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Sustaining (Dis)Embodied Inequalities in the(ir) Eurocene

Ancient Microbes, Racial Anthropometry, and Life Choices

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Abstract

Racialisation and colonialism are central to sustaining (dis)embodied inequalities. We bring together our distinct ethnographic projects to explore this. The first project accompanied a microbiome expedition involving Amazonian Indigenous non/human communities, whereas the second project focussed on medical professional' encounters with Mbya Guarani communities in the Atlantic Forest region. Both projects explore racialised assumptions of human difference and colonial extractive practices. In the case of medical intervention with the Mbya, and their forms of life, this is perpetuated through the imposition of anthropometric growth standards. With the human microbiome initiatives, identifying Indigenous Peoples as potential reservoirs for novel probiotics also ultimately amplifies racialised (dis)embodied inequalities. Rather than these interventions addressing such disembodied equalities, we draw parallels between the two, to show that they perpetuate them. Finally, we propose that part of ceasing to reproduce these (dis)embodied inequalities requires 'us' to challenge the racialised and colonial histories of the life and geological sciences, to recognise their embodied consequences in the present, as well as how they are implicated in emergent proposals for new geological '-cenes'.

Keywords

Probiotics, Nutrition, Diet, Anthropocene, Microbiome.

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Introduction

> For *Jurua*[1] [non-Indigenous peoples] to be rich you must have money, but for us this isn't true. It's become an obligation. We must have a plastic card to be able to buy their foods. And if we speak of our forest, they have logged and stolen a lot of our trees. So, we can't find many of our foods and medicines anymore. This impacts our health. Our indigenous form of life is now in poverty.

Vera, who also goes by the name Mario Borjas, shared these reflections with Coll in 2011. Vera is the leader (*cacique*) of the *Ka'a Kupe*[2] community and a state voluntary health worker for his and neighbouring Mbya-Guarani communities. This was shortly after one of the weekly visits from the municipal doctor, Mariana Mampaey to their community in central Misiones, a province in northeastern Argentina. He, like many other Mbya that Coll met, was exasperated with the provincial and national government's countless broken promises. These incorporate a longstanding vacillation on issues such as the demarcation of lands belonging to Indigenous Peoples, granting these Peoples legal land titles, as well as halting ongoing deforestation of the Atlantic Forest and encroachment into their territories. The few advances that this community has experienced on a governmental level have been limited to extensions and partial adaptions of state provisions, which, in principle, exist for all Argentine citizens. Amongst these, was the promise of the delivery of basic primary healthcare to Mbya communities through regular visits from medical professionals (de Lima Hutchison 2014). To some communities, such as the *Ka'a Kupe,* these visits increased access to pharmaceuticals, state health programmes and referrals to hospitals, along with their biomedical and public health knowledge practices. During these visits, Mariana, like the other doctors who visited, would take measurements of the Mbya children's height and weight and compare them to the World Health Organisation's (WHO) graphs of 'optimal' growth (de Onis and Garza 2007), often categorising them as stunted and malnourished. As Vera alluded to above, such practices were part of the Argentine government's ongoing colonisation of their lives, which continued to promise them medical progress and socioeconomic development as a primary avenue to improve their lives. Biomedical and state health interventions provided many Mbya in Misiones with momentary alleviation from some of their suffering. However, they were fundamentally incapable of halting, let alone 'reversing', the impoverishment and disembodying inequalities that the Mbya continued to experience. If anything, these interventions perpetuated the negation of the Mbya's form of life in favour of sustaining and intensifying the colonial, racial, and ecologically extractive foundations characteristic of the Europeans' conquest

1 *Jurua* is a Mbya Guarani term. It literally means those with a moustache or hair on their jaw. Mbya use it to refer to 'Whites'/ 'non-Indigenous' peoples.
2 In Guarani, *Ka'a Kupe* translates as 'behind the yerba mate'.

of the Americas. We will later situate these interventions in relation to current proposals for 'the Anthropocene'; a term we problematise in the next section.

Contrasting with these colonial state health interventions, Andrea Núñez Casal has observed how particular aspects of Indigenous forms of life, as well as other, mostly non-western[3] forms of life (including diets, habitation, work, and leisure, often collectively referred to as 'lifestyles' by biomedical scientists), have become crucial empirical materials for the development of 'the human microbiome' in contemporary biomedical science. Under this emerging paradigm, Andrea followed a microbiome biomedical study. Among its principal objectives was the search for what scientists refer to as 'ancient microbes' to be used as part of potential solutions to restore lost microbial diversity to modern industrialised societies. At the centre of this research are racial assumptions about 'the human' and differences in human populations. The study began from the assumption that modern people's ancestors, namely 'Indigenous Peoples', remain spatially beyond the reach of modernisation (i.e., in 'voluntary isolation'), and might host microbes that could reverse (i.e., because they are 'our' living ancestors) the damaging effects of modernisation on human microbiomes. As such, searching for these microorganisms was key to finding a better understanding of the microbiome and to reverse the loss of microbial diversity as a result of westernisation processes (i.e., diet, urbanisation, medications, etc.). As we will demonstrate, in conducting such research and making such arguments, these scientists not only fail to challenge the very Euro-American form of life that reduces 'their' microbial diversity, but also continues to racialise and threaten Indigenous lives through extending colonial extractive practices from their lands to the microbes present in their bodies and communities .

This Research Article brings together our two independent ethnographic research projects: Andrea's investigation into a microbiome research expedition to Indigenous communities in the Peruvian and Brazilian Amazon conducted between 2013 and 2017; and Coll's exploration of the encounters between medical professionals' and Mbya Guarani communities in the Atlantic Forest region in Argentina between 2008 and 2014. Although we conducted our projects in different years, places, with different actors, topics and methodologies, we have found shared points of interests and themes across our research that, by bringing them into dialogue here, allows us to develop arguments in ways that would have been empirically challenging to do separately. Juxtaposing our projects we believe it offers us a unique opportunity to jointly demonstrate how the reproduction and intensification of Indigenous embodied inequalities in the Americas are central to

3 The policy, microbiome, and nutritional science literature that we engage with in this article deploys both the terms 'western/isation' and 'modern/isation' interchangeably, as well as in opposition to 'Indigenous/traditional'. Our emphasis is not that these terms designate homogenous identities, but that they loosely correspond to collectives and their forms of life, which importantly, are currently inseparable from ongoing colonial and racialising processes.

proposals for the various geological '-cenes', which we will critically discuss in the next section. These include the Anthropocene proposal, which we interpret as a Euro-American mythical order, as evidenced in its name (i.e., including 'anthropos' as geological actors) and the socio-geological narratives it draws upon (e.g., the atomic age, Europe's industrial revolution) (Danowski and Castro 2017).

No one '-cene' to rule them all

'The Anthropocene' was proposed in the early 2000s as a term to designate a new geological epoch. Since then, Earth scientists have deliberated over which golden spike[4] should date its inception and, recently, whether it should be classed as a geological event rather than an epoch (Gibbard et al. 2022). An increasing number of voices have critically engaged with 'the Anthropocene' proposal, debating its consequences not only as a 'meta-concept' used to draw attention to accelerating global environmental changes, but also as one embedded, from its conception, in a universalising myth of 'mankind's' sociotechnical triumphs, which have led to 'our' growth into a geological force (Crutzen 2002; Haraway et al. 2015; Davis and Todd 2017).

