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Sustaining (dis)embodied inequalities in the(ir) Eurocene: ancient microbes, racial anthropometry, and lifestyle choices

Coll de Lima Hutchison and Andrea Núñez Casal

Abstract

Racialisation and colonialism are central to sustaining (dis)embodied inequalities. We draw together our distinct ethnographic projects on a microbiome expedition with Amazonian indigenous non/human communities and on medical professionals' encounters with Mbya Guarani communities in the Atlantic Forest region. Firstly, to show how through comparing and intervening on Mbya bodies and their forms of life, both anthropometric growth standards and state development projects, perpetuate racialised assumptions of human difference and legitimate colonial extractive practices (e.g., conversion of forests to 'productive' agricultural land). Similarly, human microbiome scientific initiatives, rather than addressing such racialised (dis)embodied inequalities and extractive practices, contribute to 'updating' and potentially amplifying them further through identifying indigenous peoples as western industrialised people's ancestors and as potential reservoirs for novel probiotics to restore microbes to industrialised societies' guts. 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’.

Key words: probiotics, nutrition, diet, anthropocene, microbiome

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, a state voluntary health worker for *Ka'aguy Rupi* [next to the forest] and his neighbouring Mbya-Guarani communities, shared these reflections with Author1 in 2011, just after Sara's weekly medical visit to their community in central Misiones, Argentina. He, like many other Mbya Author1 met, was exasperated with the provincial and national governments countless broken promises, longstanding vacillation to demarcate their lands and grant them legal titles, and halt ongoing deforestation of the Atlantic Forest and encroachment into their territories. The few governmental advances his community had experienced were limited to extensions and partial adaptations of state provisions, already existent in principle for all Argentine citizens. Amongst these, was the promise of regular medical visits to deliver basic primary healthcare to Mbya communities (Author1, 2014). These visits brought to some communities like *Ka'aguy Rupi*, increased access to pharmaceuticals, state health programmes and referrals to hospitals, along with their biomedical and public health knowledge practices. During these visits, Sara like other

¹ *Jurua* is 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.

doctors, would take measurements of Mbya children's height and weight and compare them to World Health Organisation's (WHO) graphs of 'optimal' growth, often categorising them as stunted and malnourished. As Vera alluded to above, such practices were part of the Argentine governments' 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 their suffering. However, they were fundamentally incapable of halting, let alone 'reversing' the impoverishment and disembodying inequalities Mbya continued to experience. If anything, they perpetuated the negation of Mbyas' form of life in favour of sustaining and intensifying the colonial, racial and ecologically extractive foundations characteristic of Europeans' conquest of the Americas and current proposals for 'the Anthropocene'; a term we problematise in the next section.

Contrasting with these colonial state health interventions, Author2 has increasingly observed how particular aspects of indigenous along with other, mostly non-western² 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

² The policy, microbiome and nutritional science literature that we engage in this article deploy both western/ization and modern/ization interchangeably, as well as in opposition to indigenous/traditional peoples. Although we follow them, our emphasis is not that they 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.

development of ‘the human’ microbiome in contemporary biomedical science. Under this emerging paradigm, Author2 followed a microbiome study, which among its principal objective was the search for what scientist referred to as ‘ancient microbes’ to be used as part of potential solutions to restore lost microbial diversity for modern industrialised societies. At the centre of this research are racial assumptions about ‘the human’ and human – population - differences: that allegedly modern people’s ancestors, namely ‘indigenous people’ who remain spatially beyond the reach of modernisation (i.e., in ‘voluntary isolation’), might host microbes that could reverse (i.e., because they are ‘our’ living ancestors) the damaging effects of modernisation on human microbiomes. 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 indigenous lands to the microbes in their communities and bodies.

This article brings together our two previously independent ethnographic research projects: Author2’s (2013 – 2017) on a microbiome research expedition to indigenous communities in the Peruvian and Brazilian Amazon; and Author1’s (2009 – 2014) medical professionals’ encounters with Mbya Guarani communities from the Atlantic Forest region, Argentina. Although we conducted them in different years, places, with different actors, topics and methodologies, we have found shared points of interests and themes across our research that in bringing them into dialogue here, allows us to develop arguments in ways that would have been empirically challenging for us to do separately.

We believe this offers a unique opportunity to jointly demonstrate how the reproduction and intensification of indigenous (Mbya-Guarani, Checherta and others) embodied inequalities in the Americas (particularly, Northeast Argentina and North Peru) are central to the emergence of various ‘-cenes’, including the Anthropocene proposal; a Euro-American mythical order evidenced in its name (i.e. ‘anthropos’ as geological actors) and the socio-geological narratives it draws upon (e.g., Atomic age, Europe’s industrial revolution) (Danowski and Castro 2017).

