



TOXIC SYNERGY: The Precarious Grasp of Human-Snake Entanglements in a Thai Venom Facility

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An unexpected display caught my attention as I passed through an educational exhibit on the reproductive biology of snakes in Thailand. Enclosed within a Plexiglass pillar near the back of the room was a clutch of monocled cobra eggs. The eggs, resting in a plastic colander, were elevated above a pool of water to maintain the appropriate humidity during incubation. On a nearby wall, 3-D cut-away models detailed the embryonic development of an egg at fifteen, twenty-eight, forty-two, and fifty-one days. The following day, a tiny monocled cobra used her egg tooth to slice open the deflated, leathery shell and escape the confines of the egg. I watched as she attempted to climb the Plexiglass wall, tumbling over and over again onto the rest of the clutch. This monocled cobra hatched as a public spectacle in the shadow of the preserved bodies of previous generations, a sign of things to come in her life as a snake used for the production of antivenom, an essential medicine (WHO 2023, 48).

Drawing inspiration from the juxtaposition of the egg and the preserved specimen, this article charts the reconstruction of the snake life course around antivenom production. Antivenom is the biological pharmaceutical used to treat snakebite envenomation (hereafter snakebite), a potentially life-threatening emergency. Snakebite's categorization as a neglected tropical disease is historically



**Figure 1. A clutch of monocled cobra eggs hatching at Siam Toxins.
Photo by Erin McConkey.**

turbulent. The World Health Organization (hereafter WHO) removed snakebite from the list of neglected tropical diseases in 2013 (Bagcchi 2015), only re-establishing this status in 2017 following backlash from the international medical community (Chippaux 2017). An enduring barrier to the treatment of snakebite envenoming is the cost, quality, and availability of antivenom (Boyer 2015; Chippaux and Habib 2015; Habib and Brown 2018). The global state of antivenom manufacturing is similarly unstable, with private manufacturers abruptly withdrawing from the market (Quet 2023, 2). The high-investment and low-profit nature of antivenom significantly contributes to this instability. To produce antivenom, snake venom is collected and injected into a horse. The horse produces antibodies against the toxins in the venom; these purified antibodies are then tested on small mammals before becoming the medicine known as antivenom

(WHO 2016). Snakes emerge as the central figure in this ecosystem of exploitation,¹ overshadowing other non-human and human actors in scientific, medical, and public imaginaries of snakebite. In what follows, I describe how snakes take on a paradoxical value to humans as the source of a disease and as a pharmaceutical wellspring for its specific treatment.

The stories presented here center around Siam Toxins,² a Thai facility dedicated to venomous snake husbandry, serum manufacturing, and public education. This facility houses more than a thousand snakes and employs twenty full-time staff, including snake handlers, three veterinarians, a herpetologist, and a public relations officer. The captive snake population ranges from medically important venomous species (Sibunruang, Suteparuk, and Sitprija 2013) and legally protected nonvenomous snakes to hand-me-downs from the international pet trade. While some snakes (like the monocled cobra described above) hatch at the facility, the majority are caught by rescue personnel in the greater Bangkok area. These captured snakes become permanent residents, with Siam Toxins housing several hundred wild-caught monocled cobras alone. In addition to venom collection, Siam Toxins hosts daily snake-handling demonstrations, operates an on-site veterinary clinic, and curates educational exhibits for the public.

The data I work with here was collected as part of a larger, multisited project on snakebite treatment and antivenom production in Thailand. I conducted twelve months of ethnographic research, including semi-structured interviews and participant observation at two public hospitals, a poison center, and Siam Toxins between 2022 and 2023. At Siam Toxins, I attended daily demonstrations, cleaned enclosures, and handled snakes alongside the staff.³ I aim to offer a glimpse into the interconnected lives of both human and non-human actors at an antivenom manufacturer as they navigate the daily challenges of this complex, high-investment process.

Encoded here is a persistent tension that catches both humans and snakes in what I call a “precarious grasp.” Snakes bite humans when the two come into conflict in increasingly urbanized landscapes (Ratnarathorn et al. 2024); in turn, humans grasp onto snakes with their bare hands in the pursuit of treatment.⁴ Each of the veterinarians and handlers featured in this article has been bitten by a venomous snake (often multiple times) and has visited an emergency department for treatment. Precarious grasp is a concept that draws inspiration from Anna Lowenhaupt Tsing’s (2015, 20) “precarity” and Mary-Jo DelVecchio Good’s (2007, 367) “embrace.” Yet unlike an embrace, to which both parties eagerly consent, human-snake entanglements bring our bodies together where we might prefer separation. We collaborate for survival as precarity renders us

vulnerable, “thrown into shifting assemblages, which remake us as well as our others” (Tsing 2015, 20). The “contaminating relationality” (Tsing 2015, 40) of interspecies entanglements becomes painfully literal in the context of snakebites and antivenom. Venom wreaks havoc within our bodies until neutralized by horses’ antibodies. Snakes bite us, but, when that happens, we cannot survive without the snakes (and the horses and beyond). I analyze this co-dependency as a precarious grasp.

ASSEMBLING A SNAKE-HUMAN SYNERGY

For this article, I center my discussion around the remaking of snakes and humans held in the precarious grasp. Here, the concept of assemblage (Deleuze and Guattari 1987) offers a useful lens to engage with the messiness of snakebite in both conceptualization and practice (Marcus and Saka 2006, 2). Snakes— as cause and cure—bring an assemblage into being. Venom collection does not necessitate the death of snakes; instead, Siam Toxins seeks to preserve the chemical integrity of venom while transforming the snake into a medico-scientific commodity with the capacity to endure the demands of antivenom production. A critical essence of the snake is preserved while simultaneously allowing for the snake to take on new, situated roles alongside other species and material commodities. Venom collection represents yet another way in which the vitality of non-human animals is capitalized, reminiscent of Sarah Franklin’s (2007, 47) analysis of Dolly the sheep as a multiply capital animal. Yet with commodification comes a reductive tendency to view objects through the lens of alienation, “as if the entanglements of living [do] not matter” (Tsing 2015, 5). In conceptualizing the grasp as an assemblage, I lean into the incongruous ways in which these entanglements encompass and extend beyond mere commodification.