Some scholars have offered alternative proposals or parallel redescriptions, to move beyond those that centre an abstracted 'human species' or 'humanity' and view all as equally responsible for escalating environmental catastrophes and as facing the same threat. These authors also highlight that anthropocentrism and eurocentrism are inherent in proposals that see 'humans' as a dominant geological force or actor. They attempt to do this through foregrounding different, but overlapping, historically-situated sociopolitical and metabolic processes or, as we refer to them, 'forms of life'. These include the ideas of the Racial Capitalocene (Moore 2017; Vergès 2017), the Plantationocene (Haraway et al. 2015; Davis et al. 2019), and the Eurocene (Grove 2019), to name a few. These redescriptions connect geological changes in the Earth not to human species in general but to specific histories of unequal capital accumulation and impoverishment, land dispossession, malnourishment, patriarchal, colonial, racial, and other forms of violence. Attention to these processes we believe helps reveal not only the unequal and uneven contributions and transformations in the Earth's geology, including where Indigenous, Black, and other peoples have been transforming the earth (Gill 2021b), albeit on smaller scales, for millennium before current Anthropocene proposals. It also helps us explore, following Hannah Landecker's (2016) history of biology, how such geological transformations are also inseparable from uneven and unequal biologies of history.

4 A golden spike is a geological marker created by an event resulting in observable changes in the Earth's geological record, which are used to date a shift in geological divisions (e.g., an epoch, era).

Like many of the authors cited above, we seek to contribute to the politicalisation of geology and biology (Yusoff 2018; Grove 2019). We strive to do so, not by siding with 'the Anthropocene' or an alternative conceptual proposal, as if a consensus can or should be arrived at about which and what single '-cene' is more objective and universally representative (geologically, politically, socially, and morally). Instead, we accept a multiplicity of overlapping '-cenes' (Larsen and Harrington 2021), rather than backing one '-cene' to rule them all. Such an approach implicitly centres the diversity of forms of life, collectives, and their embodied inequalities. In our view, each of these overlapping '-cenes' reflects, like myths or—to use a more recent popular term—narratives (Danowski and Castro 2017, 6), the situated existential and disciplinary concerns that we have as authors and, hopefully, those we wish to engage with our research. In the case of our Research Article, this materialises in an active situating of our respective fieldwork in relation to two '-cenes' that allow us to bring together aspects of our previous research on embodied inequalities, changing ecologies, and a critical exploration of the conceptual interplay between 'forms of life' and 'lifestyles' (Susen 2022).

Lifestyles is a term historically used by public health officials. It was also used by the microbial ecologists Andrea followed in her fieldwork, to refer to the various ways in which microbial scientists divided up aspects of people's everyday life into 'lifestyle factors', including diet, habitation, social habits and daily life routines, and cultural traditions. Following Manderson et al. (2010), Hite (2018), and Manicini (2011), we understand 'lifestyle' approaches as limiting, as they tend to reduce community identity and political engagement in everyday life to individual consumer choice. Such prescriptive view of 'life' and 'politics', however, does not sufficiently address, in our view, how individuals' choices and their in/abilities to enact them are contingent on particular assemblages[5] or what, following Helmreich (2011) and Grove (2019), we refer to as a 'form of life'. As Grove states, 'Not quite race and more than culture or style, this phrase refers to those ways of being in the world – always lived collectively – without which one would no longer be who or what one is' (idem, 2). We pose that the phrasing 'forms of life' allows us to juxtapose the inherent colonialism and racialisation assumed in both microbial scientists' romanticisation of Indigenous microbial diverse lifestyles and public health officials' accounts of Indigenous Peoples' lack of 'basic' (lifestyle) needs in Latin America. We show this initially through analysing aspects of Coll's fieldwork with Mbya and health professionals in Argentina, as a means to evidence how the current Euro-American geological order (the 'Eurocene') and its form of life (Grove 2019) is partly borne out of and continues to be implicated in the

5 We see 'forms of life' as an attempt to deal with similar conceptual concerns around relationality and entanglement, in a similar way to 'assemblages'. The difference for us here between assemblage and form of life, is that the latter is named after a collective's means of living (e.g., Mbya or Western form of life), while the former is named after a process (e.g., racialising assemblage in the sense of Weheliye (2014)) that shapes and is shaped by collectives and individuals' lives, including 'nonhumans'.

racialisation and colonisation of the Mbya and their form of life, including the expropriation of their lands and forests. Establishing links between field sites and geo '-cenes', we then link and centre microbiome scientists' concerns and encounters with Amazonian Indigenous Peoples in Andrea's fieldwork research within the Plantationocene (Haraway et al. 2015) by adding a geological dimension to Hannah Landecker's (2015) 'biology of history'. Thus, the second part of our Research Article evidences how ongoing colonial-racial expropriation of biodiverse locales and bodies in Latin America animates the unceasing cultivation of an industrial capitalist form of life. Finally, we conclude by reflecting on how, ultimately, these Euro/plantationocenic schemes, reproduce and deepen the unequal distribution of embodied inequalities.

Euro-American geological reordering: Racialised natures, colonial extraction and disembodying standards

When Europeans (chiefly the Spaniards and Portuguese) arrived during the second decade of the 16th century, the Guarani occupied the coastal regions south of São Paulo to Rio Grande do Sul, extending into the Atlantic Forest and as far west as the frontiers with the Incan Empire (Clastres 1995, 1). Following the founding of the city of Asunción (now the capital of Paraguay) by Spanish conquistadors in 1537, the Guarani Peoples—then estimated at approximately two million—began to suffer rapid death and decline due to wars with the colonisers, enslavement in Spanish *encomiendas*[6] and the introduction of non-native infectious diseases to the population (Sarreal 2014, 16–23). Estimates for the total number of Indigenous deaths by the mid 17th century are vast—between 20 to over 100 million, up to 90% of the total population of Latin America (Montenegro and Stephens 2006). In fact, Lewis and Maslin (2015) have proposed this date as a possible marker for a new geological period, based on detectable dips in atmospheric carbon dioxide (Murphy 2021, 8), which they named the 'Orbis Spike' (Lewis and Maslin 2015).

This atmospheric shift and the Little Ice Age that followed, are attributed—although this is still under debate—to Indigenous genocide and the subsequent reforestation of the Americas (estimated at over half a million km^2), resulting in massive carbon sequestration (Lewis and Maslin 2015). For over 50 years, it has been increasingly common to ascribe European imported microbes as the most significant cause of deaths among Indigenous Peoples. Recently, scholars have highlighted how the 'virgin soil theory' has also served as a means of absolving and rationalising

6 These were grants from the Spanish Crown provided to colonists to extract tributes and forced labour from Indigenous inhabitants.

European conquest, as it identifies Indigenous Peoples as immunogenetically inferior and obscures the roles of war, enslavement, starvation, impoverishment, and other social stresses on the transmission of infectious diseases, epidemic outbreaks and their associated deaths (Edwards and Kelton 2020; Dunbar-Ortiz 2014). Thus, for Grove, 'rather than see(ing) the condition of the Eurocene as a problem of encounter or first contact gone awry, it would be more accurate to mark it as a transformation in what constituted European conquest, the emergence of a particular pathway of modernity' (2019, 41). Similarly, da Silva describes European conquest as 'first and foremost a spatial, that is, a global event' (2007, 2), in that it enabled Europeans to act out and expand their geopolitical power through the conquest of 'new' territories, colonial conflict, and rivalry as well as the enslavement of Peoples indigenous to Africa and the Americas. Grove designates this period as the onset of the Eurocene: a 'five-hundred-year [Euro-American geo-political] project of violent terraforming' (2019, 43). In subsequent sections, we will elaborate on some aspects of this Euro-American geo-political project, in particular: how racism and colonialism are central to it, as forces of 'world making that renders some forms of life principle and other forms of life useful or inconsequential' (idem, 3).

