



A postgenomic body: histories, genealogy, politics

Citation:

Meloni, Maurizio 2018, A postgenomic body: histories, genealogy, politics, *Body & society*, vol. 24, no. 3, pp. 3-38.

DOI: <https://doi.org/10.1177/1357034X18785445>

© 2018, The Authors

Reproduced by Deakin University under the terms of the [Creative Commons Attribution Non-Commercial Licence](#)

Downloaded from DRO:

<http://hdl.handle.net/10536/DRO/DU:30111282>

A Postgenomic Body: Histories, Genealogy, Politics

2018, Vol. 24(3) 3–38
© The Author(s) 2018



Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/1357034X18785445
journals.sagepub.com/home/bod



Maurizio Meloni

Deakin University

Abstract

This article sets the stage for a genealogy of the postgenomic body. It starts with the current transformative views of epigenetics and microbiomics to offer a more pluralistic history in which the ethical problem of how to live with a permeable body – that is plasticity as a form of life – is pervasive in traditions pre-dating and coexisting with modern biomedicine (particularly humoralism in its several ramifications). To challenge universalizing narratives, I draw on genealogical method to illuminate the unequal distribution of plasticity across gender and ethnic groups. Finally, after analysing postgenomics as a different thought-style to genomics, I outline some of its implications for notions of plasticity. I argue that postgenomic plasticity is neither a modernistic plasticity of instrumental control of the body nor a postmodernist celebration of endless potentialities. It is instead closer to an alter-modernistic view that disrupts clear boundaries between openness and determination, individual and community.

Keywords

biopolitics, epigenetics, Foucault, genealogy, microbiomics, plasticity, postgenomics

Claims of a new entanglement between bodies and the environment are increasingly relevant in postgenomic models: ‘the life-sciences [today] are generating a transformative view of the biological body not as fixed and innate but as *permeable* to its environment and, therefore, *plastic*’ (Mansfield, 2017: 355, emphasis added). In research programmes of environmental epigenetics and microbiomics, the body is ‘seen as *coalesced inseparably* with environmental

Corresponding author: Maurizio Meloni. Email: maurizio.meloni@deakin.edu.au

Extra material: <http://theoryculturesociety.org>

forces (macro and micro) from the moment of conception on throughout life' (Lock, 2015: 163, emphasis added). By showing how various material instantiations of social life (toxins, food, stress and socioeconomic status) become literally embodied in the epigenome, epigenetics is said to illustrate how *the environment gets inside the body* and makes 'the boundary of the skin of little significance' (Landecker and Panofsky, 2013: 339, referring to Michael Meaney's work).

Influential accounts of plasticity exist in various branches of the life-sciences (see for cell differentiation and cell culture: Kraft and Rubin, 2016; Landecker, 2010; for neuroplasticity: Berluca and Buchtel, 2008; Rees, 2016; Rose and Abi-Rached, 2013). There is also increasing recognition that the *whole body* is plastic and therefore open to various forms of intervention (Mansfield, 2012; Warin et al., 2012; Wastell and White, 2017). Plasticity¹ has social and political implications, for instance in the treatment of people in terms of health and disease. Consider the theory of the Developmental Origins of Health and Disease or 'foetal programming', which focuses on the maternal body as a key site of plasticity in the gestating body, with long-lasting consequences for health trajectories (Hanson et al., 2011). Plasticity is a central concept in programmes and campaigns such as the First 1000 Days (Pentecost, 2018), which promote medical and social intervention in periods of heightened sensitivity to environmental influences. Mothers' pregnancy and lactation, for instance, are considered key periods that shape the food preferences (e.g. junk or healthy food) of children (Mennella, 2014). Awareness of plasticity also inspires macroeconomic analyses of the 'developing world' that attend to epigenetics. These studies recommend investments during critical windows of plasticity in an effort to foster economic growth and improved human capital (Almond and Currie, 2011). An often unnoticed aspect of the politics of 21st-century plastic bodies is that *the burden of plasticity*, so to speak, is not only unequally distributed between the sexes (Mansfield, 2017; Richardson, 2015) but also racial groups (Meloni, 2016, 2017), social classes (Perkins, 2016), and especially the global North and South (Pentecost, 2018). A large number of all articles published in the official *Journal of Developmental Origins of Health and Disease* addresses cases in Australasia, Africa or Latin America. Other Developmental Origins of Health and Disease and epigenetic

research has pointed to the durable effects of war, genocide and famine on populations living in some of the poorest areas of Africa and Asia (Perroud et al., 2014).

Much has been learned from the various recent studies of bodily plasticity, and recognition of plasticity's political consequences is potentially significant for the future of human societies. However, we should not be dazzled by the apparent novelty of today's theory of plasticity. Appreciation of the porousness of the body is not new; contemporary theories are not the latest inventions in a temporal economy of incessant innovation and knowledge growth. Postgenomics emerges against a long history of attempts to govern deeply plastic bodies – bodies exposed to and altered by environmental influences, penetrable by everything from food to wind, changes in seasons and the stars. To paraphrase Foucault, bodies have always been totally imprinted by histories and places (Foucault, 1984).

A genealogical analysis connects 'untimely' histories (Nietzsche, 1997 [1876]) to reveal complex filiations among competing epistemic paradigms (Foucault, 2003; Koopman, 2013). In the case of postgenomics, genealogy challenges the naïve and Eurocentric notion that, until today, plasticity has been silenced, pacified and marginalized in favour of a biology of fixedness. That fixedness has prevailed for centuries with its neat distinction between the interior of the body and the outer environment, and hence between nature and nurture. It challenges the naïve notion that it was only under a fixed and fatalistic view of biology that racism or biological determinism became possible, with all of their enormous political consequences. Many of these assumptions do not withstand further examination. Biological fixedness is not an obvious or default commitment that we are just now overcoming through incremental scientific advancement. It is better understood as what Walter Mignolo (2000: 22) calls 'a spectacular case of a global design built upon a local history': the invention of an insulated body in a very specific world area (Northern European and North American) since the second half of the 19th century.

I do not mean to suggest that people have long understood the molecular mechanisms of plasticity. This understanding is indeed a product of recent discoveries in neuroscience and molecular biology, made possible once scientists began to discard late 19th- or early 20th-century notions of stability and permanence. However, a more

pluralistic history of biology demonstrates that the problem of how to live with an exposed and permeable body – that is plasticity *as a form of life* – is pervasive across space and time, including in traditions pre-dating and coexisting with modern medicine's understanding of the enclosed body. The recognition of corporeal plasticity is therefore not an event enabled by the linear unfolding of scientific innovation. Rather, a range of discourses, practices and ethical visions has stubbornly persisted and resurface today in the hype, potential and anxiety surrounding plasticity. A fresh, deossified approach to past counter-traditions and even forms of anti-science (Foucault, 2003) in all their different iterations, rather than flat continuity, suggests that the present has not been reached teleologically. Postgenomics exemplifies the contingency and precariousness of perceived epistemic closure. A chief aim of this article is to show that the past is never entirely displaced, thus complicating the supposedly clean points of rupture in historical epistemology (Loison, 2016; Rheinberger, 2010).

Perhaps more importantly, I draw on genealogical method to illuminate the unequal distribution of plasticity's effects across social, gender and ethnic groups – inequality that alters the risks that individuals face, the responsibilities imputed to them and the interventions to which they may be subject. My goal is to contribute to challenging universalizing narratives about plasticity (or a lack thereof), as though there were a single and timeless human body. Plasticity is less an ideal signification or abstract resource than the result of historically situated techniques for constructing ethical subjects and governing them. Genealogy serves as a healthy reminder that histories of corporeal plasticity have always been highly gendered, racialized and classed, mapping and reproducing hierarchies through physiological distinctions (Paster, 1993). If everyone was plastic before the rise of the modern biomedical body, still some bodies have always been deemed softer, more plastic, more transparent and subject to material influences than others.

Finally, a genealogy of the permeable body serves the goal of contributing to a history of the present. It does so by taking neither a pessimistic nor celebratory stance on the contemporary turn to plasticity. Instead, genealogy contributes to a more sober history of the present by evaluating what is peculiar or 'new' in the contemporary profile of plasticity. Today plasticity is often seen as an enabling

condition underlying the modernist fantasy of instrumental management of the body and effacement of its materiality (Bordo, 1993). Or plasticity may serve the postmodernist admiration of endless potentialities, or be invoked as the making of an unprecedented figure of the human with entirely new ethical consequences (Rees, 2016). But postgenomic plasticity may also be seen along a different line, that of a *pre-* or even *alter-modernistic understanding* that disrupts boundaries between openness and determination, malleability and fixity, individual and community. I will conclude that this emerging sense of plasticity problematizes contemporary debates about determinism and anti-determinism in epigenetics still reliant on the figure of an autonomous, shielded body either defended in its integrity or denied as illusory.

Ancient Plasticity: The Humoralist Body

Trapped in the bottleneck of fixity generated by the ‘Century of the Gene’ (Keller, 2000), when the presumed stability of genes came to monopolize the biological imagination, we have forgotten what was once a ubiquitous belief in Western and non-Western cultures: that environmental factors – admittedly impoverished and late terminology (Pearce, 2010) – deeply affect a plastic human biology. Genealogy is an invitation to begin to restore our memories and disabuse ourselves of the seeming radicalism of today’s turn to permeability, by returning to the humoralist body of the ancient and early modern periods and its pervasive ramifications in non-Western experience of the body.

