Becoming Without

Making Transgenic Mosquitoes and Disease Control in Brazil

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Abstract The *Aedes aegypti* mosquito, known as the vector for Zika, dengue, chikungunya, and yellow fever viruses, has historically been targeted by public health campaigns as an enemy to be eliminated. However, new strategies, such as the transgenic approach, biologically modify the *A. aegypti* so that they can be deployed to control their own population—here, mosquito breeding and mating is operationalized as an insecticide. In this case, the insect must be simultaneously a friend and an enemy, cared for and killed, and it must establish encounters and nonencounters. Drawing on ethnographic fieldwork at a "biofactory" in the northeast of Brazil dedicated to mass-producing these transgenic mosquitoes, this article investigates the new forms of labor and value produced through these contrasting human-mosquito relations. The author also examines how the project is implemented within broader geopolitics of experimentation and more-than-human gendered conceptions. Analyzing the multispecies relationships engendered under the premise that it is possible to produce nonencounters, she identifies the historical conditions and promissory claims of transforming the *A. aegypti* 's reproductive capacity into labor for killing. Such recasting yields what the author calls the "nonencounter value" within the scientific remaking of mosquitoes, their *becoming* and *being*.

Keywords reproduction, labor, value, genetically modified organisms, health, multispecies

Resumo O mosquito *Aedes aegypti*, conhecido como o vetor dos vírus Zika, dengue, chikungunya e febre amarela tem sido o alvo de campanhas de saúde pública, sendo visto historicamente como um inimigo a ser eliminado. No entanto, novas estratégias, como a abordagem transgênica, modificam biologicamente os mosquitos a fim de empregá-los no controle de sua própria população—aqui, a criação e o acasalamento de mosquitos são operacionalizados como inseticida. Nesse caso, o inseto precisa ser, ao mesmo tempo, amigo e inimigo, precisa ser cuidado e ser morto e precisa estabelecer encontros e não encontros. Com base em pesquisa etnográfica, feita em uma "biofábrica" dedicada à produção em massa desses mosquitos transgênicos no Nordeste brasileiro, Reis-Castro investiga as novas formas de trabalho e de valor produzidas por meio dessas relações contrastantes entre humanos e mosquitos. A autora examina, também, como o projeto é implementado, de maneira mais ampla, a partir de uma geopolítica de experimentação e de concepções mais-que-humanas gendradas. A partir de uma análise das

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relações multiespécie engendradas sob a premissa de que é possível produzir não-encontros, ela identifica quais são as condições históricas e as promessas futuras que possibilitam a transformação da capacidade reprodutiva do *A. aegypti* em trabalho para matar. Tal reformulação produz o que Reis-Castro chama de "valor de não-encontro" na reconstrução científica dos mosquitos, do seu *devir* e do seu *ser*.

Palavras-chave: reprodução, trabalho, valor, organismos geneticamente modificados, saúde, multiespécie

The First Bite

At the end of a day of fieldwork in Juazeiro, a city in Northeast Brazil, I sat in bed trying to write up my notes. A noisy fan in my small room was not alleviating the suffocating heat, so I moved to the porch to breath in some fresh air. Not long after I sat down, an itch on my left arm prompted a quick swat from my right hand. I turned my hand over to see a dead mosquito, with blood smeared on my skin. During my stay in Juazeiro, in the semiarid region of the Bahia state, mosquitoes, which in this region are broadly called *muriçocas*, were a constant presence. The itchiness caused by their bites is a nuisance, but they can also be dangerous: some mosquitoes convey disease pathogens. As I inspected the dead mosquito that afternoon my trained eye recognized its black-and-white stripes as a telltale signature of the *Aedes aegypti*, a species notorious for transmitting viruses such as dengue, chikungunya, Zika, and (urban) yellow fever.

It was the *A. aegypti* that had brought me to Juazeiro. To be more precise, what had lured me here was a *biofábrica*, a "biofactory" that was mass-producing a version of *A. aegypti*, genetically modified to carry a transgene that could prevent the mosquito offspring from reaching adulthood.[1] These modified insects were to be released in hopes that they would mate with "wild" *A. aegypti*, leading to the death of the (heterozygote) progeny of such couplings. The goal was to reduce the overall *A. aegypti* population, lessening the transmission of mosquito-borne diseases. From April to May 2013 I conducted fieldwork with scientists and workers producing this transgenic organism, exploring the apparently paradoxical situation of deploying mosquitoes as a strategy to tackle mosquito-borne diseases. In this article I report on how my scientist interlocutors worked to make the *A. aegypti* embody a "solution" to the very "problem" the insects constituted. They hoped to turn mosquitoes—framed as "enemies" of humans—into an odd kind of "ally," agents that could undo their own kind.

Anthropologists and science and technology studies (STS) scholars examining manipulated mosquitoes have highlighted how these strategies transform multispecies relations, turning the mosquito into a "flying public health tool," an "auxiliary" instrument in attempts to control diseases.[2] The company promoting this strain of transgenic

1. In the presence of the antibiotic tetracycline the transgene is not expressed or is expressed at a very low and nonlethal level, enabling rearing in a lab or biofactory.

2. Beisel and Boëte, "The Flying Public Health Tool"; Dupé, "Transformer Pour Controlêr."

mosquito has trademarked the names "Friendly Mosquito" in English and "*Aedes do Bem*" (the Good Aedes) in Portuguese, using these terms in their publicity campaigns—a clear declaration that for the project to work, public perceptions of mosquitoes must change.[3] I argue here, however, that implementing this genetic strategy entails more than just turning a loathed organism into some sort of "friendly" mosquito. If the *A. aegypti* did not transmit diseases or did not exist in that area there would be no reason to release its transgenic counterpart. To put it differently, the mosquito can exist as an "ally" or a "friend" only to the extent that it also exists (simultaneously) as an enemy. In what follows I offer ethnographic descriptions of rearing practices inside the biofactory and of public engagement activities to ask: How is the implementation of this new biotechnology contingent on the calculated, careful, and constant manipulation of multispecies relations? How are new forms of labor and of value engendered through these contrasting multispecies relations?

Attempts to control, eliminate, and even eradicate mosquitoes are far from new—especially in Brazil, where humans have a long, shared history with the *A. aegypti*. Other anthropologists examining mosquito control strategies have studied the often intimate work required to disentangle these insects from human lives and space.[4] The case I examine differs from such studies in that the mosquitoes themselves are expected to enable a severing of relations with humans. Mosquito bodies are molded to instrumentalize their breeding/mating capacities: transgenic females must keep reproducing the strain and transgenic males must mate with the wild females to unmake their own species.[5] When transgenic mosquitoes are deployed their own reproduction is transformed into labor for killing. Mosquito breeding and mating are operationalized as *insecticide*.

This genetic modification of the *A. aegypti* was done on the grounds that, since this species can transmit pathogens, its absence will be beneficial to human health. The reformulation of mosquito breeding and mating into a sort of deadly reproductive labor can be understood as an example of the making of what medical sociologist Catherine Waldby has defined as "biovalue," which is "generated wherever the generative and transformative productivity of living entities can be instrumentalized along lines which make them useful for human projects."[6] However, while Waldby has mostly focused on how biotechnology yields vitality on a cellular or molecular level to capitalize on it,[7] in

3. Túllio da Silva Maia's ethnographic research with *sertanejos* in the Brazilian northeast countryside, however, shows another form of human-mosquito relation. da Silva Maia, "The Mosquito Struggle."

4. Nading, *Mosquito Trails*; Beisel, "Markets and Mutations"; Segata, "O *Aedes aegypti* e o digital"; Wolf and Hall, "Asian Tiger Mosquitos as Undesirable Cross-Border Commuters." Historians have also highlighted the challenges and repercussions of human efforts to disentangle from mosquitoes; Russell, *War and Nature*; Mitchell, *Rule of Experts*.

5. Of course instrumentalizing nonhuman animal's reproductive capacities for human desires (e.g., breeding) is far from new. Ritvo, *The Animal Estate*.

6. Waldby, *The Visible Human Project*, 33.

7. Waldby, "Stem Cells, Tissue Cultures and the Production of Biovalue," 310.

the case of the transgenic mosquitoes this is done to produce change on an ecological level. Along the way these ecological relations are transformed into economic ones. If the strategy is successful in reducing the *A. aegypti* population and, consequently, the cases of mosquito-borne diseases, the government can claim not only to be promoting health but also lessening the "economic burden" of these diseases.[8]

For the strategy to work, transgenic mosquitoes must mate with their wild kind, encountering them to create nonencounters with humans. Therefore, the strategy aims to produce what I call "nonencounter value." Here, I draw from feminist STS scholar Donna Haraway, who, expanding the Marxian categories of use value and exchange value, has proposed the notion of "encounter value": value created through relations that are primarily experiential rather than utility-based or market-ready.[9] In the case of this genetic strategy, value was generated through the experience of not being bitten by the transgenic males as well as the embodied promise that these insects would reduce the population size of their (biting) species. It was this nonencounter, this absence—a future severing of human-mosquito relations—that motivated the rearing and release of these value-added insects.

