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Health inequalities: Law & the pain of others

> [I]mages cannot be more than an invitation to pay attention, to reflect, to learn, to examine the rationalizations for mass suffering offered by established powers. Who causes what the picture shows? Who is responsible? Is it excusable? Was it inevitable? Is there some state of affairs which we have accepted up to now that ought to be challenged? All this, with the understanding that moral indignation, like compassion, cannot dictate a course of action.
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> Susan Sontag (2003) *Regarding the Pain of Others*. London: Penguin: 104-5.

Introduction

Inequalities in the distribution of resources, opportunities, and power have long been understood to correlate with the unequal distribution of ill-health (Marmot et al., 1978, 1991, 2010, 2020). Health outcomes are shaped by the 'contexts in which people live, learn, work and play' (WHO, 2008). These Social Determinants of Health (SDH) have a determinative impact on individual health outcomes, the distribution of both communicable and non-communicable diseases, and life expectancy (Marmot and Wilkinson, 1999, 2008; Marmot, 2004; WHO, 2008). Social epidemiologists have long mapped a health gradient (Marmot, 2004) whereby 'health outcomes line up on a steady slope from the have-leasts to the have-mosts' (Burris, 2011: 1652). As Scott Burris continues, 'the gradient turns up reliably at the intersection of social status (whether measured by wealth, income, education, or other common proxies) and virtually any health or social pathology you could name' (2011: 1652-3).

The link between social inequalities and health means that we should be concerned by health inequalities for the intrinsic harms these cause, and because they indicate other inequalities and social injustices (Peter, 2001). Further, adverse health outcomes can compound and deepen the social inequalities with which they correlate. This can have intergenerational

effects. Recognition of the indivisibility of health inequalities from broader structural inequalities has provoked concepts such as health justice (Ruger, 2009; Venkatapuran, 2013) and health equity (Sen, 2002; Labonte and Ruckert, 2019). These recognise that inequalities in health are inequalities in freedom and that improved population level health is essential for greater social justice (Anand, Peter and Sen, 2004). Concepts are political interventions (Bacchi, 2012), and these conceptual developments have been an important part of the significant work in recent decades to draw public and political attention to avoidable health inequalities. Notwithstanding such work, state action has remained inadequate. Indeed, in some high income countries such as the UK where the potential to address health inequalities is greatest, health inequalities are worsening, particularly in the poorest communities (Marmot, 2020: 1). This is deepening the broader inequalities and deprivations experienced.

Responding to inadequate government action, this article turns to social epigenetics, an emerging science of disadvantage (Müller et al., 2017). Epigenetics refers to the study of potentially heritable alterations in gene expressions that occur in the absence of changes to the DNA sequence itself. Social epigenetics implicates environmental or social insults in epigenetic processes, where they may impact on health outcomes and life expectancy. Epidemiological and laboratory studies point to detrimental epigenetic impacts from malnutrition, neglect, child abuse, systemic racism, and other social insults or injury (Kundakovic and Champagne, 2015). Recent work on epigenetic clocks identifies biological markers that can be used to quantify the impact of social and environmental harms on morbidity and mortality. These provide a causal mechanism (epigenetic processes) and a quantum of damage (illness and lost years). They offer a physical causal mechanism linking social disadvantage to ill-health that has previously been lacking in SDH research. Thus, social

epigenetics and epigenetic clocks carry with them the potential to explain the consequences of inequality in the sort of 'physical register' that law finds intelligible (Karpin 2018: 1133).

Engaging social epigenetics - a field in the making that is highly controversial and yet may prove to be 'paradigm shattering' (Squier, 2017: 8) - encourages an examination of processes of change in science and law. Specifically, it draws attention to the role of metaphor and paradigm in these processes. In both domains, metaphor is more than a 'pleasing comparison': it is 'an intrinsic logical part' of both scientific and legal knowledge (Harraway, 1976: 11). This examination of SDH and epigenetics considers the place of metaphor and paradigm in change processes in two contexts. First, it is argued that epigenetic claims may prove valuable in seeking a greater state response to health inequalities, not just because they provide a causal explanation, but also because they work within the gene concept, an entrenched paradigm model. An epigenetic explanation of the correlation between social inequalities and ill-health works within a system of belief (and its 'growing points' (Haraway, 1976: 3)) that is shared by the scientific community, law, and the wider public.

The second context recognises that metaphors are creative and disruptive, and as Evelyn Fox Keller notes, they can 'function as tools for material innovation' (2000: s77). Institutional understandings and responses to harm are shaped by the paradigmatic liberal subject. As Jennifer Nedelsky has argued, this 'self-determining, self-making' ideal is best characterised by the idea of the boundary (2011: 98). Thus, this bounded, autonomous, rights bearer is imagined as free from environment, social context, and dependency. As an ideological construct – 'a sort of male/human template' (Naffine, 2019: 39) – the liberal subject has very limited resemblance to human embodied existence and, as Martha Fineman notes, '[l]aw and

policy built on this deficient conceptual entity cannot be fully or justly responsive to the totality of human needs' (2020: 19). The developing field of social epigenetics evidences human life as deeply dependent on the social environment we are embedded within, supporting long-standing calls for a more representative jurisprudential figure. Here it is argued that social epigenetics can animate and support Fineman's call for a legal subject that accounts for our universal experience of vulnerability and dependency. In turn, the vulnerable subject that Fineman posits can ground an 'ethic of governance' more responsive to human need (2020: 18). While there are other models that seek to provide the architecture for a more responsive state, Fineman's particular articulation of an embodied legal subject and its implications for our understanding of the institutions of the state brings her vulnerability approach directly to bear on the social determinants of health and health inequality.

The article begins by outlining the nature and scale of health inequalities, drawing in particular on the Marmot Review of Health in England (Marmot et al., 2010) and its 10 year follow-up, released on the eve of the COVID-19 pandemic (Marmot et al., 2020). The second section begins to consider why states have failed to respond proportionately to health inequalities, engaging Susan Sontag's *Regarding the Pain of Others* (2003). In this work, Sontag explores the conditions under which images of pain, injury, and suffering are sufficient not just to generate sympathy or horror, but to change political opinion and provoke action. The third section introduces social epigenetics and epigenetic clocks. Building from this, the final section addresses why an epigenetic explanation of health inequalities has the potential to more readily provoke the action required. In doing so, it engages the interdisciplinary and metaphorical *epigenetic landscape* originally proposed by Conrad Hall Waddington in 1940. Waddington's idea has been progressively narrowed, but it is argued that his expansive and

creative vision can provide a discursive space to engage contemporary epigenetics – and the paradigms, metaphors, and models employed – to affect change. This is meant in the context of health inequalities and the need to leverage a more appropriate state response. Yet it is also argued that the epigenetic landscape provides a space within which to articulate and build a transformational social justice agenda – underpinned by a new paradigmatic legal subject - that acknowledges our shared vulnerability and inevitable dependency on social institutions (Fineman: 2020).

