



# Governance of the gut: Healthism, control, and intervention in microbiome dietary advice

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## Abstract

*The science of the human microbiome offers new possibilities for understanding embodiment and health. Microbiome dietary advice seems to celebrate the probiotic ethos of a more-than-human human, of an ecological body open and exposed to the environment, and of microbial life performing essential bodily duties. This science has the potential to explode concepts of individualism and self-control that are fundamental to the ideology of healthism. However, through my analysis of microbiome diet books, I argue that the possibilities of human microbiome science as it is taken up in dietary advice are constrained by the logic of healthism. In so doing, this article demonstrates the pervasiveness of healthist ideology within dietary advice, including discourses that appear liberatory. Instead of freeing the human eater from managerial self-governance, microbiome diet books further entrench practices of control and responsabilization. Dietary advice for the microbiome reveals something about the salience of healthism in U.S. culture—even when confronted with a scientific paradigm that rejects the premise of individualism and control, healthist dietary advice reorients self-governance down to the microscopic scale.*

## Introduction

“Can’t Stick to That Diet? Blame Your Gut Bacteria”

“Your Gut Bacteria May Be Controlling Your Appetite”

“How Gut Bacteria Help Make Us Fat and Thin”

“Your Crappy American Diet Might Leave Your Gut Bacteria Stunted”

(Feeney, 2014; Handwerk, 2015; Wallis, 2014; Mandelbaum, 2016)

Readers interested in health and wellness would have encountered these and many other headlines about gut bacteria circulating on digital content platforms starting in 2012. These news stories and countless others have popularized scientific research into the relationship between diet, health, and the gut microbiome—or, the trillions of microorganisms that live in the human gut. This scientific research has yielded insights about the role that internal microbes play in a range of human health outcomes—from manufacturing critical chemical compounds like serotonin and Vitamin K (Yano et al.,

2015), to extracting specialized nutrients from food (Ramakrishna, 2013), and bridging neurochemical pathways between the gut and the brain (Carabotti et al., 2017). Some researchers anticipate that studying the human microbiome will lead to a deeper and more intricate understanding of human nutritional needs, including its potential therapeutic role in under- and over-nutrition (Turnbaugh et al., 2007; Donovan, 2017). Others believe that human microbiome science has ushered in an exciting new phase of personalized nutrition research that connects eating for the microbiome with individualized prescriptions for health and disease (Zmora et al., 2016). Still others wonder whether microbes may be “puppet masters” on account of the gut microbiome’s biochemical potential to shape neurochemistry via the vagus nerve, which runs from the medulla oblongata to the colon (Zimmer, 2014).

The science of the human microbiome offers a dynamic landscape of the role of microscopic life in human

health. The promises and perils of the microbiome are constitutive of the probiotic present—a term that encircles the shifting landscape of knowledge, language, and practices about how the human microbiome is being taken up in contemporary U.S. culture (Maroney, 2018a). As a concept, the probiotic present helps to name a zeitgeist of new technologies and scientific collaborations, new conceptions of human embodiment, and promissory futures of personalized medicine brought about by the science of the human microbiome. Most foundationally, the probiotic present signals the current shift in scientific and popular culture from figuring microbes as largely pathogenic to largely beneficial. This article examines the promises of the new knowledge of the human microbiome, as well as the perils of how this knowledge is being taken up in the realm of diet and health. What new ways of eating come into practice if, as human microbiome science suggests, dietary choices should be feeding “trillions” rather than the single human eater (Chu and Aagaard, 2016)? I explore this question through a discursive analysis of a collection of physician- and scientist-authored diet books.

I demonstrate first how these diet books communicate the potential of human microbiome science to conceptually challenge dominant ideas about what eating does to the body and how diet figures in overall health. Dietary advice for the microbiome seems to celebrate the probiotic ethos of a more-than-human human, of an ecological body open and exposed to the environment, and of microbial life performing essential bodily duties. The idea of a mostly microbial human body has the potential to explode the concept of an autonomous, self-regulating human by taking seriously the idea that bacteria in and on bodies are fundamental to human function. However, through my analysis of microbiome dietary advice, I argue that the possibilities of human microbiome science as it is taken up in dietary advice are constrained by the logic of healthism. Crawford (2006) explains that the pursuit of health has become one of the more “salient practices of contemporary life” and commands attention, time, and resources (p. 404). He identifies health practices in the twenty-first century as “individual security strategies” (p. 416) in which control plays a fundamental part. Healthism is an ideology in which individual responsibility and self-control are the core tenants. As a practice, healthism is inextricably linked to science and the practices of biomedicine. It is perhaps unsurprising then that any new science of human embodiment (like the microbiome) would,

in part, come to be articulated through the ideology of healthism.

I find it striking that the science of the human microbiome seems to challenge individualism and control by offering a conceptualization of the human as largely microbial. By positioning diet as a technology to intervene on the malleable microbiome, I argue that diet book authors reinforce what Guthman (2009b) terms the main “tropes of neoliberal governmentality as they relate to care of self”: moralized responsibility, individualism, and self-control, in this case, extended to gut microorganisms (p. 1126). This article demonstrates the pervasiveness of healthist ideology within dietary advice, even in discourses that appear liberatory. Dietary advice for the microbiome reveals the salience of healthism in U.S. culture—even when confronted with a scientific paradigm that rejects the premise of individualism and control, healthist dietary advice reorients self-governance down to the microscopic scale.

