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Thinking with Termites about Fractious Futures for Fecal Microbiota Transplantation in the United States

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Abstract

Fecal microbiota transplantation (FMT) involves transferring fecal material from a donor to a recipient. To think about more expansive and inclusive possible futures for FMT, in particular for people in the United States, it may be helpful to think with termites—their communities, the communities within them, and the community they may inadvertently provide to humans. This essay thinks with termites to explore several frictions in FMT in the US that shape its possible futures. The first friction explored is that FMT is human and (has always been) more than human, discussing both termites as ambivalent kin and the struggles of the regulation to understand FMT as transplantation. The second friction is that the curative imagination for FMT is discordant; examining medical researcher and practitioner discussion of potential FMT donor criteria and potential recipients illuminates the inconsistent insistence that people and guts are both malleable and fixed. FMT renders some donors and microbe communities as good or bad, healthy or sick, donor or recipient, but it's much more complicated. The third friction is that FMT may be over, with recent US Food and Drug Administration approvals of pharmaceuticals that claim to supplant FMT. Thinking with other life forms that use and perform their own kinds of FMT, such as termites, may help inspire alternative, more inclusive futures for FMT.

Keywords

transplants, feces, fecal microbiota transplantation (FMT), termites, microbes

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Introduction

Fecal microbiota transplantation (FMT) involves transferring fecal material from a donor to a recipient. The practice has existed in the United States for decades (Eiseman et al. 1958), and is considered a highly effective and safe medical treatment (Kelly et al. 2021), especially for a small but growing number of people with contagious, recurring, and/or drug-resistant bacterial infections (Bakken et al. 2011). And yet FMT in the US may be becoming less available to those who want or need it— while simultaneously being discussed as a potential cure for conditions and people who may not want or need that. To think about more expansive and inclusive possible futures for FMT, in particular for people in the US, it may be helpful to think with termites—their communities, the communities within them, and the community they may inadvertently provide to humans.

This essay thinks with termites to explore several frictions in FMT in the US that shape its possible futures, using "gut feminism" (Wilson 2015) as a provocation, in this case literally about guts and gut health. How can feminist theory take biology seriously without "swallow[ing] biological claims whole" (Wilson 2015, 5)? The first friction is that FMT is human *and* (has always been) more than human. While much has been written on the microbial worlds within people, the contribution here is to show the messy, "more-than-human entanglements" (Giraud 2019) of FMT extend much further, with termites as "ambivalent insects" (Onaga and Reis-Castro 2024) and FMT a "technology as conduit" that makes them kin (Wolf-Meyer 2020). Here, the changes in US Food and Drug Administration (FDA) regulation that struggles to categorize FMT or understand it within the "transplantation paradigm" (Khoruts, Hoffman, and Palumbo 2019) are also discussed. The second friction is that the curative imagination for FMT is discordant: (almost) everyone is deemed unhealthy and in need of FMT while (almost) no one is considered healthy enough to be a donor. Examining medical researcher and practitioner discussion of potential FMT donor criteria and potential recipients illuminates the inconsistent insistence that people and guts are both malleable and fixed. This paradox reflects "biocultures" (Ehlers and Krupar 2019) of health in the US that individualize health and posit specific bodies and guts as problems. The third friction is that this eugenicist vision for FMT means its use and future in the US is quite constrained, even for the people who need it the most. FMT may be over, with recent US FDA approvals of pharmaceuticals that claim to supplant FMT. Yet more expansive views of health would make it easier for people who need (or want) FMT to get it, without pathologizing everyone with non-normative guts or bodyminds, thinking with FMT as "visceral prosthetic" (Shildrick 2022) and termites in turn as "prosthetic community" (Wheeler 2017).

FMT Is Human *and* More than Human

The goal of FMT is to transplant the community of microbes within a person's intestines, with the idea that many are found in feces. A successful transplant therefore is not achieved simply from the transfer of stool from one person to another, but rather with the establishment of a new microbiome of the recipient. The *T* in *FMT* is intentional, and a signal that this process is best viewed as part of the "transplantation paradigm" (Khoruts, Hoffman, and Palumbo 2019, 484). Doctors involved in the naming purposely including *transplantation* to reflect the complexity of the gut microbiome and process of engrafting donor bacteria (Bakken et al. 2011). A physician-scientist considered a leader in studying and practicing FMT, Alexander Khoruts, has even called fecal matter the "microbial organ" when interviewed (Dubner 2011). Aligned with the transplantation paradigm, FMT also raises questions common within the field of solid organ transplantation about identity, self/other, and impacts on family relations (McCormack and Shildrick 2021; Metselaar and Widdershoven 2017). Margrit Shildrick, for instance, reflects on stem cell therapies as an "enduring transmutation for both the recipient and the donor, and for all those with whom they interact" (Shildrick 2022, 145), and the same can be said for sharing gut microbiomes.