Humoralism was not the only premodern ‘biological’ understanding of the body, but it was the most widely believed and associated with medical practices. Since its origin with the Hippocratic corpus in the 5th century BCE and later elaboration by Galen, its multifaceted epistemologies and practices dominated the ancient world and early modernity (Siraisi, 1990; Temkin, 1973). Humoralism influenced the medieval psychology of temperaments (Klibansky et al., 1964), Renaissance theories of civilizational difference known as geohumoralism (Floyd-Wilson, 2003), and the ‘atmospheric vigilance’ that characterized Hippocratic revivals in 18th-century Britain (Golinski, 2010). The geographic diffusion of humoralism is as impressive as its longevity. It is the common thread among great medical traditions

spanning from the Mediterranean Sea to India via the Arab world. Many scholars have noticed the striking parallels between the open body of humoralism and Ayurvedic physiology, in which the body is imagined as an open field in which one could discern ‘the flows of substances through channels, and the transformation of these substances into one another’ (Trawick, 1992: 136). The Arab version of humoralism, Unani medicine (meaning from the Ionian sea, i.e. Greek), developed from the 9th century CE and is equally based on four humors (*akhlaat*). This practice, which reached India and the Malay peninsula, continues today. As known, medieval medicine owes its humoralism to Arabic texts translated into Latin (Nutton, 2004).

Although some humoralist frameworks and terminology trade in notions of stability and even fixity, especially after Galen and, more visibly, in early modern typologies of personality traits (comedies of humors), the humoralist body always was marked by a contextual dependency on time and place that gave it the resources to undermine or problematize this fixity.

As Ruth Padel (1992: 58) has written, all Greek medical theory is a theory of *poroi* (πόροι), a theory of the ‘infinitely penetrable body’. *Poroi* are literally the pores, channels, paths that allow exchange between the interior of the body and the environment, placing the body constantly on the verge of change (and each part of the body potentially set in motion by changes in other parts). Always engaged in ‘dynamic interactions’ with its milieu, the humoralist body was a ‘system of intake and outgo’ (Rosenberg, 1985: 40) in which the four humors (blood, choler, black bile and phlegm, according to Galen’s later systematization) were ‘liquid forces of nature’ (Paster, 2010: 4) that connected bodies even to the cosmos.

These beliefs were widespread in the ancient world well beyond humoralism. Indeed, ancient authors such as Soranus and Pliny the Elder describe the effects of lunar movements on organismic forms. Soranus notes the shrinking of a mouse’s liver lobes with the waning of the moon; Pliny the growth of shellfish with its waxing. The logic was that, as the queen of heaven, the moon ruled over the fluids in the sublunary world. Whatever is of watery nature will be affected by the moon’s movements. Several centuries after Pliny, Albert the Great (1200–80), Thomas Aquinas’s master, wrote that it was ‘especially the eyes, in whose composition water’s nature abounds’ that would

‘receive the greatest alterations and increases and diminutions according to the moon’ (Resnick and Albertus Magnus, 2010: 53). This opinion was shared by other key scholastic thinkers influenced by the translation from the Arabic of humoralist texts since the 12th century. Robert Grosseteste (1175–1253), Bishop of Lincoln, explicitly linked lunar movements to brain alterations. Grosseteste writes: ‘We know by experience that, of all the heavenly substances, the moon exercises the greatest control over moist and cold bodies.’ Thus, he continued, ‘certain people are called lunatics because, when the moon wanes, they suffer a diminution of the cerebrum, since the cerebrum is a cold and moist substance’ (Dales and Grosseteste, 1966: 461).

To this generalized plasticity of ancient times, humoralism offered possible mechanisms and a strong materialist ontology. As a profoundly non-dualistic view, humoralism always connected inwardness and material things. Somatic changes brought about by food, wind and hard waters shaped mental faculties. *Temperature* (of the body) was *temperament*.

Humors themselves, however, were not to be understood as immutable essences, like the four bases of DNA nowadays. Each could easily turn into another, given a corresponding change in food, season or waters (King, 1998). And since their quantity and prevalence in the body were defined by their relation to the external environment, food consumption, temperature, age, season, and even intellectual acts such as reading, humors had ample opportunities to rebalance (Spiller, 2011). Eating warm foods generated more bile, cold foods more phlegm. Similar shifts occurred during what were perceived as warmer or colder life periods. Interestingly, the notion of humors was born from botanical observations: humor (*ikmas* or *chumos* in Greek) meant literally a juice or life-giving moisture (King, 2013; see also Thomas, 2000), such as would nourish a plant in soil. This ‘analogy between the human body and the world of plants’ was widespread in the humoralist world (King, 2013). Plant development is affected by attachment to place – the characteristics of soil, availability of sunlight, intensity of the wind. Moving the plant, or planting the same species elsewhere, will produce different outcomes. The humoral body, like a plant, was always mutable, even if it looked fixed at a given moment.

The humoralist body therefore was never a stable achievement or essence. Lemnius Levinus (1505–68), an influential Dutch doctor, often complained that individual complexions (balance of humors) were ‘*easelye one into an other transmuted*’ (cited in Spiller, 2011). Stability and balance had to be conquered through complex micro-political governance of the individual’s relationship to his surroundings. This explains two very visible features of medical practice and diagnosis under a humoralist framework. First, a constant anxiety and vigilance in monitoring excretions, wastes, sweat and other flows, and the importance of medical techniques such as bloodletting, purges and vapour baths aimed at taking control of bodily channels and its secretions (Horden and Hsu, 2013). Second, a profound connection between medical diagnosis and description of ecologies and even social structures. In the Hippocratic *Airs, Waters, and Places*, advice on good health was also advice on the healthiest places to inhabit. Written as a guide for a doctor in regards to moving to a new area, the treatise famously recommends a full knowledge of the physical landscape, its winds, the hardness of its waters, its variations in temperatures, the exposures of its cities, before pronouncing any diagnosis (Lloyd, 1978).

If the phenomenological experience of humoralism, and thus the ancient body, is no longer accessible to us, it is in part because the theory is almost the exclusive province of medical histories, which characterize it only as a disqualified precursor to later scientific views. This understanding is much too narrow. Humoralism was a medical practice, but it was also an ‘ethnography’ and ‘sociology’ of the ancient world (respectively: Thomas, 2000: 25ff.; Grant, 2000: 199). Jacques Jouanna, leading expert on Hippocrates, writes that in the Hippocratic corpus we find the first ‘rational ethnography’ that ‘extends the etiological method to the study of people, so that medicine develops into an ethnography’ (Jouanna, 1999: 35). This is particularly the case in the Hippocratic *Airs, Waters, and Places*, with its interest in the biophysical landscape of different places as well as customs, social norms and political regimes (monarchy for instance). It also has a specific ethnographic focus, examining how social practices directly shape the body of certain populations (the mythical Macrocephaly with their elongated head as a consequence of the traditional practice of wrapping the head with bandages). Examining these biophysical and cultural aspects, *Airs, Waters, and*

Places produces one of the first geopolitical descriptions of the ancient world. For Hippocrates in this text, Asians are ‘more gentle and affectionate’ but also more cowardly and mentally flabby; Europeans, exposed to greater seasonal changes, are therefore naturally more ‘ferocious’; the Greeks more ‘independent’ and able to ‘enjoy the fruits of their own labour’; the Scythians, living on the steppes at the border of Europe and Asia, small and weak like their vegetation (Lloyd, 1978). The wider history of how these tropes were turned into an influential form of ancient biopolitics based on malleable not fixed traits is covered elsewhere (Meloni, in press).

Incidentally, Galen also explicitly draws on humoralist categories in his sociological analysis (Grant, 2000). Heir to a rich urban family, he notes how fatigue and odd food hardened peasants’ bodies (Matern, 2008). That is, under the humoralist framework, it is possible to understand the physiology of the peasant as wholly different from that of the affluent urbanite. Later, in early modern conceptualizations, ethnography is at the heart of Renaissance geohumoralism, which connected geographical variations to changes in national characteristics, influenced Shakespeare and Bodin, and represented ‘the dominant mode of ethnic distinctions in the late sixteenth and early seventeenth centuries’ (Floyd-Wilson, 2003; Spiller, 2011).

What medical histories failed to understand of humoralism, some literary figures preserved. For instance, the scholar Mikhail Bakhtin perceived clearly the singularity of the pre- and early modern ontology of the body. In his study of Rabelais, Bakhtin understands the grotesque as an expression of the body’s existence not as ‘a closed, completed unit’ but as something ‘unfinished’, that ‘outgrows itself, transgresses its own limits’ and hence potentially liquefies in the external world (Bakhtin, 1984: 24). Rabelais (1494–1533), who became a doctor after leaving the monastery, translated part of the Hippocratic corpus in Montpellier, one of the European centres of humoralism. The influence of humoralism is particularly explicit in Rabelais’s descriptions of the physiology of laughter and joy (Bakhtin, 1984: 67–8). The grotesque body emphasizes ‘apertures’, ‘convexities’ and ‘offshoots’ through which exchange with the outside world occurs: ‘the open mouth, the genital organs, the breasts, the phallus, the potbelly, the nose’ (Bakhtin, 1984: 26). In the grotesque, not only do places enter bodies, but bodies can become ‘building materials’ for actual places.