### Possibilities for Embodiment and Subjectivity

Rather than recognizing all microbial life as potential invaders, human microbiome science embraces an ecological view of beneficial and non-pathogenic bacteria in the human body. Scientists Justin and Erica Sonnenburg write in *The Good Gut: Taking Control of Your Weight, Your Mood, and Your Long-term Health* (2016) that human bodies are at once “bacteria-filled tubes” (p. 11), “composite organisms” (p. 11), and “homes” (p. 8) to microbial life. In the larger human microbiome science literature, human bodies are described as ecosystems, superorganisms, and dynamic environments where “the human” and its resident microorganisms are interdependent and intertwined in the project of survival. In the probiotic present, human health is distributed across human and microbial actors. Within that relationship, microorganisms are critical actors in the ongoing maintenance of human life. This perspective diverges from cultural and biomedical understandings of the human body as a self-contained, autonomous unit that—armed with a vigilant immune system poised to attack invaders—metabolizes the outside world into itself. This immunological body, articulated and critiqued by feminist anthropologist Emily Martin (1994), is portrayed in science and culture as a defended nation-state, bolstered by rigid boundaries between self and non-self. Antibiotic approaches in this body-environment paradigm use militaristic metaphors of

war-making and defense. The skin's surface represents a boundary from the outside world that, when literally breached, sets an immunological army in motion to fight microscopic invaders. In contrast, human microbiome science challenges this autonomous conception of the immunological body by conceiving of the body as a collective.

Human microbiome science suggests that human embodiment is an interconnected, dynamic relationship between the body and environment. It presents the body as permeable and affected by environmental conditions; actions like taking antibiotics, living with animals, eating unwashed produce, drinking filtered water, using anti-bacterial hygiene products, or digging in the soil can each shape which microorganisms take residence in the human body. This view of the body is akin to Alaimo's (2010) articulation of trans-corporeality, or her imagining of human corporeality as "intermeshed with the more-than-human world" (p. 2). Trans-corporeality draws focus to the material interconnections and transits between environmental actors and agents and the human body. This challenge offered by the science of the human microbiome is shared by other postgenomic sciences, including epigenetics. Guthman and Mansfield (2013) explore how epigenetics, as a new science in 2012, presents a "dynamic, iterative, and open-ended model of relations" (p. 487) between environments, bodies, and health. They argue that epigenetics had the potential to "blur boundaries between what have often been seen as ontologically separate (if interacting) objects" (p. 497) of the human body and the external environment—and they raise questions about the politics of knowledge in environmental epigenetics. Landecker (2011) addresses how epigenetics and other post(human)genomic research, including microbiome studies, are interested in the "biology of the in between" (p. 168) that happens relationally between bodies, environments, and non-humans. Landecker argues that "the great hope" of epigenetic science is the plasticity of the body that is open to the environment, and therefore "open to environmental interventions" (p. 179). As a more-than-human-genomic conceptualization of the human body, microbiome science figures the body as exposed to the environment and describes human embodiment as shared among more-than-human actors.

Along with the implications for human embodiment, scientists studying the microbiome suggest that it also has implications for human subjectivity. One of the most-cited factoids to emerge from the microbiome

scientific community was the circulation of the statistic that bacteria outnumber human cells by a ratio of at least 10:1 in the human body.<sup>1</sup> Journalist Michael Pollan (2013) further popularized the statistic that "we are only 10% human" in a widely-read New York Times Magazine article. Inspired by this powerful attestation, scientists consider how the microbiome might influence conceptions of self and new paradigms for understanding human health broadly (Rhodes et al., 2013). Jeffrey Gordon has been one of the most provocative scientists in questioning how the microbiome opens new conceptualizations of human subjectivity. In 2005, he co-authored a research proposal titled "Extending Our View of Self: the Human Gut Microbiome Initiative (HGMI)," stating that the human is a "composite of many species" and that the complete picture of human biology is incomplete without bacteria. In a later publication that "explores the microbial part of ourselves," Gordon and his research team (2007) name this genetically composite human a "supraorganism" (p. 804). Gilbert (2012) prefers the term "holobiont" to name the multicellular eukaryote (in this case, 'human') and the many symbiotic microorganisms that live in and on it. He argues that animals "cannot be considered individuals by anatomical or physiological criteria" because of the critical role that bacterial symbionts play in core metabolic function (p. 325). Recognizing the human as a "holobiont" presents a challenge to biological individualism, which has the potential to unsettle the dominance of individualism as a social value. The repositioning of the human biological being is made known and made into a figure of possibility both through new metagenomic technologies (to sequence microbial life outside of lab culture) and emergent questions about human subjectivity raised by genetic science.<sup>2</sup> Rose (2007) writes that the biological and social understandings of self are entwined in twenty-first century technoscience, and I add that human microbiome science is part of this "vital politics" (p. 3). New ecological conceptualizations of the human and microbe are shaping how human beings understand themselves as "somatic," "fleshy" individuals (Rose, 2007, p. 26) and how they will come to experience, articulate, and act.

1 This number was first articulated by D.C. Savage (1977) but re-circulated in 2006 when the National Institute of Health's Human Microbiome Project included this estimate in their reports. This statistic has since been reevaluated close to a 1:1 ratio between human and bacterial cells in the body by Sender, Fuchs, and Milo (2016).

2 Stefan Helmreich (2016) names this mostly microbial figure "Homo microbis" (p. 62).

The science of the human microbiome also seems to offer new understandings of dietary nourishment that challenge aspects of hegemonic nutrition. Hayes-Conroy and Hayes-Conroy (2013) argue that a hegemonic nutrition views the body-food relationship as standardized, reductionist, decontextualized, and hierarchical (p. 1–3). Firstly, the human microbiome subverts the idea that the human body is a machine and food is “fuel” for that machine. Landecker (2014) notes the possibilities of microbiome science to open the prospect of new forms of nutritional advice that depart from “calorie-counting self-control” and “mastery of the will” (p. 51) narratives. It offers such a possibility by using the language of “ecological husbandry” to present an “optimistic narrative” (p. 51) of nutrition and health that de-centers the existing assumption that food is “only a substrate for the things the human body will do” (p. 53). By taking microbial life forms into account, microbiome dietary advice might unsettle hegemonic paradigms of nutrition focused on the sovereign eater. Diet book authors figure microorganisms in the gastrointestinal tract as actors tasked with the responsibility for vital physiological function of the human body. In *The Good Gut* (2015), humans and microorganisms are described as locked together in an intimate symbiotic mutualism where both parties benefit through a “coevolved division of labor” (p. 21). In *Brain Maker: The Power of Gut Microbes to Heal and Protect Your Brain—for Life*, Perlmutter (2015) describes microorganisms inside the human body as “superheroes” (p. 23) and “brotherly bugs” (p. 32), who are “doing vital work under hazardous conditions” (p. 42) to secure human health. Human beings are placed in a position of responsibility for “safeguarding the extraordinary world that lives within us” (Kellman, 2014, p. 28). Pollan (2013) positions the human as a steward who should be doing more “gardening than governing” of microbial life. Microbiome dietary advice describes human beings as ecosystems whose health is deeply dependent upon heroic microorganisms in the body.