At Siam Toxins, the temporal processes of life become caught up in the grasp between entangled species. In thinking about temporality, E. P. Thompson (1967) writes that the controlled conditions of industrial capitalism changed our notion of time. Under capitalism, time takes on “a particular sense of *timing*,” or rhythm, that punctuates the flow of work (Hockey and Allen-Collinson 2009, 223; emphasis original). The workday is bounded by the physical limitations of a human worker’s body, that is, the biological need to eat, rest, and relieve oneself (Lemus 2017). Animals are positioned as having been “simply submitted to human biological constraints,” adapting to the rhythms of human labor (Despret 2013, 63). At Siam Toxins, however, I find that the biological constraints of snakes are equally as constitutive of humans. Antivenom production does not lend itself to human-centered linearity; snakes resist this tendency in ways that

speak to queer, feminist, and crip theorists' critiques of a normative capitalist time. At Siam Toxins, it is possible to think of time as organized by "speed, pace, duration, timing, rhythms, frequency" (Puar 2017, 19) and as "processural, not teleological" (Allen 2022, 5). Though the facility's goal is the production of antivenom, everyday life is constituted by a push-and-pull between economic limitation, lived experience, and the biological constraints of human and non-human animals alike. Human-snake entanglements make for an act of collaborative survival; the grasp encompasses more than just a singular, linear life.

I further situate this precarious grasp in conversation with social scientific scholarship at the intersection of medicine, care, and interspecies entanglements. Anthropologists have written about end-of-life and chronic care as an embodied religious and social practice in Thailand (Aulino 2019; Cassaniti 2015; Stonington 2020, 2022). While I find that much of this holds true for the treatment of snakebite in human patients, the care offered to *both* reptiles and humans in the context of antivenom production differs greatly. Maria Puig de la Bellacasa (2017, 5) defines care as a world-making practice and affective state at the unresolved intersection of labor, affect, and ethics. Multispecies laboratories become "sites where *care*, and not merely *welfare*, is central to one's daily work" (Sharp 2018, 14; emphasis original). Carrie Friese (2013, 130) finds that in treating laboratory animals as a translational model for human patients, care becomes a productive part of scientific practice. Similarly, Mette Svendsen (2021, 9) writes that "the life, suffering, and death of laboratory animals are deeply implicated in creating healthy lives for humans." In both cases, the care received by non-human proxies is converted into care toward human patients. I find Friese and Svendsen's models of translational care to be similar to the role occupied by snakes in snakebite treatment—non-humans are cared for to cure humans. Yet so, too, are human lives "implicated" (Svendsen 2021, 9) in the production of antivenom.

Following Lesley Sharp's (2018) critique, I hesitate to embrace optimistic multispecies "becomings" (see Kirksey and Helmreich 2010; Kirksey 2014; Haraway 1992). Human caregivers form affective relationships with the subjects of their care, but they ultimately kill them in the name of science. The needs of non-humans "are eclipsed regularly by those of the researchers" (e.g., to research a disease) (Sharp 2018, 40). Animal husbandry can also be marked by indifference, little more than a way for the caregivers to make a living (Parreñas 2018, 108–9). Though similarly intimate and violent, Siam Toxins is neither research laboratory nor zoo; furthermore, the role of venomous snakes remains to be specified in these discussions. Snakes do not visibly suffer or return affection in ways that humans recognize; there is no "interspecies pity" at Siam Toxins (Jun

2024, 298–99). The intermediary of translational care is the snake, the very creature whose venom poses a threat to human life and necessitates the production of a pharmaceutical treatment. Humans grasp onto snakes for survival, as both medicine and employment, but must also maintain their distance from the snake as a source of disease, excruciating pain, and employment instability. Thus snakes are only cared for to the extent required to keep them alive for the benefit of future human patients.⁵ This affective quagmire, of desperately clasping *at arm's length*, is precisely what makes the precarious grasp a significant analytical concept.

Antivenom production presents a twist on Thom van Dooren's (2015, 10) "regimes of violent-care," a rationale by which some species are killed to protect the conservation of others. Humans and snakes, caught in the two-way precarious grasp, are subjected to a cocktail of violence and care in pursuit of treatment for speculative patients; violent-care becomes an indispensable step toward inter-species survival. Bites, as noted by Juno Salazar Parreñas (2018, 112), constitute a routine aspect of employment in animal husbandry. Neither snake nor human is directly killed, but they are maimed. For Jasbir Puar (2017, 139), maiming concerns tampering with the temporality of life. Caring for snakes, thereby extending their life in captivity and value as medico-scientific commodities, and allowing handlers to be bitten but not die,⁶ make for manifestations of maiming at Siam Toxins.

These relationships are further contextualized by how the Thai state administers biomedicine. Biomedicine, as João Biehl (2004, 123) and Alice Street (2014, 12) illustrate, is reimagined in context. The Thai National Antidote Program (TNAP) and a universal health-care system ensure accessible treatment for all Thai citizens (Suchonwanich and Wananukul 2018).⁷ This relative success in the arena of envenoming treatment has, perhaps counterintuitively, brought the country under immense pressure from global health organizations. According to Dr. Chaiyaphum, a senior toxicologist at a public hospital in Bangkok and collaborator with Siam Toxins, antivenom production is not profitable because "snake-bite is a local disease." Surplus products can only be sold to neighboring countries or in small quantities to foreign zoos; as a result, the annual net income for antivenom is only \$1–2 million USD. Yet Chaiyaphum recounted being told by the WHO "that it's our responsibility to produce antivenom for the whole of Southeast Asia." The WHO official requested that Thailand increase production from 200,000 vials to 1,000,000 vials per year. This request was declined because Thailand does not have the geographic or financial capacity to scale up production. Presently, the number is closer to 300,000 vials per year, enough

to provide coverage for all the medically important species, the treatment of domestic patients, and a limited for-profit export of surplus antivenom to surrounding countries. The tenuous, unprofitable nature of antivenom impacts the everyday enactment of care at Siam Toxins.

In what follows I offer an everyday account of venomous snake husbandry to further demonstrate the construction of temporality through both human and snake biologies at Siam Toxins. I then describe a desperate attempt to breed more resilient captive snakes. The extension of life for the sake of productivity renders those caught within the precarious grasp vulnerable. Finally, I interrogate the logics by which snakes and those who handle them with their bare hands are maimed in service of snakebite patients.

CARE AT ARM'S LENGTH

Located in Bangkok's urban sprawl, Siam Toxins is separated from the surrounding hospital, university, and medico-scientific facilities by a simple chain-link fence and consists of two buildings, an outdoor amphitheater, and a handful of outdoor enclosures. The public reptile clinic and ticket booth occupy a recently constructed building at the front of the facility, while the five-story main building is situated near the back. The first and second floors are open to the public and feature indoor enclosures, an auditorium for venom collection, and a museum. Visitors rarely see staff in these public spaces outside of scheduled demonstrations.