Health inequalities

Health inequalities are experienced both within and between countries. In terms of inter-country comparisons, differences in life expectancy and morbidity rates are often cited. In 2016, for example, life expectancy at birth ranged from 52.9 years in Lesotho and 53 in the Central African Republic, to 84.2 years in Japan and 83.3 in Switzerland; that is, a 31.3 years difference (WHO, 2020: Annex 2). Morbidity data provides a similar story. As with life expectancy, there are dramatic differences in the number of years of life led in good health, so called healthy life expectancy. In 2016, healthy life expectancy was 44.9 in Central African Republic, compared with 76.2 in Singapore. Again, a difference of more than 30 years (WHO, 2020: Annex 2).

In terms of inequalities within countries, these are driven, in part, by inequalities in the distribution of communicable and non-communicable diseases. COVID-19 provides a graphic example of the impact of social inequalities where the disease has had dramatically different impact along – often intersecting – axis of disadvantage including race, socio-economic status, disability, gender, and age (Thomson, 2022). Social inequalities increase the risk of exposure

to the virus and the incidence of underlying health conditions that exacerbate the impact of infection. Taking Black and Asian minority ethnic (BAME) populations in the UK as an example, Rose et al., summarise the reasons for a greater risk of infection, severe disease, and the poorest outcomes:

> These include socioeconomic conditions that increase risk of transmission and vulnerability (*e.g.* overcrowded housing, employment in essential occupations, poverty and reliance on public transport), unequal access to effective healthcare and higher rates of comorbidities, such as diabetes, hypertension, and cardiovascular diseases (Rose et al., 2020).

The Office of National Statistics (ONS) found that in the early months of the pandemic in England and Wales the rate of death for Black males was 3.8 times greater than that for White males, while the rate for Black females was 2.9 times greater than for White females (ONS 2020). The experience of COVID-19 directs attention to the wider landscape of health inequalities in the UK. The availability of two comprehensive reviews focuses attention on England. Health inequalities are similar, and in some regards worse, in the other nations of the UK (Marmot et al., 2020).

In November 2008, Michael Marmot was asked by the Secretary of State for Health to chair a review to propose evidence-based strategies for reducing health inequalities in England. The Review was designed to provide evidence to underpin policy and action. *Fair Society, Healthy Lives* (the Marmot Review) was published in 2010 (Marmot et al., 2010). In February 2020, as COVID-19 spread across the globe, and was going to go on to have such a devastating and stratified impact in the UK, *Health Equity in England: The Marmot Review 10 Years On* was

published (Marmot et al., 2020). Both reports provide a detailed account of significant and widening health inequalities and waning health advances.

The 2010 report foregrounds the social gradient in health outcomes, demonstrating that life expectancy and the number of years of healthy life decrease with increasing deprivation. People in poorer areas of England can expect the shortest lives and to live more of their lives with illness or disability. By 2020 gains in health had stalled or were going backwards, and health and social inequalities between least and most deprived were increasing. During this time (2012-2018), the gap in life expectancy between the least and most deprived deciles increased from 9.1 to 9.5 years for men, and 6.7 to 7.7 years for women (Marmot et al., 2020: 15).

The 2020 review reported a slowing in overall gains in life expectancy since 2010. The general trend towards increasing life expectancy has stalled in a way it has not done in 120 years. This is not replicated in similar countries. (Marmot et al. 2010, 2020). This slowdown has affected women and those living in the most deprived areas, more than men and those living in wealthy areas. Similar trends were apparent for measures of years lived in good health, with both women and men living an increasing number of years in poor health. On average, healthy life expectancy differs by 12 years between the most and least deprived local authorities (Marmot et al., 2020: 14-15). As Ruth Müller and Georgia Samaras explain: 'Society's *wealth gap* is progressively turning into a *health gap*' (2018: 716). The report reminds us that increasing social inequalities lead to widening disparities in health: 'These inequalities are avoidable', the report states, 'the country has been moving in the wrong direction' (Marmot et al., 2020). This begs the question why, and directs us to consider when harm or injury is sufficiently intelligible to provoke meaningful action.

Regarding the pain of others

Socio-legal scholars have identified harm as an 'unstable, slippery concept' that is 'highly dependent on context' (Conaghan, 2002: 322). This challenges the idea that harm is a trans-historical fact that is always knowable and known. Rather, what is 'harmful changes overtime and as a consequence of processes of redefinition' (Smart, 1985: 392). These processes are gradual and uneven, and can see law lagging behind other domains (Smart 1985). This is evident with the harms caused by inequalities. The fact that the social environment shapes health and life chances has been known long enough to have informed the work of the early Victorian philanthropists. More recently, decades of work on SDH has provided data that compellingly links social inequalities with inequalities in health and life expectancy. Nevertheless, state responses to these profound consequences of inequality have been inadequate.

In *Regarding the Pain of Others* (2003), Susan Sontag explores the relationship between images of war and those who view them, providing 'not just a treatment of how the images *depict* disaster, but the manner in which the viewer is able to *respond*' (Chan, 2010: 376). She dissects the political and affective ambiguity of even the most apparently clear cut and brutal images. Thus, the same image can be compellingly cast by both sides of a conflict and, at the same time, may provoke both violence and apathy. At its heart, the work asks us to consider the limits of sympathy and the obligations of conscience. Sontag's enquiry centres on war, conflict and photography, returning to a question she first addressed 26 years earlier (1977). In both works, Sontag is concerned with whether photographs have the power not just to

provoke sympathy or horror, but to communicate the suffering of others in a way that alters individuals' political assessments. Her concern with how pain and suffering may be communicated in a way that generates a cognitive response and constructive action reaches beyond conflict and the medium used to communicate. Sontag's essay is directly relevant to the question of why we have neglected to adequately respond to decades of epidemiological data that links social inequalities to inequalities in health and therefore opportunities and freedom (Anand, Peter and Sen, 2004).

Sontag reminds us that while the image is powerful, it is ambiguous. The response an image generates can be 'compassion, or indignation, or titillation, or approval, as each misery heaves into view' (2003: 16). Alter the caption beneath a photograph and its meaning can change dramatically: 'Photographs of an atrocity may give rise to opposing responses. A call for peace. A cry for revenge. Or simply the bemused awareness, continually restocked by photographic information, that terrible things happen' (2003: 11-12). This ambiguity and ambivalence is complex and difficult to navigate. There is, of course, the obvious question of saturation and fatigue. Yet, there are further difficulties. Photographic representations of conflict, war, and the pain of others, make it 'real' for those who are elsewhere. Comprehension of whatever horror or atrocity is being represented will, however, be 'eerily like its representation'; the before, during, and after erased. (2003: 19). As Sontag states, 'The problem is not that people remember through photographs, but that they remember only photographs. This remembering through photographs eclipses other forms of understanding, and remembering' (2003: 79).