Establishing Argentina as a White nation-state

Beginning around the time ascribed to the 'Orbis Spike', the Catholic Church, in collusion with the Spanish colonial power, ensured that many of the Guarani that survived the initial conquest and colonisation by Europeans were incorporated into Jesuit Missions (known as *reducciones Jesuitas* (Jesuit reductions)). The Jesuits aggregated and isolated over a hundred and forty thousand 'Indians' and 'Guaranis'—as they were generically referred to by the Jesuits in Spanish—into thirty 'townships', located in what is now the province of Misiones. This was done to 'civilise' them through religious and cultural homogenisation (i.e., conversion), and increase their productivity both as religious and economic subjects. This included using their labour for cattle ranching and to harvest and sell wild yerba mate for making tea (Sarreal 2014, 1–10). Yerba mate, had long been cultivated, collected and consumed by the Guarani prior to the Jesuit Missions (Nimmo and Nogueira 2019). After a hundred and fifty years of quasi-independence and because of their growing power, the Spanish Crown identified Jesuits as a threat and ordered their expulsion from Spain and its territories in 1767. Following Jesuit expulsion, the *reducciones* were abandoned and yerba mate production declined, along with colonial practices of agriculture and livestock husbandry (Galindo Leal and Câmara 2003, 142–44; Wilde 2009, 173). Guarani that avoided or escaped the *reducciones*, and those who left after the Jesuit expulsion, continued to live with/in the Atlantic Forest region, where they remained relatively 'invisible' to European colonisers until the late 19th century (Garlet and de Assis 2009).

Before this, the Spanish colonial government had focused most of its attention on ‘the Indian problem’ south and west of the city of Buenos Aires. With Argentina’s independence in 1816, its settler-colonial government sought to consolidate and further expand its sovereign territory in pursuit of a racially homogenous White nation-state. This was not only modelled after the United States and some European nations, but was done so in order to compete with them in global markets. Indigenous Peoples represented an ‘internal’ frontier described as ‘primitive’, ‘barbaric’, and ‘heathen’ by the Argentinean government, as they were seen to be living on lands void of state control and without ‘proper’ agricultural or ‘productive’ labour practices. Argentineans proposed to ‘solve’ their ‘Indian problem’ through campaigns that sought to ‘civilise’ or eradicate them (Lublin 2021; Trinchero 2006; Taylor 2021). With the conclusion of campaigns such as the infamous Conquest of the Desert (1879), ‘the Argentine state built a narrative in which indigenous peoples had [not only] disappeared’, but that highlighted that their ‘disappearance’ was a ‘natural and even universal phenomenon’, since they were a ‘doomed race’ who belonged to the nation’s past (Larson 2020, 10).

Here, we want to emphasise the centrality of the ‘myth of virgin nature’ and the representation of Indigenous Peoples as ‘primitive’ and ‘uncivilised’ used by European settlers at that time to justify their expropriation of Indigenous lands and ‘resources’, as well as the establishment of plantations (which we will later connect with Andrea’s research). These myths enabled European settlers to erase any reference to the agency of non-humans, Indigenous Peoples, and Africans for their survival and later profit in the Americas and, in doing so, rationalised themselves as settlers/masters to be (Gill 2021b). The attitude that Indigenous lands are there to be expropriated still prevails, as experienced by the Mbya-Guarani in the Atlantic Forest region (now Argentina, Paraguay and Brazil). For example, today much of their land has been deforested for timber and converted into cash crops such as pine, tea, yerba mate, and tobacco, which deprives them of their food sources, which historically have been located in the Atlantic Forest.

Provincial wealth: Deforestation and Indigenous impoverishment

As part of Argentina’s late 19th century nationalist mythos, the Atlantic Forest emerged as an ‘enemy’ to be ‘defeated and overcome’ so that the province of Misiones could be annexed and Argentina finally made whole (Mastrangelo 2012). Representations of the Atlantic Forest as a ‘virgin’ forest, ‘inhospitable’, ‘wild’, and ‘empty’ of any human habitation, deliberately ignored the existence of the Mbya. These myths served to justify the state’s provision of land concessions to private companies and European—rather than local creole—settlers to colonise and protect Argentina’s frontiers against Brazilian settlement. These settlers were then

tasked with converting the Atlantic Forest into 'productive' land in their ongoing drive for socioeconomic development and White nationhood (Ingridsdotter 2021; Wilde 2008). By the end of the 20th century, following decades of intensified logging and expansion of yerba mate, sugarcane, tobacco, and pine plantations for national and international markets, roughly 50% of the Atlantic Forest in Misiones and less than 15% of its maximum coverage of over a million square kilometres remained (Galindo Leal and Câmara 2003, 165; Di Bitetti, Placci, and Dietz 2003).

The deforestation of the Atlantic Forest and 'invisibilisation' of the Mbya are integral to the emergence of Misiones as part of Argentina's national territory and its consequent socioeconomic development. It is worth noting here that Misiones has amongst the highest levels of poverty in Argentina (Kosacoff et al. 2004). For the Mbya, the European settler's fragmentation and replacement of the Atlantic Forest with monoculture plantations, the establishment of settlements in their territories, and the imposition of national boundaries, continue to violently undermine their abilities to sustain their form of life [*teko*], particularly in ways that cohere with their notions of a good form of life [*teko porã*]. This includes: their ability to move freely (including entire communities) and to access many of what Mbya designate as their 'true' foods [*tembi'u katu ete'*] such as various wild honey, peccary, armadillo, and many forest fruits (Tempass 2010). Here, we start to see how European colonial, then national Argentine expansion are not only central to the Mbyas' impoverishment, but also to the emergence of the Eurocene.

State of emergency: The Mbya, malnutrition and their unmet 'basic needs'

Beginning in the early 1980s, the Mbya became not only increasingly 'visible' in national discourses, but their presence—along with other Indigenous Peoples in what is now Argentina—was also acknowledged to pre-exist the Argentine state (Gordillo and Hirsch 2003). However, it was not until early 2003, when the Misiones government called a 'state of emergency', that provincial—and national—resources and policies were directed to the Mbya in Misiones in a significant way.

The 2003 'state of emergency' was initially catalysed by the death of fourteen Mbya children, and the high levels of child malnutrition recorded in their communities (World Bank 2010, 15). However, it took over two years and two months of Mbya protest for their demands for greater access to food, better healthcare, and demarcations of their territories and land titles, to be heard, even if they were not much listened to. The Misiones Provincial Ministry of Public Health (MOPH, *Ministerio de Salud Pública*) responded with a series of ministerial resolutions and an accompanying report, which stated that Mbya communities experienced a

deficit in ‘basic needs’, such as adequate drinking water, electricity, appropriate housing materials, toilets, education, and national identity documents. These, the report acknowledged, restricted the ‘eradication of diseases and recovery of patients with distinct pathologies’ (Ministerio de Salud Publica 2006, our own translation). In addition to guaranteeing 100 % of Mbya communities’ access to primary health care and MOPH programmes, the Ministry also pledged the provision of monthly food parcels to the head of each family, ‘to give their children a healthy and varied diet’ (ibid) and *‘*return to Mbya families the customs of cooking in their houses, avoiding their dependence on communal kitchens’ (Ministerio de Salud Publica 2008). Despite these statements, the food parcels were composed of ingredients reflecting European settler diets such as beef, pasta, rice, wheat flour, tomato puree, and lentils. There was no mention in the report of land ownership or of the importance of the Atlantic Forest for the Mbya, including for sourcing their foods and medicines.