Invisible to the public eye, the fourth and fifth floors of Siam Toxins bustle with activity as handlers care for thousands of snakes to produce a modest supply of antivenom. Based on the snakes' venom gland cycle, in which venom replenishes over thirty days (a conservative estimate), the staff veterinarians designed a husbandry schedule to balance the snakes' well-being with the physical demands of venom extraction. Sol, a senior handler, and I stepped through the metal grate guarding the threshold and gathered our cleaning supplies, household items that could be found in any kitchen—a green scrubbing pad, a plastic colander, and a jug of dish soap. The walls of the room were lined with clear plastic storage bins. As compared to racks, another popular storage system, these bins are cost-effective and easy to transport.

Sol pulled out a small bin and turned to me with a shrewd look. "It's a venomous snake," he warned, pausing to gauge my reaction. From over his shoulder, I observed as CR-555, a juvenile Malayan pit viper, was scooped onto the hook. Sol swiftly dumped her into a thirty-two-gallon trash can for safekeeping while



Figure 2. White-lipped pit vipers photographed inside the plastic bins in which they are housed, temporarily moved outside for a handling exercise. Photo by Erin McConkey.

we cleaned her bin. We fell into an alternating rhythm as we removed each snake, placed them into the trash can, and moved the bin into a large sink in the corner of the room. I removed the makeshift cave fashioned out of a broken clay dish and the colorful plastic dog bowl before dumping a putrefied mouse carcass into the sink with a wet thump. Wrangling snakes and scraping rotting viscera, chunks of putrid snake feces, and wet paper from the bottom of each bin with a putty knife is strenuous work; my arms began to ache. After each bin was sufficiently clean, we replaced the paper, makeshift cave, water dish, and irritable snake before returning it to a designated spot along the wall.

On another day, I shadowed Cloud, a second-generation snake handler, to observe monocled cobra husbandry. The moment he opened the door, the nearest of sixty snakes would begin to hiss and strike at the clear plastic of their bin. Like Sol, Cloud quickly fell into the groove of this monotonous task. With each bin, he checked the snake's position from the outside before using a hook to flip the plastic handle, open the lid, and scoop the snake into a trash can. Several hours elapsed in this fashion, yet we finished only half of the boxes before lunchtime. Cloud decided that we would return to the remaining monocled cobras the following morning. This was not uncommon—time is in perpetually short



Figure 3. The Malayan Pit Viper, CR-555, swimming in water at the bottom of a trash can. Her enclosure, snake hooks, and cleaning tools can be seen in the sink in the background. Photo by Erin McConkey.

supply. Handlers are often distracted by their peers, unanticipated problems, and visitors such as myself. Siam Toxins, as a medico-scientific and educational facility, is subject to periods of increased activity while hosting guests or training camps; yet the time required for husbandry does not change as snakes need to eat, digest, and replenish their venom.

When I returned the next morning, a plastic crate filled with dead frogs was waiting in the sink. The frogs are farm-raised for human consumption and purchased in bulk (200–300 kg) every three months. Cloud chucked two

defrosted frogs inside each bin before returning the snake. NK-213 struck at the frog to inject her venom and made a quick lap of the box before returning to swallow her meal. Her neighbor, NK-216, took a different approach. He hurried to devour the frog without using his venom, giving me a clear glimpse of his short fangs as the frog's legs dangled from his mouth. After consuming the second frog in quick succession, he rubbed his open mouth along the sides of the bin as if searching for anything else to gobble down. Cloud explained that captive-bred snakes, such as NK-216, "feed themselves." Veterinarians are scheduled to see each snake only once per year, so handlers become responsible for the day-to-day management of snake health. While the husbandry schedule is choreographed such that snakes will not be handled for at least a week following a meal, snakes "don't all eat in the same way" and may refuse food for months at a time.

At Siam Toxins, household objects are transformed into tools of husbandry, and time is remade to balance the needs of the facility against the biological needs of both human and non-human actors held in a precarious grasp. While some handlers experience venom collection as life-saving labor, the correlations among snakes, patients, and treatment are displaced from the quotidian practices of cleaning and feeding. Snakes used for antivenom production are treated as numbered commodities and stored in stackable bins for ease and efficiency. Commodities, notes [Arjun Appadurai \(1986, 57\)](#), are politically entrenched. The materials that Siam Toxins has access to for husbandry, and must therefore make do with, depend on what is cheap and available in Thailand. Specialized reptile husbandry tools like temperature-controlled racks represent a niche market, but everyone has a demand for kitchen supplies, paper, trash cans, and storage bins. Furthermore, commodities are encoded with "complex social forms and distributions of knowledge" about how they ought to be produced and consumed ([Appadurai 1986, 41](#)). The veterinarians' husbandry schedule endeavors to align snake biology with the anthroponormative cadence of the facility's production schedule, in very much the way [Vinciane Despret \(2013\)](#) described. Though the snake's body is not rendered as scientific data, workers are instructed to optimize the quality and quantity of venom through husbandry that attends to an idealized construction of biology.

The veterinarians, Dr. Maverick and Dr. Bran, determine the husbandry schedule by balancing a socio-biological understanding of snakes' needs against the economic and physiological demands of antivenom production.⁸ The medico-scientific "commodity" is yet a live snake that can inflict a bite or die without appropriate care. Staff want to avoid these outcomes not only for their own safety and job security but also because snakes need to remain productive. Animals'

conditions are improved “with the understanding that a happy worker makes for better productivity” (Davé 2023, 79). Providing snakes with adequate time between handling to reduce stress, replenish venom, and digest food constitutes an attempt to strike this balance. Alison Kafer (2013, 27) argues that a reorientation to time would require a recognition that “expectations of ‘how long things take’ are based on very particular minds and bodies.” Siam Toxins has to rethink the temporality of labor around snake biology—husbandry is not just “how many bins can a human clean during a workday,” but, rather, “how often should the snake be fed to produce venom” and “how long does the snake need to digest each meal before a human can remove them to clean the bin?” The time required for biological processes is not a question of (human) ability; therefore, a minimum level of care must be calculated and continually adjusted.