These ambiguities and the ambivalence generated are complicated when photographs are generally imagined as objective and unmediated; although they are, of course, chosen, edited, and - in turn – they editorialise. They shape 'what catastrophes and crises we pay attention to, what we care about, and ultimately what evaluations are attached' (Sontag, 2003: 93). Images are also not static: 'The photographer's intentions do not determine the meaning of the photograph, which will have its own career, blown by the whims and loyalties of the diverse communities that have use for it' (Sontag, 2003: 35). The same can be said for scientific findings, as amply demonstrated with the field of social epigenetics addressed in the next section (Lewis and Thomson, 2019).

Sontag attaches particular significance to Goya's *Los Desastres de la Guerra* (The Disasters of War), a sequence of 83 etchings made between 1810 and 1820 and first published 35 years after Goya's death. The series represents the cruelties of Napoleon's soldiers who invaded Spain to quell revolt against French rule in 1808. The etchings remove the spectacle of war. Landscape is pared back. Cruelty is foregrounded. For Sontag, it is a significant moment in the history of art:

> Goya's art, like Dostoyevsky's, seems a turning point in the history of moral feelings and of sorrow – as deep, as original, as demanding. With Goya, a new standard for responsiveness to suffering enters art…. The account of war's cruelties is fashioned as an assault on the sensibility of the viewer. The expressive phrases in script below each image comment on the provocation. While the image, like every image, is an invitation to look, the caption, more often than not, insists on the difficulty of doing just that (2003: 40).

If we are to successfully generate a more proportionate response from public health findings then we must 'assault' - or at least engage - the 'sensibility' of public and law-makers. In responding to Sontag, Judith Butler understands this to mean that for images to communicate affectively 'they must have a transitive function: they must act on viewers in ways that bear directly on the judgements that viewers formulate about the world' (2005, 823). This requires more than shocking and disturbing images. To engage sensibilities – to have a 'transitive function' - Sontag argues that there must be a narrative, something that she argues is always lacking with a photograph. These observations may help to explain our failure to adequately respond to the social injustice of health inequalities. The statistics do not address our sensibilities nor provide an explicit or developed narrative of the social injustices that lead to avoidable health inequalities. They provide a limited narrative and, as such, have limited purchase. The statistics become the fact. To parse Sontag, the problem is not that people remember through statistics, but that they remember only statistics: 'This eclipses other forms of understanding' (2003: 40).

This analogy drawn between Sontag's analysis of photographs and health inequalities data is supported by work highlighting the limitations of quantification. So, for example, Boaventura de Sousa Santos argues that the centrality of mathematics to modern science has meant that '[t]he intrinsic qualities of the object … do not count and are replaced by the quantities into which they are translated' (1995: 13). Sally Engle Merry similarly explores the seduction and limitations of quantification. Merry addresses the social and political processes involved in the production of human rights indicators and their effects on regulation and governance.

Merry challenges the objectivity of quantification and the way numbers flatten and homogenise. She stresses that statistics are incomplete without qualitative resources (2012).

This analysis, and the failure to adequately respond to the harms detailed in SDH research, directs attention to the social nature of harm. As Joanne Conaghan argues, while harm is understood as vested in the individual who sustains it, it is nevertheless 'thoroughly social'. By this she means first, that social location helps to determine the incidence and distribution of harm. Second, understandings of harm are a 'product of social relations and the meanings they generate.' Finally, the notion of harm 'implies some element of social recognition' (2002: 322). The next section turns to social epigenetics and the development of epigenetic clocks. Responding to the social dimensions of harm – and in particularly social meaning and recognition - it is argued that these provide new ways of talking about disadvantage and health inequalities. Importantly, this new way of articulating the effects of inequality engages existing dominant paradigms – or sensibilities – in science and law. It is argued that this has the potential to provide the sort of narrative Sontag argues is essential to generate political action. In other words, it may change our understanding of and responses to harm. The relationship between law and science is important in this regard. Law's treatment of scientific knowledge claims is not homogenous with law favouring some areas of scientific enquiry over others. As Tony Ward has argued, while law has historically treated areas such as psychiatry with scepticism, the life sciences have assumed a rather different position within law. As Ward argues, from the mid-Nineteenth Century onward, 'Science, and especially biology, partially usurped religion as a source of moral authority' (1997: 346). Biology, and the broader life sciences, maintain authority as a privileged explanatory source. This is perhaps most clearly seen with genetics and – since the mapping of the human genome - genomics.

Social epigenetics

Conrad Hal Waddington coined epigenetics in *Organisers and Genes* (1940). In this work Waddington proposed an analytical approach to embryo development, seeking to replace the descriptive modes that dominated embryology to that point. The interdisciplinary and conceptual *epigenetic landscape* was imagined as a resource – a metaphor - for those who pursued a causal analysis of development (Squier, 2017: 3) Waddington's work was supplanted in the late 1960 when molecular biology led the life sciences in a new direction.

Epigenetics resurfaced with the completion of the Human Genome Project in 2003 and the possibilities created by the emergence of high volume screening technologies and large scale modelling (Squier, 2017: 6). While this could have seen a return of the conceptual tool initially proposed by Waddington, epigenetics has taken on a narrower, mechanistic meaning. It now denotes potentially heritable alterations in gene expressions that are not dependent on changes to the underlying DNA sequence. It is understood as concerned with mechanisms that switch genes on and off, or otherwise regulate their expression, enabling the genome to respond more flexibly to a dynamic environment (Meloni and Testa, 2014: 602). There has been a growing focus on the impact of social factors (Pickersgill et al., 2013), as specific proteins are produced 'in response to the constantly changing signals it receives from its environment' (Keller, 2015). Studies track changes resulting from factors such as pollution, neglect and abuse, nutrition, income, and educational level.

In this emergent field, recourse is frequently made to key epidemiological observations and laboratory experiments. In terms of epidemiological work, studies of historic periods of malnutrition in the Netherlands and Sweden are taken to establish a connection between malnutrition in utero and early life, and subsequent metabolic disorders that are transmitted inter-generationally via the epigenome (Heijmans, 2008; Painter et al, 2008). 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 prominent (Meaney, 2001). Although contested by some (Aitken et al., 2016; Wastell and White, 2017), these, and other studies (McGowan et al., 2009), have been interpreted as evidence of trauma becoming part of the genetic 'memory', which may then be transmitted inter-generationally (Meloni and Testa, 2014: 602).

The contemporary field of social epigenetics is polarised: defined by both hype and scepticism. There are echoes of the 'neuromania' (Louvel 2020, 205) that characterised the Decade of the Brain and the neuroscience that came to dominate scientific and popular cultures. While parallels are drawn with the socio-biologies of the past that were shaped by race, gender, and class prejudices (Edwards, Gillies and Horsley, 2016), others are more accepting (Abi Rached and Rose, 2013; Lewis and Thomson, 2019; Meloni and Testa, 2014). For those who welcome the new knowledge claims – albeit to varying degrees - these are seen to further scaffold work that has long linked disadvantage to poor health and other outcomes. For these people, the 'deeply progressive' implications of this science demands attention (Callard and Fitzgerald, 2015: 7).

