly, the 'epigenetic body' gives strategies to ameliorate social and structural inequalities new impetus, before they 'get under the skin' and harm current and future generations (Meloni, 2015). More pointedly, and as Isabel Karpin argues, the ability to translate concerns around inequalities and harm into a 'physical register' provides the sort of 'evidentiary trail that is particularly appealing to law' (2018, p. 1133). This increases the likelihood of leveraging a more responsive state. While we promote engagement with the science, we do so acknowledging the biopolitical context within which this argument sits and we finish with an additional note of caution with regard to the science and this project.

4 The new social body of science and its life outside the laboratory

In the twenty-first century, the body that is emerging from neuroscience and epigenetics is embedded within and shaped by its milieu. This body is further shaped by its passage into public, legal and political spheres. Here, actors with divergent motivations employ it to do different work in different

contexts. In the public domain, the social body of neuroscience in particular has had notable reach. Its penetration into public consciousness and policy is due to various factors that have already been acknowledged, particularly the translation of neuroscientific claims into visual, mediagenic formats. Further, neuroscience has combined with a burgeoning desire for self-improvement, alongside a growing ethic of personal responsibility for biological well-being, to produce a conception of the brain/body as open to 'self-fashioning' (Rose and Abi-Rached, 2013, pp. 199–224). In this context, conceptions of our corporeality pay little heed to the impact of structural factors such as poverty, deprivation and discrimination, emphasising personal responsibility for well-being and self-improvement. Thus, they depict a body that 'is open for intervention and improvement, malleable and plastic, and for which we have responsibility to nurture and optimize' (Rose and Abi-Rached, 2013, p. 223). This represents a particular understanding of the social body that is clearly entangled with the contemporary responsibilising discourses of neoliberalism: as Dimitri Papadopoulos observes, every 'epoch has its brain' (2011, p. 433).

More relevant for our purposes, however, is a growing acceptance of brain-based explanations for human behaviour. This is evident in the legal domain, where there is, for example, increased recourse to neuroscience in criminal trials (Catley and Claydon, 2015). Recognition of the relationship between brain development and behaviour has the potential to enhance social justice through law and policy. In the youth justice field, for example, American research has demonstrated the diminished cognitive capacity of juveniles compared to adults, which may increase the risk of poor decision-making at times of stress, and has relevance for legal and social policies which infer adult capacity on children and young people (Cohen *et al.*, 2016). Mitigating evidence of the immaturity of the juvenile brain could afford young offenders in England and Wales protection from the increased 'adulteration' of youth justice practice (Walsh, 2011). Notably, protection would be afforded if the age of criminal responsibility, which is currently ten years, was raised. This was proposed by the Royal Society in a report on *Neuroscience and the Law*, where they argued 'that changes in important neural circuits underpinning behaviour continue until at least 20 years of age' to challenge the current age of criminal liability (Royal Society, 2010, p. 13).

In the legal context, then, the application of neuroscience has the potential to promote social justice. However, many writers have warned that neuroscience may be used to justify actions that do the very opposite – a familiar dual-use dilemma (Walsh, 2011) where the rhetoric of neuro-plasticity has ambivalent implications, 'divided as it is between resonance with the neo-liberal imaginary and emancipatory instances' (Meloni, 2014, p. 603). Recent years have seen the conflation of neuroscience with neoliberal and neoconservative political ideologies to conceptualise 'risky' populations, individualise social problems and justify particular interventions. In this regard, Broer and Pickersgill (2015) document the use of neuroscience within British social policy. They detail how neuroscience narratives emphasise individual responsibility (for self and community) and '[w]hile neuroscience may be leveraged by policymakers in ways that (potentially) reduce the *target* of their intervention to the soma ... they do so in order to expand the outcome of the intervention to include society writ large' (Broer and Pickersgill, 2015, p. 60, emphasis in original). Whilst such interventions may be seen as attempts to build resilience, the ascription of vulnerability to individuals, alongside stigmatising strategies to promote personal responsibility regardless of the wider context, can have the opposite effect. As we proceed to demonstrate, a universal understanding of vulnerability contests this approach, articulating state responsibility for our shared vulnerability that necessitates monitoring and shaping the social landscape to promote resilience.