Governing the Humoral Body

Governing a permeable body was far from easy. The impermanence of the humoralist body meant managing a complex number of factors and variables that were known, after Galen, as the six ‘non-naturals’: passions; air and climate; food and drink; repletion and evacuation; sleeping and vigil; and exercise. The porous and unstable physiology of the ancient body demanded a ‘constant and detailed problematization’ of the relationship with its surroundings (Arikha, 2007; Foucault, 1990). The result was a micropolitics of self-moderation that characterized the many *regimen sanitatis* (books of health management we could say) written by humoralist doctors. In early modernity, this ethics of self-discipline found its way into a number of treatises that blurred medical and moral/religious recommendations and guidance. In this literature, the humoralist body is frequently equated to a ‘castle’ under siege, which man had ‘to look after’ carefully (Shildrick, 2001). Michael Schoenfeldt’s work has been particularly helpful in highlighting how the humoralist body became the site of self-empowerment through ‘soundness of mind and body’ made possible by the manipulation of bodily fluids (Schoenfeldt, 1997: 246, 1999).

The important point to notice here, however, is that *not every body was equally malleable*. As various authors have noted (Paster, 1993), the porous body was not just an individual physical self that could be adjusted this way or that to one’s benefit or detriment. Permeability was thought to be unequally distributed and to affect groups of people differently. Gender and race rendered bodies differentially plastic and exposed, more or less at risk of leakage and therefore subject to variously intensive regimes of regulation and surveillance.

A Gendered Plasticity

For humoralist authors, whether in ancient gynaecological treatises or early modern midwifery textbooks, the female body was a point of particular anxiety. Physiologically, it was widely assumed that women were softer, more permeable and less stable (Dean-Jones, 1994; Duden, 1991; King, 1998; Kukla, 2005).

This perceived impressionability emerged from several ancient physiological and philosophical traditions. In Hippocratic texts, women are considered spongier, ‘with a capacity to absorb fluid

which makes it [the female body] directly analogous to wool or sheepskin' (King, 1998: 96). The inside of the female body was deemed particularly fluid (Duden, 1991), constructed around an open way (*hodos*, literally 'road') 'from the orifices of the head to the vagina'. The difference between women and men was epitomized by the need to discharge accumulated blood – one of the four humors – via menstruation (King, 1998). The uterus (*histera*) was understood not only as plastic in its contraction and expansion, but also capable of 'wandering throughout the female body, causing disease and distress as it travelled': hence hysteria, the wandering of the womb (Kukla, 2005: 5). In an Aristotelian view that would later be codified in medieval scholasticism, women were considered of a more watery constitution (see also Paster, 1993). For Albert the Great or Thomas, his disciple, more humid matter (and hence women, cold and moist) would receive impressions more 'easily but retain them poorly' (Hood, 2002: 68). These and other tropes were instrumental in consolidating the image of women as more subject to passions and less shielded 'against corrupting ingestions' (Kukla, 2005: 11). Women's bodies therefore provoked anxiety and could ethically be subject to greater control, surveillance and obligation. Such understandings of women's permeability also lent support to the claim, pervasive in Western medical beliefs until the early 20th century, of *maternal impression*. The theory was that a gestating mother's behaviour, thoughts and even the contents of her sight could leave a permanent imprint on her unborn child (Epstein, 1995; Fischer-Homberger, 1979; Huet, 1993; Kukla, 2005; Roodenburg, 1988). The ancient world abounds with stories of maternal imprints as a result of observing paintings, objects and people of other races. Soranus writes in *Gynaecology* (c.125 CE):

Some women, seeing monkeys during intercourse, have borne children resembling monkeys. The tyrant of the Cyprians who was misshapen, compelled his wife to look at beautiful statues during intercourse and became the father of well-shaped children; and horse-breeders, during covering, place noble horses before the mares. Thus, in order that the offspring may not be rendered misshapen, women must be sober during coitus because in drunkenness the soul becomes the victim of strange fantasies; this furthermore, because the offspring bears some resemblance to the mother as well, not only in body but in soul. (cited in Temkin, 1956: 38)

In a racialized version of maternal impression that became widespread in the Renaissance especially, Hippocrates was said to have saved a white princess from the accusation of adultery when she mothered a child 'black as a Moor'. The ancient physician pronounced that a portrait of a Moor in the princess's bedroom was to blame for the case of dissimilarity in generation (for other cases of pregnant imagination linked to race: see Doniger and Spinner, 1998). In the Middle Ages, scholastic philosophy further consolidated the notion that imagination may induce real forms into matter; further cases were reported in the early modern period as well. During the Renaissance, Montaigne wrote of women struck at the sight of executions, military invasions or other perturbing images who then 'transmitted marks of their fancies to the bodies of the children they carry in the womb' (in Huet, 1993: 13). Medical and midwifery texts of the 17th and 18th centuries, both technical and popular, offered severe prescriptions lest women's attitudes poison their offspring's future. Pregnant women, in John Maubray's *The Female Physician* (1724), were encouraged to 'suppress all Anger, Passion, and other Perturbations of Mind, and avoid entertaining too serious or melancholick Thoughts; since all such tend to impress a Depravity of Nature upon the Infant's Mind, and Deformity on its Body' (cited in Shildrick, 2001: 42). The notion that pregnancy was 'an active project requiring self-discipline and work on the part of expectant mothers' (Kukla, 2005: 21) was obviously the natural counterpart of the logic of maternal imagination, although the intensity and dangers associated with the power of the womb changed significantly with changing cultural contexts (for instance the impact of the Protestant reformation in offering a darker view of the womb after pregnant mothers ceased to identify themselves with the divine womb of the Virgin Mary: Fissell, 2004).

The persisting influence of the idea of maternal imagination is witnessed by an unsigned editorial in the *Journal of Heredity* in 1915. Even at so late a date, the editor of a flagship genetics publication felt the need to correct 'pre-natal culturists and maternal-impressionists' still existing among the emerging eugenics movement. With their unscientific beliefs, he lamented, they were 'trying to place on' the pregnant mother 'a responsibility which she need not bear'. Genetics, the editorial claimed, proved that:

most errors of development ... are due to some cause within the embryo itself, and that most of them take place in the first two or three weeks, when *the mother is by no means likely to influence the course of embryological development* by her mental attitude toward it, for the very good reason that *she knows nothing about it*. (Editorial, 1915: 17, emphasis added)

Besides exonerating mothers, the editorial was anxious to highlight how an undue emphasis on the maternal power to alter heredity was just the wrong path toward eugenic goals.

Ancient Plasticity and the Racialized Body

The permeability of the humoralist body meant not only that some bodies, such as women's, might be more or less subject to external influences (including the power of imagination) but also that any body could be presumed affected by places. The assumption that 'every place had its own unique nature, that similar places gave way to similar natures, and that different places gave way to different natures' (Wey-Gómez, 2008) was not exclusive to humoralism. It was shared by geographers such as Strabo and Ptolemy and by scholastic philosophers such as Albert the Great. Antiquity also saw other methods, disconnected from the power of places, for explaining and constructing differences between human groups and promoting proto-racist views (Isaac, 2006). However, the environmentalist modality was by far the most widespread and flexible intellectual device that asserted the superiority of certain human groups identified as wiser and fitter to rule, not because of heredity but because of the effects of climate on the body and mind. The site of greatest climatico-moral superiority shifted with time (Floyd-Wilson, 2003). One thing, however, remained constant: people inhabiting tropical areas were consistently viewed as inferior. For instance, in his path-breaking work on Columbus's geopolitical cosmography, Nicolas Wey-Gómez has shown the profoundly moral implications of the notion of *latitude*. For Columbus, North-South, not East-West, determined the gradations of civilization. Torrid zones were home to degenerates, establishing the natural privilege of colonial rulers. This model would be revised amid later colonial expansions (see for India: Harrison, 1999), but 'moral climatology' persisted as a way of making ethnic distinctions (Livingstone, 1991).

Albeit arguments about the power of places went well beyond humoralist writings, the durability of such views largely benefited from the physiological underpinnings of humoralism. Humoralist writings provided two important mechanisms whereby *people came to mirror* the places they inhabited. First, humoralists noted that local variations in temperature and humidity affected the opening and closing of pores. Naturally, this would regulate the circulation of humors between the body and the environment. Because quantities of given humors affected mental characteristics (bravery, laziness, lustfulness), climate could determine the mental characteristics of groups of people. For example, the Franciscan missionary Diego de Valadés explained that the humidity of Spanish colonies left Amerindians morally and mentally debilitated, ‘stupid’ because ‘they were born in thick air’ (cited in Canizares-Esguerra, 2006: 69).

Second, humoralists saw environmentally conditioned traits as heritable because they assumed that ‘the semen comes from all the parts of the body’ (Hippocrates), which was universally imbued with humors. Semen is not the only ancient and early modern carrier of heredity; breastmilk also plays an important role (among other imaginative factors). But semen was understood as the most rarefied product of digestion (hence advice about fully digesting food before sex: Laqueur, 1990), making it continuously porous to the effects of local habits. Thus food had powerful effects on ‘heredity’; places (via nutrition) left direct marks on the bodies of human groups.