Even if attention is warranted, this is being stifled by a lack of clarity and consistency across the fields at work. Key concepts have different meanings across different disciplines. In this

regard, Evelyn Fox Keller has highlighted the problem of heritability. While we may understand this to mean transmission of traits across generations, the means may be genetic, epigenetic, or cultural. As she writes, if words have multiple meanings then 'meaning is not so easy to control' and 'it is not only easy to mean two – or even three – things at once, it may be unavoidable. What is difficult is meaning only one thing' (2010: 75-76). Keller argues that movement across different meanings in different disciplines has generated an illusion of a coherent whole. Further, there has been sustained and compelling criticism of the design of epigenetic experiments and the interpretation of results (Louvel, 2020). Gillies, Edwards and Horsley (2017), for example, argue that the ground upon which epigenetics has been built is so 'ideologically sodden' that it forecloses any exploration of social justice implications, 'paradigm shattering' (Squier, 2017: 8) or not.

It is nevertheless true that social epigenetics as a field now exists. It has the potential to be used for progressive ends, rather than ignored and solely mobilised to shore up discriminatory and punitive policies and practices (Lewis and Thomson, 2019). It should not be assumed that there are only two pathways through epigenetics; that is, either wholesale rejection, or the sort of uncritical engagement with the life sciences that ends up 'biologising' life (Nerlich, Stelmach and Ennis, 2020). Key to a responsible engagement with epigenetics is a willingness to identify and address difficulties. This is particularly pressing in the context of criticism that highlights race and gender biases at all stages from the design of laboratory experiments through to policy outcomes (Wastell and White, 2017; Baedke and Delgado, 2019; Grossi, 2020). It also requires accepting that not all studies or avenues are equal. As an emergent field, avenues of enquiry accepted as legitimate may be quick to change.

This brings us to epigenetic clocks, a development that may come to compliment or perhaps replace earlier approaches (Louvel, 2020, 208). Epigenetic clocks (e.g. Horvarth, 2013; Hannum et al., 2013) – more correctly referred to as epigenetic age and aging estimators - acknowledge the considerable between-person variation in the rate of aging. Biological age (the age of the organism and individual tissues) can be different from chronological age (the calendar time since birth). Changes in DNA methylation patterns occur with aging and it may be a fundamental mechanism that drives human ageing (Hannum et al., 2013). Ageing is one of the principal risk factors for many chronic diseases (specifically cancer, cardiovascular disease, and dementia). As such, the development of DNA methylation age (DNAmAge) biomarkers may be good predictors of age-related diseases and disparities in life expectancy.

Identifying the factors that result in changes in DNAmAge may therefore identify the mechanism whereby social insults or injury lead to inequalities in ill-health. Put differently, social epigenetics may allow us to measure the 'biological weathering' effects of living in a socially deprived context (Louvel, 2020: 203). It is increasingly accepted that DNAmAge is 'associated with lifestyle and demographic variables, including educational level, physical exercise, income, systolic blood pressure, body mass index, markers of fruit and vegetable intake (for example, carotenoid levels) and smoking status' (Horvath and Raj, 2018: 376-377). Thus, we could see the identification of the causes of changes in DNA methylation patterns (social inequalities, trauma or injury) linked to age acceleration, age-related diseases, and increased mortality. As Horvath and Raj state:

> During the inexorable passage of time throughout life, the body is exposed to multiple stress factors that sometimes affect DNA methylation levels and DNA methylation age

> estimates…. Cumulative lifetime stress (but not acute psychological stress) has been linked to epigenetic aging. Higher income and educational levels are associated with lower extrinsic age acceleration (2018: 381).

A systematic review and meta-analysis of epigenetic clock research concluded that there was some (albeit inconsistent) evidence for an association between increased DNAmAge and risk of disease (Fransquet et al, 2019). To provide some example of studies within the systematic review, one study found an association between increased DNAmAge and ischemic stroke (Soriano-Tarraga, 2016), and another associated increased DNAmAge with poorer outcomes 3 months post-stroke (Soriano-Tarraga, 2017). A recent study found that for every 1-year increase in DNAmAge there was a 3.3% greater incidence of cardiovascular disease (Lind, 2018). The systematic review reported on two dementia studies. Younger DNAmAge was associated with better memory, while increased DNAmAge was associated with a higher incidence of dementia (Horvath and Ritz, 2015). In terms of mortality, the meta-analysis indicated that each 5-year increase in DNAmAge was associated with an 8 to 15% increased risk of mortality (Fransquet et al., 2019).

As noted in the preceding section, Conaghan has explored the unstable and contextual nature of harm; emphasising its social dimensions, including the role of social recognition. In the context of health inequalities, the argument is that the data has failed to generate such recognition. It is argued that this reflects the limitations of the data, which fails to affect the sensibilities of public and law-makers. The next section considers why and how social epigenetic discourses might more successfully affect change.

The epigenetic landscape: paradigm, metaphor, and legal change

In her work *Epigenetic Landscape: Drawings as Metaphor*, Susan Squier seeks to orientate epigenetic debates back to Conrad Hal Waddington's original conception of the epigenetic landscape. Squier explores the methodological and creative potential of the epigenetic landscape beyond the life sciences, aiming to 'recuperate the full vitality of this model as a stimulus to thinkers across the disciplinary landscape' (2017: 67). In this, she argues for an untethering of epigenetics from its current narrow mechanistic meaning and a return to its more expansive and conceptual origins. In doing so, Squier invites a broader interdisciplinary discussion around human development and flourishing.

This section responds to Squier's provocation, mobilising the epigenetic landscape as an interdisciplinary space within which to address the need for legal change. It is argued, however, that the current understanding of epigenetics should not be jettisoned. To do so ignores the persuasive potential of epigenetics as part of the broader gene paradigm, one of the 'most suggestive' paradigm models in biology (Haraway, 1976: 8). This does not negate the possibility of the creative and interdisciplinary discussions that Squier correctly urges, rather it is argued that the contemporary science has an important strategic part to play within a rich interdisciplinary dialogue aimed at addressing health and other inequalities.

As such, and in entering Waddington's interdisciplinary landscape, the first part below addresses the importance of the gene paradigm and argues that articulating health inequalities in the language of the genome has the potential to leverage a greater response to the social injustice of health inequalities. Returning to Sontag and Butler, it is argued that engaging with our genetic sensibility may have a transitive effect, acting on individual political

judgements and provoking change. It is acknowledged, however, that this potential is limited by the paradigmatic liberal subject: that 'enduring, stable and abstract philosophical idea of a male person who is law's subject' (Naffine 2019, 39). In response, the second part argues that the epigenetic landscape can act as a space within which to refigure the liberal subject of law and political governance as part of a broader transformative social justice project. It is argued that we need a legal subject that reflects our embodiment and our dependency on the institutional structures and relationships we are embedded within. This is the lesson of SDH research and social epigenetics. In response, it is argued that the epigenetic landscape provides a domain within which to articulate – and animate - the vulnerable subject, an alternative paradigmatic legal subject that has the potential to provoke a state more responsive to health inequalities (Fineman, 2010, 2018, 2020). In identifying the need for paradigm change, the final part addresses the dynamics of such change.