In 2009, when Coll began to visit *Ka’aguy Kupe* and accompany a local doctor on her community health visits, the government’s delivery of food parcels and its later replacement with food coupons for household members had been running for over four years (as had the medical visits). Despite the MOPH’s promises and measures put in place following the state of emergency, some of the communities that had the most regularised access to primary healthcare, were reported to have increases in stunting from 37% to 42% between 2003 and 2008 (Orden and Oyhenart 2006; Zonta, Oyhenart, and Navone 2011), as well as increases in obesity, particularly amongst Mbya children. These researchers concluded that ongoing stunting and increasing obesity implied chronic nutritional deficiencies, as well as a high prevalence of parasitic infectious disease, and that any genetic components were negligible or non-existent. They also asserted that such nutritional deficiencies were likely due to dramatic changes to the Mbya’s lifestyle, including increasing ‘westernisation’ of their diets, limited availability and access to land and their foods from the Atlantic Forest, and less mobility (Zonta, Oyhenart, and Navone 2011; Orden and Oyhenart 2006), in other words, the very practices the Argentine state was promoting.

It was within this context of increasing statistics and reports of their children’s death rates and malnutrition, circulating in scientific and governmental literature as well as in newspapers, that Coll met members of the Mbya community. They shared with him their confusion, and sometimes outright frustration, at the visiting doctors’ diagnosis of their bodies as ‘stunted’ and their children as ‘malnourished’. None of them denied the dramatic changes in their diets, living conditions, and their consequences for their health and growth. Rather, they wanted discussions to also focus on the validity, ethics, and situated conclusions of such comparative

evaluations of their bodies, as well as the anthropometric methods deployed to do so.

Juan, a father of three from *Ka'aguy Kupe*, observed that *Jurua* doctors used paper and graphs to conduct what the doctors referred to literally in Spanish, as 'controls' of their weight and height according to age. This, he commented, depended on quantitative divisions of their weight (kilograms), height (centimetres), linear divisions of time, and studies which 'were done far away from us, from where the *Jurua* come from, from Europe'. Ultimately, like Vera and other Mbya Coll talked to, he said: '[J]ust because we are small doesn't mean we are ill … culturally, our growth and stature are different from *Jurua*. It is not that comparing is bad, it is just that it shouldn't be done like this … It would be better to do it with our growth.'

Mariana and her clinical colleagues at the health centre Coll visited also expressed reservations regarding the appropriateness of the WHO standards used to evaluate the Mbya's growth and nutritional status. According to Mariana, in discussions held with officials from the MOPH, she and her colleagues were told that the Mbya should be able to reach the optimal growth outcomes as established by the WHO standards (de Onis and Garza 2007). This obligated Mariana and her colleagues to continue to use them as part of their weekly medical controls with the Mbya communities.

Rather than representing the Mbya's ongoing existence as a national problem to be overcome through conquest and eradication or critically attempting to atone for it, the national and provincial 'state of emergency' and its response implicitly formulated the Mbya's *teko* (or as we have more generally described, 'form of life') as a lifestyle problem. Their prescribed solution—whether explicitly or tacitly—was for the Mbya to modernise and convert to the dominant 'Argentine form of life'. In doing so, the Argentine state negated how its colonial and ongoing national socioeconomic expansion implicated it in the racialisation, expropriation, and impoverishment of Indigenous groups and their lands, such as is the case with the Mbya and the deforestation of the Atlantic Forest.

Disembodying growth standards: Racialising the Mbya's form of life

Argentina adopted the 2006 WHO anthropometric growth standards in 2008. These replaced most of the data from the previous 1987 national references, which it had developed and promoted for over twenty years[7] (Abeyá Gilardon et al. 2007).

7 Argentina was amongst a few countries (including the UK, US, or Venezuela) to have used its own national growth references. These were last updated in 2001. The references were derived from a sample of roughly 13,000 children from various studies in Argentina going back to 1965. The aim of this study was to provide evidence of how the

In 1993, the WHO had commissioned a study of new international growth references, as a result of the ongoing ethical, political, and scientific concerns with the previous study design, sampling, and the limited genetic, geographic, and socioeconomic representativeness of the growth curves that resulted (Garza and de Onis 2004). Although the original studies that the 1978 WHO growth references were derived from were not explicitly socially Darwinian and biologically racist in discourse, their reference populations somewhat reflected the US's ongoing racial segregation. It is important to note that anthropometry (the scientific study of the measurements of the body) emerged as a method for scientists and policymakers in the 19th century. It was, in part, a means for Europeans and their colonial descendants to racially classify and order humans, particular non-Europeans. Anthropometry 'discovered' correlations between *a priori* racial prejudices and differences in bodily dimensions, typically of non-Europeans, and those they deemed 'criminals' or of 'lower' class (Sandler 2021; Lasco 2020; Vargas Domínguez 2015; Machado 2018), which they believe justified their exclusionary, discriminatory, and often violent imperial and national policies.

Early development of anthropometry as a science also included attempts to create reference standards for children's growth following the UK Parliament's 1833 Factory Act. Although mobilised as part of reforms to what were increasingly deemed inadequate child labour standards in factories, the research and policy recommendations were developed by prominent eugenicists, including Francis Galton and Henry Bowditch. The concern for ensuring Britain and the US's industrialised growth and racial 'superiority' was also taken up by some of those working within child welfare movements, who at the start of the 20th century advocated for very strict rules to maintain national racial hierarchies and purity. As part of this movement, early 20th century Euro-American science and policy notions based on 'normal' children, with their associated anthropometric methods and cut offs, were inseparable from eugenic and colonial projects undertaken in pursuit of racial purity. These projects were often enmeshed with ambitions for increased industrial productivity and national profit (Sandler 2021; Machado 2018; Vargas-Domínguez 2017).

Like its 1978 predecessor, the 2006 WHO international growth standards attempted to explicitly move away from such discriminatory social Darwinian projects. It partly did so, through implementing standards developed from a multi-country study (including Brazil, Ghana, India, Norway, Oman, and the US) designed to ensure its international attractiveness. In its final report it concluded

'majority of healthy children in a country [Argentina] grow, understanding healthy as the absence of specific diseases and conditions manifestly adverse to growth' (Abeyá Gilardon et al. 2007, 162, our own translation).

that human ethnic and genetic variation[8] was not a statistically significant contributor to differences in children's growth. The 2006 WHO references aspired to an international growth standard that should describe 'how children should grow in all settings rather than to limit oneself to a description of how children grow in a specific setting and time' (Garza and de Onis 2004, S7; see also de Onis and Garza 2007; Machado 2018). The production of the international growth standards depended on a strict sampling of individuals whose socioeconomic conditions the WHO deemed 'optimal' for 'unconstrained growth' and a broadening of its definition of health, 'beyond the absence of clinically overt disease, to the adoption of practices and behaviours associated with good health outcomes [which includes] breast-feeding and appropriate complementary feeding, access to preventive and curative health care, sanitary environments' (de Onis and Garza 2007, 142).

Mariana and her clinician colleagues acknowledged that such anthropometric classifications were not always reflective of their clinical observations. Pragmatically however, she noted, they enabled some Mbya families to access food credits and powdered milk to supplement some nutrient deficiencies in their diets. However, the clinicians were frustrated with their inability to deliver substantial improvements to many Mbya children categorised as per the WHO guidelines as stunted and malnourished. Some like Monica, a doctor who worked in neighbouring communities near *Ka'aguy Kupe*, described being stuck in a vicious circle, where she repeatedly had to treat the same children for diarrhoea and parasites. She blamed the parents for their 'lack of concern', for letting their children play on their patios directly on the soil and for allegedly not cleaning their dirty hands, as well as their unsanitary environment (particularly their lack of drinking water). According to Monica, this resulted in her inability to deliver improvements to their health, let alone achieve the WHO's broadened definition of optimal growth. These observations are similar to those of Machado (2018), who noted how the WHO standards served as gateways for parents to access health services in Colombia by supposedly addressing the measured anthropometric deviations in their children's growth. This, in turn, lead to blame being placed on parents for their children's failure to achieve 'optimal' growth, in a similar way to what Mariana alludes to above.