Our challenge, then, is the responses to our corporeality that invoke a liberal subject whose (unfortunate) circumstances stem from her own failure to make the right choices. This conception is likely to lever a particular response from the state, underpinned by an alternative vision of what will promote resilience – read as self-sufficiency – with potentially regressive effects. It is to this conception, and its role in the contemporary regulation of 'problem' children and families, that we now turn. These discourses and policy initiatives illustrate how the social biologies have not led to responses that acknowledge the wider social context and environment. Rather, ideas of the social are impoverished, as the

family becomes the site at which dependency is framed and managed. In the final section, we provide an alternative response framed through a vulnerability lens that mandates a different ethical starting point and generates different policy and practice outcomes.

5 The biopolitics of brain-based public policy: the first three years' movement and beyond

Michel Foucault argued that public concern with childhood masturbation constituted for the first time the family as a site of surveillance overseen by medical science. He noted that 'precocious sexuality was presented from the eighteenth-century to the end of the nineteenth as an epidemic menace that risked compromising not only the future health of adults but the future of the entire society and species' (Foucault, 1990, p. 146). Reflecting upon this and the work of Claire Blencowe, Steve Garlick writes: '[T]he discourses and techniques of the anti-masturbation campaigns were central to modern biopolitical experience via the production of "trans-organic embodiment". This "trans-organic body" linked the bodies of children to those of the family and population' (2014, p. 4).

In rereading Foucault, Garlick recuperates the neglected place of security within his biopolitical framework. He argues that, whilst anti-masturbation tracts were aimed ostensibly at banishing masturbation, in reality, they were more concerned with enabling the mobilisation of mechanisms of security: 'From this perspective, masturbating bodies emerge as key sites for modern biopolitics, and as important figures in the genealogy of modern bodies' (Garlick, 2014, p. 6).

The contention that the (biopolitical) security of the nation rests on the physical and moral health of its young therefore has a long history and regulatory force. As the purported seat of child development has shifted over time, encompassing habits, instinct, free will and psychology, so the proposed target of intervention has changed (Rose and Abi-Rached, 2013, p. 196). In line with late twentieth- and early twenty-first-century preoccupations, today's locus of attention is the developing infant brain. This brain, and the social relationships it is configured within, has had a long gestation, however. Its origins are traceable to the early eighteenth century, where growing prosperity in Europe and America meant that women were no longer required to engage in agricultural or domestic hard labour (Bruer, 1999, pp. 29–30). As the social role of women changed, so they 'assumed, or were given, the role of shaping the futures of their infants' (Bruer, 1999, p. 30) and the view developed that 'once infancy had passed, no future experiences could reverse or change the course the mother set for her infant in those early years' (p. 30). Over time, infant determinism acquired scientific status, as psychoanalysts including Sigmund Freud and John Bowlby, and animal researchers, identified maternal behaviour as an explanatory variable in child development with lifelong effects (Bruer, 1999, pp. 30–31). This focus on maternal behaviour and responsibility is part of the genealogy of Meaney's rats.

Brain form and function were absent from these early accounts. It was not until the mid-1990s that neuroscience made real incursions into the realm of child development, when American and British policy-makers employed a selective reading of neuroscience to argue for early-intervention programmes with disadvantaged families (Bruer, 1999; 2011). John Bruer (1999) identified the rapid synaptic development and peak levels of synaptic density that occur in early childhood, notions of 'critical windows' in brain development and the importance of 'enriched environments' as the three pillars upon which 'the myth of the first three years' movement was built. On this conception, the brain displays time-bounded plasticity, such that the windows of opportunity that exist in infancy are liable to 'slam shut, never to be opened again' (Bruer, 2011, p. 6).

Whilst this narrative contradicts a cadre of research on the endurance of brain plasticity into adolescence and adulthood, it has maintained its purchase within the highest reaches of government. In 1997, for example, at a White House conference on Early Childhood Development and Learning, First Lady Hilary Clinton contended that 'children's earliest experiences, [including] their relationships with parents' will determine both 'how their brains are wired' and 'our nation's future'. She also linked individual brain development to the healthy parenting of future generations and the overall security of society, suggesting that experiences during 'the first three years' of life 'can determine whether children will grow up to be peaceful or violent citizens, focused or undisciplined workers, attentive or detached

parents themselves' (Clinton, 1997). As Garlick notes (2014, p. 6), early responses to the masturbating child, and in particular the production of 'trans-organic embodiment', provide a genealogical context for modern bodies and biopolitical interventions.