In describing animal husbandry, Parreñas (2018, 109) writes that “what may appear as domination is indeed unequal risk involving mutual vulnerability.” Here, the precarious grasp is made manifest. The snakes’ survival is contingent on the handlers’ care, but so, too, is the handlers’ livelihood dependent on the snakes’ survival. Handlers, who are routinely exposed to snakebites, provide care to earn a stable income. Rich has worked as a handler for more than a decade. “I was a poor kid from the provinces,” he explained. “I didn’t know about snake husbandry, but I do it to have a job.” Siam Toxins provides a level of employment stability that he equates with that of a civil servant. Handlers are salaried and receive hazard pay, but staff also take advantage of the facility’s fixed schedule to pursue part-time work elsewhere. Working multiple jobs means that handlers not only struggle with a lack of time to complete their assigned tasks but also do so while exhausted. On this day, for example, Cloud used his lunch break to take a brief nap rather than to eat. What Maverick, their supervisor, sometimes construes as laziness can also be framed as a tactic (de Certeau 2011, 37) to minimize one’s interaction with snakes. In Maverick’s words, “when you ignore even a little bit, you have to pay the price, even for me.”⁹ Even a second’s lapse in concentration could result in a trip to the hospital. Sol, Cloud, Rich, and Maverick shared an understanding that without the snake, there was no work; therefore, they strove to find a balance between their safety, ability, and the snake’s needs.

Caught in a precarious grasp, life at Siam Toxins is constructed by both snake and human biology. This grasp between human and snake is synergetic, as the two become “dependent on each other for their identities and livelihoods” (Kohler 1994, 91). As Tsing (2015, 33) reminds us, contamination is “often ugly.” A sick snake puts the handler’s employment at risk; similarly, an apathetic handler exposes snakes to neglectful conditions. Temporality is remade around an

ontological tempo of digestion, replenishment, and extraction. As I demonstrate in the following section, this realignment of time is not without some degree of “tinkering” (Lien 2015, 125). Husbandry is performed in service of creating venom rather than snake longevity; or, put another way, snakes are preserved as venom.

(RE)PRODUCING

Despite this intensive management, the veterinarians’ system did not always work as intended. The Siamese Russell’s viper (hereafter SRV) is one medically significant species with which the existing approach to husbandry has proven unsuccessful—those kept in plastic bins die within four years. According to Maverick, four individuals have now survived for more than six years after being allowed to “choose the temperature, humidity, water, and light for themselves” in spacious outdoor terrariums. Yet the number of vipers necessary for antivenom production makes this practice unsustainable. While Siam Toxins maintains a stockpile of lyophilized (freeze-dried) venom that can be used up to decades after collection, Maverick advised that “nowadays, many venoms have started to run out.” This species’ medical significance creates an imperative to resolve the impending shortage, but a solution is “not so simple.” Here, I describe efforts to extend life in captivity as a form of maiming. In this instantiation of the precarious grasp, humans require the venom of medically significant snakes who are, in turn, vulnerable to the limitations of their captive confinement.



Figure 4. One of the facility’s four Siamese Russell’s vipers photographed inside a naturalistic terrarium. Photo by Erin McConkey.

The WHO (2016, 243) guidelines for the production, control, and regulation of snake antivenoms recommend “regulated production using captive snakes maintained in well-designed serpentariums” and warn against “the practice of collecting venoms from wild-caught snakes that are subsequently released.” There is seemingly no distinction between captive-bred and wild-caught after snakes have become captive; these guidelines do not account for the practice of permanently housing wild-caught snakes in captivity, as is often the case at Siam Toxins. Animal welfare, as Henry Buller (2013, 162) notes, can be interpreted in this context as “a concern for the productive and the reproductive health of intensively confined animals.” The predilection for captive-bred snakes stems from a concern not for well-being, but for a snake’s productive potential to reproduce offspring who produce venom.

Though ambiguously, “captive” snakes are promoted as best practice. This goal has proven paradoxical in practice. “Like steps on a stool, we need to know how to keep them first,” Maverick explained. “Keep them alive, breed them, get the babies, raise the babies . . . the *next generation* is key.” As with any successful science experiment, the results need to be reproducible. “If they come out of the egg, we still have a chance to train them,” but wild-caught snakes “won’t adapt, they’re just going to die.” Maverick sardonically explained that solving this puzzle would require time and resources that the facility does not have.¹⁰ Allowing the SRV time to choose becomes radical, if not unreasonable, when productivity depends on optimized time management and storage. Maverick described how such calculations constrain their operations:

If a viper is this size, you get about this [many milliliters of] venom. When you dry it off, about 70 percent is gone. The dry powder is 30 percent, and 30 percent of the dry powder is something else mixed inside. With purification, the real toxin is not over 30 percent from one extraction. And we need to dose 450 horses, per kilo. You need a lot of venom to produce 200,000 vials [of total antivenom] a year.

João Biehl (2009, 490–91) writes that “once a government designates a disease . . . ‘the country’s disease,’ a therapeutic market takes shape—the state acting as both the drug purchaser and distributor.” Through TNAP, snakebite envenomation is managed as a “local” disease for which drugs are produced, purchased, and distributed in cooperation with the state. Siam Toxins must produce cost-effective medicine for the Thai government but, in turn, must also meet biological benchmarks to sustain the multitude of snakes necessary for production.

Plastic storage bins do not meet the vipers' fundamental biological needs, but the facility lacks the physical space and economic resources for hundreds of glass terrariums. Furthermore, this problem extends to *several* medically significant species, including Malayan pit vipers like CR-555. Siam Toxins houses ten Malayan pit vipers, "but ten specimens are not enough for a year, never." The existing venom stockpile will last up to five years, but these compounding concerns led Maverick to again ask: "How about the next five years?"

Maverick often lamented to me that another part of this equation is the handlers' failure to attend to the snakes' needs. From his perspective, handlers are more invested in the timely completion of their work than in updating the snakes' health records. He recalled one instance in which he inquired with a handler about how often the vipers had been fed because they looked thin. "Every week," came the handler's reply.¹¹ He asked again, but this time, the handler said, "Sometimes every two weeks." Maverick admitted that caring for more than a thousand snakes is challenging and located blame in a two-way failure of human-snake collaboration. "*Shit*," he exclaimed in frustration, "it's the snake handler problems, not just the snake problems!" "Fragile" snakes die, he said, and humans act based on "emotion"—the desire to finish work, get paid, and stay safe. Ocean, a handler assigned to the vipers, shared that he had only a thirty-minute window to attend to the terrariums in addition to his other tasks in advance of the 11 a.m. venom collection each day. While handlers may or may not care about the veterinarians' perspective, their ability to implement this feedback is limited by both time and resources.