Studies of dietary effects on the microbiome join in critiques of the caloric model of nutrition and reductionist understandings of what happens when food is eaten. The caloric model of nutrition proposes that weight gain or loss can be explained by a simple calculation of calories consumed versus expended (Nestle and Nesheim, 2012). Caloric standardization has been crucial for nutrition science in providing universal metrics for health evaluation and intervention. The quantification of food into calories and as well as the

quantification of bodily health in the form of the Body Mass Index (BMI) has allowed for greater circulation of hegemonic nutrition advice and its corresponding standardized view of the body (Mudry, 2009). Watson's *The Skinny Gut Diet: Balance Your Digestive System for Permanent Weight Loss* (2014), criticizes the energy balance model explanation for health and explains that “calories in/calories out” fails to address the “foundation of wellness” (p. 7) that Watson attributes to the gut microbiota. Spector, in *The Diet Myth: The Real Science Behind What We Eat* (2015), calls for a new approach to nutrition and diet in light of the human microbiome; he writes, “Our narrowed, blinkered view of nutrition and weight as simply energy-in and energy-out phenomenon and our failure to account for our microbes have been the main reasons for the miserable failure of diets and nutritional advice” (p. 12). Spector and others conceive of the gut microbiota as a forgotten but essential aspect of human nutrition, and this neglect is responsible for the failure of nutrition science to produce accurate and effective dietary advice. Dietary advice for the microbiome makes explicit that nutrition requires the nourishment of more-than-human life forms inside the body.

## Possibilities for Control and Intervention

In suggesting that the human body is largely microbial, that vital digestive processes are dependent upon microorganisms, and that microbial chemical secretions within the gastrointestinal tract may influence human cognition, human microbiome science opens possibilities for conceptualizing bodies, diet, and health as distributed among microbial lifeforms and not solely under the control of the human eater. However, the promise of a nutritional and cultural paradigm-shift is not realized in dietary advice for the microbiome. Microbiome diet books do not depart from “mastery of the will” narratives, but rather, reinscribe concern about self-control and responsibility. Scholarship in the critical studies of nutrition has shown that control is a prevailing component of health.<sup>3</sup> As a disciplining discourse in

3 This literature is large—examples include Charlotte Biltekoff, *Eating Right in America: The Cultural Politics of Dietary Advice* (Durham, North Carolina: Duke University Press, 2013); Robert Crawford, “A Cultural Account of Health: Control, Release, and the Social Body,” in *The Political Economy of Health Care*, ed. John B. McKinley (New York: Tavistock, 1984), 60–103; Deborah Lupton, *Food, the Body and the Self* (London: Sage, 1996). For a historical perspective, see Helen Zoe Veit, *Modern Food, Moral Food: Self-control, Science, and the Rise of Modern American Eating in the Early Twentieth Century* (Chapel Hill: University of North Carolina Press, 2013).

contemporary U.S. society, healthism operates through forms of disciplinary power like self-control (Crawford, 1994; Crawford, 2006). The pursuit of health is an opportunity to demonstrate the value of self-control, which in turn, reveals the moral dimensions of health. Like all diet books, microbiome diet books give more than directions for what to eat; they communicate values, ideologies, and beliefs about subjectivity through eating. To be a “good eater” coincides with ways of being a “good person” such that dietary advice is also moral advice (Biltekoff, 2013; Coveney, 2006). Advice on how to eat is then also advice on how to live (Shapin, 2014). Practicing appropriate self-control in the name of pursuing health requires individuals to self-surveil and regulate practices like eating. When microbiome dietary advice figures health as distributed across human and microbial life, then the practices of self-control become extended beyond only human life. Despite Pollan’s (2013) proclamation that humans “garden rather than govern” their internal microbiota, in what follows I show that dietary advice for the microbiome figures human beings as the governors of microbial life. I analyze how the tropes of control and responsibility emerge in microbiome diet books through discussion of the microbial etiology of obesity and the promise of control over malleable microbiomes.

### A Microbial Etiology of Obesity

Dietary advice for the microbiome, like the bulk of contemporary dietary advice, is often centered on weight loss. The crux of Kellman’s *The Microbiome Diet* (2014) examines the microbiome as the “secret to healthy, dramatic weight loss” (p. 6), and “the ultimate cause behind all the other causes spoken about in previous diet books” (p. 150). A familiar trope in diet books generally, Kellman, Watson, Perlmutter, and others position the microbiome as the “real” cause of all manner of health issues, including obesity. To support their arguments, these dietary advice books draw from widely cited scientific papers examining the relationship between composition of the gut microbiota and weight. Several articles between 2005 and 2009 were published out of Gordon’s lab at the University of Washington, St. Louis using germ-free mouse models to understand the function of “fat” and “lean” microbiomes (Ley et al., 2005; Turnbaugh et al., 2006; Turnbaugh et al., 2009). This research sought to explain the contributing role of gut microbiota to obesity and investigate whether an “obesity phenotype” (Carroll et al., 2009, p. 395) might be transmissible through the microbiome. These

studies represent early efforts to understand microbiota formation and nutrition using the problem of fatness, effectively locating a microbial etiology of obesity. Fatness is the problem for which Gordon’s studies sought to make the human microbiome the solution. In so doing, their research (and the subsequent wave of news articles, blog posts, and diet books bolstered by Gordon’s research) is invested in the existing pathologization of fatness and specifically the rhetoric of the “obesity epidemic,” which figures fat bodies as undesirable, unhealthy, and a threat to public health (Farrell, 2011).