In light of the humoralist relationship between locale and group traits, the first movements of the colonizer body to the New World produced unprecedented anxiety about bodily boundaries. In *The Body of the Conquistador* (2014), historian Rebecca Earle describes Spanish dietary obsessions intended to maintain clear demarcation between the colonizer and the colonized. If humoralism – a key tenet of medical teaching at the newly founded Universidad de México – implied that the Spanish body would mutate thanks to New World food, then diet ‘more than any other factor’ would separate Spanish from Amerindian bodies. Spaniards therefore paid attention to a very detailed micropolitics of food (importing bread, wine and oil, cultivating Spanish crops) for reasons that went well beyond ‘culinary nostalgia’. ‘These concerns spoke directly to Spanish worries about the physical integrity of their bodies, and about the maintenance or dissolution of the most fundamental of colonial divisions: that

between the bodies of the colonisers and the colonised' (Earle, 2014: 183). This porosity of racial characteristics to nultural aspects could support a variety of political agendas. 'Without the right foods Europeans would either die, as Columbus feared, or, equally alarmingly, they might turn into Amerindians.' But, 'with the right foods... Amerindians might perhaps come to acquire a European constitution', as champion of indigenous rights Bartolomé de Las Casas believed (Earle, 2014: 2–3).

Closing the Humoralist Body

At the end of the 18th century, the 'fluid-and-flux constitution' of the humoralist body gave way to a new solid body that emerged from a different anatomical and clinical gaze (Foucault, 1973; Risse, 1997). Disease was no longer revealed by changes in unstable fluids but firmly localized in well-defined organs, fibres and other tissues.

This strengthening of an inner, autonomous core, firmly distinct from the outside world, was the perfect biomedical counterpart to the privatization of the self that underpinned the identity of the modern, liberal-humanist subject (Taylor, 1989). No one has done more in recent years to address this dramatic 19th-century convergence of the political and the biomedical than social theorist Ed Cohen (2009; Jamieson, 2016). In Cohen's work we find an enlightening critique of how the 'monadic modern body' (2009: 4) took stage first in Bernard's *physiology* and, more substantially, in *bacteriology* and *immunology* to which he devotes most of his analysis. While Cohen's analysis is an indispensable guide to bring together the making of the modernistic body of biomedicine with the consolidation of the liberal-humanist subject, it could have advanced further in highlighting the process of delimitation of the modern sovereign body. He recognizes that Bernard's work was lethal to the 'Hippocratic imagination' (Cohen, 2009: 101), but in the light of my previous analyses it is important to emphasize that *the displacement of the humoralist view was more than a collateral effect* of the new bounded body of biomedicine.

Liberal-humanist virtues of autonomy, liberty, inwardness and inviolability are problematic under a strictly humoralist framework in which the notion of an immutable biological core is chimerical. It is true that humoralism promoted ideas and techniques of the body

that may have contributed to the rise of modern individualism (Coleman, 1974), but its view of health and disease as dispersed ‘across both bodies and landscapes’ (Nash, 2006) was at odds with the modernist notions of a fixed standard of pathology ‘applicable to all men in all times’ (Coleman, 1974; for a wider analysis of these tensions, see Meloni, *in press*). Other humoralist notions were discredited too. Enlightenment thinkers were uncomfortable with the power of imagination, seeing it as a menacing opponent of stable identity (Kirmayer, 2006). The humoralist emphasis on the environment as the first cause of disease became a subject of ridicule after the rise of a new public health concerned with causes internal to the individual. Finally, although the notion of plastic heredity persisted well into the 1900s (Kammerer, 1924), it was weakened by emerging typological views of race and finally discredited by the rise of genetics, with its notion of a stable unit of heredity. The specific contribution of genetics to the ‘new political economy of modern personhood’ (Cohen, 2009: 23) is the second point on which Cohen’s analysis could have gone further.

A Genetic Body

The emerging discipline of genetics furthered this transition from external environment to the bodily interior. It reinforced ideas of an inner biological core uncontaminated by the effects of mundane experience and therefore endowed with a quasi-mystical integrity. It caused a profound reorientation in notions of corporality and undermined ideas of generation, reproduction, and genealogy that had been hegemonic for centuries. In this older framework, compatible with humoralist notions, a parent’s body literally ‘manufactured the particles from which the body of its offspring will be constructed’ (Bowler, 1989: 25). Bodies created bodies, one generation after the other, in an ongoing process of somatic communication. The habits of one generation could always become the biology of the next. The humoralist notions of the semen as generated by all parts of the body, which logically complemented this view, never disappeared and instead persisted, in more sophisticated forms, up to Darwinian pangenesis (1865). Half a century later, however, this cluster of ideas appeared laughable. In 1911 the Danish botanist Wilhelm Johannsen mocked the claim that ‘personal qualities’ of a parent’s body directly

caused 'the qualities of its offspring'. This was, he said 'the most naive and oldest conception of heredity' (1911: 129).

What happened between the times of Darwin and Johannsen was the collapse of the developmentalist model of generation. Albeit a more complex figure, August Weismann played a large role in this intellectual transition. Weismann's doctrine of the continuity of the germplasm implied a rift between an 'immortal germplasm', whose cells were not used in the construction of the body, and transient bodily cells, the 'mortal part' of the individual. 'Reserved unchanged for the formation of the germ-cells of the following generation', the immortal germplasm was the only link running from parent to offspring (Weismann, 1891: 185). On this view, the body became a passive container for an immortal germplasm, which now stood 'to all the rest of the body in much the same relation as a *parasite* to its host, showing a life *independent* of the body' (Romanes, 1899: 26). Johannsen's (1911) later distinction between the *genotype*, the 'inner constitution' or template of a group of organisms, and *phenotype*, its morphological manifestation accessible 'by direct inspection', somehow captured this novel stratification of the body.

After Weismann and Johannsen, the body was rewritten as a *two-tiered* organism, with an immortal substance at its centre, from which emanated a visible, but ultimately superfluous phenotype. The pre-Weismannian assumption of parity among the body and hereditary material was replaced by a strict hierarchy of causes. The body became a receptacle for genetic inputs rather than a possible source for genetic variation. With the transition from the Mendelian to the molecular gene, this two-tiered ontology was even reinforced. The body was made more superfluous, under the control of a transcendent replicator, DNA, that is impervious to environmental inputs. This view was brought to its extreme consequences by the neo-Darwinian notion of the body as a mere vehicle through which DNA reproduces itself. This is truly an asceticism of the flesh, where the whole body disappears as a meaningful level of analysis, to the advantage of precious sub-units that take the place of the body itself (Gudding, 1996). It is also a unique phenomenology of the body – on the opposite end of the spectrum to the embodiment of humoralism, where any fleshy details of the body mattered and had agential power – but no less radical.

This series of transformations spelt the end for the idea of a highly plastic, environmentally sensitive body. Although an ecological view of disease persisted in the 20th century (Nash, 2006), the connection between disease aetiology and places became much more tenuous by the mid 20th century (Rosenberg, 2012). However, the notion of body plasticity was not stricken from the biomedical landscape. It was retained, with a deeply altered meaning. In the last decades of the 20th century, the body became a consumable object docilely shaped according to its owner's projects (Bordo, 1993; Pitts-Taylor, 2016). Once a quality arising from the interaction of body and milieu (including other bodies), 20th-century plasticity turned into a self-directed phenomenon aimed at strengthening human agency. Although the matter goes beyond the scope of this article, it seems possible to argue that the genetic view of the body enabled this transformation. Genetic hardwiring happily coexisted in Western biomedicine with cosmetic surgery, Botox injections, and the treatment of erectile dysfunction with Viagra (Berkowitz, 2017). There is an implicit convergence between the body as a passive result of genes' action and its apprehension as a raw material to be 'worked on by an enterprising self' (Berkowitz, 2017). In a quasi-Weberian fashion, the genetic body's lack of independence favours an instrumental view in which it is a fully controllable object, to be shaped in accordance with its master's desires.

A Postgenomic Body

Genetics' 'cosmetics of life' (Gudding, 1996) implies that the body is an ephemeral result of genes' action. Postgenomic models are quite different, understanding the phenotype as a source and not just an end product of genetic variation (West-Eberhard, 2003).

Postgenomic ideas are often read in a merely chronological sense: they came after the Human Genome Project was completed in early 2000. However, postgenomics is more than a temporal notion. It is a distinct 21st-century thought-style that emphasizes the porosity of genomic functioning and the dependence of its regulatory architecture on time and milieu. In particular, an essential feature of postgenomics is *a new material understanding* of the genome (Barnes and Dupré, 2009).

On postgenomic readings, the genome is no longer conceived as an abstract blueprint for building biological organisms, regardless of context, as it was in the heyday of the Human Genome Project (Gilbert, 1992). Rather than as naked DNA, the genome is being experimentally re-appraised as a materially complex object made of chromatin, the macromolecule into which DNA is tightly wrapped and that is actually encountered in the nucleus (Dekker et al., 2013; Lappé and Landecker, 2015). Chromatin, the matter of chromosomes, studies of which well predate the postgenomic era (Deichmann, 2015), is a flexible material, whose alteration and topological reorganization change the transcriptional capacity of DNA (Gómez-Díaz and Corces, 2014). Changes in chromatin states depend on and register the physical impact of environmental and developmental cues. Chromatin can therefore be seen as a sensitive body, whose study ‘allows quantitative measurement of the physical registration of environmental experience originating outside the body as shifts in conformation deep inside cells’ (Lappé and Landecker, 2015: 153).