The gene paradigm

Drawing on the work of Thomas Kuhn, Donna Haraway explains how science proceeds by 'exploring the suggestions derived from a dominant paradigm' (Haraway, 1976). In this understanding, a paradigm is not a rigid dictate, but a proposition or object that requires 'further articulation and specification under new or more stringent conditions.' (Haraway, 1976: 3). Yet, paradigms do not just provide the focus for scientific enquiry, rather they provide the landscape within which questions are identified and asked, experiments devised, and results interpreted. To return to Sontag, they may be understood as crafting a sensibility. As Haraway states:

> [A] shared paradigm is more than an aesthetic predisposition peculiar to a few minds. It is a concrete, common picture of the central focus of science. The picture conditions the problems seen by the community and the types of solutions admitted as legitimate (1976: 5).

The fact that we have arrived at a genomic explanation for SDH should not surprise, therefore, as dominant paradigms operate as 'directing tendencies' shaping the problems seen and the solutions sought (Haraway, 1976: 10). Now framed in the dominant language of genetics and the genome, there is the potential for a different response to health inequalities. This is bolstered as these inequalities are explained in a way that engages a culture that has actively participated in the 'geneticization' of social life, internalising genetics as a way of being (Lippman, 1991). This may explain why, compared to other contemporaneous emerging areas of scientific research, epigenetics has 'particularly enticed' the scientific community, industry, and general public (Dupras et al., 2019: 2).

It is also important to consider the specific traction that epigenetic clocks offer, where it is argued the effects of social injustices are measurable as depleted time. Metaphors are essential to the workings of paradigms. They provide the 'vital spirit' of a paradigm, acting as 'an image that gives concrete coherence to even highly abstract thought.' (Haraway, 1976). Metaphors also enable complex ideas to be communicated more readily and allow different contexts and disciplines to be bridged. This includes the communication of scientific knowledge claims to the public, as seen with the ubiquity of the 'switch' metaphor in public communication of epigenetics (Nerlich, Stelmach and Ennis, 2020). The passage of time and processes of aging, depletion, and illness are universal experiences and some of our most

familiar tropes. As such, epigenetic clocks provide a metaphor and model that is familiar and compelling, communicating in different registers, and 'drawing viewers in, confounding them, and prodding them to ask questions.' (Allen, 2015: 141). These new ways of understanding and articulating health inequalities provide more than the familiar statistical representations of health inequalities where – to parse Sontag once more – the statistics can eclipse other forms of understanding (2003: 79). In other words, working within the dominant gene paradigm – its 'growing points' (Haraway, 1976: 3) and metaphors – may more readily engage our sensibilities and generate the necessary social recognition (Conaghan, 2002).

Epigenetic claims articulate in new ways the indivisibility of the material and the social. In narrating a 'molecularisation of biography' (Niewöhner, 2011) they are heralded by some for the deeply radical implications they hold for understanding and responding to social injustices. In the context of health inequalities, social epigenetics and epigenetic clocks - with the paradigms, metaphors, and models they engage - have the potential to 'bear directly on… judgements… formulated about the world' and provoke political change (Butler 2005, 823). While it is essential that this potential is explored, we must also acknowledge that understanding and social recognition of harm is shaped and limited by the paradigmatic liberal subject, an ideological and abstract figure of political and legal imaginaries.

Recasting the legal subject

The liberal subject, crafted from masculinist ideals, has had a profound effect on the development of our understandings of harm, injury, and responsibility. In legal studies, the liberal legal subject - an 'autonomous, independent being along the lines of Lockean lore'

(Fineman, 2018: 57) - has been the focus for sustained feminist critique. A 'theoretically inadequate' construct, it has inhabited and impaired the governing imaginaries of law and politics for over two hundred years, and was shaped when our current world and lives were unimaginable (Fineman, 2018: 57). This figure has contributed to the unintelligibility of certain corporealities, embodied ways of being, and harms. Most pertinent to this discussion, this bounded figure is physically separate or autonomous: detached from the social world within which they operate (West, 1991). As Conaghan states, 'Their environment… is deemed formally irrelevant to their identity and status as persons under law' (2003, 199). The liberal legal subject is implicated in the failure to adequately respond to health inequalities. This figure underpins the rhetoric of personal responsibility that erases our relationality, interdependence, and the legitimacy of reliance on the institutions of the state (Fineman, 2004).

In response to this impoverished fictive figure, Martha Fineman has proposed the vulnerable subject as a 'more inclusive and realistic legal subject' (2017, 149). For Fineman, embodied vulnerability is the defining human condition. It is part of our shared humanity that we all age and may experience illness and misfortune. Yet our vulnerability is also generative. It has led us to come together and build social institutions that respond to this defining quality. Vulnerability is therefore not only universal but also particular. It reflects our specific embodiment and our different positions within the institutional relationships and structures we are all embedded within. By centering our embodied and embedded place in the world, Fineman creates the foundations for a framework for deliberating 'the just allocation of responsibility for individual and societal wellbeing' (2017, 141).

Within this framework, Fineman contends that the state has a responsibility to 'establish and monitor social institutions and relationships that facilitate the acquisition of individual and social resilience' (2017, 134). This is essential as our position within this complex network of relationships - and the resilience this affords - 'profoundly affect our destinies and fortunes, structuring individual options and creating or impeding opportunities' (2017, 145). Under this model, the state must be responsive to human need, acting to 'monitor and adjust institutions and relationships when they do not function in a just manner' (Fineman 2017, 4). Resilience is, of course, more than good health. It is constituted from a broader set of resources and social assets that enable us to better weather misfortune and illness, to take risks, and to recover from misfortune or failure. Health, however, is a key component of resilience and like the relationship between health inequalities and social inequalities, it is constituted through the institutions that build other aspects of resilience. It is also clear from SDH and epigenetic research that health inequalities are manifest when states fail to ensure that its institutions function justly. Returning to this research helps to illustrate the foundations of the vulnerable subject as well as demonstrating the utility of a vulnerability approach for understanding and addressing health inequalities. As Fineman writes, while the approach is grounded in our embodied vulnerability, 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' (2014: 318).

It has been noted that health is determined by the contexts within which we 'live, learn, work and play' (WHO 2008). In the landmark *Closing the Gap in a Generation*, the World Health Organisation highlighted how health inequalities are caused by different embedded experiences of the social world:

> The poor health of the poor … [is] caused by the unequal distribution of power, income, goods, and services, globally and nationally, the consequent unfairness in the immediate, visible circumstances of people's lives – their access to health care, schools, and education, their conditions of work and leisure, their homes, communities, towns or cities – and their chances of leading a flourishing life (2008: 1).