Microbiome dietary advice oriented toward the goal of weight loss provides a moralized microbial explanation for obesity that involves cultivating balance between “good” and “bad” bacteria in the gut. It often does this by employing the militaristic language that human microbiome science supposedly eschews; *The Microbiome Diet* (2014) instructs its readers how to “overpower the bad bacteria” in their guts, whereupon “the bad guys lose, the good guys win, and obesity is defeated” (p. 48). Research exploring the link between body size and microbiota composition focuses on the ratio of bacterial phyla *Firmicutes* and *Bacteroidetes*. In *Follow Your Gut*, Knight (2015) articulates these two categories of microscopic biological agents—those that “digest protein and dietary fiber” (p. 33)—through his analysis of microbial genes found in human fecal samples. These two groups, *Firmicutes* and *Bacteroidetes*, are mapped onto dietary and lifestyle patterns, including carbohydrate and protein consumption. This dyad of *Firmicutes* and *Bacteroidetes* is easily incorporated into the microbiopolitical work of dietary advice and “subjected to anthropocentric evaluation,” establishing one group of bacteria as “good” or “bad” based on their correlated relationship to human health outcomes (Paxson, 2008, p. 17). Perlmutter (2015) explains that these two kinds of bacteria determine a person’s risk for obesity: “Firmicutes are notoriously good at helping the body extract more calories from food and aiding in the uptake of fats, hence their association with weight gain when they dominate in the gut [...] Bacteroidetes, on the other hand, don’t have this same capacity” (p. 39). These categories of gut microbiota are likewise subjected to anthropocentric evaluation: Kellman (2014) describes how “bad” bacteria that feed on “processed sugar, refined carbs, and unhealthy fats” can overwhelm “good” bacteria and produce an inflammatory response in the gut (p. 40). Perlmutter (2015) writes that “bad or



pathogenic gut bacteria” cause disease and “switch on our body’s stress response system” (p. 30); in contrast, “good bacteria in the gut,” Perlmutter continues, “can turn off that chronic immune system response” and minimize the effects of the “bad guys” (p. 31).

These “good” and “bad” microbial life forms are then attached to “healthy” and “unhealthy” food choices and “skinny” and “fat” bodily states. Complex forms of microbial life in the body are reduced to two main categories and interactions between bodies and microbes become oversimplified when articulated as an etiology of fatness. For example, Watson (2014) uses the nicknames “‘Fat bacteria’ (Firmicutes) and ‘Be Skinny bacteria’ (Bacteroidetes)” (p. xi) for her readers. Watson’s readers are encouraged to eat in a way that promotes “gut balance” where the “beneficial microbes outnumber the potentially pathogenic ones” (p. 16)—pathogenic, in this instance, referring to “fat bacteria” rather than actual lethal pathogens. *The Good Gut* (2015), drawing from a 2013 Danish study, categorizes gut microbiomes as either “rich” or “poor” (p. 128). The “poor” microbiomes contain more known inflammation-causing species of bacteria and people harboring these “poor” microbiomes are also more likely “to be obese,” whereas people with “rich” microbiomes are less likely to gain weight over time. Watson’s euphemistic “fat” and “be skinny” bacteria, and *The Good Gut*’s “rich” and “poor” microbiomes illustrate how moralized language shapes the way that diet books explain the relationship between body weight and microbiota composition.

Advice to starve the “fat bacteria” is centered on the problem of weight loss. According to these books, fat bodies are overrun with “bad” bacteria; body size is an indicator of whether one has a “poor” microbiome. In this explanation of the microbial cause of obesity, notions of morality are intertwined with measures of bacterial phyla. The ratio of *Firmicutes* and *Bacteroidetes*—only quantitatively known through genetic sequencing—becomes the empirical grounds on which to express moral values attached to body size. The microbial cause of obesity is articulated as a problem of imbalance between “good” and “bad” bacteria. *The Microbiome Diet* repeatedly stresses that balancing the microbiome, or correcting an imbalanced microbiome, requires the reader to starve the bad bacteria while feeding the good bacteria; it is “literally a recipe for weight loss,” Kellman (2014, p. 43) writes. Balancing the microbiome is framed as the answer to failures of self-disciplined willpower

and to being freed from “hunger, cravings, and the feeling that your metabolism has simply gone out of control” (Kellman, 2014, p. 32). Watson (2014) writes repeatedly that gut balance and diet “go hand in hand” (p. 94) and that by “starving the bad bacteria,” her readers can “achieve lasting weight loss” and address the “true core” of their health (p. 3). Watson and others reassert the moral linkage between “bad” bodies/bacteria and fatness/illness and “good” bodies/bacteria and thinness/health.