Held in this precarious grasp, the SRV continues to cause snakebite, but the snakes die in captivity, creating more patients as handlers are bitten and complicating the means of treatment as not enough venom can be collected. The paradoxical challenge of breeding more resilient vipers by keeping wild-caught individuals alive is entangled with narratives that bridge snake biology, human labor, and medical treatment. Narratives play an important role in the social construction of scientific fact (Latour and Woolgar 1979, 32) beyond this particular facility. At Siam Toxins the fundamentals of husbandry are derived from snakes' physiological processes, but humans also play a role in shaping its everyday practice. As Bruno Latour (1999, 183) writes, "why not let the 'outside world' invade the scene"? Financial limitations constrain what is feasible, but biological requirements for life render some aspects of husbandry non-negotiable. The messy interplay between these registers creates the reality of husbandry, a reality that seeks to create (re)productive snakes that feed themselves, live in boxes, and produce venom on demand.

Narratives of captive-bred “resilience” are taken up by both veterinarians and handlers to explain their experiences with SRV husbandry, for example, that these snakes routinely die in captivity despite their best efforts to keep them alive. The stories presented in this article undeniably differ from those created through the WHO’s description of captive snakes maintained in “laboratory-like conditions” (Quet 2023, 6). Stories (and the incongruencies between them) shape reality (Briggs with Mantini-Briggs 2004, 7–8); moreover, attending to the veterinarians’ and handlers’ stories reflects my commitment to what Eduardo Viveiros de Castro (2014, 92) calls “the permanent decolonization of thought.” The ambiguous futurisms described by the WHO regarding the production of snake antivenoms fail to adequately engage with the day-to-day reality that handlers navigate; their narratives are grounded in years of embodied contamination (Tsing 2015, 29) with these species.¹² Just as Alice Street (2014) finds that biomedicine’s tendency toward instability in resource-poor spaces gives rise to new forms of care, I argue that WHO recommendations fall apart in practice when the inability to maintain a population of captive snakes undergirds the practice of life at Siam Toxins.

Venomous snakes are valued for the variation of their venom (Casewell et al. 2020). Unlike the “standardization” of other non-human animals (Blanchette 2020; Kohler 1994; Rader 2004), a “productive” snake must retain the venom composition of their wild counterpart; therefore, they cannot be domesticated or modified (e.g., through the removal of fangs or venom glands). Siam Toxins, as described by Maverick, aims to optimize the snakes’ ability to endure a life of venom collection in captivity through breeding programs. Rather than acting as a proxy for humans (Friese 2013; Svendsen 2021), the captive snake is constructed as a “reference” (Latour 1999, 58) for the chemical integrity of venom.

Maverick’s assertion that a third generation would be more adaptable to the conditions of antivenom production is constructed through his prior experience. The staff embrace this narrative to reconcile with failure—particularly when failure is synonymous not only with the death of the snake but the death of a potential human who cannot receive treatment. Rich frames his labor in life-saving terms when describing his thoughts during venom collection. “Venom extraction is what I must do to help people, to make antivenom, right? We have to be serious, because that’s our goal: we have to help people. That’s the best part: making antivenom! We extract venom from this snake *to save someone’s life.*” Captive-bred vipers offer a just-out-of-reach solution to the concern of a venom shortage and, therefore, our collaborative survival. The desperation to produce a more resilient SRV reflects what Marianne Lien (2015, 118) describes as the

alignment of physiological processes with consumer demand. This “tinkering” with temporality can, and often does, fail (Lien 2015, 125). Care is expressed by manipulating temporality, no matter how fraught, to extend life by putting human and snake bodies in sync with the demand for antivenom. Captive snakes and handlers, then, live in a mutual state of “vulnerability to others” (Tsing 2015, 29). The husbandry schedule reduces life to its barest calculations; snakes are vulnerable to the conditionality of this care, while handlers are vulnerable to the snakes’ retaliatory bites. Yet Siam Toxins “will not let die” in a way that speaks to Puar’s (2017, 139) concept of maiming. When snake and handler enter into captivity at Siam Toxins, they fall into the grasp of a slow death.

FOREVER, UNTIL IT DIES

As Maverick and I observed the handling demonstration one afternoon, I asked if he thought that snakes were merely tools for extracting venom and revenue. He gestured toward the show as evidence of this exploitation, yet amended that he saw this as a “collaboration.” For reasons I did not yet understand, we began to talk about consuming snakes. Maverick said that while he eats many animals, he refuses to eat a snake. Sensing the buildup to a joke, I asked him why. “I could never eat my boss,” he laughed. However playful, this sentiment is shared by the staff. “The snakes are our boss, we can’t kill them for no reason,” reasoned Rich, “we can’t kill snakes *even if* there’s a reason, even if we’re bitten.” Yet in working alongside Cloud, I also learned that the death of a snake can be unremarkable. Siam Toxins is home to about 500 monocled cobras. Those beyond the facility’s needs are fed to ophiophagous (snake-eating) snakes. One king cobra may eat up to six monocled cobras in one sitting. Cloud is not upset by the death of a monocled cobra; rather, the death of surplus snakes helps sustain other species. Here, I describe the logics by which some individuals are “let die” (Foucault 2003, 241) and, more importantly, maimed for the benefit of others. This practice forms part of the “precarious grasp” and makes both snakes and humans vulnerable to the antivenom industry.

J.Lo, the resident herpetologist, turned on lights and video displays as I followed him on his morning rounds. Artistic backlights soon illuminated the preserved bodies of snakes suspended in a clear liquid. When “special” snakes died, J.Lo prepared their bodies for preservation by collecting data on scale count and distribution, as well as length from head-to-tail and head-to-cloaca. The body is injected with a 10 percent polyethylene glycol (PEG) fixative solution to prevent soft tissue degradation and shriveling (Moore 1999). This method, PEG impregnation, makes for a popular alternative to formaldehyde in the wet preservation

of small reptiles (Fremling and Hemming 1965). The snake cadaver is left to soak in a 70 percent ethyl alcohol solution for twenty-four hours before being transferred to a glass container. These specimens are popular with visitors; in fact, Lily, the public relations officer, directed guests who could not tolerate live snakes to this educational exhibit on the facility's second floor. Nevertheless, J.Lo explained that the primary purpose behind the specimens' creation is taxonomic science. By carefully documenting the features of each snake and preserving their body, the natural sciences keep track of change across time and space.