Environmental humanities scholars have critiqued early multispecies studies' emphases on relationality, calling attention to how, in some situations, distance, difference, separation, and exclusion are the order of the day.[10] The cultural geographer Franklin Ginn, for example, has examined gardeners' desire for nonrelations with slugs in their efforts to "create spaces around hoped-for-absence rather than relation."[11] Indeed, when it comes to mosquitoes, human attention has mostly been directed toward establishing "interspecies separation" from these buzzing, biting organisms.[12] The transgenic mosquito strategy, however, entails more than simply creating distance.[13] This strategy is defined by ambivalent, paradoxical relations: the insect must be simultaneously a friend and an enemy, cared for and killed, and it must establish encounters and nonencounters.

The social anthropologist Matei Candea has explored how relational attitudes, such as detachment and engagement, need not be understood as polar opposites.[14] Based on

8. Martelli et al., "Economic Impact of Dengue." Within this framing these modified mosquitoes are recruited as infrastructural to capital, by creating healthy and able citizens/workers.

9. Haraway, *When Species Meet*; "Value-Added Dogs and Lively Capital."

10. Latimer, "Being Alongside"; Ginn, Beisel, and Barua, "Living with Awkward Creatures"; Giraud, *What Comes after Entanglement?*

11. Ginn, "Sticky Lives," 538.

12. Kelly and Lezaun, "Urban Mosquitoes, Situational Publics, and the Pursuit of Interspecies Separation."

13. A certain (hopefully controlled) intimacy with unwanted beings to create distance happens across a variety of situations: it is the logic behind the development of vaccines. Benchimol, *Febre Amarela*. Other examples include the deployment of "Judas goats" in Guadalupe, Mexico, to track down herds or the cultivation of specific plants in Piauí, Brazil, to feed the pests (so that they do not eat the fields). Wanderer, "Biologies of Betrayal"; Pereira, "Os Reis Do Quiabo," 110-115.

14. For a similar argument on human-bear relations, see Metcalf, "Intimacy without Proximity."

fieldwork with biologists studying Kalahari meerkats, Candea describes how "appropriate detachment was a *sine qua non* condition of engagement": the researchers had to put in a lot of work to establish a detached relation with the meerkats, while Candea also had to develop a cultivated distance to connect with the researchers.[15] Whereas with meerkats the intention was to maintain "proper distance" to establish a connection, in the case of transgenic mosquitoes, scientists and workers at the biofactory had to engage in a temporary intimacy and proximity—but only as long as it was useful in the goal of eventually creating distance and promoting a nonencounter.

To examine this nonencounter I investigate that, while the efficacy of the project depends on wild female mosquitoes considering their transgenic counterparts to be members of their own species, the viability of the effort lies in convincing local human populations that the transgenic *A. aegypti* is unlike the much-hated and much-feared biting mosquito, the muriçoca. As a result, to implement this genetic strategy proponents of this technology had to reengineer not only the mosquito body but also three different aspects of the human-mosquito encounter. First, they had to transform an insect that has long been an enemy into an ally. Second, they needed to make, rather than kill, mosquitoes. Third, they had to reenvision human-mosquito encounters as ones in which mosquitoes (especially the released ones) do not bite humans. As they tried to make sense of and explain these radically novel terms of human-mosquito relations proponents of these genetically modified organisms nonetheless often made use of older visions of animality: they deployed antiquated sociobiological ideas about males as heroic and horny and females as villainous and picky. Apparently novel mosquito-human socialities were quickly narrated in ways that aligned with all-too-hegemonic, gendered human socialities.

As Haraway has argued, human becoming and being is constituted through encounters with "companion species"—those organisms that make us materially and discursively what and who we are.[16] Whereas Haraway writes that "becoming is always a becoming *with*,"[17] I suggest that *becoming* can also be a *becoming without*, through multispecies relations that occur under the premise and motivation of producing nonencounters. Drawing from the environmental humanities and the anthropology and history of science I identify the historical conditions and promissory claims in the transformation of *A. aegypti*'s reproductive capacity, recasting it into labor for killing and yielding nonencounter value within the scientific remaking of mosquitoes, their becoming and being.

15. Candea, "I Fell in Love with Carlos the Meerkat," 247.

16. Her primary example is the domesticated dog. See Haraway, *When Species Meet*.

17. This concept expands from the notion of "becoming" developed by Gilles Deleuze and Félix Guatarri—who define it as "new kinds of relations emerging from nonhierarchical alliances, symbiotic attachments, and the mingling of creative agents" cited in Kirksey and Helmreich, "The Emergence of Multispecies Ethnography," 546. Haraway also borrows from Vinciane Despret, "The Body We Care for."

The Enemy: When Death Has Wings

Female mosquitoes need blood to mature their eggs. An *A. aegypti* that bites someone with dengue can become infected with the virus, and later, as it bites another person, the mosquito's infected saliva enters the human body.[18] It is in this second act of biting that mosquitoes transmit diseases.[19] That day on the porch, as I stared at the mosquito and at blood on the palm of my hand, my fear of contracting dengue fever became a visceral reminder of what is behind the sometimes-abstract numbers, showing the increase and spread of cases. The city was having an outbreak, and the bite—that fleeting encounter—could have infected me with the virus.

Historians of science have shown that, once the scientific community agreed that the *A. aegypti*'s bites could transmit yellow fever, the insect became the target of strategies to control the disease. In 1881 the Cuban doctor Carlos Finlay first theorized that yellow fever was propagated through an agent that is "completely independent from disease and [the] diseased."[20] Six months later Finlay asserted that the *Stegomyia fasciata*—now known as *A. aegypti*—was the disease's intermediary vector based on epidemiological observations: data on the spread of yellow fever coincided with the geographical and seasonal activity of the mosquito.

In 1900 the Reed Commission, part of the US Army's occupation program in Cuba, set up experiments focused on investigating the biting/being bitten encounter to prove that the mosquito was indeed the disease's vector. On a secluded camping ground the commission's researchers let mosquitoes, which had beforehand fed on the blood of infected patients, bite them. Two researchers fell ill and one of them died. Later experiments were conducted on volunteers from the army medical corps and on recent immigrants from Spain.[21] Thus, contrary to Finlay's findings, which were based on data that "could not be accepted as proof" by the experimental scientific community, Reed had offered "a demonstration through experience" of the relation between mosquito bite and illness.[22] For the philosopher of science François Delaporte, the notion of disease vectors redefined the alliances among living things.[23] Or as Georges Canguilhem put in the foreword to Delaporte's book, "the elucidation of yellow fever's mode of transmission altered the figure of Death," making possible a rhetoric that claimed that "Death has wings."[24]

18. However, the susceptibility of mosquitoes to dengue virus varies—that is, not all mosquitoes biting a viremic person become infected and then infectious.

19. There are also some cases of vertical transmission (infected *A. aegypti* female or male transferring the virus to their offspring). Ferreira-De-Lima and Lima-Camara, "Natural Vertical Transmission of Dengue Virus."

20. Löwy, *Vírus, mosquitos e modernidade*, 34. Löwy's quotations were translated by the author.

21. Reed was the only member of the team to not experiment on himself. On the colonial and racial legacies of these experiments, see Herzig, *Suffering for Science*; Lederer, *Subjected to Science*.

22. Löwy, *Vírus, mosquitos e modernidade*, 64–65; also Espinosa, *Epidemic Invasions*.

23. Delaporte, *The History of Yellow Fever*.

24. There are invertebrate vectors that do not have wings. Canguilhem probably had in mind the mosquito, which has become the prime example of a vector.

The historian of science Ilana Löwy also remarks that vectorial transmission was simultaneously "unsettling and reassuring," since avoiding contact with sick people could be easier than avoiding the ubiquitous mosquitoes. At the same time "experts hoped," Löwy notes, "that the mosquito would reveal itself to be the weak link in the chain and that its elimination would lead to the eradication of the pathology whose agents it disseminates."[25] Thus, historical studies have also described how the notion of a vector and the attempts to address yellow fever by targeting the *A. aegypti* were key to the emergence of the notion of species eradication.[26] Models were created and war-like campaigns implemented to eradicate the *A. aegypti* species—a deed that through the extensive and widespread use of DDT was, for a while, considered to be within reach.[27] After decades of antimosquito campaigns, by 1958 Brazil received an "eradication certificate" from the Pan American Health Organization.[28]

This "eradication," however, did not last. In 1967 the researcher Habib Fraiha, from the Evandro Chagas Institute, reported the presence of the *A. aegypti* in Belém.[29] But concerns about the mosquito's return were dismissed: either because the military rulers, in power from 1964 to 1985, did not see the insect as a serious threat, or because the *A. aegypti*'s reappearance could be seen as damaging their leadership and government's reputation—probably both.[30] In the 1980s the insect became the vector for another pathogen: the dengue virus, which can cause a debilitating disease also known in English as "breakbone fever." The state of Roraima had the first dengue epidemic in 1981–1982, followed by the major 1986 epidemic in Rio de Janeiro. From Rio, the disease quickly spread to other parts of the country—the dengue virus had made visible the widespread presence of the *A. aegypti* throughout Brazil.