Pursuing weight loss through microbial balance deepens the moralized rhetoric of personal responsibility and control—even if the books first appear to contradict dominant explanations for fatness. Throughout the dietary advice books, the authors suggest that people alone cannot and should not be blamed for their weight. Perlmutter (2015) criticizes the idea that “obese people are blamed for their own weight issues” (p. 102), when “the bad bugs in your belly must be part of the blame” for the “obesity epidemic” (p. 108). People should be “relieved,” Perlmutter writes, “to know that their weight gain might not be their fault” (p. 108). Likewise, Kellman asks his reader, “Have you ever felt that ... your body is simply not under your control?” (p. 31). The reason for this, he explains, is that “your microbiome is stronger and smarter than you are” (p. 18). Watson assures her readers, “You can’t see them and you usually can’t feel them, but your gut bacteria are in control” (p. 2). Taken together, these books appear to lighten the responsibility for fatness—usually focused on the individual human subject—by suggesting that the bad bacteria are really to blame. The failure of human willpower is rearticulated as “fat bacteria” exercising control over the human body’s metabolism. However, in the diet books, the recommended response to this potentially radical distribution of responsibility for health is to extend human control over microbial life through the eating practices of starving the bad bacteria. The eating practices suggested, particularly Phase One of *The Microbiome Diet*, are highly restrictive and practically impossible to implement.<sup>4</sup> Rather than free the individual from exercising willpower over food choices, the microbiopolitical advice to starve the bad bugs ends up

4 In the 21-day “Phase One” of *The Microbiome Diet*, Kellman advises his readers to “remove the unhealthy bacteria and the foods that unbalance the microbiome” (p. 50) including eggs, dairy, soy, corn, potatoes, gluten, grains, sugar, processed meats, iceberg lettuce, legumes, artificial sweeteners, and unhealthy fats (trans and hydrogenated).

deepening the responsabilization over dietary choices.<sup>5</sup> Human microbiome dietary advice is overwhelmingly concerned with locating the microbial etiology of fatness, and in so doing, participates in extending the pathologization and biologization of obesity. Even when responsibility for body size is shared across non-human actors, the microbiome dietary advice reaffirms individual self-control, discipline, and dietary restriction.

### Manipulating Malleable Microbiomes

Any dietary intervention on the microbiome is made possible through the discourse of malleability. Microbiota malleability—the capacity of gut microorganisms to rapidly respond to environmental conditions through cell division or nutrient extraction—is framed by the diet book authors as a distinguishing characteristic of the microbiome. Authors frequently contrast the potential of the malleable microbiome with the unrealized promises of health intervention through the human genome. “Unlike the unyielding human genome,” Sonnenburg and write, “the gut microbiome offers more flexibility and is an effective avenue to improve health or treat disease” (p. 163). Comparisons between the “first” human genome and the “second” microbial one appear throughout the scientific literature and emphasize the unique malleability of the microbiome: it is “highly malleable and sensitive to change” and especially “plastic and volatile early in life” (Mika et al., 2015); it is “flexible” and can be “modulated by foods and drugs” (Zhao and Shen, 2010); or it serves as a “manipulatable lever to improve human health and to treat or prevent disease” (Sonnenburg and Sonnenburg, 2014). Microbiome dietary advice asserts that the “tremendous plasticity” of the microbiome allows you to “rebalance your microbiome through a healthy diet” and gain “tremendous control over our health, appetite, weight, and metabolism” (Kellman, 2014, p. 16). Microbiome diet books marvel at the malleability of the gut microbiome—insofar as it provides an opportunity to enact deeper control over human and microbial lives. In this way, Mansfield (2018) notes in her study of postgenomic sciences that when embodiment is understood as “permeable, not fixed, the health of both individuals and populations is presented as something we can manipulate: it is within our control” (p. 216). The

permeable and malleable human-microbial body is put in service of healthist interventions to optimize human bodies (via weight, appetite, and metabolism).

Diet book authors argue that the most effective path for manipulating the malleable microbiome is through dietary interventions. Eating is figured as a way to control microbial plasticity toward optimized human health. For the Sonnenburgs (2015), diet is a “powerful and accessible tool that enables everyone to take some control in programming (or reprogramming) the microbes that govern so much of our biology” (p. 185) and to “exert control over the genetic hand we’ve been dealt” (p. 209). Because the gut microbiota “controls aspects of our health,” they write, “we can exert control over these microbes” (p. 112–113) by manipulating microbially malleability through the technology of diet. Diet becomes a technology of life, in the expansive sense suggested by Rose (2017), who argues that technologies are not only equipment and techniques, but they demonstrate certain ways of thinking and particular entanglements of social relations and ideas as they are “oriented toward the goal of optimization” (p. 17). New technologies of life make it possible “to refigure—or hope to refigure—vital processes themselves in order to maximize their functioning and enhance their outcomes” (p. 18). Within microbiome diet books, diet becomes a technology of optimization because it is figured, by diet book authors, as an intervention on the vital processes of microorganisms themselves.

By manipulating malleable microbiomes through the technology of diet, eaters are made responsible for controlling the environment of their bodies to ensure that certain “good” microbes are fed. Advice to “feed the good” bacteria is part of a strategy to cultivate microbial diversity in the gut as a preventative health measure and as a way to repair the deleterious effects of the Western diet. *Sonnenburg and Sonnenburg (2015) explain that Americans’ gut bacteria “belong on the endangered species list” on account of consuming the “overly processed Western diet” (p. 5). Perlmutter (2015) adds that consuming a typical Western diet (low in fiber, high in sugar) produces a “Westernized gut microbiome” defined by “little diversity and too many types of bacteria that feed fat cells” (p. 111). The Sonnenburgs (2015) further argue that increasing microbial diversity through “improvement in the food we provide to our gut-resident-microbes” is the best way to “reverse the Western microbiota extinction event occurring in the gut” (p. 112). Eating to promote gut microbial diversity through increased fiber consumption is as an*

5 Harris Solomon (2016) describes a similar process among post-gastric-bypass patients who, having hoped to escape the mental stress of exercising willpower over food choices through metabolic surgery, find that attachments to willpower are deepened through new post-surgery dietary restrictions.

optimization technology for repairing the damage of the Western diet.<sup>6</sup> The narrative of microbial diversity loss assumes that microbes are “dying off” inside the body because of the “Western diet,” but rather than draw concern to practices of industrialization and technologization of the food system—which has systematically removed dietary fiber—microbiome diet advice internalizes the problem in the human body.