This *rediscovery of the material density of the genome* is crucial to the discontinuity between genomics and postgenomics. As the focus of research moves from naked DNA to the complex scaffolding of chromatin where DNA sequences are expressed, the disembodied genome of information biology gains a body back, one that makes the notion of genomic plasticity theoretically and experimentally salient (Lappé and Landecker, 2015: 156–7). In genomics, while the same genotype could express several phenotypes through a range of environments, each of those environments remained always an external background for an otherwise-static, and ontologically prior, genome. In postgenomics, by contrast, the ‘excitable’ nature of chromatin challenges the ontological priority, and boundedness, of the genome. Social matter, and the wider biophysical environment, impinges on biological matter and impresses its regulatory architecture. This implies a shift to a different model of biological memory. As Lappé and Landecker continue:

What we wish to highlight here is the contrast drawn between DNA that is mutated versus chromatin that is reshaped after environmental input. . . . These are two different models of memory. Where the linear sequence information can remember only itself . . . the imprint

carries experience forward via three-dimensional impressions linked to gene transcriptional responses to experience. (2015: 157)

This is where epigenetics really matters: not so much as ‘tags’ or ‘bookmarks’ added to linear DNA sequences but as the complex machinery that spatially rearranges and regulates chromatin – the moving and malleable matter of chromosomes. The connection between epigenetics and plasticity therefore is not ephemeral but a structural effect of a shift in concepts and experimental practices. If, in light of the postgenomic complications between the genome and its wider regulatory network, we challenge the dualism between a static DNA and a dynamic epigenome (Griffiths and Stotz, 2013; Lappé and Landecker, 2015), we could even say that not just the epigenome but the genome itself has become an impressionable organ. The change is visible in new renderings of genomic functioning. In classical molecular genetics, gene functioning was described by a long series of rows representing nucleotide sequences, a string of information that dictated the inner programme of each organism (Keller, 2000). The three-dimensional structure of the protein encoded by gene action was necessary for regulatory functions, but the key determinant remained linear DNA sequences. Postgenomics sets aside this linearity. Rather than linear sequencing, we see the physical *folding* of chromatin fibre, the form of which is closely linked with genome function and transcriptional activity and hence biological ‘meaning’ (Tark Dame et al., 2011). If, in principle, genomic sequencing could be captured by a flat series of letters, postgenomics necessitates a multidimensional representation showing ‘the changing landscape of loops’ that regulates gene expression (Gómez-Díaz and Corces, 2014; Pennisi, 2017).

Indeed, at every scale postgenomic writings exhibit a different morphology, which privileges looping, entanglement and curvilinear forms over rectilinear tracks. *Folding*, and derivative forms like *enfoldment*, and *scaffolding* (but also adjectives such as *entrenched* and *entangled*) are terms often employed to describe not only the complex architecture of gene functioning but also organismic relations to their spatial and temporal contexts (Chiu and Gilbert, 2015; Griesemer, 2014). The postgenomic organism, we are told, is always situated ‘in a complex supraindividual web of relationships . . . that determine its ontogenetic and even transgenerational destiny’ (Baedke, 2017). Developmental

processes are not ‘self-unfolding’ but rather ‘involve the interaction of a developer with scaffolding’ – the assemblage of the organism and all the ‘external’ entities (including other organisms) which enables its growth (Griesemer, 2018: 38). Rather than a modernistic separation of inner and outer, visual representations of postgenomic models of life are better rendered with a Baroque morphology in which the outside is never an absolute limit but instead ‘a moving matter’, a fold understood recursively as an ongoing succession of ‘folds always folded within other folds’ (Deleuze, 1993: 6).

The notion of *entanglement* also connects Baroque aesthetics and postgenomics. In Baroque morphologies, entanglement refers to a:

point of view that involves two mobile positions. It neither entails something that is simply relativism nor allows universalism or absolutism to assert itself. . . . Entanglement proceeds in the knowledge that *we are always within the histories we make*, enfolded in their spatio-temporal frame and engaged in their production. (Meskimmon, 2002: 698, emphasis added)

This sort of profound situatedness is essential to understand the postgenomic body and is the source of new senses of plasticity inherent in it.

A Farewell to the Modernistic Body?

It is through this reincorporation of the body *within histories and milieus* that I suggest reading the peculiar figure of plasticity that postgenomics brings about. One significant starting point is the way in which microbiomics and epigenetics have been recently mobilized to rethink the ‘human birth narrative’. To challenge the myth that childbirth is about ‘the origins of a new individual’, developmental biologist Scott Gilbert (2014: 1) describes it ‘as the origin of a new community’, in which what is reproduced is the web of relationships among mother, child and microbe symbionts. Gilbert, who has co-authored several key articles on the dismissal of individualism in contemporary biology (Gilbert et al., 2012), challenges here the inherent solipsism of the birth narrative, understood as a modernistic ‘immunization’ of one individual from the other. Human birth does not amount to ‘the heroic trevails [*sic*] of the mother or the amazing journey of foetus’ (Gilbert, 2014), nor to the

supposed emancipation of the foetus from the mother's symbiotic system, but rather is 'the passage from one set of symbiotic relationships . . . to another' (Chiu and Gilbert, 2015: 192). This is not a simplistic argument about the 'programming' of the foetus via the maternal biology. As in the Baroque entanglement, what is brought to light here is the mobile, dynamic co-production of mother and infant. The relationship between mother, child and microbe symbionts has to be understood as one of 'mutual reliance (reciprocal developmental *scaffolding*) and mutual construction (niche construction)' (Chiu and Gilbert, 2015: 194, emphasis added). The foetus, for instance, does not simply receive in a passive way the maternal symbiotic system via the mother's hormones, food, antibodies, and later breastfeeding. The foetus too actively contributes to maternal development, for instance by modulating, modifying and stabilizing the mother's immune system or changing her blood circulation and metabolic functioning (Nuriel-Ohayon et al., 2016). This is a system of reciprocal 'enveloping–developing', in Deleuzian parlance (1993: 9), in which each being is making the scaffold for the other. Chiu and Gilbert (2015) use *scaffold* and *scaffolding* nearly fifty times in their article to convey a strong sense of shared material contexts in which development takes place. What is at stake is the plastic co-production of a number of beings-in-common, 'the unfolding of [a] community structure over time' (Chiu and Gilbert, 2015: 192: see, in anthropological commentaries, the notion of *motherfetus*: Takeshita, 2017). This blurring of individual histories within wider contexts is far from the idiosyncratic outcome of this research. There would be many possible examples of this embedding of personal biographies either in spatial relationship (especially in microbiomics) or in temporal ones (in epigenetics). In epigenetics in particular this situatedness may become even stronger, as ancestral events are often seen to linger with delayed effects on the present temporality of other biological beings. Whether the focus is on the reproduction of obesity (Rando and Simmons, 2015), the plasticity of taste preferences moulded via molecular cues across generations (Mennella, 2014), or the intergenerational transmission of famine, racism, slavery or trauma (Jasienska, 2009; Kuzawa and Sweet, 2009; Walters et al., 2011; Wells, 2010), what emerges is a nested continuum of biological states and forms replicated rather stably from one generation to another. Epigenetic temporality 'folds in

on itself' (Mansfield, 2017: 1). The image of the Russian dolls, or similar sequential representations of multiple generations folded one into the other, is in fact a recurring one in the epigenetic and developmental origins of health and disease imagination. Rather than the dematerialization of a field for the free play of desires and unlimited possibilities, plasticity here means a recognition that the past is never wholly elapsed, that a body is embedded in a very material lineage (Warin et al., 2012, 2015) that acts as regulator of the function and morphology of present and future generations (Landecker, 2011). This is not a plasticity of continuous creation of forms (Rees, 2016) or a naively modernistic self-directed plasticity, but of inter-generational *inertia* (Kuzawa, 2005), one that would be possible to associate with the famous Marxian passage that 'the tradition of all dead generations weighs like a nightmare on the brains of the living' (Marx, 1978). It is the weight of historical matter that counts in postgenomic plasticity. It is, for instance, the accumulated inequity of previous centuries of colonialism and exploitation that weighs on the uneven distribution of 'somatic capital' and metabolic capacity in different ethnic groups within and between populations (Wells, 2010). In social-theoretical terms, it is a plasticity of *viscous porosity* rather than smooth fluidity and endless possibility to change (Tuana, 2007). The postgenomic body becomes in this way not a modernistic abstract point in time, an instantaneous entity that can start anew at each generation. It is instead the sedimentation, even the concretion, of a long history into which the individual is quite literally submerged. This is why this emerging anthropological figure fits better with alter-modernistic frameworks such as the Baroque or Heidegger's analytics of *Dasein*. In contrast to the modernistic chasm of subject and object, in which an independent subject disposes of its past as a reified object, Heidegger's concept of *thrownness* (*Geworfenheit*) illustrates well the recognition of a 'referential dependence on other beings' (Richardson, 1974) that is characteristic of postgenomic plasticity. Thrownness means that I am always placed in a situation that I have not chosen, found in a terrain that 'has already constituted for itself' (Malpas, 2012) and of which I have to recognize its otherness and priority. While for Heidegger, it is *Stimmung* (mood) that reveals this belonging to an already given situation, its postgenomic iteration is embodied not psychologistic. It is not a mood like boredom or anxiety, or a linguistic web of meanings that

precedes me and discloses my possibilities; rather, it is a very material entanglement with other biologies and other histories: maternal microbiome via the placenta or breastmilk, paternal sperm physiology, the range of exposures that ceaselessly sculpt my identity. This model can be called plastic because my skin is not an insuperable wall, rather one of the points of entrance for innumerable microbiomic exchanges; my genome is impregnable by developmental and environmental cues; and there is no reset button at each generation given the inertial effects of past biological histories on present temporality.