No one ‘-cene’ to rule them all

‘The Anthropocene’ was initially proposed as a new geological epoch in the early 2000s. Since then, Earth scientists have deliberated over evidence to date its inception and, recently, whether it should be a geological event rather than epoch (Gibbard *et al.* 2021). An increasing number of voices have critically engaged with ‘the Anthropocene’ proposal, debating its consequences not only as a ‘meta-concept’ to draw attention to accelerating global environmental changes, but also one embedded, from its conception, in a universalising myth of ‘mankinds’ growth ‘into a significant geological, morphological force’ (Crutzen 2002; Haraway *et al.* 2015; H. Davis and Todd 2017). Some have offered alternative proposals or parallel redescriptions, to move beyond centring an abstracted ‘human species’ or ‘humanity’ as being equally responsible and under threat from escalating environmental catastrophes, as well as highlighting anthropocentrism and eurocentrism inherent in such proposals of ‘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', including the Racial Capitalocene (Moore 2017; Vergès 2017), Plantationocene (Haraway *et al.* 2015; J. Davis *et al.* 2019) and Eurocene (Grove 2019), to name a few. In doing so, their redescrptions reveal how geoscientists proposals for golden spikes to date their Anthropocene to Europe's sociotechnical triumphs, attempt to grapple with how 'human historical events and processes' materialise as geological events and processes. However, they fail to acknowledge not only how they are implicated in unequal capital accumulation and impoverishment, land dispossession, malnourishment, patriarchal, colonial, racial and other forms of violence, which are embodied as the uneven and unequal biologies of history (Landecker 2015, 3), but also how indigenous, black and other peoples have also been transforming – the – earth (Gill 2021b), albeit on smaller scales, for millennium before current Anthropocene proposals.

Like many of the above authors, we seek to contribute to the politicalisation of geology – and biology - (Yusoff 2018; Grove 2019). We strive to do so, not through taking sides with 'the Anthropocene' or an alternative proposal, as if a consensus can or should be arrived at on which and what single '-cene' is more objective and universally representative (geologically, politically, socially, morally). In our view, such an approach implicitly centres different forms of life, collectives (i.e. a 'we') and their embodied inequalities as geologically more real or true than others, and by association politically, ethically and ethnographically too. Rather than backing one '-cene' to rule them all, we accept a multiplicity of overlapping '-cenes' (Larsen and Harrington 2021), each of which reflects, like myths (or as is popular now, narratives, Danowski and Castro 2017, 6), the situated existential and disciplinary concerns of us as authors and hopefully, those we engage

with in our research. In the case of our article, this means situating our 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 was a term often used by public health officials and microbial ecologist we followed in our respective fieldworks to refer to the various ways they 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 ‘lifestyles’ approaches, as where commodification and personal over community identity reduces - political - engagement in everyday life to individual consumer choices. Such prescription of ‘life’ and ‘politics’, does not sufficiently address in our view how individuals’ choices and their in/abilities to enact them are contingent on particular assemblages³ or what following Helmreich (2011) and Grove (2019), we refer to as a ‘form of life’; ‘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’ (ibid. 2). Thus, we actively use the phrasing ‘forms of life’ to allow us to juxtapose the inherent colonialism and racialisation

³ We see ‘forms of life’ as an attempt to deal with similar conceptual concerns around relationality and entanglement, as the likes of 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. racializing assemblage in Weheliye’s sense (2014)) that shapes and is shaped by collectives and individuals’ lives, including ‘nonhumans’.

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 first show this through analysing Author1's fieldwork with Mbya and health professionals in Argentina as means to evidence how the current Euro-American geological order (Eurocene) and its form of life (Grove, 2019) is partly born out of and continues to be implicated in the racialisation and colonisation of 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 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 article evidences how ongoing colonial-racial expropriation of biodiversity-rich locales and bodies (human, microbial, soil, air) in Latin America and Africa animates the unceasing cultivation of industrial capitalist form of life, including probiotic lifestyle solutions. Finally, we conclude by reflecting on how, ultimately, these Euro/plantationocenic schemes, reproduce and deepen the unequal distribution of embodied inequalities.

Euro-American geological re-ordering: racialised natures, colonial extraction and dis-embodiment standards

At the time Europeans (chiefly Spaniards and Portuguese) arrived during the second decade of the 16th century, the Guarani occupied the coastal regions south of Sao Paul to Rio Grande do Sul, extending into the Atlantic Forest and as far west as the frontiers of 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* and introduction of non-native infectious diseases (Sarreal 2014, 16–23). Estimates for total indigenous deaths by the mid 17th century were so vast – between 20 to over 100 million, up to 90% of the total population of Latin America (Montenegro and Stephens 2006) – that Lewis and Maslin (2015) proposed it as a possible dating for a new geological period based on synchronic detectable dips in carbon dioxide (Murphy 2021, 8); what they called the ‘Orbis Spike’.