The human gut microbiome is estimated to be hundreds or thousands of species of microbial organisms and as many as one hundred trillion individuals (Gill et al. 2006). The idea of the microbiome, or microbiota as a unit itself, rather than the hundreds or thousands of different types of organisms potentially totaling in the trillions, is a decades old concept in microbiology (Prescott 2017). The later emergence of metagenomics as a field and approach enabled a critical shift in understanding a microbial community, from culturing organism types individually to genomically sequencing them as a group without the need for further identification (Benezra, DeStefano, and Gorden 2012, 6378). Fecal matter has played a critical role in this turn. Much of what scientists know so far about gut microbes is from sequencing fecal samples (Benezra 2023, 138). As gut microbiota and their genomes are microscopic, technological changes in computation and visualization have also facilitated new representations and understandings of human insides, which Catherine Waldby (1997) connects to the Human Genome Project while tracing the Visible Human Project. Jessica Houf has followed evolving discourses surrounding FMT in the US: from notions of waste within medicine, to anxieties about unknown harms from transferring stool, to the enthusiasm for the potential of microbes in that stool. In each instance, the human microbiome functions as a boundary object also doing boundary work (Houf 2021). Doctors, scientists, and FMT donors and recipients have disparate interests in and understandings of feces, such as a source of illness or cure, ordinary or disgusting. These stakeholders' perspectives may not evenly overlap, but the microbiome is urgent to all of them and the boundary work performed by the microbiome "resulted in the transformation of fecal transplants into FMTs" (Houf 2021, 300).

The human microbiome has also become a generative area of research and exploration for humanists and social scientists (e.g., Greenhough et al. 2020; Holl and Bossert 2002). There's a growing acknowledgment that microorganisms may have agency, and that multispecies collaboration will mean moving beyond understanding them only through binaries—good/bad, living/dead, growing/dying. As Aaron Bradshaw writes, in their case researching and writing on collaborating with plastic-eating microbes, microorganisms may be cultured and cultivated by people, "yet [they are] able to interact with other microbial species through unknown exchanges and interactions" (2022, 54). Kateřina Kolářová and colleagues focused on the experiences of people with irritable bowel disease or "crip guts" cooperating with and caring for the microorganisms within them in ways that are attuned to "more than human relationality" and "community/multiplicity" (Kolářová, Stöckelová, and Senft 2023, 1254). Alice Beck's (2021) work interviewing recipients of FMT may support this in-between space, with recipients discussing their microbiome as a companion animal that they have become aware of and that they feed and nurture.

Thinking with termites is different from thinking with gut microbes. At the same time, there are important parallels and intersections between these populations of insects and populations of gut microbiota. Termites are unlikely "companion species" (Haraway 2002) like dogs, in the sense that many humans in the US are not mutually dependent on them. Termites refers to many different insects, an estimated three thousand of them, under the banner of infraorder Isoptera, now grouped with cockroaches in the order Blattodea (Constantino 2021). They are small, squishy, and (eu)social, with their exact body traits (color, wings, jaws) varying by their roles within the nest. In fact, termites can cause extensive damage to people's homes and people may actively not want to be in close relation with them. As such, they may be "unloved others" (Bird Rose and Van Dooren 2011), disliked and targeted for death. They may also be a kind of "estranged companions" like bedbugs (Hollin and Giraud 2022), in that where and how people in the US (dis)engage with termites is shaped by very specific histories and politics. Who gets to own a house in the US is shaped by past and present factors, including settler colonialism and Indigenous land theft, anti-Black racist housing covenants, redlining, and sexist requirements for male loan and mortgage co-signers. Homeowners may be more likely to closely encounter and intentionally engage termites. Renters may also encounter termites, but often have no control over management or removal choices by landlords—putting tenants and termites together, but also not to mutual benefit. Lack of housing, housing instability, and eviction are also higher for BIPOC and marginalized communities in the US, shaping who encounters termites and where.

Much of what is known about termite guts is specifically from scientists studying them, in order to eradicate them. Over the past century, termites were some of

the domestic objects of chemical extermination for pests that attack human environments, labeled harmful and enrolled in the logics and "technoscientific practices of eradication" (Giraud 2021, 38). Specific kinds of termites can be identified by analyzing excreted fecal pellets (Haverty et al. 2005); the same pellets can be tested to see if the termites are currently alive (Lewis et al. 2010). Identifying termites and their life status is to aid the commercialization of extermination. In the process, termites and their gut microbes have become perhaps the most studied symbiotic relationship (Scharf and Peterson 2021). As Lisa Onaga and Luísa Reis-Castro (2024) have written, moth larvae and mosquitoes have also been studied by scientists as "tools and targets" in service of eradicating those same organisms. They offer "ambivalent insects" as a way to move beyond binary categories while examining insect-human relations in the history of science. Termites are an ambivalent insect that we can learn from: they are *ambivalent kin* in FMT.