Some of the specimens had visibly aged—eyes were clouded, and chunks of debris floated in murky liquid—so I asked if J.Lo had prepared these himself. Shaking his head, he motioned for me to follow him around the corner to a display near the clutch of incubating eggs. Underneath a massive sign reading “Sexual Organs” stood another row of glass containers. Each cylinder contained a dissected snake tail, with the hemipenes everted from the cloaca to render the male reproductive organs visible. The anatomical shape, size, and texture of each hemipene pair varied by species. J.Lo proudly described how he prepared these specimens for the new exhibit on snake reproduction by injecting saline into the snakes' cloacae to force the organs out. After becoming “captive,” he said that the snake would remain at Siam Toxins “forever, until it dies.” This “forever” takes on new meaning for those snakes preserved as scientific specimens.



Figure 5. The everted hemipenes of a variety of snake species on display at Siam Toxin's exhibit on snake biology. Photo by Erin McConkey.

The curation of specimens in Siam Toxins' second-floor museum can be interpreted as a manifestation of the freak show. The disability scholar [Rachel Adams \(2001, 6\)](#) writes that the freak show is a fantasy in which “the division between freak and normal is obvious, visible, and quantifiable.” The audience is assured of their normality through a confrontation with the “abnormal” bodies on display.¹³ Snakes' construction as a freak is evident through the staging of everted hemipenes, by which internal organs are forced from the dissected tail in a mimicry of sexual reproduction. The staff wanted to make these organs visible to visitors, J.Lo said, as part of their education on snake biology. Siam Toxins' exhibit on reproductive anatomy does not display the dissected ovaries of female snakes; instead, the wall opposite the hemipenes featured egg dioramas that model embryonic development. While [Sharp \(2011, 12\)](#) notes the tendency of medico-scientific renderings to “skip over” the female human body, I find the exclusion of female snake bodies to be an exercise in locating difference. Egg dioramas and everted hemipenes emphasized the differences between snake and human anatomy from the inside out. In being encouraged to visibly confront this difference, visitors could position the snake as an other to our human selves.

The construction of snakes as a biological other translates into the logics of violence and care ([van Dooren 2015](#)) by which some snakes are allowed to die for the benefit of others. As [Adriana Petryna \(2013, 41\)](#) writes, “the processes of making scientific knowledge are inextricable from the forms of power those processes legitimate.” The classification of some snakes as “medically significant” in accordance with the risk posed to human life legitimizes this violent-care.¹⁴ Just as the snakes' reproductive anatomy was constructed as a biological spectacle, so, too, are the inner workings of venoms' chemical composition rendered visible. The construction of medical significance demarcates snakes as a *dangerous* other based on the type and severity of a potential envenomation. Snakes come to be labeled in this way as a consequence of the implementation of syndromic diagnosis, political pressure to achieve quotas, and the institutional limitations of biomedicine in Thailand.¹⁵ These all constitute important elements of the precarious grasp in which snakes and personnel find themselves entangled at Siam Toxins. Medical significance influences the quantities of antivenom produced and the types of medical intervention made available for treatment. In turn, this conveyed to handlers which snakes to care about in terms of their labor. Will you be fired or disciplined if this snake dies? Medico-scientific classifications “organize and are organized by work practice” ([Bowker and Star 2000, 228](#)). As such, we can reframe Cloud's response to snake death as structured in part by medical significance. A monocled cobra's death is not sad, but the death of a king cobra

that he helped raise is a “normal amount of sad.” Furthermore, if biological categorization is a site on which “power relationships, political action, and work” converge (Friese 2010, 148), then rendering snakes as a medically significant other affords the state with the power to legitimize sacrifice in the name of antivenom production.

Part of the “contaminating relationality” (Tsing 2015, 40) of human-snake entanglements is the extension of this othering to those who touch snakes with their bare hands. Maverick said that the staff are “strange enough to stick with snakes, so they’re never normal.” For J.Lo and Lily, this “strangeness” became visible when losing friends on social media. “I know that a lot of my friends unfriended me because I work with snakes,” J.Lo said. The othering of “snake people,” as Maverick called them, stems from a sense of “abjection” (Kristeva 1982, 4) against that which threatens to disrupt the integrity of our body. This abjection is embodied (Warin 2009, 115) through the fear of being bitten; closeness with snakes presents a definite risk of contaminating the body. Once, while eating lunch in the poison center’s breakroom, one of the staff members told me that she had visited Siam Toxins to watch the venom extraction and was horrified to see the handlers use their bare hands. When I shared that my research activities at Siam Toxins included participation, her expression shifted to that of disgust. In the course of one conversation, I had become as strange to her as the Siam Toxins staff. In a conspiratorial tone, she added, “You know [Maverick’s] been bitten, right?”¹⁶ Another employee reluctantly asked, “Is it common [to be bitten]?” My second-hand accounts of snakebite seemed to confirm their fears. Touching, particularly with one’s bare hands, creates an opening for the snake to violate bodily integrity.

As human and snake biologies co-create a new rhythm of labor in the precarious grasp, it becomes unfamiliar to those who are not “strange.” An “anticipatory temporality” (Puar 2007, xix) takes shape in which human and snake lives are held in suspense of a bite, their own or some unknown else’s. “I am strange,” Maverick insisted, “and you know [J.Lo]? He is also strange.” And, of course, I am strange as well for choosing to undertake this research.

Snakes present a threat to human survival, and handlers, caught in their grasp, join them in a (supposedly) necessary sacrifice.¹⁷ Such sacrifice is routinely justified in the biomedical sciences, where laboratory animals find productivity through death in the service of human life (Sharp 2018; Svendsen 2021; Svendsen and Koch 2013). Similarly, van Dooren (2015) describes the sacrifice of the “abundant” mouse or the “introduced” mongoose for the sake of the comparatively “rare” and “native” Hawaiian ‘alalā. A comparison can be made with

Siam Toxins, where mice, frogs, and snakes are routinely sacrificed as food. An ecosystem of exploitation takes shape in which certain individuals must die to sustain antivenom production. Clinical trials offer another point of comparison, in which humans are subjected to risk for the potential benefit of other humans (Petryna 2009; Saethre and Stadler 2017). The staff at Siam Toxins rationalized the risks of husbandry and the provocation of venom collection as a sacrifice that those who are othered must endure to create life-saving antivenom. Those caught within the precarious grasp are maimed for the benefit of an unknown patient who, ultimately, may or may not even exist,¹⁸ as Chaiyaphum reported that between 30 and 50 percent of antivenoms expire on the shelf. The snakes and the “snake people” do not embrace this, but rather are forced to grasp on with the promise of survival.