The mosquito's bites were, once more, a potentially dangerous encounter and, therefore, the insect was, again, framed as an enemy to be eliminated. With the increasing spread of dengue, the Ministry of Health created the 1996 Program for *A. aegypti* Eradication (PEAa) to coordinate national efforts. Nevertheless, (re)eradication was eventually ruled to be "technically infeasible" by Ministry of Health experts, so in 2002 another program was launched: the National Program for Dengue Control (PNCD).[31] This meant a shift from eradication to monitoring (*vigilância*), with governmental institutions and careers, national and local policies and campaigns, and budget allocations all focused on addressing dengue by controlling the *A. aegypti* population.[32] However,

25. Löwy, *Vírus, mosquitos e modernidade*, 14.

26. Cueto, "The Cycles of Eradication"; Stepan, *Eradication*; Magalhães, *A Erradicação do Aedes aegypti*.

27. Farley, *To Cast out Disease*; Kinkela, *DDT and the American Century*.

28. Löwy, "Leaking Containers."

29. Fraiha, "Reinfestação do Brasil pelo *Aedes aegypti*." The mosquito, whose eggs can be dormant for months, might never have been completely eliminated or it might have been introduced from another country.

30. Lopes and Reis-Castro, "A Vector in the (Re)Making."

31. Ministério da Saúde—FUNASA, "Programa Nacional de Controle Da Dengue," 3.

32. Segata, "A doença socialista e o mosquito dos pobres."

notwithstanding these efforts, there was an upsurge of cases. In 2013 more than 1.5 million dengue cases were reported in Brazil, with incidences in every state, and with concerns about the increase of a more severe form of dengue—known as hemorrhagic dengue fever—and with it, more fatalities related to the disease.[33]

Then, in 2015–2016, the *A. aegypti*—and Brazil—made international headlines. When I had arrived in Juazeiro, in 2013, there had been Zika outbreaks on islands in the Pacific, but these had not attracted much attention.[34] Scientists would later establish an association between the virus and neurological complications such as the autoimmune disorder Guillain-Barré syndrome and health issues in fetuses and newborn babies.[35] Zika not only drew attention to the social and personal impact of mosquito-borne diseases in families and communities—especially in a context in which disabled people face social barriers and a lack of public policies that address their needs[36]—but also prompted a renewed attention to vector control strategies. Although Zika can also be sexually transmitted, the *A. aegypti* was the center of campaigns and policies,[37] with strategies such as the transgenic mosquito highlighted as a potential response to curb the disease transmission.[38]

While these transgenic mosquitoes were presented in popular and scientific media as a new ethical framework for species eradication,[39] this technology can be alternatively understood as a new phase in a continuous effort to *not* encounter these insects. Anthropologists of health and science Ann Kelly and Javier Lezaun have described this historical effort as "insecticidal utopianism": an eagerness for the nonexistence of certain insects—or at least, their distance from humans.[40] Humans have long striven to reinforce a distance between themselves and mosquitoes, with eradication sought by scientists and policy makers as something not only feasible but also desirable. If there is continuity in the human effort to not encounter these insects (considered to be in a potentially dangerous somatic proximity), what is new is the use of mosquitoes themselves in these endeavors—mosquitoes are turned into insecticide.

33. Ministério da Saúde, "Situação epidemiológica." In 2013 the World Health Organization reported a thirty-fold increase in the global incidence of dengue over the last fifty years. WHO, *Sustaining the Drive to Overcome*.

34. Duffy et al., "Zika Virus Outbreak on Yap Island."

35. Miranda-Filho et al., "Initial Description of the Presumed Congenital Zika Syndrome."

36. Williamson, "Cuidado Nos Tempos de Zika"; Lustosa Alves and Fleischer, "O Que Adianta Conhecer Muita Gente."

37. On the racial and gendered politics at play in this disregard for the sexual transmission of Zika, see Reis-Castro and Nogueira, "Uma Antropologia Da Transmissão."

38. For example, see WHO, "Zika Strategic Response Plan." See also Bennett, "Reinventing Mosquito Control." As Nading has examined, even before Zika, the deployment of transgenic mosquitoes has often hinged upon "scalar narratives" that anticipate potential global health threats. Nading, "The Lively Ethics of Global Health GMOs."

39. Fang, "A World Without Mosquitoes"; Regalado, "The Extinction Invention"; Adler, "Kill All the Mosquitoes?!"

40. Kelly and Lezaun, "The Wild Indoors," 395.

This transformation—from an organism that carries a problem (a pathogen) to one that carries the solution (its own species' self-annihilation)—turns mosquitoes into something valuable. The transgenic mosquito embodies the promise to reduce the cases of mosquito-borne diseases, to improve the health of the human population. By mating with their conspecifics these transgenic insects should foster nonencounters: they are released with the expectation that humans will be able to become without the wild *A. aegypti* and, by extension, the pathogenic viruses. The mosquito as an "ally" in the quest for healthier humans, however, can only exist to the extent that the mosquito as an "enemy" is still looming, threateningly, in the background. It is through this paradoxical mosquito-human interaction that the strategy can generate health value. To make mosquitoes have *value* here can be understood not only through the money saved from health and death costs but also the value of the mosquito as a commodity.

The transgenic *A. aegypti* examined in this article contains a genetic construct developed and patented by Oxitec, a spin-off company of Oxford University, in the United Kingdom.[41] In 2013 Oxitec was trying to assure that their mosquito technology would be considered an effective tool to address diseases. Some scientists (especially those working at Oxitec) claim that, after a prolonged period of releases, the *A. aegypti* population can be suppressed to a point that results in the mosquito's local elimination—a rehash of the century-old desire to annihilate the species. However, most entomologists I have talked to assert that, even if the population's size is reduced, local elimination of the species through this genetic strategy is infeasible.[42] Thus, with this genetic strain, eradication is not truly the goal; in fact, the strategy entails the ongoing, continuous release of this transgenic organism. If releases are discontinued the mosquito population tends to return to its "original" numbers or might even increase. Indeed, results published after my fieldwork showed that there was a suppression of the *A. aegypti* population during sustained releases but, once these stopped, there was a gradual recovery to prerelease numbers—bringing no long-lasting benefit to residents of the areas where experiments were conducted.[43]

The need for constant releases creates a business model in which, to prevent future *A. aegypti* generations, there must be a continuous production and release of transgenic mosquitoes. In other words, Oxitec hoped that what was considered a pest would be embraced as a product. This is yet another example of what several anthropologists of science and STS scholars have analyzed as "life itself" being remade through biotechnology, with the generative capacity of living beings and living materials transformed into (lively)

41. In 2015 Oxitec was bought by Intrexon and is now a subsidiary of the US-based synthetic biology corporation.

42. This is the case particularly in places with a widespread presence of *A. aegypti* (like most Brazilian cities), since the local suppression could be easily undone through migration from surrounding areas.

43. Garziera et al., "Effect of Interruption of Over-Flooding Releases."

commodities, circulating across different spheres to produce (bio)capital.[44] However, during fieldwork, I could not investigate the (promissory) processes of commodification or capital accumulation in the mosquito, since, at the time, the mosquito was not yet a commodity; it had been approved in Brazil only as part of a research experiment in a collaboration between the São Paulo University and a not-for-profit biofactory.[45]

The Brazilian releases' rationale was to test if the strategy could be adopted in the country, under the consensus that the current tactics (destroying mosquito breeding sites and spraying insecticide) were not working. If scientists prove the transgenic mosquito's efficacy Oxitec hoped to leverage Brazil's particular geopolitical position to further expand the strategy to other countries in the region and consolidate their technique.[46] During my fieldwork I knew the company planned to establish a subsidiary in the southeast of the country (which it later did, in Campinas, São Paulo). With its long and complicated history of "living with" mosquitoes, Brazil was seen as an ideal site to test and validate the genetic strategy.

Although releases were being conducted in the northeast of the country, all staff scientists working on them, as well as the biofactory's director at the time, were from Brazil's Southeast.[47] As someone who is also from the southeast region, I was quickly categorized by the biofactory workers—all of whom were locals—as yet another *sulista* researcher who was there (temporarily) to gather knowledge about the releases.[48] Even though the biofactory had initially been established in 2005 to control pests and contribute to regional agricultural development, and even though the researchers (all of them white, most of them from São Paulo) were convinced they could improve the national policy for mosquito-borne diseases and promote national scientific development, the workers were aware of the politics of conducting experiments in the northeast's *sertão,* the semiarid hinterlands—a historically marginalized part of the country.

The anthropologist of science and health Rosana Castro has described how Brazil's social and racial (and in this case regional) inequalities are reframed by scientists as conditions that enable and propel scientific research in the country—what Castro defines as "opportune precariousness."[49] Thus, the workers' jokes and remarks about the *sulistas* could be understood as social commentaries on the regional geopolitics at play in these experimental releases. Medical anthropologist Johanna Crane has described

44. For example, see Franklin and Lock, *Remaking Life and Death*; Helmreich, "Species of Biocapital"; Sunder Rajan, *Biocapital*; Cooper, *Life as Surplus*; Roosth, *Synthetic*.

45. Carvalho et al., "Suppression of a Field Population of *Aedes aegypti*."

46. On the international geopolitics at play in these releases, see Reis-Castro and Hendrickx, "Winged Promises"; for a broader theorization of international-interspecies relations, see Gutkowski, "Bodies That Count."

47. The only exception was a student from the nearby Federal University of the Vale do São Francisco, who was developing her master's thesis in collaboration with the biofactory.