Figure 1: People and termites alike have microbial communities within their bodies, including different parts of their digestive systems. Both also can, and do, share their microbes with others via fecal transplantation. Illustration by Mary Nyugen and Liliana G. Ramos, and used with permission.

What can be learned from termite kin, who also use FMT? FMT can be considered a kind of "technology as conduit" (Wolf-Meyer 2020, 235), making kin of donors and recipients who may never even meet each other. Haraway (2012) links herself and her dog Cayenne as "cyborg littermates" through their respective estrogen

hormone replacements. Bovine and human bodies are similarly brought together in the work of Rebecca Howes-Mischel and Megan Tracy exploring breastmilk microbes, showing that attending to "*maternal microbis*" (2023) can reveal connections between reproductive bodies across species lines. Thinking with termites about guts, microbes, and FMT can do similar work.

We are, in fact, somewhat like termites. Like people, termites have different parts of their digestive tracts—fore- and hind-gut in termites, small and large intestines in people. Also like people, their guts house and rely on specific, complex communities of prokaryotic (e.g., bacteria) and eukaryotic (e.g., protozoa) microbial communities to digest their food. Many kinds of insects have gut microbes that enable their digestion, including bees, beetles, and stink bugs (Ohbayashi, Mergaert, and Kikuchi 2020). Similarly, termite guts are not homogenous, but thought to be at least three distinct micro-environments each with their own microbiota—and each of those thought to have their own symbionts! (Karasov and Martínez del Rio 2007). Termites cannot digest wood directly but their endosymbionts can. This is similar to how breastmilk for human babies contains nutrients that cannot be digested by the gut microbes—but not the human baby (Zivkovic et al. 2011). Additionally, the metagenomics shift that has radically transformed the study of humans has also done the same for termites. Termites and their gut microbes are the longest-studied association of insects and symbionts by biologists, beginning over a century ago (Scharf and Peterson 2021). Several termite genomes, metagenomes—and now gut metagenomes— have been sequenced, and these technological advances have been credited with a changed understanding of the importance and interdependence of termites as host-symbiont systems (Scharf and Peterson 2021). Yet a century of scientists studying termites and their microbes does not necessarily mean that the mechanisms of using fecal matter to share microbes for immune protection are well understood. For example, while scientists have conducted experimental manipulations of termite fecal contents and exchanges, one study was not able to experimentally cause social immunization of a group of termites with fecal material sharing (Mirabito and Rosengaus 2016). In this way, humans and termites are also similar—with gut communities eluding easy categories and mechanistic understanding.

FMT Is Transplant Medicine

The abundance and complexity of the more-than-human microbial assemblages inherent to FMT has led to debate in the US over whether it really fits in the transplantation paradigm. The US FDA has changed stool and FMT regulations several times over the past decade, as FMT prevalence has increased and been considered effective (Hoffmann 2019). Biomedical entities interested in developing FMT practices or providing FMT products, outside of clinical trials and hospital settings, are required to use the investigational new drug application process, labeling stool and FMT as a "biological product" under the purview of the

Center for Biologics Evaluation and Research (FDA 2023b). FMT arguably is not a good match for the FDA drug review and approval process. Feces are an unstable actor that elides the categories and processes used for pharmaceutical and biologics regulation in the US. The biologic product regulations imagine a typical drug and require controlling variation, both for consistency in manufacturing and consumer safety, not the variability of people and their fecal matter that would be represented by FMT products created by donors and stool banks (Hoffmann et al. 2021). FMT resists standardization, but the regulation processes are set up for standardizable and commercialized products. Supporters of the FDA have instead argued that many biological products regulated are also complex and that using these processes will require FMT proponents to identify and test causal pathways for efficacy using standardized clinical trials (Ossorio and Zhou 2019).

Regulating FMT as a drug is in contrast to its potential regulation as a human tissue or tissue-based product, which some scholars believe could be appropriate (Riley and Olle 2015). FMT is currently considered a tissue transplant in Italy, the Netherlands, and Belgium (Porcari et al. 2023), and those countries have known stool banks for FMT (Scheeler 2019). The FDA made a determination in a public workshop in 2013 that stool and FMT did not fit into this category, as the microorganisms in fecal matter are nonhuman (Hoffmann 2019). The "microbiopolitics" (Paxson 2008, 17) of FMT are similar in some ways to those of the microbes and cheese that come from raw, unpasteurized milk centered in Heather Paxson's ethnographic work, with US laws and regulatory agencies viewing microbes as a potential hazard to manage. It's not simply that microbes are alive. Jamie Lorimer (2017, 2018) has written extensively on people using helminthic therapy, with the idea that hookworms as a keystone species whose presence or absence plays an outsized role in the gut. The FDA regulates hookworms as biologic products also (Young 2014). But FMT is conceptually different, because there is no known or understood keystone species and *species* isn't the unit of interest—transplanting and establishing entire microbial communities is the goal. In the sections that follow, I examine dissonance in conceptions of those whole microbial communities and people who are FMT recipients as plastic—and donors as fixed and hierarchical—in discourse about the existing and imagined future uses of FMT in the US. Following the microbiopolitics of FMT in people and in termites can help conjure alternative, still frictious, futures for microbiomes and human health that embrace a diversity of bodies and the worlds within them.