Mariana also felt guilty for blaming Mbya parents. After all, 'how can you demand so much from them if they don't have adequate conditions?' she noted. Like Monica, she also felt frustrated and trapped. Over three years she had measured the prevalence of malnutrition and infectious diseases in the communities she attended to (Mampaey and Van Velde 2015) including in *Ka'aguy Kupe*, and found

8 Coll has not come across any definitions nor detailed discussions of ethnicity nor its assumed relation to genetic sameness and variation in the 2006 WHO growth standard reports and associated publications. In addition, these documents deploy ethnic and national identity categories as interchangeable.

no substantial improvements. She had come to realise that 'the problem was not in the provision of healthcare nor in the patients themselves, but in their environment.' Like Monica, she was aware of how her practices as a state employee not only failed to deliver on the MOPH's promises of improvements in health, but also contributed to undermining the people of *Ka'aguy Kupe* and their pursuit of their 'form of life'. In part, she noted, this was because the health measures neglected the connection between the Mbya's health and their struggles for land titles and deforestation processes.

Besides Mariana, none of the medical professionals Coll talked to mentioned without a prompt, the Mbya's lack of land titles or the destruction of the Atlantic Forest as central to the state of their health. This was a matter that Vera, the Mbya voluntary health worker echoed. In relation to the WHO growth graphs, he noted frustratedly that they were 'not made in our communities. They were made in another place', and so, '[t]he graphs show us another way of being, a different culture from ours.' As Vera elaborated at the opening of this article, this *Jurua*, or more specifically, the form of life promoted through the WHO growth standards, insists their community embodies very different values from their own People's *teko* (form of life), including what health, wealth, and poverty are understood and practiced as.

The 2006 WHO standards attempt to focus attention away from racial purity and genetic differences to socioeconomic development (including sanitary environments) and assume lifestyle differences, including 'behaviours' such as hand washing. Their prescriptive focus, however, on 'optimal' growth does not overcome the racialisation that Vargas-Dominguez (2017) describes in relation to the classification of Indigenous Peoples in the context of Mexico as having inferior metabolism relative to a 'normal' standard derived from studies carried out in North American and Europe. Rather, it dictates new forms of comparing, categorising and hence ordering Mbya and their *teko* according to the WHO's standards of 'optimal' bodies and growth (Yates-Doerr 2017; De Lima Hutchison 2014). In this way, the WHO standards serve as part of an emergent global 'racialising assemblage' (Weheliye 2014) through evaluating the Mbya, their bodies and form of life according to what the WHO values as 'optimal' growth in weight and height and the conditions to realise them (e.g., sanitary environment, hygiene practices, and socioeconomic development). Any variations in the Mbya's growth can then be localised as effects of 'inequalities' in Mbya's access to services, lifestyles choices, and socioeconomic conditions that the WHO standards and the Argentine state presupposes as un/desirable. This, in turn, serves to justify further state and international interventions into Mbya communities in order to 'modernise' them.

Here, possibilities for the Argentine state to engage with the Mbya's *teko* and their growth as different rather than deviant are foreclosed or, at the very least, not taken seriously. Vera articulates this in his observations on what *Jurua*'s colonial extractive and capitalist values demand the Mbya to embody to be healthy and wealthy. The Mbya potentially experience this as disembodying, as it necessitates that they give up on their differences, cease resisting, and convert to a violently homogenising form of life. Such a form of life is sustained through the expropriation and exhaustion of their bodies and lands, as well as the onto-epistemological denial of their non-industrialised form of life, which is central for the realisation of their health. In essence, it demands them to become *Jurua* and accept their racialised place in the current Euro-American cosmo-geological order: that is, the Eurocene. In the following section, we draw on Andrea's research to demonstrate how the emergence of human microbiome science and its current preoccupation with Indigenous Peoples, are also implicated in these disembodying inequalities and geological transformations, particularly through the racial and colonial formations of the Eurocene and the Plantationocene,

The Plantationocene as colonial origin of modern microbial and dietary imbalance

Since the US National Institutes of Health (NIH) launched the initiative known as the 'Human Microbiome Project' (HMP) in 2007, the biomedical understanding of microbes in human health and disease has shifted abruptly. Pathogenic microbes (i.e., those that can cause disease) are now increasingly understood to be the exception. Most microbes inhabiting the surfaces, orifices, and visceral interior of the human body are now described as symbiotic and commensal organisms, essential for metabolic, immunological, and even behavioural functions (Blaser 2006). Human microbiome science is concerned with the study of such non-pathogenic microbial diversity. As its central tenet, it emphasises coevolution (of microorganisms and animals) and a symbiotic relationship between microbes and humans, yet to be explored. This view disproves and contests the dominant antimicrobial culture—in the form of hygiene and sanitation techniques (see Latour 1988) and the wide implementation of vaccination. Since 2012, when Andrea commenced her doctoral studies, scientific research on the human microbiome has dramatically surged. In such a fast-moving field, scientific articles and media news on the microbiome are being published daily. Today, the popularity of its proposals has traversed the life sciences, reaching the social sciences and humanities as well, particularly those academic fields concerned with social and cultural aspects of biomedicine such as science studies, body studies, anthropology of science, and sociology of medicine.

An increasing number of scholars are critically calling for reconceptualisations of the idea of 'the Anthropocene' as, for instance, the Plantationocene (see Davis et al. 2019). We, the authors, understand the Plantationocene as interlocking and overlapping with Grove's concept of the Eurocene (2019), particularly in the possibilities it offers to decentre Euro-American narratives. These narratives constitute modernity and the industrial revolution as 'the epicentre of global environmental change including transformations in microbial diversity'(Gill 2021b, 9), while failing to engage with their racial, colonial, imperial, and capitalist underpinnings (Murphy and Schroering 2020). We situate the microbiome science project that Andrea has studied within the Plantationocene. This includes ethnographic fieldwork conducted between 2013 and 2017 on a human microbe project entitled *Microbiomes of Homes across Cultures* (MHC). The Principal Investigator of this project, microbial ecologist María Gloria Domínguez-Bello, is a key actor in the international human microbiome research landscape. Her prolific research has been published in renowned scientific journals such as *Science, Nature*, and the *Journal of Clinical Microbiology*. She was a founding and advisory member of the crowdfunded, citizen microbiome project *American Gut* and has sat on the scientific advisory board of the American Microbiome Institute (AMI). Beyond her position in the scientific world of microbiome research, her work has generated remarkable media attention. The interviews she has given to diverse media in different countries are numerous—such as the international television channels NTN24, and BBC News (Collen 2015), the newspaper *El País* (Criado 2015), and the Smithsonian Channel's documentary *Aliens Inside Us* (Cohen 2013), which focused on the microbiome expedition she led in the Peruvian Amazon.