THE PRECARIOUS GRASP

In describing antivenom as the end result of a “high-investment process,” Maverick compared Siam Toxins’ operations to that of a pharmaceutical company that produces chemically manufactured pills. For example, if 200,000 people take a pill used to treat high cholesterol twice daily, the company can guarantee a daily sale of 400,000 pills. Even if the profit is only thirty cents per pill, this still amounts to more than \$43 million USD in annual net revenue. These numbers are what make a real pharmaceutical company, said Maverick. Siam Toxins’ yearly net revenue from antivenom, by comparison, amounts to only \$1–2 million USD. “If you ever think that antivenom is worthwhile,” he encouraged us to consider the investment of venomous snakes, horses, feeder animals, humans, physical security, and facilities required to produce just one vial of antivenom.¹⁹ This is a matter of living with our “mess” (Tsing 2015, 19). We are fundamentally reshaped by the stakes of this investment.

At the end of the workday, Maverick would bid me farewell with a cheerful “see you if I’m not dead!” Our routine exchange made for a lighthearted reminder of the “slow but simultaneously intensive death-making” (Puar 2017, 139) at Siam Toxins; captivity is but death out of time. Snakes remain at the facility “forever,” and handlers, too, will be bitten for as long as they continue to grab snakes with their bare hands. In many ways, this manifestation of maiming extends to snakebite patients as well. The labors of care described in this article are done in service of what many medical professionals have described to me as an imperfect, “toxic” medicine. Antivenom may save patients from snakebite by neutralizing the snake’s venom, but has irreparable damage already been done

to the body? Will the attending physician provide appropriate wound care? Will the antivenom itself be what kills the patient?²⁰ These examples (and more) featured prominently in my research activities outside Siam Toxins. The snake is remade multiple (Mol 2003)—as toxins, reproduction, and anatomy—through the interspecies engagements that constitute antivenom production; yet humans are also remade through our collaboration with snakes. The boundaries between cadaver and egg become amorphous, blurred with the vitality of other species.

As discussed in this article, innumerable lives are implicated in the “precarious grasp” that takes shape around antivenom production. Snakebite necessitates a medicine made from snake venom (and horse blood), bringing us closer together and, therefore, into further conflict. Ethnographic examples from Siam Toxins explored these varied entanglements of vulnerability. The facility’s productivity is held in tension with the socio-biological needs of venomous snake and handler alike. Handlers remain within arm’s length to care for snakes and collect venom, making them both physically and economically vulnerable. Snakes are, in turn, vulnerable to the conditions of their detainment (i.e., limitations on time, resources, space, and manpower). In many cases, the snakes’ only recourse is to bite. Ultimately, both snakes and “snake people” are made vulnerable to antivenom production and the logics on which this industry selectively exposes individuals to harm. The grasp tightens its hold precariously as snakes are held indefinitely captive, and handlers are faced with the inescapable threat of a snakebite.

ABSTRACT

Venomous snakes offer unique insight into core topics of anthropological inquiry because they are both the cause of a disease, snakebite envenoming, and the source of the cure. At a Thai facility dedicated to venomous snake husbandry for the production of antivenom, the biological pharmaceutical used in the treatment of this disease, a team of staff manages a captive population of the snakes most likely to cause a medically significant bite. Here, both snakes and snake handlers face a significant risk of bodily harm. Drawing on twelve months of multisited ethnographic research, this essay shows how everyday acts of husbandry in service of antivenom production reconstitute the temporal processes of life through the interplay of biological necessity, lived experience, and economic limitation. Overall, I find that snakes and those who handle them with bare hands, caught in a two-way “precarious grasp,” are maimed in pursuit of treatment for speculative patients. [venomous snakes; antivenom; pharmaceuticals; care; medicine; interspecies; Thailand]

บทคัดย่อ

งูพิษเป็นสิ่งมีชีวิตที่สามารถให้มุมมองอันน่าสนใจในประเด็นสำคัญทางมานุษยวิทยา เนื่องจากงูพิษเหล่านี้เป็นได้ทั้งสาเหตุของโรค คืออาการป่วยจากการถูกงูพิษกัด และในขณะเดียวกันก็เป็นแหล่งของยารักษาอีกด้วย ในประเทศไทยมีสถานเลี้ยงงูพิษที่เชี่ยวชาญด้านการดูแลและเพาะเลี้ยงงูเพื่อผลิตเซรุ่มต้านพิษงู ซึ่งเป็นยาที่ใช้รักษาผู้ที่ได้รับพิษจากการถูกงูกัด เจ้าหน้าที่ต้องดูแลงูพิษหลากหลายชนิดที่มักเป็นสาเหตุของการถูกกัดที่มีอันตรายต่อชีวิต ทั้งนี้ งูพิษและเจ้าหน้าที่ต่างต้องเผชิญกับความเสี่ยงที่จะได้รับบาดเจ็บอย่างมีนัยสำคัญ จากการศึกษาวิจัยภาคสนามเชิงชาติพันธุ์วรรณนาเป็นเวลาสิบสองเดือนในหลายพื้นที่ชี้ให้เห็นว่า การดูแลและเพาะเลี้ยงงูในแต่ละวันเพื่อผลิตเซรุ่มต้านพิษงูนั้นเป็นกระบวนการที่เปลี่ยนแปลงและผสมผสานกันผ่านประสบการณ์ชีวิตของคนและงู ด้วยปฏิสัมพันธ์ทางชีวภาพและข้อจำกัดทางเศรษฐกิจ โดยสรุป การศึกษานี้พบว่าทั้งงูพิษและเจ้าหน้าที่รีดพิษงูที่ต้องจับงูด้วยมือเปล่าต่างก็ผูกพันอยู่ในความสัมพันธ์ที่เปราะบางและเต็มไปด้วยความเสี่ยงต่อการบาดเจ็บทั้งคู่นี้ในการผลิตยารักษาให้กับผู้ป่วยที่อาจถูกงูพิษกัดในอนาคต [งูพิษ; เซรุ่มต้านพิษงู; ยารักษาโรค; การดูแล; แพทยศาสตร์; หลากสายพันธุ์; ประเทศไทย]

NOTES

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1. I thank one of the anonymous reviewers for this phrasing.
2. Siam Toxins and the names of the people and snakes featured in this essay are pseudonyms.
3. To protect my own safety and that of my participants, I only handled snakes without medically significant venom.
4. This phrase, to catch a snake with one's bare hands, was frequently used by handlers to describe their work. Bare hands are juxtaposed against tools such as snake hooks, tongs, tubes, or gloves.
5. Quite often, these patients are the Siam Toxins veterinarians and handlers.
6. The proximity of an emergency department has contributed to positive treatment outcomes for all workers.
7. According to my participants, statistics on the incidence of snakebite envenoming in Thailand are unreliable and likely underreported. Estimates may range from 1,000 cases seen per year in hospitals to upward of 10,000 cases.
8. Veterinarians take WHO recommendations into consideration, but they prefer to frame their choices as a matter of lived experience. For more on expertise as "authority acquired through experience," see [Parreñas 2018](#) (118).