This atmospheric shift and the Little Ice Age that followed it, are attributed – although still debated – to indigenous genocide and subsequent reforestation of the Americas (estimates at over half a million km²), resulting in massive carbon sequestration (Lewis and Maslin 2015). For a little over 50 years, it has been increasingly common to ascribe European imported microbes as the most significant cause of these deaths. More recently, scholars have highlighted how this ‘virgin soil theory’ has also served as means of absolving and rationalising European conquest, as it identifies indigenous peoples as immunogenetically inferior and obscures the roles of war, enslavement, starvation, impoverishment and other social stresses on epidemics and their associated deaths (Edwards and Kelton 2020; Dunbar-Ortiz 2014). Thus, for Grove, ‘rather than see 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’ (ibid, 41). da Silva describes this as

'first and foremost a spatial, that is, a global event' (da Silva 2007, 2), in that it enabled Europeans' to act out and expand their geopolitical conflicts and rivalries through the conquest of 'new' territories – and enslavement peoples indigenous to Africa and the Americas. Grove designates this as the emergence of the Eurocene; a 'five-hundred-year [Euro-American geo-political] project of violent terraforming' (Grove 2019, 43).

In subsequent sections, we elaborate on some aspects of this Euro-American geopolitical project, in particular: how racism and colonialism are central to it, as a forces of 'world making that renders some forms of life principle and other forms of life useful or inconsequential' (Ibid, 3).

Establishing Argentina as white nation-state

Beginning around the time of the 'Orbis Spike', the Catholic Church, in collusion with the Spanish colonial government, ensured that many of the Guarani that survived the initial conquest and colonisation by Europeans were incorporated into Jesuit Missions (also known as *Reductions*). The Jesuits aggregated and isolated over a hundred forty thousand 'Indians' and 'Guaranies' – as they were generically referred to – into thirty 'townships', located in what is now the province of Misiones, to 'civilise' them through religious and cultural homogenisation (conversion), and increase their religious and economically productive subjects. This included cattle ranching and the harvesting and sale of wild yerba mate (Sarreal 2014, 1–10); the later which was already consumed, collected and cultivated by the Guarani (Nimmo and Nogueira 2019). After a hundred and fifty years of quasi-independence and for these same reasons, the Spanish Crown

identified Jesuits as a threat and ordered their expulsion in 1767. Following Jesuit expulsion, the *Reductions* 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 *Reductions*, and those that left after the expulsion of the Jesuits, continued to live with/in the Atlantic Forest region, where they remained relatively ‘invisible’ to European colonisers till the late 19th century (Garlet and de Assis 2009).

Until the 19th century, the Spanish colonial governments had focused most of their attention on their ‘Indian problem’ south and west 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 that was not only modelled after the US and European nations, but sought to compete with them in global markets. Indigenous peoples represented an ‘internal’ frontier described as ‘primitive’, ‘barbaric’ and ‘heathen’, living on lands void of state control and ‘proper’ agricultural or ‘productive’ labour practices. Argentineans proposed to ‘solve’ their ‘Indian problem’ through ‘civilising’ and eradication campaigns (Lublin 2021; Trincherro 2006; Taylor 2021). With the end 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 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 Europeans' 'myth of virgin nature' and indigenous peoples' as 'primitive' and 'uncivilized' for justifying their expropriation of peoples, lands and 'resources', as well as the establishment of plantations (which we latter connect with Author2's research through literature on the Plantationocene). These myths enabled Europeans 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). Such was and is the case for the Mbya-Guarani in the Atlantic Forest region (now Argentina, Paraguay and Brazil). For example, with relation to yerba mate and their trails that would later become roads, as well as many other forest and domesticated foods that compose their form of life.

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 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 Mbya. They served to justify the state's provision of land concessions to private companies and European – rather than local creole – settlers. This occurred so that they could colonise and protect Argentina's frontiers against Brazilian settlement, in order to convert 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 peak 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 Mbya, are integral to the emergence of Misiones as national territory and its consequent socioeconomic development; it's worth noting Misiones has amongst the highest poverty levels in Argentina (Kosacoff et al. 2004). However, for Mbya, European's fragmentation and replacement of the Atlantic Forest with monoculture plantations, establishment of settlements in their territories and 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 access to many of their true foods [*tembi'u katu ete*] such as various wild honeys, 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 Mbyas' impoverishment, but also the emergence of the Eurocene

State of emergency: Mbya malnutrition and their lack of 'basic needs'

Beginning in the early 1980s, Mbya emerged – similar to that of other indigenous groups across Argentina – through ratification of international treaties, political protests and constitutional reforms, as not only increasingly 'visible' in national discourses, but acknowledged as pre-existing Argentina's formation (Gordillo and Hirsch 2003).

However, it wasn't until early 2003, when the Misiones government called a 'state of emergency' that provincial – and national – resources and policies were significantly directed to Mbya in Misiones.