48. For an analysis of the importance and limits of positionality, see Robinson, *Hungry Listening*.

49. Castro, "Precariedades oportunas, terapias insulares."

similar circumstances in collaborations between Uganda and US-based universities, where the "poverty and inequality" that institutions in the United States (or in Europe) are aspiring to "remedy is also what makes their global health programs both *possible* and *popular*."[50] Crane defines these as "valuable inequalities"; in the Brazilian case, then, they would be *national* valuable inequalities. After all, within Brazil, "Our [global] North is the South."[51]

Brazil was the third country in which this particular transgenic mosquito strain was released.[52] During my fieldwork mosquitoes were released in a few neighborhoods in the outskirts of Juazeiro, but preparations were underway for a citywide project in Jacobina, also located in the state of Bahia. These larger-scale releases were, as the president of the biofactory told me one day, "the real thing." Jacobina was the "real thing" because releases there were intended to prove not simply the effectiveness of this technology but also the feasibility of transforming transgenic mosquitoes into a large-scale public health program. Here, a crucial aspect was producing these insects at the numbers needed for these extensive releases. In the next section I describe how these transgenic mosquitoes needed to be reared as care-demanding organisms as well as standardized productions of large-scale manufacturing.

The Work of (Re)Production

One day I arrived at the biofactory to find workers and scientists celebrating. Once they saw me, they called "Luísa, come see how wonderful the *posturas* (layings) were!" I noticed that the 10 × 30 cm paper strips had much darker stains than others I had seen before. These stains contained hundreds, even thousands, of mosquito eggs. I asked if they knew why the females had laid more eggs. They explained that another container with water and an extra paper strip had been added inside the cages. One of the scientists, Jacqueline,[53] commented, "Maybe they were too stressed with not enough space before. It's great that they have laid so many more eggs! We really need it to increase production." Control over the insects' capacity for biological *reproduction* was vital for the feasibility and continuity of the project: the *production* of transgenic mosquitoes. Therefore, scientists and workers in the biofactory were seeking ways to allow them to cater to the mosquitoes' needs while simultaneously improving the efficiency needed for mass-production.

50. Crane, *Scrambling for Africa*, 168.

51. The sentence "Our north is the South" is Mercosul's motto, based on Uruguayan artist Joaquín Torres García's 1935 "The School of the South Manifesto" and 1943 drawing "Inverted America."

52. For a report of earlier releases on the Cayman Islands and Malaysia: Harris et al., "Field Performance of Engineered Male Mosquitoes"; Lacroix et al., "Open Field Release of Genetically Engineered Sterile Male *Aedes*." For a commentary on ethics and political accountability: Nading, "The Lively Ethics of Global Health GMOs"; de Campos et al., "Responsible Innovation and Political Accountability." For a critical assessment of scientific evidence and regulatory conditions: Reeves et al., "Scientific Standards and the Regulation of Genetically Modified Insects." For a concern response: GeneWatch UK, "Oxitec's Genetically Modified Mosquitoes."

53. All names are pseudonyms.

Rearing transgenic *A. aegypti*, however, is quite different from the insects' reproduction and development out in the environment. While *A. aegypti* is known for its capacity to adapt and survive under a variety of conditions, inside the laboratory rearing the transgenic counterpart had become quite demanding. Sustaining "an uninterrupted cycle of mosquito reproduction under laboratory conditions," as Kelly and Lezaun have described, is usually a challenging endeavor—a process entomologists commonly refer to as "colonization."[54] In these "colonies" even small differences in the room temperature or the number of mosquitoes in a cage can cause significant variation in the number of eggs laid. The careful attention required for rearing often clashed with the imperative to increase production. If too many mosquitoes were crammed in a cage almost no eggs would be laid; if the right amount of fish-food (which is what is usually used to rear mosquitoes) was not patiently measured and added into the trays larvae would not turn into pupae. To facilitate rearing conditions, and as part of the public funding to test this strategy, in June 2012 the *Unidade de Produção do Aedes Transgênico* (Production Unit for Transgenic Aedes), or UPAT, was constructed: a 720 m^2, one-story building, with a 450 m^2 room dedicated to rearing, with rows of racks holding trays filled with larvae and cages filled with mosquitoes.[55]

Every day during fieldwork, as I entered the UPAT building, I had to choose two possible entrances—one, on the left, with a sign saying *Feminino*, and another, on the right, saying *Masculino*. These doors would take one to separate bathrooms and changing rooms. But it was not just humans who were differentiated daily as they had to decide between left and right to enter the UPAT. Since the project aimed at releasing only nonbiting transgenic males, sex-separation of mosquitoes—described as *sexagem* (sexing)—was arguably the most-labor intensive task of production. These to-be-released males were called *mosquitos de supressão* (suppression mosquitoes) because of their assigned role to reduce the *A. aegypti* population. Only males were released, but females were still needed in the UPAT to maintain the continuous production of the mosquitos de supressão. Those that stayed inside the UPAT were the *mosquitos de colônia* (colony mosquitos), continuing the lineage in a collection of cages, each containing around 1,500 females and 500 males.

Mosquitoes were sexed using a device known as a "plate separator," instrumentalizing body size because "larvae tend to be smaller than male pupae which are in turn smaller than female pupae."[56] The insects were dropped into a space between two glass panes, held together by four adjustable screws. A worker would slowly turn the screws and, with the help of water running out from a small hose, the three groups slid down the two panes and were put into different trays: (1) the smallest ones, the larvae (that

54. Kelly and Lezaun, "The Wild Indoors," 383. To describe groups of insects as "colonies" is rooted in an idealized view of colonialism as well as of colonization as "natural"; Brown, "Insects, Colonies, and Idealization."

55. Diário Oficial da União, "Seção 1."

56. Carvalho et al., "Mass Production of Genetically Modified *Aedes*," e3579.

are not yet pupae), stayed on the lower part; (2) the smaller pupae, classified as males, were found in the middle; and (3) the largest pupae, classified as females, stayed in the upper part.

Sexagem was applied not only to the suppression mosquitoes (with only males selected for the releases) but also to those continuing the lineage. Although both sexes were needed in this colony group, attention was directed toward the female mosquitoes and their capacity to lay plentiful and robust eggs—rehashing tendencies among humans to situate reproduction solely on women's bodies.[57] That is to say, there was a focus on the production of males and reproduction capacity of females. The rearing of mosquitoes in the biofactory becomes an almost-caricatured insect-version of what feminist scholars have long been pointing out as the perception of women merely as the "means of reproduction."[58]

All insects that were not used were put into a bucket, microwaved, and discarded. This killing of mosquitoes that had been carefully and laboriously raised can perhaps be explained through environmental anthropologist Alex Blanchette's analysis that spaces and logics set in place to protect animals as a species—at times privileging these nonhuman lives over human ones—can simultaneously consider these individual animals as radically killable (in Blanchette's case, pigs at a factory farm).[59] Similarly, besides microwaving "useless" mosquitoes, there was often a playful hunt for insects that had escaped their cages (an activity I participated in many times). Equipped with a racket discharging a small electric current we would swiftly kill these fugitives. After all, their lives were only considered to be valuable to the extent they were executing their role: to eventually kill off their wild counterparts. Eliminating their own species was why these mosquitoes existed, why they had been patented, and why so much work and so many resources were being devoted to their rearing. And, because males and females performed different roles in this endeavor, the multispecies encounter was sexed.

Females were expected to prolifically lay eggs to guarantee uninterrupted production. This next (re)produced generation should be healthy because the released males, I was told, needed to be strong enough to "compete" with wild males—an aspect presented in the scientific literature as the mosquito's "performance" or "fitness."[60] The wild female *A. aegypti*, as one of the researchers commented, could be quite "picky" about choosing her mate, and the modified mosquito, after generations of inbreeding inside the lab, tended to be larger than wild *A. aegypti*. The challenge inside the biofactory, the scientists there explained to me, was to produce transgenic males "strong enough" to compete for females, but "the right size" so females could "recognize" them as potential and viable

57. Almeling, "Reproduction."

58. Harris and Young, "Engendered Structures"; Engels, "The Origin of the Family, Private Property, and the State." Black feminists have also drawn attention to how enslaved women's reproductive capacity was transformed into reproductive labor to "produce" new slaves; Morgan, *Laboring Women*.

59. Blanchette, "Herding Species."

60. Massonnet-Bruneel et al., "Fitness of Transgenic Mosquito *Aedes aegypti* Males."

mates. For that purpose, the mosquitos de supressão were put into trays that had a higher density of mosquitoes and were given less food than those that would stay in the UPAT to continue the lineage. These sexed male mosquitoes were molded to be "suitable partners," their bodies instrumentalized to foster encounters with wild females.[61]

"We release these mosquitoes, and they do all the work for us. This technology works so well, because the best thing *machos* (males) can do is to find *fêmeas* (females). All machos think about is sex," one of the scientists jokingly noted. During fieldwork, I heard many variations of "jokes" about horny machos that, driven by their insatiable and unending desire for sex, won over picky fêmeas. The person telling the joke (almost always a man) would usually not specify that it was about mosquitoes, therefore implying that these remarks referred not just to insects but also to more-than-human gendered sexualities.