Similar arguments have appeared elsewhere. In England and Wales, a cross-party report entitled *Early Intervention: Good Parents, Great Kids, Better Citizens* (Allen and Duncan-Smith, 2008) and the subsequent *Early Intervention: The Next Steps* (Allen, 2011b) made the case for early intervention 'to break the cycle of underachievement and dysfunction which blights so many individuals, families and neighbourhoods' (Allen and Duncan-Smith, 2008, p. 5). The authors spoke of an expanding 'underclass' or 'dysfunctional base' within society characterised by benefit dependency, educational underachievement, family breakdown, alcohol and drug addiction, debt, violence and crime (Allen and Duncan-Smith, 2008, pp. 8–10). Whilst advocating both early intervention and remedial help across the early life course for children aged from birth to eighteen, the authors deemed the first three years of life especially important, drawing upon neuroscience to suggest that parental behaviour 'sculpts' brain development (for good or ill) during this period in particular, 'after which the basic architecture is formed for life' (Allen, 2011b, p. 6). A dominant theme was the risk that 'the intergenerational transmission of disadvantage – the legacy that all too often is destiny' – poses to society, and the associated social and financial costs (Allen and Duncan-Smith, 2008, p. 9). The social and economic benefits of measures to promote 'good parenting' and support children's social and emotional development, as mediated by the evolving brain, were the focus of a further report entitled *Early Intervention: Smart Investment, Massive Savings* (Allen, 2011a). Again, the risks posed by poor parenting were made clear: 'the costs of educational underachievement, drink and drug abuse, teenage pregnancy, vandalism and criminality, court and police costs, academic underachievement, lack of aspiration to work and the bills from lifetimes wasted while claiming benefits' (Allen, 2011a, p. xiv).

This (trans-organic) narrative linking poor parenting, children's brain development and societal security resurfaced in a speech by David Cameron, in which he outlined the Conservative government's strategy for extending the *Life Chances* of children (Cameron, 2016). Returning to Garlick's attention to security in Foucault's biopolitics, running throughout the speech was an appeal to security, which suggested that social and economic stability are intertwined. Moreover, as before, neuroscience was employed to support the need for early intervention: '[W]hen neuroscience shows us the pivotal importance of the first few years of life in determining the adults we become, we must think much more radically about improving family life and the early years' (Cameron, 2016, p. 5). The threat posed by dysfunctional families to children's development and future life chances, and to social and economic security more broadly, appeared evident.

In line with these policy pronouncements, recent years have seen increased recourse to early intervention with deprived children and families. With clear echoes of the past, many measures aim to regulate the behaviour of parents in order to address problematic behaviour in children, though now they invoke narratives about brain development as justification. Efforts to 'police pregnancy' provide an example of such brain-based early intervention (Lowe *et al.*, 2015, p. 16). The effects of domestic violence, 'psychosocial stress' and maternal alcohol consumption during pregnancy on the foetal brain are all cited in policy documents as reasons to intervene with 'risky' mothers (Allen, 2011b). Although efforts to support women during pregnancy are welcome, there is concern about the construction of 'risk' within these narratives. Whilst recent years have seen increased regulation of, and intrusion upon, pregnant women in general (Lowe, 2016), Frederick (2017, p. 75) notes a particular focus on those who, by virtue of their poverty, ethnicity, disability or sexuality, 'are systematically defined as "risky" mothers who are inadequate for the task of ideal mothering'. And, whilst concern for the foetal brain may be the stated rationale, some suspect that 'underlying political concerns about potential societal disorder from poor women's children ... [are] at the heart of these policies' (Lowe *et al.*, 2015, p. 26).

