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Confronting constructs with cataclysms in neuroepigenetics

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I went to a Science and Technology Studies (STS) conference in Melbourne recently and listened to a panel of social scientists share their work about psychological disorders. There was no doubt I had stakes in being there; I study embodiment and trauma and so I knew what I was hoping to hear. I sat, in anticipation, waiting to hear about embodied experiences, about mindly-bodily aches and pains and struggles and about the complexity of it all. But what I heard was a different kind of discussion, and I couldn't help but shed a few tears of frustration in the toilets afterwards. The speakers talked about addictions, diagnoses, and in particular, the notorious Diagnostic and Statistical Manual (DSM) in terms I was most familiar with. I heard sour, frustrated voices saying, "Video gaming and drinking constructed as addiction, *why?*", "Pathological labels assigned to normal human behaviour, *why?*", and, "Socially and politically 'incorrect' ways of being, this is deviance, not *disease*." Sitting there hearing these arguments and rhetorical questions, I wondered about the theoretical traditions undergirding this well-established analytical lexicon. In one hour and with multiple blows, the legitimacy of psychiatric ideations and terminology came crashing down; this seemed to be precisely the point of the exercise – to deconstruct the constructs. As a fresh sociology doctoral candidate, this all made sense to me, but I also felt like a fool for thinking that perhaps there might still be some use for – and some merit in using – biological data and psychiatric terminology to help fathom, or at the very least, shed light on the multiple forms of emotional suffering.

There appears to be a fair amount of discomfort in critical mental health studies regarding psychiatric and biological terminology. Social scientists in this field have heavily critiqued what is normatively described as "pathologising" language in the DSM, as well as in Australian mental health discourse more generally. But my concern with the tendency to turn away from, be suspicious of or cut down psychiatric and biological narratives of mental distress is that it may in fact stonewall any opportunity to creatively and constructively engage the question: how do traumas perceivably "get under the skin", transmute and affectively *stay there*? When a single strand of knowledge – be that biological or social – is sourced to speak on behalf of mental terrors and hardships alone, how

can we locate trauma with analytical sophistication? How can we trace its movements inside and outside the body to the outside if our own disciplinary lexicon remains limiting?

Since the early 2000s, the biological sciences have undergone some salient changes, particularly in response to the recent rise of molecular epigenetics, where conventional meanings of bodily borders, socialities and environments are taking on new configurations (Landecker, 2011). What can be said about this emerging field of research is that the barriers between bodies and environments are considerably more permeable than previously thought, which has garnered much interest from medical anthropologists and STS scholars. In his study on metabolism, food and chronic illness in India, Harris Solomon (2016:5) builds on the term “absorption” to conceptually grasp the “possibility for bodies, substances, and environments to mingle, draw attention to each other, and even shift definitional parameters in the process.” Metabolism – conceived less as the biological conversion of nutritional substrates in this context and more as a “regulatory interface” between bodies and environments– is rendered a political and empirical object of enquiry (Landecker 2011: 168).

Drawing from what has been established in contemporary metabolic analyses, I respond in this essay to the claims I heard at the conference. I do so because I think there are, to use Solomon’s term, “thicker” ways to articulate the enduring and destructive effects of trauma. To do this, I raise the term *cataclysms*, (from the Greek kataklysmós, which joins the prefix kata – “down” – and klyzein – “to wash away”), as an entry point into trauma’s material, embodied ontologies. By evoking the prefix “cata” – meaning to descend – my hope is that it may help us fruitfully engage with the conceptual narratives of embodied trauma emerging from the so-called postgenomic (or relational) sciences, and in particular, a new field of research called neuroepigenetics. I purposefully use *cataclysms* in the plural to move away from the idea of trauma as singular, disparate and only fathomable when rendered a construct. This idea of pluralising *cataclysm* comes from Annemarie Mol and other STS pioneers of empirical ontologies. I say *cataclysms* to make *cataclysmic* events – micro, meso, macro – not so much plural, but explicitly multiple, as different versions of a kind that are variously entangled, and potentially competing with one another. My purpose for doing this is to spur us into thinking about what kind of realities are good to live with, and which ones are worse (Mol, 2014). Accepting a multiplicity of what *is* *cataclysmic* – in a very specific sense – nudges us to question who and what receives care and who and what remains marginal.

I draw on one idea fundamental to neuroepigenetics to help think trauma as biosocially temporal, impressionable and durable, namely, the prospect

of “molecular memory”. Critical feminist, posthumanist, disability and queer studies show that knowledge of the body needn’t be accepted as static or singular; nor should biological data be seen as the antithesis of our own worldviews. As Donna Haraway (1988: 579) reminds us, “Feminists have to insist on a better account of the world; it is not enough to show radical historical contingency and modes of construction for everything.” In what follows, I begin by charting some of the claims inherent to epigenetics and neuroepigenetics specifically, and conclude with a meditation on cataclysms.