Restoring microbial diversity is figured as a personal responsibility achieved through dietary interventions. So, in addition to providing lists of foods to avoid or remove, the microbiome diet books equally recommend specific eating practices intended to cultivate microbial diversity. Good microbiota health is described throughout the dietary advice books as the presence of microbial diversity and the concept emerges as a metric to assess gut—and by extension, human—health. Kellman (2014) writes, “the more diverse your microbiome [...] the healthier you are likely to be *and* the better you will be able to control unwanted weight gain” (p. 12). In *Follow Your Gut*, Knight (2015) explains that low diversity gut microbial communities have been associated with disease states, but that in “microbial diversity, there is strength” (p. 51). Within the microbiome dietary advice, microbial diversity paradoxically identifies a problem and offers the solution that “lacking” gut microbiota diversity is a diagnostic of a dysbiotic gut environment from which poor health manifests and cultivating gut microbiota diversity is the cure, secured through the health technology of diet. Spector (2015) suggests his readers think of diversity as both gut microbiota and food choices. “As a measure of good diversity,” he writes, “I suggest aiming for ten to twenty food types, per week, that are good for your microbes” (p. 265). This healthiest solution of diversity includes consumption of diverse microorganisms themselves (in the form of probiotic and fermented foods) as well as food components that are meant to “feed” the microbes, like dietary fiber.

Sonnenburg and Sonnenburg (2015) urge readers to proactively intervene on their gut microbiota in order to cultivate “good” microbiomes. Their book—*The Good Gut*—asks and answers the question of how to cultivate a “good” diverse gut microbiome and lays out two options for improving microbiota diversity: the first option is acutely probiotic in its orientation to increase

exposure to “good” bacteria by eating fermented foods and refrain from using antimicrobial cleaning products. The second option for cultivating microbial diversity requires the human eater to consume *pre*biotics—specifically “microbiota accessible carbohydrates” or “MACs” (p. 113). MACs are components of dietary fiber that gut microbes consume, and the Sonnenburgs believe that eating more MACs provides direct nourishment to the microbiota, which leads to long-term diversity in the gut. Advice to feed the microbes directly through consumption of prebiotics (whether in the form of dietary fiber or functional food products) invites the reader/eater to see their consumption as a practice of feeding others, to the desired end of increased microbial diversity.

Microbiome dietary advice conceives relations between the human body and microorganisms through the lens of health and a set of practices that reaffirm self-control, down to the microscopic scale. To improve microbiota diversity and achieve a “rich” microbiome that protects against weight gain and other undesired health outcomes, microbiome dietary advice calls upon the reader to make “good” microbes live by taking control over them. Feeding good microbes is a probiotic intervention to manage the ecology of the gut in a way that secures a promise of future health. Diet is the technology for manipulating the environmental conditions of the gut so that certain microbes are “fed.” Probiotic interventions on the microbiome figure diet as a tool for enacting environmental forms of governance of self, but also over microbial lives. Cultivating diversity in the gut requires a shift in eating patterns, but also a shift in subjectivity so that the human reader learns to see themselves as responsible for “feeding” gut microbiota. To do this effectively, the human eater must learn to make the “right” dietary choices to foster a diversity of “good” microbes. In this way, microbiome dietary advice reveals how the permeable human-microbial body is exposed to both new forms of intervention and new forms of responsibility and vulnerability in the shifting name of health.

## Conclusion

The science of the human microbiome is celebrated among scientists and humanists as ushering in a new paradigm in understanding what the human body is, what human health is composed of, and ultimately, how the human relates to and makes relations with the more-than-human world. Microbiome diet books

6 See Hobart and Maroney (2019) for a discussion of how optimization technologies (like fecal transplants) meant to restore “missing” microbes to the Western gut emerge from legacies of colonial science and extraction.



celebrate the human-microbial body and valorize the function of microbial life in the human body to the extent that it unsettles hegemonic understandings of nutrition and health. But, when I analyzed the dietary advice in these books, I found further entrenchment of the ideology of healthism through practices of control and responsabilization. Advice to “eat for your microbes” reasserts normative ideas of the autonomous individual engaged in the work of managerial self-governance. The interconnected and symbiotic relation between human body, environment, and microbiota is positioned in the dietary advice as an opportunity for control and calculated manipulation toward benefit for the human host. The “vulnerable, unbounded body” that Mansfield (2018b) has recognized in post(human)genomic sciences, like the microbiome, is a body made even more open to intervention. Indeed, microbiome dietary advice shows how recognition of the distributed multiplicity of the human body reaffirms how health and well-being is (or should be) brought under human control. To be against healthisms in a post-human-genomic moment thus requires a critical eye to how discourses of openness and interrelation can also be opportunities for further intervention.

Healthism in the probiotic present is marked by an ecological conception of human embodiment that embraces the multi-species human while continuing an investment in individualism and control. Human microbiome scientists are engaged in a “broader environmentalist vision” of uncovering the complex interrelations between human beings and microorganisms while also suggesting ways to manage and manipulate those lively relations (Paxson and Helmreich, 2013, p. 18). This analysis of the salience of healthist ideology in microbiome dietary advice reveals a form of biopolitics that serves to advance neoliberal responsabilization and care of the self but extended to microbial life in the “ecosystem” of the gut. Ecological discourses of health and nutrition require a critical analysis of the actual practices and relationships that are being expressed. The ecological conception of life shared among human microbiome science and attendant dietary interventions are situated in the broader emergence of “environmental modes of biopower” that have accelerated in the twenty-first century but have their roots in colonialist ecological management (Lorimer, 2015, p. 40).

Microbiome dietary advice misses a powerful opportunity to advance ecological models of nutrition and health that are not centered on control and

management (Hayes-Conroy, 2014). Instead of engaging the gut microbiota as a way to extend the web of relations between digestion, nourishment, health, and environment (Maroney, 2018b), microbiome diet books intensify the self-making work of dietary advice. The kind of self discursively produced by microbiome dietary advice—even when figured as a super-organism—is emblematic of the larger North American cultural values that shape dietary advice generally, such as individualism, self-control, and responsibility for one's own health.