Similar logics also appear to inform the recent increase in non-consensual adoption cases (Wastell and White, 2017, pp. 111–127). When asked in 2012 about the rise in children being taken into care, the then president of the Association of Directors of Children's Services attributed it (in part at least)

to better understandings of the link between ‘neglectful parenting ... and the physical damage to brain development it can do with very young children’ (Wastell and White, 2012, p. 410). Section 14 of the Children and Families Act 2014 requires courts to process care proceedings ‘without delay’ and ‘in any event within twenty-six weeks beginning with the day on which the application was issued’, although extensions are permitted in exceptional cases. Critics contest the scientific basis of these developments, suggesting that the conflation of early intervention and child protection has created a ‘perfect storm’ (Featherstone *et al.*, 2014a, p. 4) that has driven the increase in applications for care orders, which must, on this narrative, occur quickly before the critical window of opportunity to support brain development closes. The concern is that this drives a policy of speedy removal, rather than sustained and meaningful efforts to support families to stay together.

Current debates around Adverse Childhood Experiences (ACEs) as a potential indicator of later life outcomes provide the latest policy discourse to repeat this pattern. As the ACE movement gains momentum globally, scientists contend that ACEs such as ‘abuse, neglect, exposure to domestic violence, alcohol and mental health problems, and having an incarcerated family member’ have significant implications for later life outcomes (Bellis, cited in Science and Technology Committee, 2018, Q.2). However, contemporary models construct ACEs as individual and family factors (Bellis, cited in Science and Technology Committee, 2018, Q.7), thus again articulating a narrow view of the social environment (White, cited in Science and Technology Committee, 2018, Q.12) and targeting particular families for intervention.

Parsing Garlick (2014), during the last three decades, the developing infant brain has emerged as a key site for modern biopolitics, as the ‘trans-organic brain’ links the actions of mothers to children’s brain development and the well-being of the wider population. These developments – a form of biopolitical governing through the brain (Rose and Abi-Rached, 2014) – continue a long tradition of governmental strategies to regulate children and families and are controversial for multiple reasons, not least the scientific basis underpinning many arguments (Rose and Abi-Rached, 2013; Bruer, 1999; 2011; Lowe *et al.*, 2015; Wastell and White, 2017). Notions of ‘critical periods’ in brain development help to construct a liberal conception of parenthood characterised by personal responsibility, with little reflection upon the wider social context in which parenting takes place. Moreover, these constructions are not gender-neutral and particularly impact on marginalised women, whose actions are deemed to threaten not only the welfare of their children, but also the security of wider society, as they incubate and parent the next generation of risky citizens.

6 A vulnerability-theory response to the young social brain

Policy responses to the claims of developmental neuroscience appear primarily directed at the family as the social environment of concern. Embedded in a neoliberal logic, these policies suggest that the main threat to individual and societal security is inadequate parenting (Gustafson, 2011). Thus, contemporary readings of the embedded ‘brain-body’ (Papadopoulos, 2011) reflect notions of personal and parental responsibility for behaviour and ignore broader social and structural factors. Developmental neuroscience becomes part of a ‘trans-organic embodiment’ that draws together early childhood development, ‘problem’ families and the future (social and economic) security of the population. Further, biopolitics has always had political economy as its organising rationale and, as Papadopoulos observes, every understanding or configuration of the brain ‘is the result of the conjoined action of capital and technoscience in Western capitalist societies’ (2011, p. 449). This translates in a number of ways, from the somewhat mundane policy level where packages offered by private-sector players get bundled up in public policies around early intervention (Rose and Rose, 2016, p. 152), to the more complex mechanisms whereby our very understanding of brain physiology becomes inseparable from the logics of neoliberalism with significant biopolitical consequences for regulation of the self and families. In terms of the latter, while Jan Macvarish *et al.* talk of the ‘politicisation of parenting’ (2014, p. 795), it might be more correct to talk of ‘biologised parenting’ (Lowe *et al.*, 2015, p. 198), or ‘neuroparenting’ (Macvarish, 2016), albeit in a context where we have ‘politics

disguised as science' (Bruer, 2011, p. 12). Yet, it is a particular science and a particular social body, and we contend that these policies engage an impoverished understanding of both the life sciences and the 'embodied and embedded' child.