The 'state of emergency' was initially catalysed by the death of fourteen Mbya children, and high levels of child malnutrition 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 health care, demarcations of their territories and land titles, to be heard, if not much listened to. The Provincial Ministry of Public Health (MOPH) responded with a series of ministerial resolutions and an accompanying report, which stated Mbya communities experienced a deficit in 'basic needs', such as lack of drinking water, electricity, appropriate housing materials, toilets, education, and national identity documents, that restricted the 'eradication of diseases and recovery of patients with distinct pathologies'. In addition to guaranteeing 100 percent 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' (Ministerio de Salud Publica 2006) 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, with no mention of land ownership or of the importance of the Atlantic Forest for the Mbya, including for sourcing their foods and medicines.

In 2009, when Author1 began to visit *Ka'aguy Rupi* and follow a local doctor on her community visits, the government's delivery of food parcels and its later replacement with food coupons for household members, as well as medical visits, had been running for over four years. 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 health care, were reported to have increases in stunting from 37 percent to 42 percent between 2003 and 2008 (Orden and Oyhenart 2006), as well as increases in overweight and 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 parasites, and that any genetic components were negligible or non-existent. They also asserted that such nutritional deficiencies were likely due to dramatic changes to Mbyas' 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 in this context of circulating numbers and scientific, newspapers and government reports of their children's deaths and malnutrition, that Mbya expressed to Author1 their confusion and sometimes outright frustration, at doctors' diagnosis of their bodies as stunted and 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 our discussions and those beyond their community 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 Rupi*, observed that *Jurua* doctors used paper and more specifically, graphs to *control* [compare and evaluate] their weights and heights according to age. All of which 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, he said, like Vera and other Mbya Author1 talked to, that:

[J]ust because we are small doesn't mean we are ill [*achy*]...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.

Sara and her colleagues at the health centre Author1 visited, also expressed reservations regarding the appropriateness of the WHO standards. According to their discussions with officials from the MOPH, Mbya should be able to reach the WHO's optimal growth outcomes, and so they were obligated to continue to use them as part of their weekly medical controls.

Rather than representing Mbyas' 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 Mbyas' *teko* (or as we have more generally described, form of life) – how they exist – as a lifestyle problem, and their prescribed solution – whether explicitly or tacitly – was for Mbya to

modernise and convert to their dominant, Argentine form of life. In doing so, the Argentine state continued to negate how its colonial and ongoing national socioeconomic expansion continues to be implicated in the racialisation, expropriation and impoverishment of indigenous groups and their lands (i.e. earth as per geology), like the Mbya and the deforestation of the Atlantic Forest.

Dis-embodiment growth standards: racializing Mbyas' 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 years⁴ (Abeyá Gilardon et al. 2007). The WHO commissioned these new international growth curves in 1993, due to ongoing ethical, political and scientific concerns with the previous references sample design and their limited genetic, geographic and socioeconomic representativeness (Garza and de Onis 2004). Although the original studies that the WHO 1978 growth references were derived from were not explicitly socially Darwinian and biologically racist in discourse, their reference populations reflected the US's ongoing racial segregation. It is important to note that anthropometry as a method for scientists and policymakers, emerged in the 19th century as means for Europeans and their colonial descendants to racially classify and

⁴ Argentina was amongst a few countries (including UK, US, Venezuela, amongst others) to have used its own national growth references, which it updated in 2001. The references were derived from a sample of roughly 13,000 children from various studies in Argentina going back to 1965, which aimed at providing a reference of how the '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).

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' classes (Sandler 2021; Lasco 2020; Vargas Domínguez J. 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 Parliaments 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. Their concern for ensuring Britain and the US's industrialised growth and racial 'superiority' was also taken up by some of those within children 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, early 20th century Euro-American science and policy for 'normal' children and their associated anthropometric methods and cut offs, were inseparable from eugenics and colonial projects pursuit of racial purity, which were often enmeshed with ambitions for increased national capitalist industrial productivity and 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 standards developed from a multi-country (Brazil, Ghana, India, Norway, Oman

and the USA) study, designed to ensure its international attractiveness, concluding in its final report that ethnic and genetic variation⁵ was a not significant contributor to differences in children's growth. It aspired for an international growth standard that would 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; de Onis and Garza 2007; Machado 2018; Author1 2014). This 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).

Pragmatically, Sara and her colleagues acknowledged that while such anthropometric classifications were not always reflective of their clinical observations, they enabled some Mbya families to access food credits and powdered milk to supplement deficiencies in their diets. However, they were frustrated with their inability to deliver substantial improvements to many Mbya children categorised as stunted and malnourished. Some like Monica, a doctor who worked in neighbouring communities to *Ka'aguy Rupi*,

⁵ Author1 has not come across any definitions nor detailed discussions of ethnicity nor its assumed relation to genetic sameness and variation in WHO growth standard reports and associated publications. In addition, they deploy ethnic and national identity categories as interchangeable.