[No One / Everyone] Is [Healthy / Sick] and FMT Is the Cure

Often, people who pursue FMT do so for what feminist philosopher Jane Dryden (2021) refers to as "gut issues." *Gut issues* is an intentionally vague term, including people with a range of biomedical diagnoses, who may not identify as disabled but whose relational autonomy is impacted by guts. The gut microbiomes within people *do* impact their lives and well-being. Elizabeth Wilson (2015), in her book

Gut Feminism, asks and explores how feminist theory works *with* biological data to think about contingent states of health, writing about depression and gut-mind connections. How can this provocation and invitation be extended to help think with other questions about human bodies? Feminist philosopher Emily R. Douglas's recent thesis thinks with the new materialist feminisms of Wilson's gut feminism, while arguing ideas of bodily plasticity can become "part of the good health imperative, the duty to be well, and the push towards optimization" (Douglas 2022, 102) for minoritized and sick people. Other feminist scholars are challenging the idea of a singular gut and making space for "non-normative guts" (Kolářová, Stöckelová, and Senft 2023). Here, one goal is to extend the focus on guts as a generative area of feminist inquiry that rejects antibiologism and acknowledges the material realities of gut issues, without "swallow[ing] biological claims whole" (Wilson 2015, 5). This mode of engagement (critical yet considered) orients my own approach to FMT. FMT, I argue, can and does address the material, bodily realities of gut issues and gut/bodymind connections seriously, and yet supporting FMT access or expansion need not also mean endorsing curative or eugenic approaches to feces, gut microbiomes, and people.

In much of the biomedical discussions of the future of FMT, the "curative imaginary" (Kafer 2013, 27) is positioning it as a limitless intervention for all kinds of states and identities marked as in need of curing. Depending on who you believe, FMT is just beginning. It may soon be everywhere for almost everyone, for all manner of ills deemed worthy of intervention—which, according to its proponents, could be, well, almost anything. Like Paxson's work on raw-milk cheeses and the microbes that make them, FMT similarly evokes post-Pasteurian promises of good, diverse microbes from FMT donors replacing and outcompeting the perilous bad microbes in recipients (Paxson and Helmreich 2014). Catherine Waldby, writing about stem cell technologies and transplantation, discussed the imagined unlimited supply of transplantable tissue, coupled with the imagined near unlimited range of potential conditions it could be useful for (Waldby 2002, 306). The same can be said for FMT, with a curative imaginary of a seemingly unlimited supply of transplantable material and many conditions to use it for. This is part of a broader "microbiomania" (Paxson and Helmreich 2014, 166), hype within the life sciences about the possibilities of microbes. FMT represents a "'hope technology,' based upon the exchange of fecal samples repurposed to represent golden eggs" (Mackenzie 2017, 57). Robin Mackenzie traces how the power of FMT is in its potential for transformation, not necessarily evidence, warning that it's an area adjacent and susceptible to grift by self-declared wellness gurus. This caution may be warranted, as one direct-to-consumer fecal microbiome testing and diagnostic service in the US, uBiome, was accused of healthcare and securities fraud (United States Department of Justice 2021). More recent startups in this space, such as Viome, advertise "intelligence tests" to genetically test, diagnose—and then proscribe and sell—consumers products to improve their health based on their gut microbiome (Viome, n.d.).

Discourse, clinical guidelines, and consensus research on recipients and donors illuminate the "biocultures" (Ehlers and Krupar 2019; Krupar and Ehlers 2021) of FMT, the knowledge claims, technologies, and realms of power that structure relationships between bodies, guts, and biomedicine. FMT renders some donors and microbe communities as good or bad, healthy or sick, donor or recipient, but it's much more complicated: "the microbial body [is] comprised of a population of unruly and unknown potentials that defy medical, scientific, and lay conceptions of discrete human bodies" (Wolf-Meyer 2017, 301). This complexity is also seen in other microbial systems. One such example is Erin Koch's (2011) ethnographic work on the local microbiologies of tuberculosis in the Republic of Georgia, finding that TB diagnosis and associated bacteria are complex, context-dependent, and unstable. The microbial and protobiotic turns have not ended determinism in biomedicine. Instead, you are what helps you eat and excrete. Biomedical imaginations for the future of FMT is toward "standard, normal donors" to "produce a normal individual" (Wolf-Meyer 2017, 303).