This analysis directs attention to our embodied and embedded existence and the obligation on states to monitor institutions and ensure they are functioning justly. This was also evidenced in the Marmot Review of Health in England, where it was argued in 2010 that differences in health across groups are socially determined, rather than related to individual behaviours. This was explained by persistent inequalities across key domains: 'inequalities in early child development and education, employment and working conditions, housing and neighbourhood conditions, standards of living, and, more generally, the freedom to participate equally in the benefits of society' (2010: 10). Accordingly, they recommended government efforts across each of these areas.

By the time of the 10 year Review in 2020, national policies on social determinants of health were still lacking, and inequities in the social factors impacting on health had risen, in some cases because of government austerity policies (Marmot et al., 2020: 31). Looking across the domains identified, the authors highlight that social mobility had declined; inequalities in child readiness for school and educational attainment persisted; more children were being excluded from school; and there were increases in the rate of child poverty, youth crime, poverty among workers, work related stress, wealth inequalities, and homelessness

(including children) (2020: 16-30). As has already been noted, this has resulted in declining health outcomes and a stalling in gains in life expectancy not seen in 120 years (2020: 15). In a vulnerability analysis, the domains identified across the two reports exist as important sites where the state is obligated to build the resilience of citizens. The health failures that are documented can be understood as part of a broader failure to acknowledge universal vulnerability and the associated obligation to generate resilience. As such, a vulnerability analysis can provide clear guidance for the law and policy needed to affect health improvements.

Health is 'foundational to human well-being, and social and political existence' (Coggon 2014, 372). Addressing health inequalities and promoting health equity should therefore be a key goal of the state and a primary function of law. Contrary to this, recent government policy has in fact increased health inequalities. Fineman's theory offers a means of articulating state obligations that are more responsive to human need and attentive to the importance of health and health equity. Central to achieving this is the vulnerable subject, offering a different paradigmatic subject for law and policy. This directs us to consider the dynamics of paradigm change.

Paradigm change

Paradigms are not simply replaced as the model or framework is no longer seen to carry the same explanatory weight. As Thomas Kuhn states, the judgement that leads to the rejection of a 'previously accepted theory is always based upon more than a comparison of that theory with the world' (1970: 77). Periods of crisis and change in thought in the social and life

sciences are marked by disquiet over philosophical foundations: 'Ordinary scientists, used to a certain degree of confidence in their epistemological and metaphysical commitments, come to feel the need to defend their position or to evolve new ones' (Haraway, 1976: 6). Crisis is not, however, sufficient. Discredited and increasingly qualified and marginalised paradigms are only replaced when a new theory that is adequately elegant and underpinned by a plausible metaphor emerges. Important in this trajectory is 'the progressive concretization of aesthetic dictates' (Haraway, 1976: 13).

Our current epoch is experiencing both disquiet over philosophical foundations and a 'progressive concretization of aesthetic dictates' as questions of dependency and social embeddedness proliferate across the arts, humanities, social and life sciences. In these contexts there is a growing turn to the social body (Lewis and Thomson, 2019). In the social sciences and humanities, long-standing dissatisfaction with disembodied and atomistic accounts of human life has underpinned work on relationality, dependency, and care. Similarly, corporeality has grounded new models of social justice in feminist, political and legal theory. Here theorists have located the body in a new and expanding vocabulary of social justice that engages not just vulnerability, but also precarity, social flesh, depletion, health equity, and so forth (Lewis and Thomson, 2019). These developments have happened at the same time that interest in social biology has been rekindled (Meloni et al., 2016). The epigenetics discussed here is a key example, with social epigenetics and epigenetic clocks now providing causal explanations that link social disadvantage, insults, and injury to health inequalities. Elsewhere – notably in neuroscience – increasingly complex interactions between the organic and the social are detailed (Thomson, 2018). These diverse accounts of

the social body may provide the conditions of possibility for a new paradigmatic legal and political subject.

Squier promotes Waddington's epigenetic landscape as a discursive space within which to address questions of human development and flourishing. The epigenetic landscape provides a domain where we can address the inadequacy of the liberal legal subject and pose an alternative. Fineman has articulated a potential counter-figure in the vulnerable subject. Locating this counter figure in the epigenetic landscape engages Waddington's metaphor in the spirit of collaboration and interdisciplinary dialogue originally intended. It is argued here that this dialogue must explore the potential of contemporary epigenetic research given the cultural weight of the gene paradigm and the way it narrates bodies as deeply embedded in their social environments. This also supports Fineman's focus on our institutional embeddedness and further challenges the discourses of personal responsibility that currently prevail. Yet this dialogue, addressing human development more broadly, must be enriched by the many disciplines that are contributing to the progressive concretization of the social body, that figure premised on the indivisibility of the material and the social. As such, the epigenetic landscape provides a terrain upon which we might position ourselves and the vulnerable subject as we claim an alternative for law and politics. As Squier writes, 'figures can help us figure things out' (2017: 11).

Conclusions

In responding to Goya's *The Disasters of War*, Sontag argues that the series marked a turning point, where a 'new standard for responsiveness to suffering' entered art. She grounds this

in Goya's ability to 'assault… the sensibility of the viewer' (2003: 40). Responding to Sontag, and the fact that our understanding of harm is 'fluid and contentious, shifting and changing over time' (Conaghan, 2002: 322), this article has sought a new way to discuss health inequalities, exploring how we may reach the sensibilities of the public and law-makers. In doing so, it has addressed health inequalities as a social injustice and engaged with the role of metaphor and paradigm in processes of change.

It is argued that the epigenetic landscape with its creative and interdisciplinary origins can become a site where a more appropriate and just understanding of human development and interdependence can be nurtured and promoted. It has been argued that social epigenetics provides a language and mechanism with potential purchase. It provides a causal narrative in a physical – and specifically genetic - register (Karpin, 2018). The emergence of epigenetic clocks increases potential traction. This work engages the universal experience of time and temporality, the image of the clock, and the tropes and metaphors of lost time, depletion, and the lifespan. Relying on the familiarity of time and the epistemic dominance of genetics may allow us, as Butler writes, to 'transform… affect into effective political action' (2007: 966). Such action must address the structural inequalities that cause and compound health inequalities.

Social epigenetics is an important element of the 'progressive concretization' of the social body emerging across the arts, humanities, social and life sciences. This is challenging the image of the bounded and autonomous self that is 'deep and pervasive in Western Culture' (Nedelsky, 2011: 98). The vulnerable subject is an embodiment of this broad ideological challenge and an important counter-figure. The vulnerable subject can underpin a new ethic of governance that acknowledges that as 'embodied beings we are inevitably embedded in

and dependent upon social institutions and relationships' (Fineman, 2020: 28). It is within these 'social institutions that we generate the resources or social assets that cumulatively provide resilience' (Fineman, 2020: 28). Health is both an essential component of resilience and, as SDH and epigenetic research demonstrates, it is constituted through the other elements of resilience; that is, education, economic security, employment, adequate housing, and so forth. Thus, a vulnerability approach, supported by SDH research, provides a guide for practical legal changes to address social and health inequalities.