Dominguez-Bello and her team have hypothesised that industrialisation and the 'modern lifestyles' associated with it have 'led to changes in microbial patterns in humans and their environments, with reduced microbial diversity … [producing] profound changes transmitted by descent and perpetuated in future generations' (Dominguez-Bello 2012, 1). In contrast to what we have described in relation to the Mbya in Misiones, for these scientists, modernisation was not uniformly desirable. The MHC project aimed to gather empirical evidence to test their hypothesis. This United States-based team of microbial scientists (generously incentivised by the NIH and similar US governmental agencies' funding calls) have gained and solidified consensus and authority in the emerging field of microbiome science over the past decade by studying what Hannah Landecker calls the 'biology of history' (2015). The 'biology of history' is a notion that refers to the materialisation of historical events in biological bodies, processes, and ecologies. The microbial scientists that Andrea accompanied assert that changes in food cultures, use of antibiotics, built environments, social norms and so forth—which they indistinctively and interchangeably relate to processes of modernisation and

westernisation—are a major contributor to what they refer to as ‘modern diseases’ (i.e., autoimmune, metabolic, and inflammatory diseases such as asthma, diabetes or obesity) (Blaser 2014; Dominguez-Bello et al. 2016; Ruiz-Calderon et al. 2016). In the following sections, we resituate the history of these modern diseases and the biologies of their history (Landecker 2015) in the Plantationocene. We do this through developing an anthropologically-grounded speculation that links the microbiome scientists’ sense of urgency to study and sample Indigenous Peoples for their microbes ‘before it is too late’ (Bello et al. 2018).

Indigenous forms of life as western lifestyle solutions

In 2016, the team of microbial ecologists that Andrea collaborated with, published a short comment in *Nature Microbiology* entitled ‘Ethics of Exploring the Microbiome of Native Peoples’. In it, the authors articulated a hypothetical ethical imperative that if: ‘urban-related factors impact the human microbiome in ways that cause or perpetuate disease states, leading to the extinction of microbionts in industrialized societies, then solutions might depend crucially on the microbionts of people untouched by western lifestyles’ (Dominguez-Bello et al. 2016, 2). The scientists speculated that if this was the case, then Indigenous Peoples might serve as reservoirs from which ‘we’ in modern industrialised countries could restore our lost and extinct microbes.

The MHC project (2012–2014) was funded by the Alfred P. Sloan Foundation Programme ‘Microbiology of the Built Environment’, as part of the emerging interdisciplinary study of human-microbe entanglements in human constructed environments. The scientists sought to describe differences in microbial taxonomy and diversity in terms of the evolution of lifestyles across what they referred to as the ‘westernisation/modernisation gradient’. Accordingly, the settings where they carried out this comparative study included a ‘remote jungle village’ with Indigenous populations [Checherta] to rural settings (Puerto Almendras), mid-size cities [Iquitos] to a modern metropolis [Manaus], in Peru and Brasil.

These scientists referred to Checherta, for instance, as an ‘uncontacted’ Indigenous community in the Amazon basin, ‘untouched by western lifestyles’. However, historical evidence demonstrates that missionaries had made their way to Checherta and other previously ‘uncontacted’ Indigenous communities in the region since the end of the 1970s. Many of these Indigenous communities have been defending their land for decades against oil companies and associated environmental contamination and toxic dumping. These criminal practices created an unprecedented health and environmental crisis, especially in the northern Amazon. Although Checherta had not been as badly affected by industrial and

petroleum operations as other Peruvian communities, such as Samurillo or Nuevo Andoas, they were not socially isolated nor were they unaware of these industrial incursions into their territories and, unsurprisingly, distrusted foreigners. Despite this, the microbial ecologists Andrea accompanied insisted on the validity of the site to their research and asserted that, most importantly for their study, the Checherta had ‘never confronted antibiotics, touched antibacterial soaps, or breathed conditioned air; as a result, their microbiomes are relatively pristine’ (Dominguez-Bello, personal communication, 28 January 2014).

During the MHC project, scientists first collected samples from humans, non-humans (including pets and objects), and home environments with the aim of carrying out microbial genetic studies. They collected skin, nose, mouth, and anal swabs from ninety-four humans (thirty-seven men and fifty-three females) (Ruiz-Calderon 2015, 37). They took microbial samples from the floors and walls of the living rooms, kitchens, bedrooms, and bathrooms of each household (forty in total, ten per location). Immediately after the collection, they stored the swabs in liquid nitrogen (at −80°C). The team brought with them a questionnaire to collect additional information or ‘metadata’, including anthropometric and dietary information, surface material, sample height, cleaning frequency, and the presence of pets in the home.

Unlike classical experimental microbiology, in which specific microbes are cultured in Petri dishes in a laboratory setting and under controlled conditions, the ‘metagenomic’ approach of microbiomes consist of ‘the study of genetic material directly extracted from an environmental sample’ (Rhodes, Gligorov, and Schwab 2013, 35–36). The metagenomics approach is about identifying ‘communities’ of microbes (i.e., populations of bacteria) through the DNA, rather than individual bacterial ‘colonies’. Once they extract the DNA from the microbial sample, the scientists follow, what in microbiome science is known as the ‘16S-based approach’.

The research results of the MHC partly confirmed the team’s hypothesis. They found the lowest microbial diversity in the city of Manaus (except for the oral microbiome, which was lower in the rural town of Puerto Almendras) and the highest in Checherta. Overall, the results showed that in ‘urbanised’ spaces there was a higher prevalence of processed foods, antibiotic use, and a lack of access to green spaces. Therefore, these populations had less contact with environmental microbes (those associated with plants, trees, other animals, air, etc.), and were associated with decreases in human microbial diversity, the transmission of potential pathogens, as well as increases in ‘immune and metabolic disorders that have become the new disease paradigm in the industrialised world’ (Ruiz-Calderon et al. 2016, 5). The MHC was the first and only study at the time to compare

microbial diversity across an ‘urbanisation/westernisation gradient’, the scientists highlighted. Here we begin to see, how through seeking empirical evidence for their hypothesis-driven research, microbiome scientists not only questioned modernity’s promise of unproblematic health benefits but do so through recentring ‘primitive’ Indigenous Peoples. In other words, their ‘pristine’ microbial diversity, and ‘traditional’ non-industrialised forms of life are seen in these research findings as constitutive of the theoretical core of their emerging science and future probiotic and other lifestyle solutions.

Ancient microbes and traditional Peoples: Microbiomisation as a racialising assemblage

Ancestry genomics is one of the biomedical areas that most explicitly reflects the contemporary imbrication between race and the life sciences. This is because scientists who trace human migration—or colonisation, although this term is rarely used—do not tell a story from the standpoint of those peoples who were colonised and displaced. Rather they tell them from the standpoint of the colonisers and their descendants, who named and ordered many millions of peoples into undifferentiated groups of ‘Native Americans’, ‘Africans’, ‘Asians’, and ‘Indo-Europeans’, as the work of feminist Indigenous studies scholar Kim TallBear highlights (2013, 5). Here, we draw parallels between the WHO anthropometric standards of growth and the area of human microbiome science, which involves the reinscription of race in biological experimental science and knowledge about human-microbe entanglements. This includes, for instance, the reference to microbes as ‘indigenous’ and ‘ancient’, as well as deploying particular social evolutionist narratives and categories of human difference.