This "natural instinct" of males to hunt down females was also mobilized to explain the approach's efficacy and naturalness. The anthropologist of science Stefan Helmreich has examined how the belief that a biotech product is already latent in biomaterial, seeing organisms as "little laborers," naturalizes the biotech endeavor—adding a particular type of value to it.[62] In the case of the transgenic mosquitoes the costly implementation and the construction of naturalness was made invisible by foregrounding male instinct. The transgenic males were promoted as a sort of (naturally) *horny* little laborers. In addition, similar to what anthropologist of food Heather Paxson has indicated with her analysis of artisanal cheese-making, the idea that nonhuman labor was being enlisted legitimated the endeavor as being part of a "natural process."[63] Transgenic mosquitoes were not reared/produced to kill but to mate. The undoing of their own species was perceived to be a by-product of their ("natural") reproductive labor.

This need to put so much work into carefully attending to mosquitoes was viewed with resentment by some workers. In one of my first days visiting the biofactory, I joined Francisca and Jonatan, two workers there, in preparing food for the transgenic larvae. To maintain standardized production the genetically engineered mosquitoes were given the same fish-food that was used in the English laboratory in which they were developed; but in Brazil it was an expensive imported brand. Moreover, the fish-food needed to be ground twice and later sifted to turn it into a very fine powder. These steps ensured that there were no clumps, so it could be precisely measured and more easily dissolved in the water. While they went through this arduous and messy process, Jonatan remarked, "All this imported food and we need to go through all this effort to feed them." After a short reflective pause, he said, shaking his head, "These mosquitoes have a better life than I have!"

61. For a historical analysis about experiments and interpretations about sexual selection and female choice, see Milam, *Looking for a Few Good Males*.

62. Helmreich, *Alien Ocean*. To describe nonhumans as laboring also risks naturalizing and projecting a labor theory of value into all of the planet's energies; Yanagisako and Delaney, *Naturalizing Power*; Besky and Blanchette, *How Nature Works*."

63. Paxson, *The Life of Cheese*.

Such comments and jokes about the good life and high maintenance of these mosquitoes were common within the UPAT, where many workers came from low-income backgrounds. The workers would often call attention to the apparent contradiction of spending so much time, energy, and money on rearing an organism that is often an unwanted guest in houses and on bodies. Perhaps the remarks about these mosquitoes—remade to be at the same time commodity and laborer—were also a social critique on how more value seemed to be given to the "labor" of mosquitoes than to the human labor needed to implement this strategy.[64] These instances also highlight the paradoxical situation in which situations that, outside of the UPAT, are fiercely avoided (*A. aegypti* laying eggs, developing to adulthood, and mating), could only happen at the biofactory because of labor-intensive efforts and expensive infrastructure.

Workers had to care for the enemy while also killing the ally to manufacture mosquitoes in order to (eventually) eliminate them. Through a sexual division of reproductive labor, horny little laborers were to be released with the mission of betraying their own species.[65] But the viability of this strategy depended on the local human population perceiving mosquitoes being released as severing the human-mosquito relation. To convince them proponents presented the transgenic (male) as a nonbiting organism. In the next section I describe the different ways in which the scientists attempted to redefine the mosquito-human encounter of biting/being bitten.

Bites, Blood, Saliva, and Sweat

Research in genetics and sensorial behavior argues that the *A. aegypti* preference for human blood could be traced back to a genetic evolutionary adaptation that makes it more sensitive to human odors.[66] Beyond genes and smells, it is important to highlight how *A. aegypti* has become habituated to people and insists on encountering humans. This unwanted "domestic but not domesticated"[67] organism—with which we share our streets, homes, and bodies—is highly urban, cosmopolitan, and anthropophilic, with a long history of living with and alongside humans. Inasmuch as females bite because blood is a requirement to enable the mosquito's reproduction, humans usually do not want the bite, do not want the insect's proboscis piercing their skin, and do not want mosquito saliva, which might contain pathogens. In this multispecies interaction, the exchange of fluids means the survival of some beings (mosquitoes) but a potential threat to others (humans). The bite, then, is a haptic reminder of how the production of diseases is always relational in our porous and permeable bodies.[68]

64. Parreñas, "The Job of Finding Food Is a Joke."

65. Wanderer, "Biologies of Betrayal."

66. McBride et al., "Evolution of Mosquito Preference for Humans."

67. Govindrajan, *Animal Intimacies*, 6. For multispecies explorations on "domestication": Haraway, *The Companion Species Manifesto*; Cassidy and Mullin, *Where the Wild Things Are Now*; Sautchuk, "Eating (with) Piranhas." For an analysis of vector control as a "domestic" endeavor: Nading, *Mosquito Trails*. For an entomological review: Powell and Tabachnick, "History of Domestication and Spread of *Aedes aegypti*."

68. Nash, *Inescapable Ecologies*.

In spite of this preference, during my time visiting the biofactory I learned that enough human blood could not be acquired to meet the demands of large-scale mosquito production. Thus, goat blood from a local abattoir was used. A worker would take a metal plate, wrap it with plastic foil, and inject the goat blood in between the metal plate and the plastic foil. To attend to the *A. aegypti*'s preference for humans, however, before injecting the blood some workers would also rub the plastic foil on their face and neck, to get some of their sweat/smell, and only then wrap it around the metal plate. Additionally, a heat bag was placed on top of the blood and metal. The temperature and human smell would incite more mosquitoes to bite and, as a result, more eggs would be laid. These practices attempted to create the first redefinition of the biting/being bitten encounter: by mimetically transforming blood of a goat—an animal which is food for humans—into a form of humans as food, the transgenic *A. aegypti* could be fed (and therefore reproduce) without having them pierce their proboscis into human skin.

The paramount human-mosquito encounter that had to be reenvisioned, however, was the one outside the UPAT. Usually I could not accompany releases because they were conducted from a small pickup truck with no space for me. But one day another car was used to accommodate a news group reporting on the transgenic mosquitoes, and I was able to go along. I watched as plastic containers were opened, releasing swarming mosquitoes in the streets of Juazeiro. It was late morning and the sun shone brightly. Together with Fernando, one of the staff scientists, I sat under a tree waiting, while the news crew filmed as the insects flew through the streets. As we complained about the heat, away from the car's air conditioner, I asked if it was not too hot for the mosquitoes. Fernando explained that when the project first started in Juazeiro, releases were conducted in the late afternoon because during the day the hot dry weather from the sertão could harm the mosquitoes' ability to fly—but late afternoon was also when the muriçocas would fly out to bite.

The similarity between the release time and the muriçoca-biting time led to some questions and complaints from residents. Fernando recounted, "They [residents] would see this cloud of mosquitoes being released, thousands of them, and at the same time they were being bitten. We tried to explain that it was a different mosquito, but they were sure the ones we were releasing were the ones biting them." To head off such an interpretation, releases started to be conducted in the morning, even though the heat could prevent some mosquitoes from flying or even kill a few. Fernando then added, "It's better to release them [transgenic mosquitoes] in the morning. Some will not make it and because of that we might have to release more." He sighed. "But it's better than having people think our mosquitoes are biting them."

While the biting/being bitten encounter is vital for mosquito reproduction and its species continuity, for humans it can be not just a nuisance but also possibly harmful or even fatal. It is the very acknowledgment of how our bodies and communities are constituted through desirable and undesirable relations with other beings—our relatedness,

as environmental anthropologist Radhika Govindrajan puts it[69]—that marks the *A. aegypti* as an enemy. Therefore, proponents of these genetically modified mosquitoes focused on the biting/being bitten encounter to convince locals that releasing more insects was actually a solution and not worsening the problem.

As part of the group's public engagement effort, I traveled over the course of a weekend to Jacobina with a worker and a staff scientist to organize an event before releases in the city. We set up a small tent in the main shopping street and we brought a box of fine mesh net packed with swarming transgenic mosquitoes to showcase. While we prepared for the day's activities, the scientist, Pedro, confirmed that there were only males in the box, putting his hand inside and making sure none of the mosquitoes would bite him. He knew that errors can happen in sex separation based on pupal size[70] and that one single biting mosquito would be enough to alarm those around it, failing the expected goal of acquiring public support. Throughout the day passersby were invited to put their hands inside the box and confirm that they would not be bitten. To have the hand surrounded by swarming *A. aegypti* was to have proximity without the bite. To put the hand inside a box teeming with mosquitoes became an evidentiary practice: a somatic test to establish a new kind of human-mosquito relation. This choreographed encounter, these nonbites of transgenic males, proponents hoped, should represent a performative, experiential promise of a nonencounter—thus yielding the nonencounter value of these genetically modified organisms.

That day in Jacobina as we stood underneath the tent, one person passing by pointed to the box of swarming mosquitoes and asked, "Are these the *mosquitos da dengue* (the dengue mosquitoes)?" The person looked at me for a reply but I genuinely did not know how to respond—the sameness or not of these transgenic mosquitoes with their nontransgenic conspecifics was (and still is) the very question intriguing me. But Pedro quickly came toward us and answered, "No, no. This is a transgenic mosquito." The person skeptically stared at the box. So the scientist started to describe how the transgenic mosquito strategy worked, how the group releasing it had been dealing with this strain for a long time, and how the experiments in Juazeiro and other parts of the world had been done. Then, he added, "We are only releasing males. They are the heroes that arrived to fight dengue. It is only the female that bites for blood. It is she who is the villain in this story."