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 earth patios and allegedly not cleaning their dirty hands, as well as their unsanitary environment (particularly their lack of 'drinking water'), resulting in her inability to deliver improvements to their health, let alone achieve the WHO's broadened definition. These observations are similar to those of Machado (2018), who noted how the WHO standards served in Columbia as gateways for parents to access services to supposedly address any measured anthropometric deviations in their children's' growth, which also lead to placing blame on parents for their children's failure to achieve 'optimal' growth, similar to what Sara alludes to above.

Sara 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, like Monica, also felt frustrated and trapped. Over three years she had measured the prevalence of malnutrition and infectious diseases in the communities she attended, including *Ka'aguy Rupi*, and found no substantial improvements. She had come to realise that 'the problem was not in the provision of health care nor in the patients themselves, but in their environment.' Like Monica, she was aware how her practices as a state employee not only failed to deliver on the MOPH's promises of improvements in health, but also through not connecting them to Mbya struggles for land titles and against deforestation, contributed to undermining the peoples of *Ka'aguy Rupi* pursuing their distinct 'form of life'.

Besides Sara, none of the medical professionals Author1 talked to mentioned without prompt, Mbyas' lack of land titles or the destruction of the Atlantic Forest as central for the state of their health. A matter that Vera echoed with relation to the WHO growth graphs, which he noted frustratedly 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 on at the start of the article, this *Jurua* or more specifically, the form of life promoted through the WHO growth standards, insists they embody very different values from his and his community's *teko*, including what health, wealth and poverty are understood and practiced as.

Although the WHO standards attempt to focus attention away from racial purity and genetic differences to socioeconomic development (including sanitary environments) and assumed lifestyle differences, including 'behaviours' such as hand washing. Their prescriptive focus on 'optimal' growth does not overcome the racialisation that Vargas - Dominguez (2017) describes with relation to classification of indigenous peoples in Mexico as having inferior metabolism relative to a 'normal' standard derived from North Americans and Europeans. Rather it dictates new forms of comparing, categorising and hence ordering Mbya and their *teko* according to WHO's standard of 'optimal' bodies and growth (Yates-Doerr 2017; Author1 2014). In this way, WHO standards act as part of an emergent global 'racialising assemblage' (Weheliye 2014) that – through the Cartesian society-nature distinction – projects what it values (e.g., numbers, sanitary environment, hygiene practices, socioeconomic development), including how its particular form of life should be embodied (e.g., 'optimal' growth in weight and height by age). Any variations

in Mbyas' growth can then be localised as effects of 'inequalities' in their access to services, lifestyles choices and socioeconomic conditions that the WHO standards and the Argentine state presupposes as un/desirable. This serves to justify further state and international interventions into Mbya communities in order to 'modernise' them.

Here, possibilities of the Argentine state's engagement with Mbyas' *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 at the start of this article, on what *Jurua*'s colonial extractive and capitalist values demand Mbya to embody to be healthy and wealthy. Mbya potentially experience this as disembodiment, as it necessitates they give up on their differences, cease resisting and convert to a violently homogenising form of life that 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 as central for the realisation of their health. In essence, it demands them to become *Jurua* and accept their racialised place in Euro-American's current cosmo-geological order; the Eurocene. In the following section, we draw on Author2's research to demonstrate how the emergence of human microbiome science and its current preoccupations with indigenous peoples, are also implicated in these dis-embodiment inequalities and geological transformations, particularly through the racial and colonial formations of the Euro- and Plantationocene,

The Plantationocene as colonial origins of microbial and dietary disbalance

Since the National Institutes of Health (NIH) launched the initiative Human Microbiome Project (HMP) in 2007, the biomedical understanding of microbes in human health and disease has shifted abruptly. Pathogenic microbes are now increasingly understood to be the exception. Most microbes inhabiting the interior, surfaces, and orifices of the human body are symbiotic and commensal organisms, essential for metabolic, immunological, and even behavioural functions (Blaser 2006). Likewise, human microbiome science emphasises co-evolution and symbiosis between microbes and humans. This 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 Author 2 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, its popularity has traversed the life sciences, reaching the social sciences and humanities as well, particularly those academic fields concerned with social and cultural aspects of postgenomics such as science studies, body studies, anthropology of science, and sociology of medicine.