The MHC team explicitly avoided invoking behavioural, sociocultural, and racial/ethnic/national population categories as explanations of ‘changes’ in microbial diversity in relation to their own published results (Ruiz-Calderon et al. 2016). Instead, they used concepts (often interchangeably) such as transculturation, industrialisation, modernisation westernisation, and urbanisation. Though they provided limited theoretical development and differentiation, they maintained implicit social evolutionist and developmentalist assumptions (Núñez Casal 2019). However, when comparing their results in relation to other studies, they often reverted to using various categories of difference. Here, it is worth noting the variety of ethnic, racial, socio-economic, and national categories of human difference that are deployed, often conflated and used in opposition to each other, in microbiome studies. For example, in their attempts to find the most diverse human microbiomes and causes of variations in microbial diversity, scientists have compared the racial/ethic category of ‘Amerindian’ and nationality (i.e., US, Malawi) (Yatsunenko et al. 2012). Another example is the highly cited study by De

Filippo et al. (2010), on the impact of diet on the gut microbiome that compares 'European' and Burkina Faso children. Clearly, comparing populations within a political and economic 'consortium' of nation states (i.e., Europe) with a single nation state (i.e., Burkina Faso) is problematic. Firstly, it conflates different ways of dividing and uniting peoples (e.g., national, ethnic, racial) as symmetrical and hence, comparable. This categorisation often obscures how microbiome scientists give broader, imprecise, and fuzzy definitions for some categories (e.g., modernisation) and leave others undefined, particularly ethnic, racial (e.g., Asian, Amerindian), and national categories. Other studies, for example, compare the socioeconomic category of 'industrialised' populations with the racial category of 'traditional' 'Hadza' hunter-gatherers (Smits et al. 2017). We argue that these approaches, which provide limited or no explication of the ontological presuppositions of such categories beyond their sampling (e.g., inclusion/exclusion criteria), enact a form of liberal racism where race is a constant presence through its very absence (Shilling 2012; M'charek, Schramm, and Skinner 2014). In other words, although microbiome scientists use categories such as 'traditional' or 'Burkina Faso' rather than skin colour, when enacting their comparisons, they are implicitly or explicitly racially coding people as undeveloped, primitive, and rural, amongst other terms (Benezra 2020; Núñez-Casal 2019).

Although racialisation is historically associated with phenotypic traits (i.e., an individual's observable traits such as skin colour, eye colour, height, etc.), it has never only been about skin colour. This is very much the case in many human microbiome studies, where population categories are taken as 'transparently' reflecting socioeconomics, sociocultural practices, behaviours, and lifestyles as pre-existing 'natural' phenomena. Thus, microbial science deploys genomic analysis to correlate and attribute microbes and microbial profiles to different populations, where population categories serve as a proxy for race. Andrea (2019) refers to these processes as the 'microbiomisation of race', following the work of Stefan Helmreich (2016) and the notion of 'microbiomisation'. The microbiomisation of race is consonant with Alexander G. Weheliye's (2014) idea of 'racialising assemblages'. In other words, although microbial scientists 'commonly rely on phenotypical differences', such as seeking to attribute different microbial profiles to population or other categories, the primary function of the microbiomisation process 'is to create and maintain distinctions between different members of the *Homo sapiens* species that lend a suprahuman explanatory ground (religious or biological, for example) to these hierarchies' (Weheliye 2014, 28), which are assumed between humans and their differences, being these microbial or otherwise

At first glance, the hierarchies established by microbiome scientists in their research might appear to unfavourably evaluate 'industrialised', 'European' and

'western' forms of life. This is due to the fact that they associate the increases in 'modern diseases' with microbial loss and extinction. This, they contrast with a positive evaluation of 'uncontacted' Indigenous Peoples. As the MHC researchers state, the 'Yanomani[s] harbor a microbiome with the highest diversity of bacteria and genetic functions ever reported in a human group' (Clemente et al. 2015, 1).

However, the research carried out by microbiome scientists into high human microbial diversity also casts uncontacted Indigenous Peoples—and their 'ancient' microbes—as being closer to or part of 'pristine' nature. It depends, in the same way as with the WHO growth standards in Misiones, on a racialised 'by-nature' distinction (Gill 2021a), which invokes social evolutionary and development theory either implicitly or explicitly. Thus, compared to themselves—Euro-Americans and their colonial descendants—Indigenous Peoples are framed as less evolved, both socioeconomically and technologically, and less human. Researchers, like those of the MHC, insist on the scientific and ethical imperative 'for extensive characterisation of the function of the microbiome and resistome in remote non-westernized populations before globalization of modern practices affects potentially beneficial bacteria harboured in the human body' (Clemente et al. 2015, 6). Hence, as Alex Nading (2016) has described, human microbiome science depends on 'ecological nostalgia'; that is, a selective means of engaging with and positively evaluating particular Indigenous Peoples (like the Hadza or Checherta). More specifically, the microbial scientists' ecological nostalgia allows them to justify and rationalise contemporary Indigenous People's forms of life as sites to test their hypotheses. This approach enables them to propose that 'ancient' microbes from those Indigenous Peoples who continue to 'hold on' to their 'traditional' forms of life, 'be used to protect our children from the modern diseases *now* plaguing them' (Blaser 2014, 325, original emphasis; see also Obregon-Tito et al. 2015). In the next section, we elaborate on how the racial and colonial histories embedded in these scientific epistemologies and practices obscure Indigenous People's agency and rationalises the instrumentalisation of their microbial diversity for the benefit of privileged segments of neoliberal societies.

Impoverished lifestyles: Embodying the Plantationocene

The American Gut Project (AGP) which claimed to be the world's largest crowdsourced and funded 'citizen' science project (Núñez Casal 2019), aimed to 'discover microbes and microbiomes 'in the wild' and reveal how phenotypes and lifestyle variations correlate to human population and translate between them (McDonald et al. 2018, 2). AGP was set up by anthropology-trained entrepreneur Jeff Leach and biochemical and microbial scientist Rob Knight in 2012, who are both collaborators of the MHC research group led by Dominguez-Bello. Between 2012 and 2017, the project amassed the largest open access database in the world

of human microbiome samples (>11,000 ‘citizens’). The majority (94%) of the samples from the 45 countries represented were provided by ‘citizens’ from the UK, US, and Australia (McDonald et al. 2018); populations these scientists interchangeably referred as ‘western’ and ‘industrialised’.

A central aspect of incentivising citizen-customers to fund and submit their data to the AGP was the opportunity for individuals to compare their microbiome profiles to populations sampled from prior microbiome studies. As a ‘personalised’ microbiome initiative, the AGP did not provide any explanation or criteria for how its population categories were established. A closer look at the AGP data reveals that the three racial categories of difference (‘western’, ‘Venezuelan’, and ‘Malawian’), which individuals could compare their samples with, were derived from a single landmark study in the field of human microbiome conducted by Yatsunenko and colleagues (2012), that had also included researchers from the MHC project. There is a clear difference between the two studies in how the embodied form of the microbial samples were produced within the scientific discourse of microbiome science. In contrast to the AGP, whose participants are ‘citizen scientists’, those of the landmark study—its ‘Malawian’, ‘Amerindian Venezuelan’, participants and the blurry category of ‘westerners’—are framed passively as research subjects (idem, 9), a product of the ‘racialising assemblages’ of microbial science: not fully human, simply ‘flesh’ (Weheliye 2014).

Those who benefit from the microbiome of Indigenous communities are not ‘westerners’, or citizens of economically rich (western) countries in general, and much less so Checherta or Yanomami. Rather, they benefit very specific sections of ‘western’ societies: that is, those from higher socioeconomic backgrounds and not just because they hold cultural and economic capital to participate in personalised microbiome initiatives, for example. Rather, it is the fact that this capital enables them to pursue lifestyle ‘choices’ (Manderson and Naemiratch 2010), such as going on diets and using probiotics (including those potentially developed from bioprospecting[9] non-western biodiversity (Hayden 2003). These ‘choices’ are associated with ‘cultivating’ microbial diversity and therefore benefitting their overall health. The healthy lifestyle choices employed to cultivate microbial diversity (and therefore maximise overall health) are not innocent and without repercussion. On the contrary, in neoliberal capitalism, attaining microbial diversity reproduces health disparities and ‘immunitary privileges’ (Núñez-Casal 2019). In other words, as Harrison and Taren (2018, 279) have demonstrated, socioeconomic deprivations and marginalisation are likely to be embodied as poor

9 Bioprospecting refers to the search and commercialisation of biological resources or bioproducts and is a form of piracy or ‘biopiracy’, ‘leading to a loss of power of indigenous people over their own resources’ (Cluis 2006, 1). Cori Hayden’s ethnographic study in Mexico (2003) points out that bioprospecting ‘is the new name for an old practice: it refers to corporate drug development based on medicinal plants, traditional knowledge, and microbes culled from the “biodiversity-rich” regions of the globe—most of which reside in the so-called developing nations’ (2003, 1).

microbial diversity, which is associated with higher susceptibility to autoimmune, metabolic, and inflammatory diseases, as well as malnutrition (including obesity), whilst also further serving racialised explanations of any of these observed microbial differences.