Conclusion: Another Plasticity is Emerging

What sort of anthropological figure is taking shape in emerging models of plasticity in epigenetics, microbiomics and Developmental Origins of Health and Disease? Is postgenomic plasticity the apogee of a modernistic view of the body as fully malleable and ‘enhanceable’, the plasticity of a strategic transformation of the body? Or is it a plasticity of pure becoming, a postmodernist destabilization of the intentional agent via the creative force of biological matter itself? Or, finally, might not it be a liberation from the tyranny of fixedness that opens spaces for political resistance? Each of these positions has been advanced in social and theoretical commentaries on postgenomic plasticity. It is easy to see why one might frame the discourse on the plastic genome as the triumph of a fully managerial view of the body, at the mercy of its owner’s wishes. Contemporary plasticity is readily marshalled to the neoliberal imperative that we each become the best possible version of our selves, reinforcing the privatization of health, risk and disease (Pitts-Taylor, 2010, 2016). Yet new forms of plasticity might also liberate us from that imperative, as they promise ‘constant renewal’ that challenges stability (Rees, 2016) and enables the multiplying and decentring of subjectivity (Watson, 1998). Postgenomic plasticity may also be consistent with forms of resistance: properly secured into a new political consciousness, biological non-determinism can foster social and political non-determinism by disentangling plasticity from its dark doppelgänger, capitalistic flexibility (Malabou, 2008). One might reasonably hold any of these positions. In some cases, they are important and timely. However, they are also incomplete. With the partial exception of

Malabou's (2005) first writings, *all share a modernistic assumption* that ignores the sedimented histories of corporeal plasticity that precede and inform present body/world configurations, which may unfold again. Recognizing the complex filiation of contemporary notions and practices helps us to appreciate their ambiguous and polysemic nature; dissuades us from the radicalism of today which ignores longer histories of plasticity; and, finally, helps us to break free from stale points in contemporary debate. Postgenomic plasticity is not only modernist (taking full control of the body) or postmodernist (generating endless forms that undermine any stable agency). It is not only reactionary (governing vulnerable populations, women and ethnic minorities in particular) or revolutionary (breaking with the iron cage of fixed social forms). It is also non- or alter-modernistic. It speaks to a relational or communitarian dimension of biology that is partly alien to post-Enlightenment modalities. It is best represented by ancient and early modern morphologies (like the Baroque) of profound situatedness and disruption of dichotomies between the inner and the outer, activity and passivity, determination and openness, malleability and stability (or robustness: Bateson and Gluckman, 2012). In this way, postgenomic plasticity complicates debates on determinism and non-determinism, making somehow unproductive contemporary attempts to either condemn or rescue postgenomics from one of these two extremes. Determinism and anti-determinism, programming and freedom, all imply the modernistic figure of an autonomous, shielded body that either one has to deny as illusory or defend in its integrity. But this integrity is deceptive, according to postgenomic models in which entanglement (with others and the external world) comes ontologically first. As in older ecological models or in more recent biosocial and biocultural approaches (Frost, 2016; Ingold and Palsson, 2013), bodies are entangled in the inextricable nexus of biological and social matter, neither determined by biology (as if they *couldn't* be), nor abstract from it (as if they *could* be). It is, however, a very ambiguous plasticity. On the one hand it is capable of undermining atomistic and insulated models of the body in favour of more relational views of personhood and autonomy beyond notions of property and control (see Prainsack, 2017). On the other hand, by re-embedding the individual within a wider lineage of ancestral experiences and reconfiguring it as a holobiontic assemblage, it may literally dissolve the

subject of emancipation. Moreover, the power of biological heredity may be so expanded (as it includes potentially any single ancestral experience) to become stronger than in any previous genetic view. Finally, the several iterations of plasticity that emerge from this genealogy appear so deeply racialized and gendered that it is difficult to quickly turn them into an inherently emancipatory concept. Even as a concept, plasticity has an inertial weight and viscosity that is the task of the genealogist to excavate and bring into view.

Acknowledgements

A number of persons have been helpful in writing this paper, commenting on various iterations of it, particularly all the participants in the Biopolitics of Epigenetics Symposium at the University of Sydney (and Melinda Cooper as discussant of this paper), organized by Sonja van Wichelen in June 2017. Thanks also to Stephanie Lloyd (Laval) for numerous conversations around the world on the peculiar nature of plasticity in epigenetic research. Thanks to Vincent Cunliffe (Sheffield) for help in clarifying the role of chromatin. Thanks finally to Simon Waxman (Boston), Jenny Lucy and Claire Kennedy (Melbourne) for assisting with copy editing.

Funding

Research for this article was funded by a Leverhulme grant on Epigenetics and Social Inequality at Sheffield University (PI Paul Martin).

Note

1. A helpful standard definition of (phenotypic) plasticity is West-Eberhard's: the capacity of an organism to react to environmental inputs 'with a change in form, state, movement, or rate of activity' (2003: 33). Plasticity here refers to two semantic areas: 'responsiveness and flexibility' (West-Eberhard, 2003). A wider polysemy is in Malabou's (2005) reading, where the term is caught within three diverse semantic areas: generation, receptivity and destruction of forms. Rather than fixing its definition, I intend to take advantage of the fundamental ambiguity of the concept, turning it into a productive resource for unpacking its polysemy and following its contradictory movements across various

histories. Moreover, in this article I have abstracted away from the different disciplinary specification of the term (synaptic, morphological, functional, etc.) guided by my research question on ‘whole body’ plasticity.

References

- Almond, Douglas and Currie, Janet (2011) Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives* 25(3): 153–172.
- Arikha, Noga (2007) *Passions and Tempers: A History of the Humours*. New York: Harper.
- Baedke, Jan (2017) Locating the organism in the environment. Paper presented at the Annual ISHPSSB conference, São Paulo, Brazil, July.
- Bakhtin, Mikhail (1984) *Rabelais and His World*. Bloomington, IN: Indiana University Press.
- Barnes, Barry and Dupré, John (2009) *Genomes and What to Make of Them*. Chicago, IL: University of Chicago Press.
- Bateson, Patrick and Gluckman, Peter (2012) *Plasticity, Robustness, Development and Evolution*. Cambridge: Cambridge University Press.
- Berkowitz, Dana (2017) *Botox Nation: Changing the Face of America*. New York: New York University Press.
- Berlucchi, Giovanni and Buchtel, Henry (2008) Neuronal plasticity: Historical roots and evolution of meaning. *Experimental Brain Research* 192(3): 307–319. doi:10.1007/s00221-008-1611-6.
- Bordo, Susan (1993) *Unbearable Weight: Feminism, Western Culture, and the Body*. Berkeley, CA: University of California Press.
- Bowler, Peter (1989) *The Mendelian Revolution: The Emergence of Hereditarian Concepts in Modern Science and Society*. Baltimore, MD: Johns Hopkins University Press.
- Canizares-Esguerra, Jorge (2006) *Nature, Empire and Nation*. Stanford, CA: Stanford University Press.
- Chiu, Lynn and Gilbert, Scott (2015) The birth of the holobiont: Multi-species birthing through mutual scaffolding and niche construction. *Biosemiotics* 8: 191–210.
- Cohen, Ed (2009) *A Body Worth Defending: Immunity, Biopolitics and the Apotheosis of the Modern Body*. Durham, NC: Duke University Press.

- Coleman, William (1974) Health and hygiene in the *Encyclopédie*: A medical doctrine for the bourgeoisie. *Journal of the History of Medicine and Allied Sciences* 4(1): 399–421.
- Dales, Richard and Grosseteste, Robert (1966) The text of Robert Grosseteste's *Questio de fluxu et refluxu maris* with an English translation. *Isis* 57(4): 455–474.
- Dean-Jones, Lesley (1994) *Women's Bodies in Classical Greek Science*. London: Clarendon Press.
- Deichmann, Ute (2015) Chromatin: Its history, current research, and the seminal researchers and their philosophy. *Perspectives in Biology and Medicine* 58(2): 143–164.
- Dekker, Job, Marti-Renom, Marc and Mirny, Leonid (2013) Exploring the three-dimensional organization of genomes: Interpreting chromatin interaction data. *Nature Reviews Genetics* 14(6): 390–403.
- Deleuze, Gilles (1993) *The Fold: Leibniz and the Baroque*. London: Bloomsbury.
- Doniger, Wendy and Spinner, Gregory (1998) Misconceptions: Female imaginations and male fantasies in parental imprinting. *Daedalus* 127(1): 97–129.
- Duden, Barbara (1991) *The Woman Beneath the Skin: A Doctor's Patients in Eighteenth-century Germany*. Cambridge, MA: Harvard University Press.
- Earle, Rebeca (2014) *The Body of the Conquistador: Food, Race and the Colonial Experience in Spanish America, 1492–1700*. Cambridge: Cambridge University Press.
- Editorial (1915) Maternal impression: Belief in their existence is due to unscientific method of thought. *Journal of Heredity* 3: 512–518.
- Epstein, Julia (1995) The pregnant imagination, fetal rights, and women's bodies: A historical inquiry. *Yale Journal of Law & the Humanities* 7(1): 139–162.
- Fischer-Homberger, Esther (1979) On the medical history of the doctrine of imagination. *Psychological Medicine* 9(4): 619–628.
- Fissell, Mary (2004) *Vernacular Bodies: The Politics of Reproduction in Early Modern England*. Oxford: Oxford University Press.
- Floyd-Wilson, Mary (2003) *English Ethnicity and Race in Early Modern Drama*. New York: Cambridge University Press.
- Foucault, Michel (1973) *The Birth of the Clinic*. New York: Pantheon.