An increasing number of scholars are critically calling for redescriptions of ‘the Anthropocene’ proposal as the Plantationocene (J. Davis *et al.* 2019). We understand the Plantationocene as interlocking and overlapping with Grove’s Eurocene (2019), in particular the possibilities it offers to help decentre Euro-American narratives that 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 and scientists that Author 2 has studied, including between 2013 and 2017, conducting ethnographic fieldwork on a human microbiome project entitled 'Microbiomes of Homes across Cultures' (MHC) within the Plantationocene. The PI of this project, microbial ecologists María Gloria Domínguez-Bello, is a key actor in the international human microbiome research. 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, personalised microbiome project *American Gut* and sat on the scientific advisory board of the *American Microbiome Institute (AMI)*. Beyond the scientific world of microbiome research, her work has generated remarkable media attention. The numerous interviews she has given to diverse media in different countries—such as the international television channel *NTN24*, *BBC News* (Collen 2015), and *El Pais* (Criado 2015), together with the *Smithsonian Channel's* documentary *Aliens inside us* (Cohen 2013) on her microbiome expedition in the Peruvian Amazon—are only a handful of the many examples evidencing the repercussion of her research in non-specialist contexts.

Dominguez-Bello and her team hypothesised that industrialisation and associated 'modern lifestyles' 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). In contrast to what we have described in relation to Mbya in Misiones, for these scientists, modernisation was not uniformly desirable. The MHC project aimed at gathering empirical

evidence to test their hypothesis. This United States-based team of microbial scientists have gained and solidified (generously incentivised by the National Institutes of Health in the US and similar governmental agencies) 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), a notion that refers to the materialisation of historical events in biological bodies, processes and ecologies. The microbial scientists that Author 2 followed, believed that changes in food cultures, use of antibiotics, building environments, social norms and so forth – which they indistinctively and interchangeably related to processes of modernisation and westernisation - were 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 microbiomes scientist’s sense of urgency to study and sample indigenous peoples for their microbes ‘before it is too late’ (Bello et al. 2018) to Europeans’ transatlantic trade of enslaved Africans and the establishment of their New World plantations, which has increased pressure on indigenous territories and intensified shifts in their diets, forms of life and microbiomes.

Indigenous forms of life as Western lifestyle solutions

In 2016, the microbial ecologists’ team Author2 followed, 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: ‘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’. 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 (Dominguez-Bello *et al.* 2016: 2).

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 evolution of lifestyles across what they referred to as ‘westernisation/modernisation gradient’ from: a ‘remote jungle village’ with indigenous populations (Checherta) to rural settings (Puerto Almendras), mid-size cities (Iquitos) to a modern metropolis (Manaus).

The scientists referred to Checherta as an ‘uncontacted’ indigenous community in the Amazon basin, ‘untouched by Western lifestyles.’ However, missionaries had made their way to Checherta and other previously ‘uncontacted’ indigenous communities in the region over the years. 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 incursions into their territories and, unsurprisingly, distrusted foreigners. Despite this, the microbial ecologists Author2 followed insisted on the urgency of their research and asserted that more 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' (M. G. Dominguez-Bello, personal communication, January 28, 2014).

During the MHC project, scientists first collected the microbial DNA samples from humans, non-humans (including pets and objects), and homes. 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 (-80°C). The team brought with them a questionnaire to collect additional information or 'metadata', including anthropometric and dietary information, surface material, sample height (walls), cleaning frequency, and the presence of pets in the home.

Unlike classical microbiology, in which microbes were cultured in Petri dishes, purely done at the benches, the study of microbiomes is conducted in the natural environment in which microbes reside (which is literally everywhere). This approach is known as

'metagenomics', that is, '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, they follow, what in microbiome science is known as the '16S-based approach'. The 16S rRNA sequences 'serve as a proxy for the entire genome' (ibid, p. 37).

The research results of the MHC partly confirmed the teams' hypothesis. They found lowest microbial diversity in the city Manaus (except for the oral microbiome, which was lower in the rural town of Puerto Almendras) and highest in Checherta. Overall, the results showed that in 'urbanised' spaces, higher prevalence of processed foods, antibiotic use and the lack of exposure to green spaces and therefore environmental microbes (of plants, trees, other animals, air, etc.), were associated with decreases in human microbial diversity and transmission of potential pathogens, as well as increases of 'immune and metabolic disorders that have become the new disease paradigm in the industrialised world' (Ruiz-Calderon et al. 2016, 5). As emphasised by the authors, the MHC was the first and only study at the time to compare microbial diversity across an 'urbanisation/westernisation gradient'. Here we begin to see, how through seeking empirical evidence for their hypothesis driven research, microbiome scientists not only question modernity's promise of unproblematic health benefits but do so through recentring 'primitive' indigenous people, their 'pristine' microbial diversity, and 'traditional'

non-industrialised forms of life 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 migrations – or colonisation, although this term is rarely used - do not tell a story from the standpoint of those peoples who were colonised and displaced, but rather from the colonisers and their descendants, who named and ordered many millions of peoples into undifferentiated masses of ‘Native Americans’, ‘Africans’, ‘Asians’, and ‘Indo-Europeans’, as the work of feminist indigenous studies scholar Kim TallBear highlights (2013, 5). By including in the racialisation we described with relation to Mbya through the WHO anthropometrics standards of growth and ideals of health, we argue that human microbiome science, as an area of postgenomics, involves the reinscription of race in biological experimentation and knowledge about human–microbe entanglements, including through referring to microbes as ‘indigenous’ and ancient, as well as deploying particular social evolutionist narratives and categories of human differences.