Framing impoverished 'westerners'[10] and Mbya experiences of malnutrition as embodied inequalities—whether via racialised measures of microbial diversity or anthropometric standards—can obscure how different embodied forms of life and ongoing historical experiences, while entangled, are not the same. Rebecca Earle's book *The Body of the Conquistador* (2012) is relevant here, as she cogently demonstrates how Europeans and their inheritors' concerns over human racialised differences, bodies, and lifestyles, including foods, were central to their colonisation of Indigenous Peoples and the Americas. Spanish conquistadors feared that 'living in an unfamiliar environment, and among unfamiliar peoples, might alter not only the[ir] customs but also the[ir] very bodies', weakening their constitutions to the 'extent that they died' or even transformed into 'Indians' (idem, 3). They believed that growing and consuming their own foods—including wheat flour, almonds, sugar, meat, and wine—would protect them against the 'malign' warm and damp climate of the New World, as well as 'Indian' foods. Food was also a 'civilising' tool for the conquistadors. The success of their imperial expansion depended on their ability to cultivate these foodstuffs in their colonies, as well as convert Indigenous Peoples and their lands to their use, and, in turn, European lifestyles more broadly (idem, 16).

European involvement in the transatlantic trade of enslaved Africans and the establishment of their New World plantations increased pressure on Indigenous territories and accelerated shifts in their diets, forms of life and, possibly, microbiomes. New World plantations resulted in further large-scale homogenisation of landscapes through the exploitation and killing of Indigenous Peoples and Africans, the importation and exportation of humans, plants and other nonhuman life, as well as the deforestation of forests and the establishment of urban settlements. The plantations reconfigured the relationship between Indigenous Peoples and enslaved Africans with their lands in 'ways that better suited the life of colonists and their imperial counterparts in Europe' (Murphy 2021, 7). They also served as the model and condition for configuring contemporary Euro-American industrial capitalist life (including its metabolism, as Hannah Landecker (2019) insightfully shows) and global markets as modern 'civilising' forces (including industrialised diets), at the ongoing 'expense of the Earth's

10 By 'impoverished westerners' we had in mind migrant workers, but also a growing precarious segment of European societies of poor and precarious yet 'enthusiastic' workers (e.g., in creative industries, academia), as it is the case in countries like Spain and the United Kingdom (see Zafra 2017).

assorted ecosystems' (idem, 7)—human microbiomes included—and those racialised as 'other.'

In sum, we suggest that the Plantationocene, the 'biology of (its) history' (see Landecker 2015), reverberates and is temporally sustained in the embodied inequalities of the Mbya, as much as in communities in the 'west' and elsewhere, who—under a climate of increased precarity and environmental degradation—have been dispossessed of the necessary conditions of possibility to sustain other forms of life.

Conclusion

Microbiome researchers Skelly et al. (2018) speculate that European colonial setters may have been able 'to maintain some microbial stability' relative to Indigenous Peoples, through expropriation and transformation of these Peoples' lands, in order to sustain and extend their own European forms of life (i.e., lifestyles and dietary 'choices'). This may be partly the case in Misiones, where the logging of the Atlantic Forest and plantations— albeit not exclusively for local consumption—are part of a state 'civilising' process. This has not only undermined the Mbya's ability to follow their *teko* (form of life) and contributed to increases in reports of malnutrition, infectious, and modern diseases (e.g., obesity and diabetes), but has also increased state provision of healthcare and other interventions in their communities. These modernising interventions include antibiotics and credits for European food items that can potentially reduce these communities' microbial diversity further. These programmes do not include, however, probiotics or any means for promoting gut friendly diets, let alone any acknowledgement of the effects of deforestation and initiatives for land repatriation and reforestation of the Atlantic Forest.

Indigenous Peoples in the Americas have not only been dealing with the savage consequences of European forms of life, including dietary and other lifestyle 'choices', for over 500 years, but also their racial and colonial exploitive practices. Recent examples of this, as we have mentioned, include research undertaken by microbiome scientists, in search of microbial quick fixes in order to tackle so-called 'modern diseases'. One aspect of avoiding the continuation of the racial and colonial exploitive practices we have documented, might involve increased awareness from microbiome scientists, like health professionals and state policymakers, of their work as being situated in the longer, overlapping *durée* of the Eurocene, Plantationcene and other '-cenes'. In practice, this might mean acknowledging how industrialised 'goods' (e.g., foods, antimicrobial drugs, and pesticides), 'western' lifestyles choices and biologies (including the bodies, microbiomes, and ecologies in which they live) are sustained through European

colonialism and capitalist exploitation of Indigenous and other Peoples, such as in the case of microbiome research in Latin America, and expropriation and deforestation of Mbya lands in Argentina. It should also be acknowledged that an individualist consumer approach sustains itself on these health disparities and immunitary privileges (Núñez Casal 2019). Instead, this type of research should aim to transform the systems by which forms of life are expropriated and commodified, as well as attend to the associated socioeconomic deprivation, and racial and colonial histories. It needs to be recognised that these histories have come to be embodied as stunted growth, infectious and modern metabolic disease amongst the Mbya in Misiones and among increasingly impoverished 'western' peoples. In short, microbiome scientists and state policies that focus on 'lifestyle choices' protect rather than challenge those who have benefited most from forms of life that have given rise to the Eurocene and the Plantationcene.

In a similar way to the history of antibiotics (Landecker 2015), racial hierarchies, violent colonial expropriation and exploitation, as well as ecological catastrophes are not removed from microbiome scientists, Argentine citizens, the Mbya, the Checherta, westerners and microbes. They are embodied 'in' and 'through' them, albeit differentially and unevenly. However, to trace and cease reproducing colonial and racialised biogeologies of history, requires 'us' to challenge the racialised and colonial histories of life and geological sciences, to recognise their embodied consequences in the present, as well as how they are implicated in the geologies of the Eurocene, Plantationcene, amongst other 'cenes'. This, we propose, constitutes a politicalisation of geology and biology (Yusoff 2018; Grove 2019) that refuses to flatten the diverse struggles and forms of life of Indigenous and other Peoples into a Euro-American racialised geological order. Instead, it understands them as moving the earth too, albeit at minor geological scales (Gill 2021b).

Authorship statement

This article brings into conversation empirical materials collected as part of Coll de Lima Hutchison (CLH) and Andrea Núñez Casal (ANC) doctoral research projects. CLH and ANC initially analysed their doctoral data inductively to identify emergent themes. Then both authors discussed their themes and relevant literature, and jointly drafted, edited, and responded to reviewer comments. Finally, CLH was responsible for the final revisions and editing of this paper.

Ethics statement

CLH's research received institutional approval from the London School of Hygiene and Tropical Medicine ethics board (reference number: 5286) and 'local' (Misiones, Argentina) endorsement from *Centro de Salud* Ruiz de Montoya and *Equipo Misiones de Pastoral Aborigen*. ANC's research received institutional approval from Goldsmiths, University of London's Practice on Research Ethics and Integrity Sub-Committee and endorsement from The University of Puerto Rico and New York University Langone Health.

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