## References

- Alaimo, S. (2010). *Bodily natures: science, environment, and the material self*. Bloomington: Indiana University Press.
- Biltekoff, C. (2013). *Eating right in America: the cultural politics of dietary health*. Durham: Duke University Press.
- Carabotti, M., Scirocco, A., Maselli, M. A., & Severi, C. (2017). The Gut-brain Axis: Interactions between Enteric Microbiota, Central and Enteric Nervous Systems. *Annals of Gastroenterology*, 28(2), 203–209.
- Carroll, I. M., Threadgill, D.W., & Threadgill, D.S. (2009). The Gastrointestinal Microbiome: A Malleable, Third Genome of Mammals. *Mammalian Genome: Official Journal of the International Mammalian Genome Society*, 20(7), 395–403.
- Chu, M.D & Aagaard, K. (2016). Microbiome: Eating for Trillions. *Nature*, 532(7599), 316–317.
- Coveney, J. (2006). *Food, morals and meaning: the pleasure and anxiety of eating*. New York: Routledge.
- Crawford, R. (2006). Health as Meaningful Social Practice. *Health: An Interdisciplinary Journal for the Social Study of Health, Medicine, and Illness*, 10(4), 401–420.
- Crawford, R. (1994). The Boundaries of the Self and the Unhealthy Other: Reflections on Health, Culture and AIDS. *Social Science Medicine*, 38(10), 1347–1365.
- Crawford, R. (1984). A Cultural Account of Health: Control, Release, and the Social Body. In *The Political Economy of Health Care* (pp. 60–103). New York: Tavistock.
- Donovan, S. M. (2017). Introduction to the special focus issue on the impact of diet on gut microbiota composition and function and future opportunities for nutritional modulation of the gut microbiome to improve human health. *Gut Microbes*, 8(2), 75–81.
- Farrell, A.E. (2011). *Fat shame: stigma and the fat body in American culture*. New York: New York University Press.
- Feeney, N. (2014, August 17). Can't Stick to That Diet? Blame Your Gut Bacteria. *Time*. Retrieved from <http://time.com/3131789/gut-bacteria-eating-habits-mind-control/>

- Gilbert, S. F., Sapp, J. & Tauber, A.I. (2012). A Symbiotic View of Life: We Have Never Been Individuals. *Quarterly Review of Biology*, 87(4), 325–341.
- Gordon, J. I., Ley, R.E., Wilson, R., Mardis, E.R., Xu, J., Fraser, C.M., & Relman, D.A. (2005). Extending Our View of Self: the Human Gut Microbiome Initiative (HGMI). <http://www.genome.gov/10002154>.
- Guthman, J. (2009). Teaching the Politics of Obesity: Insights into Neoliberal Embodiment and Contemporary Biopolitics. *Antipode* 41(5), 1110–1133.
- Guthman, J. & Mansfield, B. (2013). The Implications of Environmental Epigenetics: A New Direction for Geographic Inquiry on Health, Space, and Nature-society Relations. *Progress in Human Geography*, 37(4), 486–504.
- Handwerk, B. (2015, November 24). Your Gut Bacteria May Be Controlling Your Appetite. *Smithsonian*. Retrieved from <https://www.smithsonianmag.com/science-nature/gut-bacteria-may-be-controlling-your-appetite-180957389/>
- Hayes-Conroy, J., Hite, A., Klein, K., Biltekoff, C. & Kimura, A.H. (2014). Doing Nutrition Differently. *Gastronomica*, 14(3), 56–66.
- Hayes-Conroy, J., & Hayes-Conroy, A. (2013). Doing nutrition differently: critical approaches to diet and dietary intervention. New York: Routledge.
- Helmreich, S., Roosth, S., & Friedner, M. (2016). *Sounding the limits of life: essays in the anthropology of biology and beyond*. New Jersey: Princeton University Press.
- Hobart, J.H., & Maroney, S. (2019). On Racial Constitutions and Digestive Therapeutics. *Food, Culture & Society*, 22(5), 576–594.
- Kellman, R. (2014). *The microbiome diet: the scientifically proven way to restore your gut health and achieve permanent weight loss*. Boston: De Capo Press.
- Knight, R. (2015). *Follow your gut: the enormous impact of tiny microbes*. New York: Simon & Schuster.
- Landecker, H. (2014). The Dietary Ecology of the Microbiome. *Gastronomica*, 14(3), 51–53.
- Landecker, H. (2011). Food as Exposure: Nutritional Epigenetics and the New Metabolism. *BioSocieties*, 6(2), 167–194.
- Ley, R., Bäckhed, F., Turnbaugh, P., Lozupone, C.A., Knight, R.D., & Gordon, J.I. (2005). Obesity Alters Gut Microbial Ecology. *PNAS*, 102(31), 11070–11075.
- Lorimer, J. (2015) *Wildlife in the anthropocene: conservation after nature*. Minneapolis: University of Minnesota Press.
- Lupton, D. (1996). *Food, the body and the self*. London: Sage.
- Mandelbaum, R.F. (2016, December 29). Your Crappy American Diet Might Leave Your Gut Bacteria Stunted. *Gizmodo*. Retrieved from <https://gizmodo.com/your-crappy-american-diet-might-leave-your-gut-bacteria-1790595730>
- Mansfield, B. (2018a). A New Biopolitics of Environmental Health: Permeable Bodies and the Anthropocene. In *The SAGE Handbook of Nature: Three Volume Set* (pp. 216–230). London: Sage.
- Mansfield, B. (2018b). From the Commons to the Body to the Planet: Neoliberalism/ materiality/ socationatures. *Environment and Planning E: Nature and Space*, 1(1–2), 58–61.
- Maroney, S.R. (2018a). *Eat For Your Microbes: Reimagining Diet, Health, and Subjectivity in the Probiotic Present*. (Unpublished doctoral dissertation). University of California, Davis.
- Maroney, S.R. (2018b). Sandor Katz and the Possibilities of a Queer Fermentive Praxis. *Cuizine: The Journal of Canadian Food Cultures*, 9(2), [doi.org/10.7202/1055217ar](https://doi.org/10.7202/1055217ar).
- Martin, E. (1994). *Flexible bodies: tracking immunity in American culture—from the days of polio to the age of AIDS*. Boston: Beacon Press.
- Mika, A., Van Treuren, W., González, A., Herrera, J.J., Knight, R., & Fleshner, M. (2015). Exercise Is More Effective at Altering Gut Microbial Composition and Producing Stable Changes in Lean Mass in Juvenile Versus Adult Male F344 Rats. *PLoS ONE*, 10(5), e0125889.
- Mudry, J. (2009). *Measured meals: nutrition in America*. Albany: State University of New York Press.
- Nestle, M., & Nesheim, M. (2012). Why calories count: from science to politics. Berkeley: University of California Press.
- Paxson, H. (2008). Post-Pasteurian Cultures: The Microbiopolitics of Raw-Milk Cheese in the United States. *Cultural Anthropology*, 23(1), 15–47.
- Paxson, H., & Helmreich, S. (2013). The Perils and Promise of Microbial Abundance. *Social Studies of Science*, 44(2), 165–193.
- Perlmutter, D. (2015). *Brain maker: the power of gut microbes to heal and protect your brain—for life*. New York: Little, Brown and Company.
- Pollan, M. (2013, May 15). Some of My Best Friends Are Germs. *New York Times Magazine*. Retrieved from <https://www.nytimes.com/2013/05/19/magazine/say-hello-to-the-100-trillion-bacteria-that-make-up-your-microbiome.html>
- Ramakrishna, B.S. (2013). Role of the Gut Microbiota in Human Nutrition and Metabolism. *Gastroenterology and Hepatology*, 28(4), 9–17.
- Rhodes, R., Gligorov, N., & Schwab, A.P. (2013). *Human microbiome: ethical, legal, and social concerns*. Oxford: Oxford University Press.
- Rose, N. (2007). *The politics of life itself: biomedicine, power, subjectivity in the twenty-first century*. Princeton: Princeton University Press.
- Savage, D.C. Microbial Ecology of the Gastrointestinal Tract. *Annual Review of Microbiology*, 31, 107–133.