Scientists and doctors are discussing, testing, or advocating FMT as an intervention for all kinds of states of being. Writing about this "imperative of normalcy" in gut microbiome research, Dryden argues that "excitement involved in the current wave of microbiome research enables the belief that people's body-minds can be entirely remade through microbiotic therapeutics" (2023, 33). These include, for example, FMT proposed to cure "autism" (e.g., Aroniadis and Brandt 2013; Choi and Cho 2016) or "obesity" (e.g., Choi and Cho 2016). Scientists are already conducting FMT studies in mice with the goal of curing "obesity" (e.g., Brandopadhyay and Ganguly 2022). Others imagine FMT and microbial intervention as preventative medicine. For example, scholars are thinking about microbiome manipulation at scale as a tool of public health, such as imagining developing microbiome therapeutics to give to those deemed more likely to have depression in the future (O'Doherty, Virani, and Wilcox 2016). These potential futures for FMT do not necessarily make space for many ways to live and thrive, with many different microbes.

Current frameworks for FMT donation through biomedical regulation in the US, and as discussed in other countries, are not making space for difference. Importantly, most of the FMT done to date used an unknown donor, such as material from a stool bank (Kelly et al. 2021). So the exclusion or inclusion criteria matter. Yet there is not currently a standard, agreed-upon set of donor criteria, whether for acceptable or optimal donors, presenting scientific and ethical issues for choosing them (Ma et al. 2017). Potential insights may be gleaned from information shared publicly by OpenBiome, the former nonprofit stool bank that was the major source of microbial organs for FMT in the US until they shut down the service in 2021 (Sheridan 2021). Co-founder Mark Smith openly bragged about how restrictive their donor screening process was, telling the *Washington*

Post that 4 percent of potential donors are accepted and likened the process to applying to selective colleges: "It's harder to become a donor than it is to get into MIT" (Feltman 2015). He went on to boast about soliciting donors from the building next door, a gym near a university—implying that these characteristics would be associated with healthy donors.

Additional insights on who is imagined as having healthy stool and guts to donate for FMT may be gained from the donor criteria that scientists and doctors are discussing amongst themselves—and considering who may be left out as a result (see Table 1 for some examples). The first example, gastrointestinal symptoms within the past three months, may seem straightforward enough a proxy for pathogens. However, many pathogens of concern can be, and are, specifically tested for in the donor screening process. Using changes in stool texture as a screening criterion instead or in addition may label large segments of the population unfit for FMT donation —and implicitly unhealthy. This exclusion criterion ignores non-pathogenic reasons for changes in stool texture, such as the documented impact of hormonal cycles in menstruating people altering bowel movements (Judkins et al. 2020). Even people who have aged out of menstruating may be screened out, many donor criteria also endorsed excluding people over age sixty.

Example potential FMT donor exclusion criteria proposed
"Gastrointestinal symptoms within the past 3 months (e.g., diarrhoea, constipation, haematochezia, vomiting, abdominal pain)"[a]
"Age (accepted if ≥18 and ≤60 years)"[a]
"Overweight and obesity (body mass index >25)"[b]
"History of psychiatric conditions" [b]
"History of neurological disorders"[b]
"Autism spectrum disorder"[c]
"Attention deficit hyperactivity disorder"[c]
"Previous prison term"[a]
"Psychological status"[d]

[a]Keller et al. 2021, in Europe; [b]Cammarata et al. 2017, in Europe; [c]Haifer et al. 2020, in Australia; [d]Mullish et al. 2023, in Europe

Table 1. Examples of potential exclusion criteria for FMT donor screening processes discussed in scientific journal articles by medical researchers and/or practitioners.

The "variability" of older folks' microbes is provided as rationale; however, there's no mechanism provided to explain why this variation would be detrimental, let alone pathogenic, to potential recipients.

Examining donor traits deemed worthy of inclusion is also illuminating. One study mulled encouraging "other donor characteristics associated with a healthy microbiome (e.g. vaginal delivery, breast-feeding or Mediterranean diet)" (Mullish et al. 2023). These potential inclusion criteria connect previous correlative research on microbiome differences in people with different health histories and eating choices to potential FMT donor status. Yet no evidence is provided that *not* making those choices, such as not eating a Mediterranean diet, would render someone an unsuitable FMT donor. There are cultural and personal reasons that dietary information may be important in donor screening, to ethically match the needs and dietary requirements of potential recipients, such as for religious reasons (Bokek-Cohen and Ravitsky 2017). However, that's a very different idea than rejecting donors for not following a particular diet, with the implication that they are not healthy enough. Requiring or advocating these behaviors would very much change whose stool is considered healthy and able to be a donor. Variation in cultural and personal acceptability of donating stool, or participating in research that involves fecal matter, may further contribute to the pool of donors potentially not reflecting the society (Hawkins and O'Doherty 2011).