The vulnerable subject, an alternative to the 'dominant limited and disingenuous vision of legal subjectivity' (Fineman, 2020: 33) can be creatively located in Waddington's epigenetic landscape as a catalyst for the change that is needed. This is essential if developments in the social biologies are to become more than a further means of biopolitical surveillance and control. As Müller and Samaras write, such developments may either move us away from the biocentrism of genetics, or they may add an additional biopolitical layer to this biocentrism (2018: 717). Thus, the epigenetic landscape is renewed as an invitation to come together to reimagine human development, flourishing, and the role and obligations of the state in promoting this. It is an invitation for genuine interdisciplinary investigation encompassing not just those engaged with the social biologies, but also lawyers, political theorists, sociologists, and others who are exploring our shared embodied experience, what this means for being in the world, and a more appropriate role for the state.

Reference List:

Abi-Rached JM and Rose N (2013) *Neuro: The New Brain Sciences and the Management of the Mind*. Princeton, NJ: Princeton University Press.

Allen M (2015) Compelled by the Diagram: Thinking Through C.H. Waddington's Epigenetic Landscape. *Contemporaneity* 4: 119-142.

Anand S, Peter F and Sen A (2004) *Public Health, Ethics and Equity*. Oxford, UK: Oxford University Press.

Aiken CE, Tarry Adkins JL, Ozanne SE (2016) Transgenerational effects of maternal diet on metabolic and reproductive ageing *Mammalian Genome* 27(7) 430-439.

Bacchi C (2012) Strategic interventions and ontological politics: Research as political practice. In Bletsas A and Beasley C (eds) *Engaging with Carol Bacchi: Strategic Interventions and Exchanges*. Adelaide: University of Adelaide Press.

Baedke J and Delgado AN (2019) Race and nutrition in the New World: Colonial shadows in the age of epigenetics. *Studies in History and Philosophy of Biological and Biomedical Science* 76: 1-11.

Braveman PA et al. (2011) Broadening the focus: The need to address the social determinants of health. *American Journal of Preventative Medicine* 40(1): S1, S5.

Burris S (2011) From health care law to the social determinants of health: A public health law research perspective. *University of Pennsylvania Law Review* 159(6): 1649-1667.

Butler J (2005) Photography, War, Outrage. *PMLA: Theories and Methodologies* 822-827

Butler J (2007) Torture and the ethics of photography. *Environment and Planning D: Society and Space* 951-966.

Callard F and Fitzgerald B (2015) *Rethinking Interdisciplinary across the Social Sciences and Neurosciences.* London, England: Palgrave Macmillan UK.

Chan S (2010) The pain of Susan Sontag. *Global Society* 369-380.

Coggon J (2014) Global health, law, and ethics: Fragmented sovereignty and the limits of universal theory. In Freeman M, Hawkes S, Bennett B, *Law and Global Health: Current Legal Issues (*Oxford University Press. 369-385.

Conaghan J (2002) Law, harm and redress: A feminist perspective. *Legal Studies* 22(3): 319-339.

Conaghan J (2003) Tort Law and Feminist Critique. *Current Legal Problems* 56(1): 175-209.

Dubois M, Louvel S and Rial-Sebbag E (2020) Epigenetics as an interdiscipline? Promises and fallacies of a biosocial research agenda. *Social Science Information* 59(1): 3-11.

Dupras C et al. (2019) Potential (mis)use of epigenetic age estimators by private companies and public agencies: human rights law should provide ethical guidance. *Environmental Epigenetics* 1-12.

Edwards R, Gillies V and Horsley N (2016) Brave new brains: Sociology, family and the politics of knowledge *The Sociological Review* 64(2): 219-237.

Edwards R, Gillies V and Horsley, N (2017) *Challenging the Politics of Early Intervention –Who's 'Saving' Children and Why.* Bristol, UK: Policy Press.

Faden R and Powers M (2006) *Social Justice: The Moral Foundations of Public Health and Health Policy.* Oxford, UK: Oxford University Press.

Feil R and Frega M (2012) Epigenetics and the Environment: Emerging patterns and implications. *Nature Review Genetics* 13(2): 97.

Fineman M (2004) *The Autonomy Myth.* New York: New Press.

Fineman M (2010) The vulnerable subject and the responsive state. *Emory Law Journal* 60: 251-275.

Fineman M (2014) Vulnerability, resilience, and LGBT youth. *Temple Political & Civil Rights Law Review* 23: 307.

Fineman M (2018) Injury in the Unresponsive State: Writing the Vulnerable Subject into Neo-Liberal Legal Culture. In: Bloom A, Engel DM and McCann M (eds) *Injury and Injustice: The Cultural Politics of Harm and Redress*. Cambridge: Cambridge University Press, 50-76.

Fineman M (2020) Reasoning from the Body: Universal Vulnerability and Social Justice. In: Dietz C, Travis M and Thomson M (eds) *A Jurisprudence of the Body.* New York, NY: Palgrave, 17-34.

Fleck L (1979) *Genesis and the Development of Scientific Fact*. University of Chicago Press.

Fransquet PD et al. (2019) The epigenetic clock as a predictor of disease and mortality risk: systematic review and meta-analysis. *Clinical Epigenetics* 11(1): 62-62.

Hannum G et al. (2013) Genome-wide Methylation Profiles Reveal Quantitative Views of Human Aging Rates. *Molecular Cell* 49(2): 359-367.

Haraway D (1976) *Crystal, Fabric, and Fields: Metaphors that Shape Embryos.* Berkeley: North Atlantic Books.

Heijmans B, Tobi E, Stein A, Putter H, Blauw G, Susser S, Slagboom P, Lumey L. (2008) Persistent epigenetic differences associated with prenatal exposure to famine in humans. *Proceedings of the National Academy of Sciences* 105 (44) 17046-17049.

Horvath S (2013) DNA methylation age of human tissues and cell types. *Genome biology* 14(10): R115.

Horvath S and Ritz BR (2015) Increased epigenetic age and granulocyte counts in the blood of Parkinson's disease patients. *Aging* 7(12): 1130-1142.

Horvath S and Raj K (2018) DNA methylation-based biomarkers and the epigenetic clock theory of ageing. *Nature Reviews: Genetics* 19(6): 371-84.

Karpin I (2018) Vulnerability and the intergenerational transmission of psychosocial harm' *Emory Law Journal* 67: 1115-1134.

Keller EF (2000) Models of and models for: Theory and practice in contemporary biology. *Philosophy of Science* 67(3): s72-s86.

Keller EF (2010) *The Mirage of a Space between Nature and Nurture.* Durham, NC: Duke University Press.

Keller EF (2011) Genes, Genomes, and Genomics. *Biological Theory* 6(2): 132-140.

Keller EF (2015) The Postgenomic Genome. In: Richardson S and Stevens H (eds) *Postgenomics: Perspectives on Biology after the Genome.* Durham: Duke University Press, pp. 9-32.

Kuhn T (1970) *The structure of scientific revolutions.* Chicago: University of Chicago Press.