The MHC team avoided explicitly invoking behaviour, 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, such as transculturation, industrialisation, modernisation westernisation, and urbanisation in their publications, often as synonyms, with limited theoretical development and differentiation, but implicit social evolutionist and modern developmentalist assumptions (Author2). However, when comparing their results in relation to other studies, they reverted to using various human categories of differences. Here it worth noting the variety of ethnic, racial, socio-economic and national categories of human differences 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 compared: the racial category of the 'Hadza' and the socio-economic category of 'industrialised'; or the study by Yatsunenکو *et al.* (2012) compares racial/ethnic categories (i.e. 'Amerindians') with nationality (i.e., US, Malawi). Another example is De Filippo *et al.* (2010), highly cited study on the impact of diet on the gut microbiome 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 up peoples (e.g., national, ethnic, racial) as symmetrical and hence, comparable. This 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. For example, as is the case in De Filippo (2010) paper or in comparing 'industrialised' populations versus 'traditional' 'Hadza' hunter-gatherers (Smits *et al.*

2017). These studies, in providing 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 absent presence (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, rural, etc (Benezra 2020, Author2).

Although racialisation is historically associated with phenotypic traits, it has never only been about skin colour. This is very much the case in many human microbiome science studies, where population categories are taken as 'transparently' reflecting socioeconomics, sociocultural practices, behaviours, lifestyles, as pre-existing 'natural' phenomena, Using the concept of population as proxy of race (i.e. including phenotypical traits) microbial science deploys genomic analysis to correlate and attribute microbes and microbial profiles to certain populations (Author2). Author2 refers to this 'biologisation', following Stefan Helmreich (2016), as the 'microbiomisation of race' (Author2), a notion which is consonant with Alexander G. Weheliye's (2014) 'racializing assemblages'. In other words, although they 'commonly rely on phenotypical differences,' such as seeking to attribute different microbial profiles to population or other categories, the primary function of microbiomisation '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).

In microbiome scientists accounts, this hierarchy at first glance can be read as their unfavourable valuation of 'industrialised', 'European' and 'Western' forms of life (i.e., lifestyles), due to their reports of increases in 'modern diseases' associated with microbial loss and extinction. This contrasts with their affirmative valuation of 'uncontacted' indigenous people, because 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, microbiome scientists research of high human microbial diversity depends, like the WHO growth standards and Argentina state practices, on a racialized 'by-nature' distinction (Gill 2021a), which through implicitly or explicitly invoking social evolutionary and development theory, casts uncontacted indigenous people – and their 'ancient' microbes – as closer to or part of pristine nature and, thus, compared to themselves – Euro-Americans and their colonial descendants – as less socioeconomically and technologically evolved, less human. Thus, scientist 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'; a selective means of engaging with and positively valuing particular indigenous peoples (like the Hadza or Checherta). More specifically, microbial scientists' spatiotemporalities of ecological nostalgia allow them to justify and rationalise contemporary indigenous people's forms of life as sites to test their hypotheses. They also enable them to propose '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; see also Obregon-Tito *et al.* 2015).

In the next section, we elaborate on how the racial and colonial obscures indigenous people's agency and rationalises the instrumentalization of their high 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 (Author2), 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). Setup by anthropology-trained entrepreneur Jeff Leach and scientist Rob Knight in 2012, both collaborators of the MHC research led by Domínguez-Bello, the project amassed the largest open access database of human microbiome samples (>11,000 'citizens') in five years. However, the majority (94%) of the samples from the 45 countries represented, were 'citizens' from the UK, US and Australian (McDonald *et al.* 2018); populations the scientists referred often interchangeable 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 samples from other 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 to, were derived from a single landmark study in the field of human microbiome conducted by Yatsunenکو and colleagues (2012), including researchers from the MHC project. There is a clear difference here in how the embodied form of the microbial samples are produced in the scientific discourse of microbiome science. In contrast to the AGP, whose participants are 'citizen scientists', those of the landmark study – its 'Malawian' and 'Amerindian Venezuelan', and the blurry category of 'Westerners' participants – are framed passively as research subjects (2012, 9), a product of the 'racialising assemblages' of microbial science: not fully human, simply 'flesh' (Weheliye 2014).