Martyn Pickersgill argues that the complexity of contemporary developmental models directs us to revisit 'social scientific theories of embodiment, habitualization and the reproduction of social inequality' (Pickersgill *et al.*, 2013, p. 440). In an attempt to challenge social inequality, the universal vulnerable subject is figured as inhabiting an 'embedded' body. In this section, we illustrate how a vulnerability theory that takes embodiment seriously can provide an analytical and deliberative framework to facilitate the translation of contemporary life science claims into more effective and more just state responses. An important part of this is the way in which the theory challenges the current policy default to the family as a source of privatised responsibility.

To begin, it is worth repeating that Fineman identifies vulnerability as both universal and particular. The issue of particularity links to the state provision of resources that is responsive to individual circumstances and needs:

'[O]ur individual experience of vulnerability varies according to the quality and quantity of the resources we possess or can command. While society cannot eradicate our vulnerability, it can and does mediate, compensate, and lessen our vulnerability through programs, institutions and structures.' (Fineman, 2012, p. 80)

Fineman's vulnerability approach is therefore institutionally focused, identifying the responsibility of state institutions to provide assets to strengthen our resilience – that is, our ability to respond to what might befall us. Fineman notes that these may be assets, such as financial capital that we are able to mobilise to mitigate harm, illness and so forth, but also assets understood in terms of human capital or capabilities that enhance our ability to 'bounce back'. However, the new social biologies deepen this idea of resilience, as our biological 'assets' are shaped at a molecular level and may be heritable by future generations. Thus, the social bodies of the life sciences afford another tool in the armoury of those calling for a responsive state, strengthening demands by illustrating the importance of social environment and its impact upon the (molecular) fabric of our lives. Thus, we must recognise the 'many ways in which the state – through law – shapes institutions from their inception to their dissolution, and the ways in which those institutions produce and replicate inequalities' (Fineman, 2010, p. 274). This may shape not only personal circumstances, but also the soma, with implications for the resilience of current and future generations.

Bringing science and theory together in this way can challenge impoverished understandings of the 'social' in both science and policy, to contest the situation where '[t]he genetic determinism and reductionism of the past are replaced by a conception of early years plasticity through the interaction of brain as biology and the social as parenting' (Gillies *et al.*, 2016, p. 229). While Fineman recognises the family as a source of nurturing and care, it is also a political mechanism through which responsibilities are privatised and inequalities elided. The family is, she argues, 'a very public institution, assigned an essential public role within society. The family is delegated primary responsibility for dependency' (Fineman, 2013, p. 15). In the policies noted above, the broad range of environments within which we are embedded and upon which future development may be dependent (both in terms of the individual and potential future generations) is reduced to the family and, frequently, the mother. This is, of course, an impoverished understanding of both the scientific claims and ideas of social responsibility. Importantly, it also fails to account for the limited impact that individual families might make in the context of broader social environments of disadvantage and the fragility of families themselves. While the family may provide a source of shelter and resilience, it is itself a vulnerable structure and 'susceptible to harm and change' (Fineman, 2013, p. 11). As such, under a vulnerability analysis, both individuals and families require the state to (equitably) provide assets that enable resilience and flourishing.

In terms of the social biologies, it is clear that government cannot privatise all responsibility for our dependency on our environments to families, but must be responsive to environments of poverty, stress and degradation. As Fineman notes, ‘Inequalities are produced and reproduced by society and its institutions. Because neither inequalities nor the systems that produce them are inevitable, they can also be objects of reform’ (Fineman, 2008, p. 5). In the context of early development, this would require us to attend to children’s ‘embodied and embedded’ lives beyond the family, in the wider context of social welfare, health provision and the broader physical environment. This clearly requires a more responsive state – one that is responsibilised to secure our neural and epigenetic futures. This challenges much of the current approach, as Lowe *et al.* argue:

‘[T]he mind of the child is reduced to the brain, and the brain comes to represent the child. It is argued that a highly reductionist and limiting construction of the child is produced, alongside the idea that parenting is the main factor in child development [T]his focus on children’s brains ... overlooks children’s embodied lives and this has implications for the design of children’s health and welfare services.’ (Lowe *et al.*, 2015, p. 198)