This sort of villainous portrayal is also evident in one of Oxitec's early promotional videos: a short animation of an interview with two anthropomorphized *A. aegypti*, a female and a male. Outfitted with tiny high heels, the female (Aegypta) is depicted as having an abrasive and unkind personality, her recurrent laugh sounding particularly evil. When confronted about transmitting dengue, Aegypta disdainfully dismisses the whole thing as not being her problem while also mocking the many failed human attacks

69. Govindrajan, *Animal Intimacies*.

70. Phuc et al., "Late-Acting Dominant Lethal Genetic Systems."

against her. She even scorns the male mosquito (Haedes) for being a "veggie" (vegetarian) and being good at nothing more than following her around. Haedes, on the other hand, is characterized in a much more sympathetic way. The male is soft-spoken and seemingly submissive until it is revealed, at the very end, that he is secretly deceiving the female: Haedes is a transgenic mosquito.[71]

As medical anthropologist Alex Nading argues in his investigation of how community health workers in Nicaragua presented the female *A. aegypti* as "single mothers," metaphors and jokes connecting humans and mosquitoes can be understood as means to bring worlds together, to recognize both similarity and difference across our shared multispecies lives[72]—what environmental anthropologist Kay Milton defines as "egomorphism," a recognition that nonhumans are "just like us" rather than "humanlike."[73] In the case of transgenic *A. aegypti*, it seemed that to make sense of the remaking of human-mosquito encounters into significantly new terms, proponents of this technology had to hold on to more-than-human gendered stereotypes of horny males and picky females, of heroic males and villainous females. And, to frame the male transgenic mosquito as an ally (a hero!), proponents of this strategy also had to foreground the act of biting and the biological need for blood—something only females seek—as the defining characteristic in the negative human-mosquito relationship.

The Final Bite

The genetic strategy examined in this article is only one among various techniques aimed at biologically modifying mosquitoes so they can be deployed to control mosquito-borne diseases. Alternatives include other strains of genetically engineered mosquitoes, bacterium-infected mosquitoes with a hindered capacity to transmit pathogens, and irradiated mosquitoes turned sterile.[74] What all these techniques have in common is that they operationalize the insect's reproductive capacity, which is transformed into reproductive labor enlisted in the quest for human health. For example, on its website Oxitec promotes its patented *A. aegypti* as a "solution [that] harnesses the natural instincts of male mosquitoes to find females in the wild."[75] It is through this ("natural") deadly reproductive labor that, according to the genetic strategy proponents, mosquito-borne diseases can be mitigated.

71. The original video is in (British) English. It's also available in the Oxitec Brasil YouTube channel (www.youtube.com/watch?v=NHYADWpNidc) with a mixture of dubbing and subtitles in Portuguese. The video also displays other topics discussed in this article, including highlighting the nonbiting characteristic of male mosquitoes and stating that, "Humans don't do anything, Oxitec male mosquitoes do all the work."

72. Nading, "Dengue Mosquitoes Are Single Mothers."

73. Milton, *Loving Nature*. See also Candea, "I Fell in Love with Carlos the Meerkat," 252; Nading, "Dengue Mosquitoes Are Single Mothers," 587.

74. Dupé, "Transformer Pour Controlêr"; Kirksey, "The CRISPR Hack"; Amarillo, "Aegypti." For an overview of these approaches, see Ritchie, "Rear and Release."

75. Oxitec, "The Oxitec Approach."

However, this article has shown that implementing this genetic approach requires not only modifying mosquito bodies but also managing their encounters. By examining how these insects established ambivalent relations with the humans with whom they interacted—biofactory workers rearing them, scientists promoting them, residents living with them—I have shown how nonencounters create value. This adapts Haraway's concept of encounter value, which accounts for the value-making process in experiential "engagements across difference."[76] Following Haraway, environmental geographer Jamie Lorimer writes, "encounter value describes the value that accrues from multispecies encounters, recognizing the agency (even perhaps the labor) of other life-forms."[77] In the case of transgenic mosquitoes, however, scientists, workers, and residents encountered these mosquitoes (and molded them to encounter their wild counterparts) under the premise that these would result in a severing of relations; an intimacy motivated by distance—these contrasting human-mosquitoes encounters generate what I called nonencounter value.

This nonencounter value also yields another transformation: the response-ability of humans toward mosquitoes. In response to Haraway's call for response-ability—the ability to respond and share the suffering—toward other beings, STS scholar Uli Beisel has asked what it means to be "polite" with "dangerous species," such as mosquitoes and the pathogens they transmit? For Beisel concern should orbit around "ending [human] suffering"—not sharing it. She argues that response-ability toward mosquito-beings is still possible but that "the interesting question is not so much if we should or should not kill. The more relevant questions are rather concerned with *how* do we kill, *who* is the we, and how do we react to the *mosquito's response*?"[78]

In deploying transgenic *A. aegypti*, humans no longer have to engage in and respond to the killing of mosquitoes; that is, the response-ability shifts, delegated from humans to the mosquitoes themselves. Transgenic *A. aegypti*, turned into a technology of disease control through genetic modification, embody the promise of encountering their own species and delivering nonencounters to humans. As these genetically modified mosquitoes are released into streets, as they are cared for in the biofactory, and as they are conscripted into performing "nonbites," humans become without mosquitoes. To become without entails relationally experiencing (the potential of) absence and distance as valuable. To adapt Haraway's formulation: becoming without happens in a contact zone where the outcome—that is, where who is *not* in the world—is at stake.[79]

76. Faier and Rofel, "Ethnographies of Encounter," 364.

77. Lorimer, *Wildlife in the Anthropocene*, 155; see also Nash, "Breed Wealth." For analyses focused on the commodification and marketization of encounter value, see Barua, "Lively Commodities and Encounter Value"; Pütz, "Making Companions."

78. Beisel, "Jumping Hurdles with Mosquitoes?" 47.

79. Haraway, *When Species Meet*, 244.

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References

Adler, Jerry. "Kill All the Mosquitoes?! New Gene-Editing Technology Gives Scientists the Ability to Wipe out the Carriers of Malaria and the Zika Virus." *Smithsonian Magazine*, 2016. www.smithsonianmag.com/innovation/kill-all-mosquitos-180959069/.

Almeling, Rene. "Reproduction." *Annual Review of Sociology* 41 (2015): 423–42.

Amarillo, Claudia Rivera. "*Aegypti*: Ideología de género, feminismo y extinción." *Sexualidad, Salud y Sociedade* 27, no. 10 (2017): 199–219.

Barua, Maan. "Lively Commodities and Encounter Value." *Environment and Planning D: Society and Space* 34, no. 4 (2016): 725–44.

Beisel, Uli. "Jumping Hurdles with Mosquitoes?" *Environment and Planning D: Society and Space* 28, no. 1 (2010): 46–49.

Beisel, Uli. "Markets and Mutations: Mosquito Nets and the Politics of Disentanglement in Global Health." *Geoforum* 66 (2015): 146–55.

Beisel, Uli, and Christophe Boëte. "The Flying Public Health Tool: Genetically Modified Mosquitoes and Malaria Control." *Science as Culture* 22, no. 1 (2013): 38–60.

Benchimol, Jaime. *Febre amarela: A doença e a vacina, uma história inacabada*. Rio de Janeiro: Editora Fiocruz, 2001.

Bennett, Priscilla. "Reinventing Mosquito Control: Experimental Trials and Nonscalable Relations in the Florida Keys." In *Locating Zika: Social Change and Governance in an Age of Mosquito Pandemics*, edited by Kevin Bardosh, 195–217. New York: Routledge, 2020.

Besky, Sarah, and Alex Blanchette, eds. *How Nature Works: Rethinking Labor on a Troubled Planet*. Santa Fe, NM: School of Advanced Research Press, 2019.

Blanchette, Alex. "Herding Species: Biosecurity, Posthuman Labor, and the American Industrial Pig." *Cultural Anthropology* 30, no. 4 (2015): 640–69.

Brown, Eric C. "Insects, Colonies, and Idealization in the Early Americas." *Utopian Studies* 13, no. 2 (2002): 20–37.

Campos, André, Sarah Hartley, Christiaan de Koning, Javier Lezaun, and Lea Velho. "Responsible Innovation and Political Accountability: Genetically Modified Mosquitoes in Brazil." *Journal of Responsible Innovation* 4, no. 1 (2017): 5–23.

Candea, Matei. "I Fell in Love with Carlos the Meerkat: Engagement and Detachment in Human-Animal Relations." *American Ethnologist* 37, no. 2 (2010): 241–58.

Carvalho, Danilo, Andrew McKemey, Luiza Garziera, Renaud Lacroix, Christl Donnelly, Luke Alphey, Aldo Malavasi, and Margareth Capurro. "Suppression of a Field Population of *Aedes aegypti* in Brazil by Sustained Release of Transgenic Male Mosquitoes." *PLoS Neglected Tropical Diseases* 9, no. 7 (2015): 1–15.

Carvalho, Danilo, Derric Nimmo, Neil Naish, Andrew McKemey, Pam Gray, André Wilke, Mauro Marrelli, Jair Virginio, Luke Alphey, and Margareth Capurro. "Mass Production of Genetically Modified *Aedes aegypti* for Field Releases in Brazil." *Journal of Visualized Experiments*, no. 83 (2014): e3579.

Cassidy, Rebecca, and Molly Mullin. *Where the Wild Things Are Now: Domestication Reconsidered*. Oxford, UK: Berg, 2007.

Castro, Rosana. "Precariedades oportunas, terapias insulares: Economias políticas da doença e da saúde na experimentação farmacêutica." PhD diss., Universidade de Brasília, 2018.