Here, Author 2 suggests that through the lens of the MHC, AGP and related studies, those who benefit from the microbiome of indigenous communities are not 'westerners' or, generally, citizens of economically rich (Western) countries, much less so Checherta or Yanomami. Rather, they are very specific portions of 'Western' societies: those from higher socio-economic backgrounds, not just because they hold cultural and economic capital to participate in personalised microbiome initiatives for example, but because, overall, such capital enables them to pursue lifestyle 'choices' (Manderson and Naemiratch 2010), such as diets and probiotics (including those potentially developed

from bioprospecting⁶ non-western biodiversity (Hayden 2003)), associated with 'cultivating' microbial diversity and therefore their overall health. Those healthy lifestyle choices necessary to cultivate microbial diversity (and therefore overall health) are not innocent, on the contrary, in neoliberal capitalism, attaining microbial diversity reproduces health disparities and 'immunitary privileges' (Author 2). In other words, as Harrison and Taren (2018, 279) have demonstrated, socio-economic deprivations and marginalisation are likely to be embodied as poor 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'⁷ 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

⁶ Bioprospection 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). 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, p. 1).

⁷ By 'impoverish Westerners' we had in mind migrant workers but also a growing precarious segment of European societies of poor and precarious yet 'enthusiastic' workers (creative industries, academia), as it is the case in countries like Spain and the United Kingdom (see Zafra 2017).

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' (2012, 3). They believed that growing and consuming their 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 'Indians' foods. Food was also a 'civilising' tool for the conquistadors. The success of their imperial expansion, depended on their ability to cultivate them in their colonies, as well as convert indigenous peoples and their lands to their use, and European lifestyles more broadly (2012, 16).

Europeans' transatlantic trade of enslaved Africans and the establishment of their New World plantations increased pressure on indigenous territories and intensified shifts in their diets, forms of life and, possibly, microbiomes. New World plantations entailed further large-scale homogenisation of landscapes through the exploitation and killing of indigenous and Africans, importation and exportation of humans, plants and other nonhuman life, deforestation of forests, and the establishment of urban settlements. They reconfigured indigenous peoples and enslaved Africans relations 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 conditions and models for configuring contemporary

Euro-American's 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 assorted ecosystems' (ibid, 7) – human microbiomes included – and those racialised as 'other.'

In sum, we suggest that the Plantationocene, its 'biology of history', reverberates and is temporally sustained in the embodied inequalities in Mbya, as much as in peoples and communities in the 'West' and elsewhere, who – under a climate of intense increased precarity and environmental degradation – have been dispossessed of the necessary conditions of possibility to sustain other – or the 'Others' – forms of life.

Conclusion

Microbiome researchers Skelly et al (2018) speculate that European colonial settlers may have been able 'to maintain some microbial stability' relative to indigenous peoples, through expropriation and transformation of their lands, in order to sustain and extend their European form 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 – although not exclusively for local consumption – are part of a state 'civilising' process, which have not only undermined Mbyas' ability to follow their *teko* [form of life] and contributed to increases reports of malnutrition, infectious and modern diseases (e.g. obesity and diabetes), but also increased state provision of health care and other interventions into their communities. These modernising interventions include antibiotics and credits for European foods that potentially reduce their microbial diversity further, and do not include

probiotics and means for gut friendly diets, let alone repatriation of their lands and reforestation of the Atlantic Forest.

Here, we can clearly see that 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, of which some microbiomes scientists, so-called modern diseases and search for microbial quick fixes are just the most recent example. Thus, when microbiome scientists pronounce that 'Native peoples must decide their own destinies,' and the destiny that the authors end their paper with, is indigenous peoples' choosing 'to remain in their lands, to live their traditional way, and to continue being the guardians of their unspoiled micro- and macro-habitats [...] for the benefit of humanity' (Dominguez-Bello *et al.* 2016, 2). We believe they, like health professionals and state policymakers, would do well to situate their work within longer, overlapping *durée* of the Euro, Plantation and other -cenes, rather than reproduce the Eurocentric myth of 'the Anthropocene'. This would mean first acknowledging how industrialised 'goods' (e.g., foods, antimicrobials, and pesticides), 'western' lifestyles choices and biologies (including their bodies, microbiomes, and ecologies in which they live) are sustained on European colonialism and capitalist exploitation of indigenous and other peoples, such as in the case of microbiome research and expropriation and deforestation of Mbya lands in Argentina. And secondly, because an individualist consumer approach sustains itself on these health disparities and immunitary privileges (Author2), rather than transform the very expropriation and commodification of forms of life, let alone the associated socioeconomic

deprivation, racial and colonial histories that have come to be embodied as stunted growth, infectious and modern metabolic disease amongst Mbya in Misiones and increasingly impoverished 'Western' peoples. In short, microbiome scientists and state policies focus on 'lifestyle choices' protects rather than challenges those who have benefited most from forms of life that have given rise to the Eurocene and Plantationcene.

In a similar way to the history of antibiotics (Landecker 2015), racial hierarchies, violent colonial expropriation and exploitation, ecological catastrophes are not removed from microbiome scientists, Argentine citizens, Mbya, Checherta, Westerners and microbes, but 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 the life and geological sciences, to recognise their embodied consequences in the present, as well as how they are implicated in the geologies of the Euro, Plantation, 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 and understands them as moving the earth too (Gill 2021b).

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