An unaddressed tension of FMT is that many of these donor screening criteria are static, some even lifetime designations, even as scientists are acknowledging—*and relying on*—the variability and plasticity of the microbial communities in people for FMT to succeed. It's not just that "one microbiome does not fit all" (Ishaq et al. 2021, 7) for FMT donors or imagined future recipients. One person's microbiome itself is situational and plural, changing in time, space, and circumstance. Moreover, there's a circular logic happening, in which metagenomics are deployed to find correlative differences in populations' gut microbiome (such as finding people who are autistic and allistic to have different gut microbiomes)—and then assigning causality and pathology to the people and gut microbes identified as disabled or different. And then using that correlation to not only identify these people and communities as targets for cures, but also to use those identities to create exclusion criteria for individuals to not be able to serve as an FMT donor for others.

As Stefan Helmreich writes about *Homo microbis*, a conception of humans and their associated microbes, the microbiome "does not speak for itself" and cannot be separated from the technologies scientists use to study them (2016, 72). "Geneticization" (Hedgecoe 2009, 1) originally referred to the reduction of people to their DNA and assigning genetic causes to people's traits and actions. The metagenomic and probiotic turns have contributed to the geneticization of gut microbiomes to describe—and arguably to create—differences between individuals and groups, based on the genetic code of the microbes. Geneticization of guts and

microbes can be seen in the discussion by scientists of "enterotypes" (e.g., Cheng and Ning 2019, 4), which is an attempt to stratify individuals across the world by the predicted community composition of their gut microbiomes, using metagenomic analyses of fecal matter. Arguably one of the goals was to identify functional differences—and not to presume gut microbiome likeness to be associated with individual traits or group identity. Even scientists applying and advocating this approach are not sure what causes the similarities in people's microbiomes—adding that they are "probably not driven by nutritional habitats and cannot simply be explained by host properties such as age or BMI" (Arumugam et al. 2011). And yet other studies argue that enterotypes are driven by "habitual diet" in young children (e.g., Christensen et al. 2018, 646) or that enterotype labels are unstable when applied to babies or older adults (e.g., Claesson et al. 2012). However, enterotypes are still being used in static, deterministic ways that presume these differences are real, meaningful, and necessary for medical intervention. For example, studies looking for enterotypes have led to claims such as "there might be a new enterotype in the Asian population" (Cheng and Ning 2019, 5). In contrast to race as unnamed "ghost variable" (Benezra 2020, 879), these studies explicitly name race while arguably still ghosting it—ignoring complexity in populations and in racial categories over time and space. In fact, writing about "race-specific biopolitics of health" (Ehlers and Krupar 2019, 47) and biomedical targeting in the US, Nadine Ehlers and Shiloh Krupar note that "race itself is thus *not undone*: that is, race as a stratifying mechanism that orders the social is not called into question" (2019, 50). While their work was focused on BiDil, a heart failure medication and the first drug that the US FDA approved for a specific racial group, encoding race and racism into gut microbiomes and fecal matter is an extension of the same—casting biomes and guts of nonwhite bodies as othered and noncurative. As Travis De Wolfe and colleagues write, race categories in microbiome science should be used carefully, intentionally, and not without acknowledging and examining racism (de Wolfe et al. 2021). Recent research has found that people experiencing racial discrimination experience structural and functional differences in gut microbiomes taken from fecal samples (Dong et al. 2023). These claims are similar to scientists' discussion of sex differences in gut microbiomes (e.g., Vemuri et al. 2019), mostly using evidence from rodents, to claim that biological sex must be meaningful for human guts and FMT, without taking into account lived experiences, such as gender identity, sexism, and intersectionality. These are examples of how the "datafication of microbes" (Benezra 2023, 143) are then applied back onto the health and lives of humans they inhabit.

With all of this in mind, we return to the termite. Exploring FMT in termites can help elucidate the complex unknowns of microbial worlds in guts and sharing them amongst individuals and communities that resist flattening. Termites, while sometimes maligned as "lower" life forms even by scientists who study them, also remind us that FMT has existed for millennia—and across disparate life forms and life histories, ranging from earwigs (Körner et al. 2016) to moose (Spitzer et al. 2023), sharing fecal matter for health(care). FMT has always been entangled with

animals—and the long history of animals sharing waste products with each other complicates the idea of FMT as a solely human endeavor. Histories of FMT tend not to include the parallels to termites or other animals (e.g., Aroniadis and Brandt 2013), except for discussion of veterinary uses. But those stories also always assume humans are the agents of transplantation, the arbiters and providers of nonhuman health. Evidence and arguments for FMT using animals has been here since the beginning of the procedure in some ways. One of the medical studies documenting FMT, not yet known by that name, for very sick human patients also documents the doctors' attempts to explore the mechanisms and potential success further by infecting and then treating two adult dogs (Eiseman et al. 1958). Veterinarians also provided critical testimony about efficacy in animals, in support of creating regulatory futures for FMT in people (Wolf-Meyer 2017). And now that the FMT imaginary expands far beyond acute gut issues, the curative imaginary for FMT in animals also expands. For example, with some evidence that FMT helps people with inflammatory bowel disease, there are similar interventions tested for dogs with the disease (e.g., Collier et al. 2022).