Cooper, Melinda. *Life as Surplus: Biotechnology and Capitalism in the Neoliberal Age*. Seattle: University of Washington Press, 2008.

Crane, Johanna. *Scrambling for Africa: AIDS, Expertise, and the Rise of American Global Health Science*. Ithaca, NY: Cornell University Press, 2013.

Cueto, Marcos. "The Cycles of Eradication: The Rockefeller Foundation and Latin American Public Health (1918–1940)." In *International Health Organisations and Movements, 1918–1939*, edited by Paul Weindling, 222–43. Cambridge: Cambridge University Press, 1995.

da Silva Maia, Túllio Dias. "The Mosquito Struggle: Other-than-Vector Ecologies in a 'Zika-Free' Brazilian Sertão." Somatosphere, March 2, 2020. somatosphere.net/2020/mosquito-struggle-zika.html/.

Delaporte, François. *The History of Yellow Fever: An Essay on the Birth of Tropical Medicine*, translated by Arthur Goldhammer. 1989; repr., Cambridge, MA: MIT Press, 1991.

Despret, Vinciane. "The Body We Care for: Figures of Anthropo-Zoo-Genesis." *Body and Society* 10, nos. 2–3 (2004): 111–34.

Diário Oficial da União (Official Journal of the Union [Brasília]). "Seção 1—Página 16, Nº 128, Quarta-Feira, 4 de Julho" ("Section 1, Page 16, No. 128, Wednesday, July 4"). July 4, 2012. www.jusbrasil.com.br/diarios/38427445/dou-secao-1-04-07-2012-pg-16.

Duffy, Mark R., Tai-Ho Chen, W. Thane Hancock, Ann M. Powers, Jacob L. Kool, Robert S. Lanciotti, Moses Pretrick, et al. "Zika Virus Outbreak on Yap Island, Federated States of Micronesia." *New England Journal of Medicine* 360, no. 24 (2009): 2536–43.

Dupé, Sandrine. "Transformer pour controlêr: Humains et moustiques à la réunion, à l'ère de la biosécurité." *Revue d'anthropologie des connaissances* 9, no. 2 (2015): 213–36.

Engels, Friedrich. "The Origin of the Family, Private Property, and the State." In *The Marx-Engels Reader*, edited by Robert C. Tucker, 734–59. 1884; repr., New York: W. W. Norton and Company, 1978.

Espinosa, Mariola. *Epidemic Invasions: Yellow Fever and the Limits of Cuban Independence, 1878–1930*. Chicago: University of Chicago Press, 2009.

Faier, Lieba, and Lisa Rofel. "Ethnographies of Encounter." *Annual Review of Anthropology* 43 (2014): 363–77.

Fang, Janet. "A World without Mosquitoes." *Nature* 466, no. 7305 (2010): 432–34.

Farley, John. *To Cast Out Disease: A History of the International Health Division of the Rockefeller Foundation (1913–1951)*. Oxford: Oxford University Press, 2004.

Ferreira-De-Lima, Victor Henrique, and Tamara Lima-Camara. "Natural Vertical Transmission of Dengue Virus in *Aedes aegypti* and *Aedes albopictus*: A Systematic Review." *Parasites and Vectors* 11, no. 1 (2018): 77–85.

Fraiha, Habib. "Reinfestação do Brasil pelo *Aedes aegypti*: Considerações sôbre o risco de urbanização do vírus da febre amarela silvestre na região infestada." *Revista do Instituto de Medicina Tropical de São Paulo* 10, no. 5 (1968): 289–94.

Franklin, Sarah, and Margaret Lock. *Remaking Life and Death: Toward an Anthropology of the Biosciences*. Santa Fe, NM: School of American Research Press, 2003.

Garziera, Luiza, Michelle Pedrosa, Fabrício Souza, Maylen Gómez, Márcia Moreira, Jair Virginio, Margareth Capurro, and Danilo Carvalho. "Effect of Interruption of Over-Flooding Releases of Transgenic Mosquitoes over Wild Population of *Aedes aegypti*: Two Case Studies in Brazil." *Entomologia Experimentalis et Applicata* 164, no. 3 (2017): 327–39.

GeneWatch UK. "Oxitec's Genetically Modified Mosquitoes: Ongoing Concerns." Briefing, August 2012. www.genewatch.org/uploads/fo3c6d66a9b354535738483c1c3d49e4/Oxitec_unansweredQs_fin.pdf.

Ginn, Franklin. "Sticky Lives: Slugs, Detachment, and More-than-Human Ethics in the Garden." *Transactions of the Institute of British Geographers* 39, no. 4 (2014): 532–44.

Ginn, Franklin, Uli Beisel, and Maan Barua. "Living with Awkward Creatures: Vulnerability, Togetherness, Killing." *Environmental Humanities* 4, no. April (2014): 113–23.

Giraud, Eva. *What Comes after Entanglement? Activism, Anthropocentrism, and an Ethics of Exclusion*. Durham, NC: Duke University Press, 2019.

Govindrajan, Radhika. *Animal Intimacies: Interspecies Relatedness in India's Central Himalayas*. Chicago: University of Chicago Press, 2018.

Gutkowski, Natalia. "Bodies That Count: Administering Multispecies in Palestine/Israel's Borderlands." *Environment and Planning E: Nature and Space*, January 23, 2020. doi.org/10.1177/2514848620901445.

Haraway, Donna. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press, 2003.

Haraway, Donna. "Value-Added Dogs and Lively Capital." In *Lively Capital: Biotechnologies, Ethics, and Governance in Global Markets*, 93–120. Durham, NC: Duke University Press, 2012.

Haraway, Donna. *When Species Meet*. Minneapolis: University of Minnesota Press, 2008.

Harris, Angela, Derric Nimmo, Andrew McKemey, Nick Kelly, Sarah Scaife, Christl Donnelly, Camilla Beech, William Petrie, and Luke Alphey. "Field Performance of Engineered Male Mosquitoes." *Nature Biotechnology* 29, no. 11 (2011): 1034–37.

Harris, Olivia, and Kate Young. "Engendered Structures: Some Problems in the Analysis of Reproduction." In *The Anthropology of Pre-Capitalist Societies*, edited by Joel Kahn and Joseph Llobera, 109–47. London: Macmillan Press, 1981.

Helmreich, Stefan. *Alien Ocean: Anthropological Voyages in Microbial Seas*. Berkeley: University of California Press, 2009.

Helmreich, Stefan. "Species of Biocapital." *Science as Culture* 17, no. 4 (2008): 463–78.

Herzig, Rebecca. *Suffering for Science: Reason and Sacrifice in Modern America*. New Brunswick, NJ: Rutgers University Press, 2005.

Kelly, Ann H., and Javier Lezaun. "Urban Mosquitoes, Situational Publics, and the Pursuit of Interspecies Separation in Dar es Salaam." *American Ethnologist* 41, no. 2 (2014): 368–83.

Kelly, Ann H., and Javier Lezaun. "The Wild Indoors: Room-Spaces of Scientific Inquiry." *Cultural Anthropology* 32, no. 3 (2017): 367–98.

Kinkela, David. *DDT and the American Century: Global Health, Environmental Politics, and the Pesticide That Changed the World*. Chapel Hill: University of North Carolina Press, 2011.

Kirksey, Eben. "The CRISPR Hack: Better, Faster, Stronger." *Anthropology Now* 8, no. 1 (2016): 1–13.

Kirksey, Eben, and Stefan Helmreich. "The Emergence of Multispecies Ethnography." *Cultural Anthropology* 25, no. 4 (2010): 545–76.

Lacroix, Renaud, Andrew R. McKemey, Norzahira Raduan, Lim Kwee Wee, Wong Hong Ming, Teoh Guat Ney, Siti Rahidah A. A., et al. "Open Field Release of Genetically Engineered Sterile Male *Aedes Aegypti* in Malaysia." *PloS One* 7, no. 8 (2012): e42771.

Latimer, Joanna. "Being Alongside: Rethinking Relations amongst Different Kinds." *Theory, Culture, and Society* 30, nos. 7–8 (2013): 77–104.

Lederer, Susan. *Subjected to Science: Human Experimentation in America before the Second World War*. Baltimore: Johns Hopkins University Press, 1995.

Lopes, Gabriel, and Luísa Reis-Castro. "A Vector in the (Re)Making: A History of *Aedes aegypti* as Mosquitoes That Transmit Diseases in Brazil." In *Framing Animals as Epidemic Villains*, edited by Christos Lynteris, 147–75. London: Palgrave Macmillan, 2019.

Lorimer, Jamie. *Wildlife in the Anthropocene: Conservation after Nature*. Minneapolis: University of Minnesota Press, 2015.

Löwy, Ilana. "Leaking Containers: Success and Failure in Controlling the Mosquito *Aedes aegypti* in Brazil." *American Journal of Public Health* 107, no. 4 (2017): 517–24.

Löwy, Ilana. *Vírus, mosquitos e modernidade: A febre amarela no Brasil entre ciência e política*, translated by Irene Ernest Dias. 2001; repr., Rio de Janeiro: Editora Fiocruz, 2005.

Lustosa Alves, Raquel, and Soraya Fleischer. "'O que adianta conhecer muita gente e no fim das contas estar sempre só?' O desafio da maternidade em tempos de síndrome congênita do Zika vírus." *Revista anthropológicas* 29, no. 2 (2018): 6–27.