Epigenetics and neuro-epigenetics

Neuroepigenetics is an infant subfield branching from the more recent overlap between neuroscience and molecular epigenetics. Epigenetics, put simply, is the modification of gene expression without changes in the DNA sequence itself. A useful and popular metaphor often shared amongst epigenetic researchers may help to get a sense of how this works. DNA is like a written score for a symphony, which contains the music for an entire orchestra. Epigenetic mechanisms, such as methylation for instance, serve as the conductor of this orchestra, harmonically switching genes on and off (de Sauvage, 2015). Here, gene expression – the process by which the instructions in DNA are converted into products like proteins – is not controlled just by DNA itself. Instead, all manner of environments external to DNA – the nucleus, cellular cytoplasm, homely abodes and breathable air in our atmosphere for instance – drive changes in gene expression, a point which challenges 20th-century gene-centric theories of heredity. Fundamental to epigenetic thinking is the notion that environments not only act as mediators of gene expression, but as *exposures*, which dictates that anything from food to greenhouse gas to stress can be potentially noxious when ingested, absorbed or experienced.

There is no shortage of excitement in response to this seemingly radical paradigm shift in molecular biology. For some, demoting the gene and turning to environment and sociality signifies a major change in thinking. As Keller (2000: 69) asserts, epigenetic factors are so significant in organismic development and growth, they put “the very concept of the gene into jeopardy.” For leading scholars in the field, the epigenome may be the “missing link” to construct environments as exposures. Via epigenetics, life experience alters expression of genes, which, in turn, will influence the ways that neuronal circuitry develops – in particular, the brain’s so-called stress response system, the Hypothalamic-Pituitary-Adrenal (HPA) Axis. As indicated by the prefix “neuro”, neuroepigenetics is specifically interested in how environmental influences cause epigenetic modifications in neurons, which may subsequently affect their function, lifespan and capacity to retain

experiential memories – not only in an individual sense but also across generations.

Formally introduced by neurobiologist Jeremy Day and neuroscientist David Sweatt (2011: 321), neuroepigenetics can be defined as a subfield of epigenetics that investigates the molecular mechanisms and processes that allow for “experience-dependent regulation of the epigenome in nondividing cells of the nervous system.” Although still in its infancy, Day and Sweatt predict that neuroepigenetics has the potential to sharpen current knowledge about the impacts adverse and traumatic life experiences have on gene regulation, phenotype, and subsequent predisposition to mental illness. Evoking the controversial theory of the “engram” – a (again, hypothetical) biophysical change in the brain that accounts for the material existence of memory – Day and Sweatt (ibid: 1322) speculate that epigenetic mechanisms may be key for memory-making processes. Fascinatingly, epigenetic markers – or the epigenome – are said to act as the “the molecular memory” of by-gone stimuli, which allows a cell, brain and body to “remember” past events that an organism has experienced (Bonasio et al., 2010: 612).

Focusing on Post-Traumatic Stress Disorder (PTSD), specifically, Day makes the claim that neuroepigenetic research shows a correlation between epigenetic markers, memory and traumatic experiences (University of Alabama 2015). PTSD has a complex history, and although I do not give a thorough account here, it is important to note that the question of what constitutes “trauma” has been a pivotal one for psychiatry. Like any good contemporary science fiction, an imagining of the human as open and infinitely biologically adaptable (and editable) appears part and parcel; Day suggests that by removing or altering epigenetic markers, memories of trauma could be manipulated and even possibly erased.

Epigenetics and Cataclysms

There is no straight-forward, fault-free way to engage with scientific ideations like the ones I have outlined above. Nor is there a clear consensus about what neuroepigenetics will mean for the responsibility, care, provision and governance of mental health in Anglo-Western post-industrial countries like Australia. Bearing this in mind, it is safe to say that there is inherent potential for the field to alter and even reconfigure how we think and feel about the destructive possibilities of lived experience, especially when they are signified by changes in genetic expression. Neuroepigenetic speculations about body-environment relations, as well as the idea of “molecular memory” may offer conceptual creativity to build a framework of embodied trauma. A possible way to think about trauma as temporally durable, biosocial and vastly

consequential is, I suggest, through the notion of cataclysms, a concept that is not far from some original ideas in epigenetics.