Yet other models may be possible. Termites practice forms of care interdependence that, yes, involve feces and transfer of fecal microbiota. Termite FMT is common and routine collective care for individual and group health. Termites and other insects use intentional, social behaviors to share fecal material with each other to ensure transgenerational maintenance of the specialized gut microbes (Ohbayashi, Mergaert, and Kikuchi 2020). These behaviors include coprophagy (eating feces), egg-smearing (putting fecal matter on eggs so it will get on young when they hatch), and capsule transmission (leaving fecal matter capsules near eggs so that young will touch them after hatching). Trophallaxis is another social practice of termites and social insects, using mouth-to-mouth (stomodeal trophallaxis) or anus-to-mouth (proctodeal trophallaxis) between individuals to transfer fluids (Onchuru et al. 2018). Termites have short lifespans, molt between life stages, and require specialized symbionts; so these practices create and maintain their needed gut microbes (Onchuru et al. 2018). Termites don't just have obligate relationships with gut symbionts; they also engage in opportunistic mutualisms with other microbes. Some termites build nests out of fecal material, intentionally to cultivate microbes in the soil that can protect their group against pathogens; this behavior is believed by scientists to have originated in termite ancestors sixty-five million years ago (Chouvenc et al. 2018). Just as they are for people, microbiomes are transgenerational links (Benezra 2021) for termites that make and remake environments and relations. Termite fecal practices can help us reject a static view of feces or who they are in—they change and are transferred throughout their life.

FMT Is [Not?] Over

In November 2022 the FDA announced the first FMT product had successfully gone through its approval process (FDA 2022b). REBYOTA is pronounced "re-

biota" and called a "microbiota suspension" by producing company Ferring Pharmaceuticals (2022). Seemingly trying to distance itself from FMT, although it is still a stool-based product administered rectally, Ferring's website for potential patients puts the emphasis on microbes, with phrases like "microbiome-based treatment," instead of where they come from (REBYOTA, n.d.). Even more recently, in April 2023, the FDA approved VOWST, another FMT product, jointly commercialized by Seres Therapeutics and Nestlé Health Science (FDA 2023a). This one is distinguished by its potentially less squicky method of delivery: "microbiota-based therapeutic in oral capsules" to be swallowed whole (VOWST, n.d.). While FMT in name, these products can be thought of in contrast as a move away from FMT and toward MMT: manufactured microbial-based therapies. Some scientists refer to this shift as the post-FMT era, imagining stable, reproducible therapies in pill form (Porcari et al. 2023). All the imagined curative benefits of microbes without the messiness of the feces and transplantation.

These newly approved FMT products, and the direction of the FDA's regulatory approach over the past decade, are a departure from the "transplantation paradigm" (Khoruts, Hoffman, and Palumbo 2019, 484) of FMT. The new pills reflect the shift from feces as waste product to valuable medical product, reflecting the "biovalue" created by the "biotechnical reformulation of living processes" (Waldby 2002, 310). This reformulation is similar to Shiloh and Krupar's exploration of fat as a waste product "redeployed in biocultures of stem cell therapy, where fat is 'liquid gold'" (2019, 82–83). When harvested, and outside of bodies, fat and feces are turned into value for industry. Pharmaceutical companies creating and attempting to maximize biovalue from fecal material creates and forecloses different relationships between people, not just guts. Turning FMT into a pharmaceutical drug, instead of community care, could change social relations and sever relationships between people that can occur with the "circulation of biological 'gifts'" (Waldby 2002, 309) in communities which can come from transplantation paradigms and economies. This shift away from acknowledging the humans behind FMT, whether in pill or other transplantable forms, renders donors invisible—but it does not resolve the aforementioned issues of who is imagined to be healthy and whose gut microbes are curative. Donor stool used in the new pills understandably must be screened for pathogens to prevent potential disease transmission to recipients during transplantation. The newly approved proprietary FMT products are not required to, and do not, disclose the demographics of their donors in their website info for doctors or patients (REBYOTA. n.d.; VOWST. n.d.), how donors are found, or the details of the screening criteria in their patents (Jones et al. 2017). It is difficult to understand specifically which donors and which traits are being selected for in the regulatory futures of FMT in the US. Writing about organ and tissue transplantation, Shildrick explores the "hybridity" and "process of co-construction" inherent in acquiring a donor organ (2022, 58). The medical model

that aims to supplant FMT prohibits such co-construction by distancing donors and recipients and making them unknown.