Magalhães, Rodrigo. *A erradicação do Aedes aegypti: Febre amarela, fred soper e saúde pública nas Américas (1918–1968)*. Rio de Janeiro: Editora Fiocruz, 2016.

Martelli, Celina Maria Turchi, Joao Bosco Siqueira Jr., Mirian Perpetua Palha Dias Parente, Ana Laura de Sene Amancio Zara, Consuelo Silva Oliveira, Cynthia Braga, Fabiano Geraldo Pimenta Jr., et al. "Economic Impact of Dengue: Multicenter Study across Four Brazilian Regions." *PLoS Neglected Tropical Diseases* 9, no. 9 (2015): e0004042.

Massonnet-Bruneel, Blandine, Nicole Corre-Catelin, Renaud Lacroix, Rosemary Lees, Kim Phuc Hoang, Derric Nimmo, Luke Alphey, and Paul Reiter. "Fitness of Transgenic Mosquito *Aedes aegypti* Males Carrying a Dominant Lethal Genetic System." *PLoS One* 8, no. 5 (2013): 1–8.

McBride, Carolyn, Felix Baier, Aman Omondi, Sarabeth Spitzer, Joel Lutomiah, Rosemary Sang, Rickard Ignell, and Leslie Vosshall. "Evolution of Mosquito Preference for Humans Linked to an Odorant Receptor." *Nature* 515, no. 7526 (2014): 222–27.

Metcalf, Jacob. "Intimacy without Proximity: Encountering Grizzlies as a Companion Species." *Environmental Philosophy* 5, no. 2 (2008): 99–128.

Milam, Erika. *Looking for a Few Good Males: Female Choice in Evolutionary Biology*. Baltimore: Johns Hopkins University Press, 2010.

Milton, Kay. *Loving Nature: Towards an Ecology of Emotion*. London: Routledge, 2002.

Ministério da Saúde [Brasília]. "Situação epidemiológica/dados." 2015. portalsaude.saude.gov.br/index.php/situacao-epidemiologica-dados-dengue.

Ministério da Saúde—FUNASA [Brasília]. "Programa nacional de controle da dengue." Vigilância Epidemiológica, July 24, 2002. bvsms.saude.gov.br/bvs/publicacoes/pncd_2002.pdf.

Miranda-Filho, Demócrito de Barros, Celina Maria Turchi Martelli, Ricardo Arraes de Alencar Ximenes, Thalis Velho Barreto Araújo, Maria Angela Wanderley Rocha, Regina Coeli Ferreira Ramos, Rafael Dhalia, et al. "Initial Description of the Presumed Congenital Zika Syndrome." *American Journal of Public Health* 106, no. 4 (2016): 598–601.

Mitchell, Timothy. *Rule of Experts: Egypt, Techno-Politics, Modernity*. Berkeley: University of California Press, 2002.

Morgan, Jennifer. *Laboring Women: Reproduction and Gender in New World Slavery*. Philadelphia: University of Pennsylvania Press, 2004.

Nading, Alex M. "Dengue Mosquitoes Are Single Mothers: Biopolitics Meets Ecological Aesthetics in Nicaraguan Community Health Work." *Cultural Anthropology* 27, no. 4 (2012): 572–96.

Nading, Alex M. "The Lively Ethics of Global Health GMOs: The Case of the Oxitec Mosquito." *BioSocieties* 10, no. 1 (2015): 24–47.

Nading, Alex M. *Mosquito Trails: Ecology, Health, and the Politics of Entanglement*. Berkeley: University of California Press, 2014.

Nash, Catherine. "Breed Wealth: Origins, Encounter Value, and the International Love of a Breed." *Transactions of the Institute of British Geographers* 54, no. 4 (2020): 849–61.

Nash, Linda. *Inescapable Ecologies: A History of Environment, Disease, and Knowledge*. Berkeley: University of California Press, 2007.

Oxitec Ltd. "The Oxitec Approach." 2017. web.archive.org/web/20170818191455/ http://www.oxitec.com/our-solution/ (accessed July 1, 2021).

Parreñas, Juno Salazar. "The Job of Finding Food Is a Joke: Orangutan Rehabilitation, Work, Subsistence, and Social Relations." In *How Nature Works: Rethinking Labor on a Troubled Planet*, edited by Sarah Besky and Alex Blanchette, 79–96. Santa Fe, NM: School of Advanced Research Press, 2019.

Paxson, Heather. *The Life of Cheese: Crafting Food and Value in America*. Berkeley: University of California Press, 2013.

Pereira, Lucas. "Os reis do quiabo: Meio ambiente, intervenções urbanísticas e constituição do lugar entre vazanteiros do médio parnaíba em Teresina-Piauí." Master's thesis, Universidade de Brasília, 2017.

Phuc, Hoang, Morten H. Andreasen, Rosemary S. Burton, Céline Vass, Matthew J. Epton, Gavin Pape, Guoliang Fu, et al. "Late-Acting Dominant Lethal Genetic Systems and Mosquito Control." *BMC Biology* 5, no. 1 (2007): 11.

Powell, Jeffrey, and Walter Tabachnick. "History of Domestication and Spread of *Aedes aegypti*—A Review." *Memórias do Instituto Oswaldo Cruz* 108, suppl. 1 (2013): 11–17.

Pütz, Robert. "Making Companions: Companionability and Encounter Value in the Marketization of the American Mustang." *Environment and Planning E: Nature and Space*, May 14, 2020. doi.org/10.1177/2514848620924931.

Reeves, Guy, Jai Denton, Fiammetta Santucci, Jarosław Bryk, and Floyd Reed. "Scientific Standards and the Regulation of Genetically Modified Insects." *PLoS Neglected Tropical Diseases* 6, no. 1 (2012): e1502.

Regalado, Antonio. "The Extinction Invention." *MIT Technology Review*, April 13, 2013. www.technologyreview.com/s/601213/the-extinction-invention.

Reis-Castro, Luísa, and Carolina de Oliveira Nogueira. "Uma antropologia da transmissão: Mosquitos, mulheres e a epidemia de Zika no Brasil." *ILHA revista de antropologia* 22, no. 2 (2020): 21–63.

Reis-Castro, Luísa, and Kim Hendrickx. "Winged Promises: Exploring the Discourse on Transgenic Mosquitoes in Brazil." *Technology in Society* 35, no. 2 (2013): 118–28.

Ritchie, Scott. "Rear and Release: A New Paradigm for Dengue Control." *Austral Entomology* 53, no. 4 (2014): 363–67.

Ritvo, Harriet. *The Animal Estate: The English and Other Creatures in the Victorian Age*. Cambridge, MA: Harvard University Press, 1987.

Robinson, Dylan. *Hungry Listening: Resonant Theory for Indigenous Sound Studies*. Minneapolis: University of Minnesota Press, 2020.

Roosth, Sophia. *Synthetic: How Life Got Made*. Chicago: University of Chicago Press, 2017.

Russell, Edmund. *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring*. Cambridge: Cambridge University Press, 2001.

Sautchuk, Carlos. "Eating (with) Piranhas: Untamed Approaches to Domestication." *Vibrant* 13, no. 2 (2016): 38–57.

Segata, Jean. "A doença socialista e o mosquito dos pobres." *Iluminuras* 17, no. 42 (2016): 372–89.

Segata, Jean. "O *Aedes aegypti* e o digital." *Horizontes antropológicos* 23, no. 48 (2017): 19–48.

Stepan, Nancy Leys. *Eradication: Ridding the World of Diseases Forever?* Ithaca, NY: Cornell University Press, 2011.

Sunder Rajan, Kaushik. *Biocapital: The Constitution of Postgenomic Life*. Durham, NC: Duke University Press, 2006.

Sunder Rajan, Kaushik, ed. *Lively Capital: Biotechnologies, Ethics, and Governance in Global Markets*. Durham, NC: Duke University Press, 2012.

Waldby, Catherine. "Stem Cells, Tissue Cultures, and the Production of Biovalue." *Health* 6, no. 3 (2002): 305–23.

Waldby, Catherine. *The Visible Human Project: Informatic Bodies and Posthuman Medicine*. London: Routledge, 2000.

Wanderer, Emily. "Biologies of Betrayal: Judas Goats and Sacrificial Mice on the Margins of Mexico." *BioSocieties* 10, no. 1 (2014): 1–23.

WHO (World Health Organization). *Sustaining the Drive to Overcome the Global Impact of Neglected Tropical Diseases: Second WHO Report on Neglected Tropical Diseases*. Geneva: WHO, 2013.

WHO (World Health Organization). *Zika Strategic Response Plan*. Geneva: WHO, 2016.

Williamson, Eliza. "Cuidado nos tempos de Zika: Notas *Da Pós-Epidemia Em* Salvador (Bahia), Brasil." *Interface* 22, no. 66 (2018): 685–96.

Wolf, Meike, and Kevin Hall. "Asian Tiger Mosquitos as Undesirable Cross-Border Commuters: Invasive Species and the Regulation of (Bio-)Insecurities in Europe." *Journal for European Ethnology and Cultural Analysis* 5, no. 1 (2020): 64–76.

Yanagisako, Sylvia, and Carol Delaney. *Naturalizing Power: Essays in Feminist Cultural Analysis*. New York: Routledge, 1995.