- Foucault, Michel (1984) Nietzsche, genealogy and history. In: Rabinow, Paul (ed.) *The Foucault Reader*. New York: Pantheon, 76–100.
- Foucault, Michel (1990) *The History of Sexuality*, vol. 3: *The Care of the Self*. London: Penguin Books.
- Foucault, Michel (2003) *'Society Must Be Defended': Lectures at the Collège de France, 1975–1976*. New York: Picador.
- Frost, Samantha (2016) *Biocultural Creatures: Towards a New Theory of the Human*. Durham, NC: Duke University Press.
- Gilbert, Scott (2014) A holobiont birth narrative: The epigenetic transmission of the human microbiome. *Frontiers in Genetics* 5: 282.
- Gilbert, Scott, Sapp, Jan and Tauber, Alfred (2012) A symbiotic view of life: We have never been individuals. *Quarterly Review of Biology* 87: 325–341.
- Gilbert, Walter (1992) *A Vision of the Grail, in the Code of Codes: Scientific and Social Issues in the Human Genome Project*, edited by Daniel J. Kevles and Leroy Hood. Cambridge, MA: Harvard University Press, 83–97.
- Golinski, Jan (2010) *British Weather and the Climate of Enlightenment*. Chicago, IL: University of Chicago Press.
- Gómez-Díaz, Elena and Corces, Victor (2014) Architectural proteins: Regulators of 3D genome organization in cell fate. *Trends in Cell Biology* 24(11): 703–711.
- Grant, Mark (2000) *Galen on Food and Diet*. New York: Routledge.
- Griesemer, James (2014) Reproduction and scaffolded developmental processes: An integrated evolutionary perspective. In: Minelli, Alessandro and Pradeu, Thomas (eds) *Towards a Theory of Development*. Oxford: Oxford University Press, 183–202.
- Griesemer, James (2018) Landscapes of developmental collectivity. In: Gissis, Snait, Lamm, Ehud and Shavit, Ayelet (eds) *Landscapes of Collectivity in the Life Sciences*. Cambridge, MA: MIT Press, 25–48.
- Griffiths, Paul and Stotz, Karola (2013) *Genetics and Philosophy*. Cambridge: Cambridge University Press.
- Gudding, Gabriel (1996) The phenotype/genotype distinction and the disappearance of the body. *Journal of the History of Ideas* 57(3): 525–545.
- Hanson, Mark, Low, Felicia and Gluckman, Peter (2011) Epigenetic epidemiology: The rebirth of soft inheritance. *Annals of Nutrition and Metabolism* 58(Suppl. 2): 8–15.

- Harrison, Mark (1999) *Climates and Constitutions*. New York: Oxford University Press.
- Hood, John (2002) *The Essential Aquinas*. Westport, CT: Praeger.
- Horden, Peregrine and Hsu, Elisabeth (eds) (2013) *The Body in Balance: Humoral Medicine in Practice*. New York: Berghahn.
- Huet, Marie-Helene (1993) *Monstrous Imagination*. Cambridge, MA: Harvard University Press.
- Ingold, Tim and Palsson, Gisli (2013) *Biosocial Becomings: Integrating Social and Biological Anthropology*. Cambridge: Cambridge University Press.
- Isaac, Benjamin (2006) *The Invention of Racism in Classical Antiquity*. Princeton, NJ: Princeton University Press.
- Jamieson, Michelle (2016). The politics of immunity: Reading Cohen through Canguilhem and New Materialism. *Body & Society* 22(4): 106–129.
- Jasienska, Grazyna (2009) Low birth weight of contemporary African Americans: An intergenerational effect of slavery? *American Journal of Human Biology* 21: 16–24.
- Johannsen, Wilhelm (1911) The genotype conception of heredity. *The American Naturalist* 45(531).
- Jouanna, Jacques (1999) *Hippocrates*. Baltimore, MD: Johns Hopkins University Press.
- Kammerer, Paul (1924) *The Inheritance of Acquired Characteristics*. New York: Boni and Liveright.
- Keller, Evelyn Fox (2000) *The Century of the Gene*. Cambridge, MA: Harvard University Press.
- King, Helen (1998) *Hippocrates' Woman: Reading the Female Body in Ancient Greece*. New York: Routledge.
- King, Helen (2013) Female fluids in the Hippocratic corpus: How solid was the humoral body? In: Horden, Peregrine and Hsu, Elisabeth (eds) *The Body in Balance: Humoral Medicine in Practice*. New York: Berghahn.
- Kirmayer, Laurence (2006) Toward a medicine of the imagination. *New Literary History* 37(3): 583–605.
- Klibansky, Raymond, Panofsky, Erwin and Saxl, Fritz (1964) *Saturn and Melancholy: Studies in the History of Natural Philosophy, Religion, and Art*. New York: Basic Books.

- Koopman, Colin (2013) *Genealogy as Critique: Foucault and the Problems of Modernity*. Bloomington, IN: Indiana University Press.
- Kraft, Alison and Rubin, Beatrix (2016) Changing cells: An analysis of the concept of plasticity in the context of cellular differentiation. *BioSocieties* 11: 497–525.
- Kukla, Rebecca (2005) *Mass Hysteria: Medicine, Culture, and Mothers' Bodies*. Lanham, MD: Rowman and Littlefield.
- Kuzawa, Chris (2005) Fetal origins of developmental plasticity: Are fetal cues reliable predictors of future nutritional environments? *American Journal of Human Biology* 17: 5–21.
- Kuzawa, Chris and Sweet, Elizabeth (2009) Epigenetics and the embodiment of race: Developmental origins of US racial disparities in cardiovascular health. *American Journal of Human Biology* 21(1): 2–15.
- Landecker, Hannah (2010) *Culturing Life: How Cells Became Technology*. Cambridge, MA: Harvard University Press.
- Landecker, Hannah (2011) Food as exposure: Nutritional epigenetics and the new metabolism. *BioSocieties* 6(2): 167–194.
- Landecker, Hannah and Panofsky, Aaron (2013) From social structure to gene regulation, and back: A critical introduction to environmental epigenetics for sociology. *Annual Review of Sociology* 39: 333–357.
- Lappé, Martine and Landecker, Hannah (2015) How the genome got a life span. *New Genetics and Society* 34(2): 152–176.
- Laqueur, Thomas (1990) *Making Sex: Body and Gender from the Greeks to Freud*. Cambridge, MA: Harvard University Press.
- Livingstone, David (1991) The moral discourse of climate: Historical considerations on race, place and virtue. *Journal of Historical Geography* 17(4): 413–434.
- Lloyd, Geoffrey (1978) *Hippocratic Writings*. Harmondsworth: Penguin Books.
- Lock, Margaret (2015) Comprehending the body in the era of the epigenome. *Current Anthropology* 56(2): 151–177. doi:10.1086/680350.
- Loison, Laurent (2016) Forms of presentism in the history of science: Rethinking the project of historical epistemology. *Studies in History and Philosophy of Science* 60: 29–37.

- Malabou, Catherine (2005) *The Future of Hegel: Plasticity, Temporality and Dialectic*. London: Routledge.
- Malabou, Catherine (2008) *What Should We Do with Our Brain?* New York: Fordham University Press.
- Malpas, Jeff (2012) *Heidegger and the Thinking of Place*. Cambridge, MA: MIT Press.
- Mansfield, Becky (2012) Race and the new epigenetic biopolitics of environmental health. *BioSocieties* 7(4): 352–372.
- Mansfield, Becky (2017) Folded futurity: Epigenetic plasticity, temporality, and new thresholds of fetal life. *Science as Culture* 26(3): 355–379.
- Marx, Karl (1978) *The Eighteenth Brumaire of Louis Bonaparte*. Peking: Foreign Languages Press.
- Mattern, Susan (2008) *Galen and the Rhetoric of Healing*. Baltimore, MD: Johns Hopkins University Press.
- Meloni, Maurizio (2016) *Political Biology: Science and Social Values in Human Heredity from Eugenics to Epigenetics*. New York: Palgrave.
- Meloni, Maurizio (2017) Race in an epigenetic time: Thinking biology in the plural. *British Journal of Sociology* 68(3): 389–409.
- Meloni, Maurizio (in press) *Impressionable Biologies: From the Archaeology of Plasticity to the Sociology of Epigenetics*. London: Routledge.
- Mennella, Julie (2014) Ontogeny of taste preferences: Basic biology and implications for health. *American Journal of Clinical Nutrition* 99(3): 704–711.
- Meskimmon, Marsha (2002) Time is of the essence: Histories, bodies and art. *Art History* 25: 697–700. doi: 10.1111/1467-8365.00355.
- Mignolo, Walter (2000) *Local Histories/Global Designs: Coloniality, Subaltern Knowledges, and Border Thinking*. Princeton, NJ: Princeton University Press.
- Nash, Linda (2006) *Inescapable Ecologies: A History of Environment, Disease, and Knowledge*. Berkeley, CA: University of California Press.
- Nietzsche, Friedrich (1997 [1876]) *Untimely Meditations*, edited by Brezale, Daniel. Cambridge: Cambridge University Press.
- Nuriel-Ohayon, Meital, Neuman, Hadar and Koren, Omry (2016) Microbial changes during pregnancy, birth, and infancy. *Frontiers in Microbiology* 7.