While our policy analysis has highlighted significant problems with how the science is responded to or mobilised, we note that the policy landscape is not without potentially positive examples. The New Labour government’s Sure Start initiative is one ambivalent example where the ‘life course’ of the initiative provides an illustration of both the limitations and possibilities of social-policy engagement with neuro-developmental claims. Introduced in 1998, the initial aim was to establish 250 Sure Start local programmes to support parents in providing education and care for pre-school children in deprived areas (Bate and Foster, 2017, pp. 4–5). Subsequently, however, local programmes were combined with existing children’s services to create over 3,600 Sure Start Children’s Centres by mid-2009 (Smith *et al.*, 2018, p. 4), representing a shift from targeted to universal provision. This shift reflected a concern that disadvantage was felt by families outside the first Sure Start areas and that targeted programmes were stigmatising (Bate and Foster, 2017, p. 11). The move to universal provision can be characterised as providing a limited but important illustration of Fineman’s conception of the responsive state, where institutions are monitored to ensure the fair and just distribution of resilience (Fineman, 2017a, p. 4).

Views of Sure Start are mixed. Karen Clarke (2006, p. 699), for example, describes the scheme as focusing on parenting practices and the home environment rather than the wider structural context, which ‘risks sliding into a moral discourse of social exclusion that blames parents for poor outcomes’, whilst Macvarish (2016, p. 87) views the automatic birth-registration practised by one Sure Start Centre as ‘increasing the net of monitoring and surveillance that surrounds parents in poorer areas’. Any critique must, however, recognise that some schemes stretched beyond narrow constructions of the social: the development of community allotments and the provision of ‘safe and fun’ activities for fathers and children in a deprived, high-traffic area are examples of work to ameliorate poverty conducted under the auspices of Sure Start (Featherstone *et al.*, 2014b, p. 107). The assertion in a 2010 select committee report that ‘[i]t is common for parents to describe the impact of their contact with [Sure Start] Children’s Centres as “life changing”’ is also salient (Bate and Foster, 2017, p. 13).

In 2010, the new Tory-led Coalition government resurrected a targeted model for Sure Start that focused on ‘the neediest families’ (cited in Bate and Foster, 2017, p. 14). This return to a focus on ‘vulnerable groups’ and shrinking conception of the social, alongside funding cuts under the Coalition and subsequent Conservative government, have precipitated a reduction in Sure Start provision: 1,000 centres have now closed or provide reduced services (Smith *et al.*, 2018). As austerity politics have taken hold, some practitioners have employed neuroscience to promote their professional interests and contend that early intervention is more cost-effective than remedial action with risky families (Gillies *et al.*, 2017, pp. 79–80). This appeal to a narrow, economic rationale chimes with a neoliberal, responsibilising agenda, ignoring the ‘real-life ambiguities of culture, diversity and difference’ (Gillies *et al.*, 2017, p. 80) that shape our embodied and embedded lives. When read together, the different chapters

of the Sure Start story demonstrate how neuroscience may be used for progressive or regressive ends. Our emphasis would be on the policy's middle years, where a responsive state expanded coverage, distributing benefits or assets across a population, thereby developing resilience in individuals and families. Indeed, it is worth noting Fineman's appraisal of the potential benefits of Head Start, the American precursor of Sure Start:

'sometimes privileges conferred in one system can compensate for or even cancel out disadvantages encountered in others. A solid, early start with regard to education, such as that provided by Head Start, an effective pre-school programme, may trump poverty as a predictor of success later in School.' (Fineman, 2017b, p. 148)

Fineman is, of course, correct and our argument is that the life sciences can scaffold and propel such arguments forward, as science has the epistemological weight to provoke a more decisive political response (Karpin, 2018). Before concluding, however, we wish to strike a note of caution. We have argued that the new social biologies may enhance the political purchase of social-justice projects that are premised on our embodied and embedded place in the world. Nevertheless, we must not forget that scientific knowledge is not severable from the contexts within which it is fabricated (Latour, 1987). More specifically, the body of the social turn in the biological sciences is itself shaped by the social context within which knowledge of that body is generated. Meaney's rats provide a clear illustration, and we have already signalled our concerns in this regard, but we return now to these northern hood rats and the social structures they are interpolated and constructed within.