And despite the broad curative imagination for FMT, the allowed recipients of the new drugs are a very limited group of people currently. The FDA approvals are specifically and only for one kind of highly contagious, recurring, and potentially drug-resistant bacterial infection in adults, known as rCDI, recurrent Clostridium difficile infection (Bakken et al. 2011). FMT performed to date in the US is considered highly effective and safe for this use (Kelly et al. 2021). And while those impacted have urgent, acute need for these products to live and thrive, part of the argument for FMT products and its attendant terms is how few people will need them. "Orphan product" designation by the US FDA for these commercial products means that the companies behind them get various financial benefits (FDA 2022a), including "market exclusivity," which means that generic versions of the drug cannot be sold for seven years (FDA, n.d.). This designation also requires evidence that fewer than two hundred thousand people annually will need the product. And even though that coveted approval has now been won for the pharmaceutical companies, the high cost of biologics and the high number of residents without medical insurance may mean that while the US FDA has deemed two products available, they may not be available for patients (Khoruts, Hoffman, and Palumbo 2019). At the same time, the FDA narrowed the legal pathways for FMT in the US moving ahead. In 2022 the agency released guidance that it did not intend to continue regulatory flexibility that had existed since mid-2013 for stool banks (FDA 2022c). Krupar's (2020) framework of "folklore of operational banality (FOOB)" is helpful for naming and understanding these simplifications and contradictions that emerge from administrative practices and algorithmic thinking that localize health and disease in individual bodies. FOOB is the "reductive, tautological, and iterative" banality of health administration, which works to "narrow health problems to that of humans/human bodies while also effectively dehumanizing the response—by despatializing and dehistoricizing the body and invisibilizing inequities" (Krupar 2020, 447). While Krupar's work focused on geodata, medical hotspotting, and "superusers" of the US healthcare system, for FMT, FOOB is reflected both by the donor exclusion policies and also by the small pool of who is eligible as a recipient—and that neoliberal policies and practices mean the healthcare system itself is responsible for many of the resistant infections leading to the need for transplantation. Instead of being more available, FOOB in FMT the "technocratic methods to define and allocate health care provisions" (447) result in FMT becoming legal as an expensive, market pharmaceutical and *less* available for those who need and want it. With these new product approvals and changes in regulation, people with gut issues in the US cannot get FMT for non rCDI uses, outside of clinical trials, through off-label use, from stool banks or DIY from peer donors.

Attending to the more-than-human history and present of FMT can also provide inspiration for alternative futures. Termites and people with gut issues perhaps aren't so different. Termites, and other social animals practicing FMT, serve as reminders of the importance of interdependence and collective care. Shildrick explored stem cell therapies as "visceral prosthesis that impacts the ontological as well as empirical relation between self and other" (2022, 131) and "enduring transmutation for both the recipient and the donor, and for all those with whom they interact" (145). The same can be said for FMT, with "transformation generated in the nexus of chimerism" (145) unstably changing microbes, guts, and people, and potentially changing the microbes of others. With FMT as a visceral prosthetic, termites are in turn a key part of the "prosthetic community" (Wheeler 2017). Elizabeth Wheeler initially conceived prosthetic community as the "cluster of living beings, ideas, resources, and objects that enable disabled children's full inclusion" (Wheeler 2017, 594). While she was writing about animals in picture books, here we can extend and apply the idea of prosthetic community for people with gut issues and termites as living beings and ideas that serve as reminders that FMT can be critical yet routine, building and reinforcing networks. Termites and their gut microbes can be part of the "prosthetic assemblages show up the fault-lines in the closure of normativity, and gesture towards other modes of existence" (Shildrick 2022, 208) for people. Amber Benezra cautions that "care must be taken not to erase the people from which the microbes came" (2023, 124). For FMT, this could mean futures that embrace the transplantation paradigm and recognize FMT as the sharing of people as a form of care. Embracing a broad view of who can share fecal material, rather than potentially encoding a narrow, racist, and ableist idea of who has healthy guts, would actually provide *more* donors for folks with chronic and serious infections treated with FMT, as well as anyone else with gut issues who needs and wants FMT. Yet such futures may be closed off by biomedical regulatory practices and expectations that reward uniformity and narrow imaginations of health. The material and ecological realities of FMT elide such simplistic categories. Termite FMT is a reminder that a plurality of bodies and communities within them can be healthy and useful. The future of FMT in the US need not require hierarchies that reify eugenic logics.

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