- Sender, R., Fuchs, S., & Milo, R. (2016). Revised Estimates for the Number of Human and Bacteria Cells in the Body. *PLOS Biology*, 14(8), e1002533.
- Shapin, S. (2014). 'You are what you eat': historical changes in ideas about food and identity. *Historical Research*, 87(237), 377–392.
- Solomon, H. (2016). *Metabolic living: food, fat, and the absorption of illness in India*. Durham: Duke University Press.
- Sonnenburg, J.L., & Sonnenburg, E.D. (2016). *The good gut: taking control of your weight, your mood, and your long-term health*. New York: Penguin.
- Sonnenburg, J.L., & Sonnenburg, E.D. (2014). Starving Our Microbial Self: The Deleterious Consequences of a Diet Deficient in Microbiota-Accessible Carbohydrates. *Cell Metabolism*, 20(5), 779–786.
- Spector, T. (2015). *The diet myth: the real science behind what we eat*. London: Weidenfeld & Nicolson.
- Turnbaugh, P.J., Hamady, M., Yatsunenko, T., Cantarel, B.L., Duncan, A., Ley, R.E., Sogin, M.L., Jones, W.J., Roe, B.A., Affourtit, J.P., Egholm, M., Henrissat, B., Heath, A.C., Knight, R., & Gordon, J.I. (2009). A Core Gut Microbiome in Obese and Lean Twins. *Nature*, 457(22), 480–485.
- Turnbaugh, P.J., Ley, R.E., Hamady, M., Fraser-Liggett, C.M., Knight, R., & Gordon, J.I. (2007). The Human Microbiome Project: Exploring the Microbial Part of Ourselves in a Changing World. *Nature*, 449(7165), 804–810.
- Turnbaugh, P.J., Ley, R.E., Mahowald, M.A., Margrini, V., Mardis, E.R., & Gordon, J.I. (2006). An Obesity-associated Gut Microbiome with Increased Capacity for Energy Harvest. *Nature*, 444(21/28), 1027–1031.
- Veit, H.Z. (2013). *Modern food, moral food: self-control, science, and the rise of modern American eating in the early twentieth century*. Chapel Hill: University of North Carolina Press.
- Wallis, C. (2014, June 1). How Gut Bacteria Help Make Us Fat and Thin. *Scientific American*. Retrieved from <https://www.scientificamerican.com/article/how-gut-bacteria-help-make-us-fat-and-thin>
- Watson, B. (2014). *The skinny gut diet: balance your digestive system for permanent weight loss*. New York: Harmony Books.
- Yano, J. M., Yu, K., Donaldson, G. P., Shastri, G. G., Ann, P., Ma, L., & Hsiao, E. Y. (2015). Indigenous Bacteria from the Gut Microbiota Regulate Host Serotonin Biosynthesis. *Cell*, 161(2), 264–276.
- Zhao, L., & Shen, J. (2010). Whole-body Systems Approaches for Gut Microbiota-Targeted, Preventive Healthcare. *Journal of Biotechnology*, 149(3), 183–190.
- Zimmer, C. (2014, August 14). *Our Microbiome May Be Looking Out For Itself*. New York Times. Retrieved from <https://www.nytimes.com/2014/08/14/science/our-microbiome-may-be-looking-out-for-itself.html>
- Zmora, N., Zeevi, D., Korem, T., Segal, E., & Elinav, E. (2016). Taking it Personally: Personalized Utilization of the Human Microbiome in Health and Disease. *Cell Host & Microbe*, 19(1), 12–20.

## Author bio

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