Importantly, epigenetics and ideas of memory are deeply intertwined. Think, for instance, of Waddington's "epigenetic landscape". During research labours in the 1930s and 1940s, Waddington coined the term "epigenetics" to draw a connection between genotype – the genetic constitution of an organism – and an expressed phenotype – the observable physical characteristics of an organism that arise from interactions between genotype and its environment. Waddington represented the impact of environmental cues on cell differentiation during development through the iconic "epigenetic landscape" where, as in the Greek root for cataclysm, the ball rolls downhill and cannot be reversed to their original position. In drawings of epigenetic landscapes, Waddington visualised cell differentiation as a process of "canalisation" which signified the relationship between environmental memories and the organism. Importantly, Waddington didn't necessarily believe that a return to "pre-impressed" biology was impossible. As Ferrell (2012: R462) explains, "alternative fates remain present somewhere on the landscape" and are potentially accessible; however, temporality cannot be reversed.

This distinctive view of memory and plasticity says something interesting about trauma. It underscores the prospect of a vulnerable and temporally-bound kind of biology, where cataclysmic events can and do leave the memory of their presence. After all, a cataclysm literally refers to a watery demise; to the flooding of all Earth by rains and rising rivers. As the ball and the water run and impress themselves into the land, trauma is likely soaked up, assimilated and solidified into the flesh. Plasticity today may imply biologically-endowed changeability, yet epigenetic landscapes and cataclysms suggest that what saturates and stains may give shape to biological trajectories that bear residue of the past (Meloni, 2019).

Waddington's epigenetic landscape leads us to think human, non-human and more-than-human mutualities and interdependencies not just as *political* per se, but also as potentially destructive in an ongoing, temporal sense. This is because clearly trauma doesn't just get under the skin. It doesn't simply enter permeable mind-bodies with predictable effects. Most of the time, it breaks through, violates, assaults, dissolves, brutalises, pierces, ruptures and eats its way in. Neuroscientists and biologists may speak about the particularities of exchanges between genes, brains and socialities; about the ways in which a mind-body's stress response system takes form as a response to life external to the skin; about the possibility of reversing such impressions; and, more controversially, about finding the engram in its biophysical form. But thinking beyond biological specificity and measurability and turning instead to the traffic cascading between and amongst kinds of matter – words from loved ones, racism

and dopamine for instance – give us a salient (though not entirely original) picture of body-environment interactions that can and do leave a horrific mess behind.

The term “cataclysms” has definite value in a non-trivial reading of plasticity as stabilisation rather than as an opening of forms. Even more, the notion of cataclysms resonates with connections between plasticity and ideas of destructiveness and irrevocable alteration of forms (Malabou 2012). I raise cataclysms here as both a response to metabolic politics and to a tension I have felt lingering in critical mental health studies, because weight and validation needs to be given to the ambiguous, material and enduring configurations trauma takes, and how such configurations can shift (and shapeshift) through and in time and place. We might think of cataclysms – like organic substrates – as ontologically porous and watery; as spilling, weaving and protruding into each other. While trying to make sense of the inherent harms of climate change, hetero-patriarchy, capitalism and imperialism, I worry that we may incidentally turn away from addressing the ruins they leave and the clandestine connections between them when we pour all our energy into derailing powerful and problematic sources of knowledge. Without taking the term too literally, molecular memories suggest that what happens, what flows in, out and over the flesh may leave traces after the fall-out has passed.

Conclusion: an ethic of care

In *Of Two Minds* – an ethnographic study of psychiatric training in the United States – Tanya Luhrmann (2001) brings our attention to the multiplicity (and politics) of knowledge about mental illness. As Luhrmann (ibid.: 8) puts it, “I don’t think that any domain of knowledge ‘mirrors’ the world as it is. The real issue for me is how one learns to look at mental illness through different lenses and the consequences of those ways of seeing.” Like Luhrmann, I don’t suggest that neuroepigenetic speculations – or indeed, any domain of knowledge – can alone conceptualise trauma, nor do I believe epigenetics and neuroepigenetics offer a radically new way of fathoming such a complex concept. But, perhaps, a more pragmatic way of moving forward means acknowledging what is at stake. To recognise what pains, ruptures and lingers under the surface means thinking openly about where history spills and stays, and what tools may help us to perceive these locations. It means stepping closer to devastation and focusing our gaze on what persists, on what is washed away in the flood and what grows in its absence, on what can be recovered and what cannot. If anything, perhaps the value (and danger) of neuroepigenetics lies in its rhetorical potential to strengthen an ethic of care for body-environment relations, and in its capacity to discursively locate and characterise a durable kind of bodily memory. Even if it is just for argument’s sake. If I am to be openly partial, I’d say that it is in our

interest to lean in and grasp what may challenge, mobilise and ground our own ethics, because the extent, gravity and residue of what is unjust and damaging – in its infinite forms – calls for many kinds of recognition.

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