- Nutton, Vivian (2004) *Ancient Medicine*. London: Routledge.
- Padel, Ruth (1992) *In and Out of the Mind: Greek Images of the Tragic Self*. Princeton, NJ: Princeton University Press.
- Paster, Gail (1993) *The Body Embarrassed: Drama and the Disciplines of Shame in Early Modern England*. Ithaca, NY: Cornell University Press.
- Paster, Gail (2010) *Humoring the Body: Emotions and the Shakespearean Stage*. Chicago, IL: University of Chicago Press.
- Pearce, Trevor (2010) From 'circumstances' to 'environment'. *Studies in History and Philosophy of Biological and Biomedical Sciences* 41: 241–252.
- Pennisi, Elizabeth (2017) Watch the human genome fold itself in four dimensions. *Science Blogs*, 10 October. Available at: <http://www.sciencemag.org/news/2017/10/watch-human-genome-fold-itself-four-dimensions> (accessed 18 June 2018).
- Pentecost, Michelle (2018) The first thousand days: In: Meloni, Maurizio, Cromby, John, Fitzgerald, Des and Lloyd, Stephanie (eds) *The Handbook of Biology and Society*. London: Palgrave.
- Perkins, Adam (2016) *The Welfare Trait: How State Benefits Affect Personality*. Basingstoke: Palgrave Macmillan.
- Perroud, Nader, et al. (2014) The Tutsi genocide and transgenerational transmission of maternal stress. *World Journal of Biological Psychiatry* 15: 334–345.
- Pitts-Taylor, Victoria (2010) The plastic brain: Neoliberalism and the neuronal self. *Health* 14(6): 635–652.
- Pitts-Taylor, Victoria (2016) *The Brain's Body: Neuroscience and Corporeal Politics*. Durham, NC: Duke University Press.
- Prainsack, Barbara (2017) The 'we' in the 'me': Solidarity and health care in the era of personalized medicine. *Science, Technology, & Human Values* 43(1): 1–24.
- Rando, Oliver and Simmons, Rebecca (2015) I'm eating for two: Parental dietary effects on offspring metabolism. *Cell* 161(1): 93–105.
- Rees, Tobias (2016) *Plastic Reason*. Oakland, CA: University of California Press.
- Resnick, Irven and Albertus Magnus (2010) *On the Causes of the Properties of the Elements*. Milwaukee, WI: Marquette University Press.

- Rheinberger, Hans-Jörg (2010) *On Historicizing Epistemology*. Stanford, CA: Stanford University Press.
- Richardson, Sarah (2015) Maternal bodies in the postgenomic order. In: Richardson, Sarah and Stevens, Hallam (eds) *Postgenomics*. Durham, NC: Duke University Press, 210–231.
- Richardson, William (1974) *Heidegger: Through Phenomenology to Thought*. The Hague: Martinus Nijhof.
- Risse, Guenter (1997) La synthèse entre la anatomie et la chirurgie. In: Grmek, Mirko (ed.) *Histoire de la Pensée Médicale Occidentale*, vol. 2. Paris: Seuil, 177–197.
- Romanes, George (1899) *An Examination of Weismannism*, 2nd edn. Chicago, IL: Open Court.
- Roodenburg, Herman (1988) The maternal imagination: The fears of pregnant women in seventeenth-century Holland. *Journal of Social History* 21(4): 701–716.
- Rose, Nikolas and Abi-Rached, Joelle (2013) *Neuro: The New Brain Sciences and the Management of the Mind*. Princeton, NJ: Princeton University Press.
- Rosenberg, Charles (1985) The therapeutic revolution. In: Leavitt, Judith and Numbers, Ronald (eds) *Sickness and Health in America*. Madison, WI: University of Wisconsin Press.
- Rosenberg, Charles (2012) Epilogue: Airs waters places. *Bulletin of the History of Medicine* 86(4): 661–670.
- Schoenfeldt, Michael (1997) Fables of the belly in early modern England. In: Hillman, David and Mazzio, Carla (eds) *The Body in Parts: Fantasies of Corporeality in Early Modern Europe*. London: Routledge, 243–262.
- Schoenfeldt, Michael (1999) *Bodies and Selves in Early Modern England*. Cambridge: Cambridge University Press.
- Shildrick, Margrit (2001) *Embodying the Monster: Encounters with the Vulnerable Self*. London: Sage.
- Siraisi, Nancy (1990) *Medieval and Early Renaissance Medicine*. Chicago, IL: University of Chicago Press.
- Spiller, Elizabeth (2011) *Reading and the History of Race in the Renaissance*. Cambridge: Cambridge University Press.
- Takeshita, Chikako (2017) From mother/fetus to holobiont(s): A material feminist ontology of the pregnant body. *Catalyst: Feminism, Theory, Technoscience* 3(1).

- Tark-Dame, Mariliis, van Driel, Roel and Heermann, Dieter (2011) Chromatin folding – from biology to polymer models and back. *Journal of Cell Science* 124(Pt 6): 839–845.
- Taylor, Charles (1989) *Sources of the Self: The Making of the Modern Identity*. Cambridge, MA: Harvard University Press.
- Temkin, Owsei (1956) *Soranus' Gynecology*. Baltimore, MD: Johns Hopkins University Press.
- Temkin, Owsei (1973) *Galenism: Rise and Decline of a Medical Philosophy*. Ithaca, NY: Cornell University Press.
- Thomas, Rosalind (2000) *Herodotus in Context: Ethnography, Science and the Art of Persuasion*. Cambridge: Cambridge University Press.
- Trawick, Margaret (1992) Death and nurturance in Indian systems of healing. In: Leslie, Charles and Young, Allan (eds) *Paths to Asian Medical Knowledge*. Berkeley, CA: University of California Press, 129–159.
- Tuana, Nancy (2007) Viscous porosity: Witnessing Katrina. In: Alaimo, Stacy and Hekman, Susan (eds) *Material Feminisms*. Bloomington, IN: Indiana University Press, 188–212.
- Walters, Karina, Mohammed, Selina and Evans-Campbell, Teresa (2011) Bodies don't just tell stories, they tell histories: Embodiment of historical trauma among American Indians and Alaska Natives. *Du Bois Review: Social Science Research on Race* 8(1): 179–189.
- Warin, Megan, Zivkovic, Tanya, Moore, Vivienne and Davies, Michael (2012) Mothers as smoking guns: Fetal overnutrition and the reproduction of obesity. *Feminism & Psychology* 2(3): 360–375.
- Warin, Megan, Moore, Vivienne, Davies, Michael and Ulijaszek, Stanley (2015) Epigenetics and obesity the reproduction of habitus through intracellular and social environments. *Body & Society* 22(4): 53–78.
- Wastell, Dave and White, Sue (2017) *Blinded by Science: The Social Implications of Epigenetics and Neuroscience*. Bristol: Policy Press.
- Watson, Sean (1998) The neurobiology of sorcery: Deleuze and Guattari's brain. *Body & Society* 4(4): 23–45.
- Weismann, August (1891) *Essays upon Heredity and Kindred Problems*, vol. 1. edited by Poulton, Edward. Oxford: Clarendon Press.

- Wells, Jonathan (2010) Maternal capital and the metabolic ghetto: An evolutionary perspective on the transgenerational basis of health inequalities. *American Journal of Human Biology* 22(1): 1–17.
- West-Eberhard, Mary (2003) *Developmental Plasticity and Evolution*. Oxford: Oxford University Press.
- Wey-Gómez, Nicolas (2008) *The Tropics of Empire: Why Columbus Sailed South to the Indies*. Cambridge, MA: MIT Press.

Maurizio Meloni is a social theorist and an STS (science and technology studies) scholar. He is the author of *Political Biology: Science and Social Values in Human Heredity from Eugenics to Epigenetics* (Palgrave, 2016), co-editor of *Biosocial Matters: Rethinking the Sociology–Biology Relations in the Twenty-first Century* (Wiley, 2016) and chief editor of *The Palgrave Handbook of Biology and Society* (2018). He is Associate Professor of Sociology at Deakin University, Australia. His forthcoming book is *Impressionable Biologies: From the Archaeology of Plasticity to the Sociology of Epigenetics* (Routledge, 2019).