Kundakovic M and Champagne FA (2015) Early-Life Experience, Epigenetics, and the Developing Brain. *Neuropsychopharmacology* 40(1): 141-153.

Labonte RN and Ruckert A (2019) *Health Equity in a Globalizing Era: Past Challenges, Future Prospects*. Oxford, UK: Oxford University Press.

Lappe M and Landecker H (2015) How the genome got a life span. *New Genetics and Society* 34(2): 152-176.

Lewis S and Thomson M (2019) Social bodies and social justice. *International Journal of Law in Context* 15(3): 344-361.

Lind L et al. (2018) Methylation-based estimated biological age and cardiovascular disease. *European Journal of Clinical Investigation* 48(2): e12872.

Lippman A (1991) Prenatal genetic testing and screening: constructing needs and reinforcing inequities. *American Journal of Law and Med*icine 17(1–2): 15-50.

Marmot MG et al. (1978) Employment grade and coronary heart disease in British civil servants. *Journal of Epidemiology and Community Health* 32(4): 244-249.

Marmot MG et al. (1991) Health inequalities among British civil servants: The Whitehall II Study. *Lancet* 337(8754): 1387.

Marmot M and Wilkinson R (1999) *The Social Determinants of Health: The Solid Facts*. Report, Geneva: WHO.

Marmot MG (2004) *The Status Syndrome: How Social Standing Affects Our Health and Longevity.* New York: Owl Books.

Marmot MG et al. (2010) *Fair Society, Healthy Lives: The Marmot Review Executive Summary.* Report no. 2/2010, February 2010. London: Institute of Health Equity.

Marmot MG et al. (2020) *Health equity in England: The Marmot Review 10 years on Executive Summary.* Report for the Health Foundation. February 2020. London: Institute of Health Equity.

McGowan PO et al (2009) Epigenetic regulation of the glucocorticoid receptor in human brain associates with childhood abuse *Nature Neuroscience* 12(3): 342.

Meaney M (2001) Maternal care, gene expression and the transmission of individual differences in stress reactivity across generations. *Annual review of neuroscience* 24: 1161-1192.

Meloni M and Testa G (2014) How biology became social, and what it means for social theory. *The Sociological Review* 62(3): 593-614.

Meloni M, Williams SJ and Martin P (2016) *Rethinking the Sociology-Biology Relations in the Twenty-First Century*. Wiley.

Merry SE (2016) *The Seduction of Quantification: Measuring Human Rights, Gender Violence, and Sex Trafficking.* Chicago, University of Chicago Press.

Müller R et al. (2017) The biosocial genome?: Interdisciplinary perspectives on environmental epigenetics, health and society. *EMBO Reports* 18(10): 1667-1682

Müller R and Samaras G (2018) Epigenetics and aging research: Between adult malleability and early life programming. *BioSocieties* 13(4): 715-736.

Naffine N (2019) *Criminal law and the Man Problem.* Oxford, Hart.

Nedelsky J (2011) *Law's Relations: A Relational Theory of Self, Autonomy, and Law.* New York, OUP.

Nerlich B, Stelmach A and Ennis C (2020) How to do things with epigenetics: An investigation into the use of metaphors to promote alternative approaches to health and social science, and their implications for interdisciplinary collaboration. *Social Science Information* (2020) 59(1): 59-92.

Niewöhner J (2011) Epigenetics: Embedded bodies and the molecularisation of biography and milieu. *BioSocieties* 3(6) 279-298.

Office for National Statistics (2020) Updating ethnic contrasts in deaths involving the coronavirus (COVID-19), England and Wales: deaths occurring 2 March to 28 July 2020. London, ONS.

Painter et al. (2008) Transgenerational effects of prenatal exposure to the Dutch Famine on neonatal adiposity and health in later life. *BJOG: An International Journal of Obstetrics & Gynaecology* 115(10): 1243-1249.

Peter F (2001) Health equity and social justice. *Journal of Applied Philosophy* 18(2): 159-70.

Pickersgill et al. (2013) Mapping the new molecular landscape: social dimensions of epigenetics. *New genetics and society* 32(4): 429-477

Ward T (1997) Law, Common Sense and the Authority of Science: Expert Witnesses and Criminal Insanity in England, CA. 1840-1940. *Social & Legal Studies.* 6(3): 343-362.

Rose TC, Mason K, Pennington A, McHale P, Buchan I, Taylor-Robinson DC, & Barr B. (2020). Inequalities in COVID19 mortality related to ethnicity and socioeconomic deprivation [Preprint]. *Infectious Diseases (except HIV/AIDS).* https://doi.org/10.1101/2020.04.25.20079491;

Ruger JP (2009) *Health and Social Justice.* Oxford: Oxford University Press.

Santos BS (1995) *Towards a New Legal Common Sense: Law, Globalization and Emancipation*. Cambridge: Cambridge University Press.

Sen A (2002) Why Health Equity. *Health Economics* 11: 659-666.

Shildrick M (1997) *Leaky Bodies and Boundaries: Feminism, Postmodernism and (Bio)ethics.* London: Routledge.

Sontag S (1977) *On Photography* New York: Picador.

Sontag S (2003) *Regarding the Pain of Others.* London: Penguin.

Soriano-Tarraga C et al (2016) Ischemic stroke patients are biologically older than their chronological age. *Aging* 8(11): 2655-2666.

Soriano-Tarraga C et al. (2017) Biological age is better than chronological as predictor of 3-month outcome in ischemic stroke. *Neurology* 89(8): 830-836.

Squier SM (2017) *Epigenetic landscapes: drawings as metaphor.* Durham: Duke University Press.

Thomson M (2018) Bioethics & vulnerability: Recasting the objects of ethical concern. *Emory Law Journal* 67: 1207-34.

Thomson M (2022) Legal Determinants of Health. *Medical Law Review* https://doi.org/10.1093/medlaw/fwac025

United Nations Committee on Economic, Social and Cultural Rights (2000) General Comment 14: The Right to the highest Attainable Standard of Health (Art. 12).

Vaisman N (2018) *The Human, Human Rights, and DNA Identity Tests*. Los Angeles. Sage.

Venkatapuran S (2013) *Health Justice: An Argument from the Capabilities Approach*. Cambridge: Polity.

Waddington CH (1940) *Organisers and Genes.* Cambridge: Cambridge University Press.

Wastell D and White S (2017) *Blinded by Science: The Social Implications of Epigenetics and Neuroscience.* Policy Press.

West R (1991) The Difference in Women's Hedonic Lives: A Phenomenological Critique of Feminist Legal Theory. In Fineman M and Thomadsen (eds) *At the Boundaries of Law: Feminism and Legal Theory.* New York, Routledge.

WHO Commission on the Social Determinants of Health (2008) *Closing the gap in a generation: health equity through action on the social determinants of health: Final report of the Commission on Social Determinants of Health.* Report, WHO, Geneva.

World Health Organisation (2020) World health statistics 2020: monitoring health for the SDGs, sustainable development goals. World Health Organisation, Geneva.