In epigenetics, methylation has emerged as an identifiable and therefore measurable object. Nevertheless, how it becomes embedded in – and activated through – particular experimental hypotheses and designs is open-ended. This process has been eclectic. Environmental epigenetics has relied on laboratory animal experiments where pregnant rats and the pups offer an observable world where confounding variables are limited: the 'pragmatic reductionism' of laboratory science (Beck and Niewöhner, 2006). Emerging from this, and part of the 'stabilisation of an experimental system', *early-life adversity* has surfaced as an epistemic object. This object provides both an interpretive frame and an established concept anchoring ongoing research in relevant pasts (Niewöhner, 2011, p. 288). As such, scientific fact is propelled forward by the exigencies of the laboratory and its traction is increased as it dovetails with the long-standing biopolitical focus on early development in health and social-policy discourses. Thus, while the bodies of the new social biologies are understood as embedded in and affected by their social environments, claims can reinscribe or rearticulate existing inequalities while simultaneously obscuring and individualising their social causes and contexts (Karpin, 2016; 2018), as we see in the current debates around ACEs. These processes take place both in the laboratory and in the translation of scientific findings into policy. As Fernando Vidal argues in respect of the scientific focus of this paper, the ideology of 'brainhood' – the pervasive idea that we are our brains – 'impelled neuroscientific investigation much more than it resulted from it' (Vidal, 2009, p. 5). While we argue for careful engagement with the science, we acknowledge that others caution that it is 'bad science' (Gillies *et al.*, 2016). Nevertheless, we argue that, at the very least, a strategic mobilisation of underlying claims can support arguments that seek to provide a counter-narrative to the weight of discourses championing austerity and responsabilisation.

7 Conclusion

This paper seeks to provoke collaboration across the humanities, social and life sciences in the context of an increasingly visible population of social bodies. Our starting point has been the corporeal humanisms that centre the body in new models of ethical responsibility. Specifically, we have addressed Fineman's vulnerability theory, through the lens of the 'social turn' in the life sciences. Those engaging with vulnerability theory have primarily directed themselves towards the social and institutional structures within which bodies are embedded. However, acknowledging overlapping

understandings of the social bodies that have been at the centre of our argument, we argue that we can employ investigations within the ‘new biosocial terrain’ (Meloni, 2014, p. 595) to more fully flesh out the embodied dimension of this framework. The body of environmental epigenetics, for instance, is:

‘a body that is heavily impregnated by its own past and by the social and material environment within which it dwells. It is a body imprinted by evolutionary and transgenerational time, by early-life and a body that is highly susceptible to changes in its social and material environment.’ (Niewöhner, 2011, p. 290)

Both vulnerability theory and epigenetics thus depart from the body associated with the liberal subject, ‘with its notion of skin-bounded self and autonomy, steered through life by the individual mind and brain’ – an idea ‘engrained in Western cosmology’ (Niewöhner, 2011, p. 290). The ‘multiply connected social brain’ (Meloni, 2014) similarly challenges this ‘skin-bounded self’. These richer understandings of what it is to recognise the body as ‘embedded’ strengthens the theory, helping to articulate what a more responsive state would look like, and why it matters. In the context of the scientific claims and policies we address, it is notable that vulnerability theory directly problematises and challenges the default to the family and the privatisation of responsibility this entails.

Developments in the life sciences are being shaped not only by method and what is technically achievable (Fujimura, 1987), but also by dominant preoccupations and pre-existent logics. Hence, the maternal body emerges as an ‘epigenetic vector’ (Richardson, 2015) and this extends to a regulatory focus on the child and her early-years neurological development. The ‘social’ is reduced to ‘nursing’ (qua parenting) in the laboratory, and ‘social’ responsibility is reduced to the family in policy (Gillies *et al.*, 2016, p. 224). Vulnerability theory provides a framework where we are directed to consider, and expect, a more public and institutional grounding of responsibility. A circumspect engagement with the potentially profound shifts taking place in the life sciences may bolster this necessary challenge to our current politics while asking important questions of experimental practices in the laboratory.

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