9. Dr. Maverick's personal experience with snakebite was described by both handlers and medical professionals as a traumatic event that left a lasting impact. Cloud said it was a call to reality, stating that "it doesn't matter if the snake is fast or slow, old or young, the bite will kill you all the same."
10. Dr. Maverick has traveled to catch individuals of a specific species, but this is a costly endeavor with no guarantee of success.
11. The identity of this handler was not disclosed; it is possible that they were fired.
12. Dr. Maverick, Dr. Chaiyaphum, and many other experts with whom I spoke are critical of the WHO's plan to reduce the number of snakebite deaths and disabilities by 2030 (see also [Quet 2023](#), 1).
13. *Body Worlds*, an exhibition of plastinated human cadavers, offers interesting parallels to Siam Toxins that cannot be adequately explored within the scope of this article. For more on this topic, see *The Anatomy of Body Worlds: Critical Essays on the Plastinated Cadavers of Gunther von Hagens* (2009), edited by T. Christine Jespersen, Alicita Rodriguez, and Joseph Starr.
14. See Suchai Suteeparuk, "เซรุ่มต้านพิษงู" [Snake antivenoms], accessible at https://www.rama.mahidol.ac.th/poisoncenter/sites/default/files/public/pdf/books/Antidote_book3-03_Antivenoms.pdf
15. These are complex topics, each deserving of attention in future publications.
16. The poison center works closely with Dr. Maverick, a valued colleague, but has no interactions with the handlers.
17. I want to "embrace," in [Mary-Jo DelVecchio Good's](#) (2007) use of the term, research into next-generation treatments that may have the potential to render antivenom as we know it, and therefore such a sacrifice, obsolete.
18. Antivenom is also routinely used in veterinary contexts; therefore, I may go so far as to argue that humans are maimed for dogs. This presents an important area for future inquiry.
19. During my research, the amount of antivenom used to treat snakebite ranged from a starting dose of five vials to, in one extreme case, eighty vials.
20. Dr. Chaiyaphum claimed that the risk of early adverse reactions (including anaphylaxis) is higher than the reported incidence rate of 3.5 percent. Based on data from the poison center, the number is likely closer to 10 percent.

REFERENCES

- Adams, Rachel
 2001 *Sideshow U.S.A.: Freaks and the American Cultural Imagination*. Chicago: University of Chicago Press.
- Allen, Jafari S.
 2022 *There's a Disco Ball between Us: A Theory of Black Gay Life*. Durham, N.C.: Duke University Press.
- Appadurai, Arjun
 1986 "Introduction: Commodities and the Politics of Value." In *The Social Life of Things: Commodities in Cultural Perspective*, edited by Arjun Appadurai, 3–63. Cambridge: Cambridge University Press.
- Aulino, Felicity
 2019 *Rituals of Care: Karmic Politics in an Aging Thailand*. Ithaca, N.Y.: Cornell University Press.
- Bagcchi, Sanjeet
 2015 "Experts Call for Snakebite to Be Re-established as a Neglected Tropical Disease." *BMJ* 351: h5313. <https://doi.org/10.1136/bmj.h5313>
- Biehl, João
 2004 "The Activist State: Global Pharmaceuticals, AIDS, and Citizenship in Brazil." *Social Text* 80, no. 3: 105–32. https://doi.org/10.1215/01642472-22-3_80-105

- 2009 "The Brazilian Response to AIDS and the Pharmaceuticalization of Global Health." In *Anthropology and Public Health: Bridging Differences in Culture and Society*, edited by Robert A. Hahn and Marcia C. Inhorn, 480–511. New York: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195374643.003.0018>
- Blanchette, Alex
2020 *Porkopolis: American Animality, Standardized Life, and the Factory Farm*. Durham, N.C.: Duke University Press.
- Bowker, Geoffrey C., and Susan Leigh Star
2000 *Sorting Things Out: Classification and Its Consequences*. Cambridge, Mass.: MIT Press.
- Boyer, Leslie V.
2015 "On 1000-Fold Pharmaceutical Price Markups and Why Drugs Cost More in the United States Than in Mexico." *American Journal of Medicine* 128, no. 12: 1265–67. <https://doi.org/10.1016/j.amjmed.2015.08.007>
- Briggs, Charles L., with Clara Mantini-Briggs
2004 *Stories in the Time of Cholera: Racial Profiling during a Medical Nightmare*. Berkeley: University of California Press.
- Buller, Henry
2013 "Individuation, the Mass, and Farm Animals." *Theory, Culture & Society* 30, no. 7/8: 155–75. <https://doi.org/10.1177/0263276413501205>
- Casewell, Nicholas R., Timothy N. W. Jackson, Andreas H. Lausten, and Kartik Sunagar
2020 "Causes and Consequences of Snake Venom Variation." *Trends in Pharmacological Sciences* 41, no. 8: 570–81. <http://doi.org/10.1016/j.tips.2020.05.006>
- Cassaniti, Julia
2015 *Living Buddhism: Mind, Self, and Emotion in a Thai Community*. Ithaca, N.Y.: Cornell University Press.
- Chippaux, Jean-Philippe
2017 "Snakebite Envenomation Turns Again into a Neglected Tropical Disease!" *Journal of Venomous Animals and Toxins including Tropical Diseases* 23: 38. <https://doi.org/10.1186/s40409-017-0127-6>
- Chippaux, Jean-Philippe, and Abdulrazaq G. Habib
2015 "Antivenom Shortage Is Not Circumstantial But Structural." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 109: 747–48. <https://doi.org/10.1093/trstmh/trv088>
- Davé, Naisargi N.
2023 *Indifference: On the Praxis of Interspecies Being*. Durham, N.C.: Duke University Press.
- De Certeau, Michel
2011 *The Practice of Everyday Life*. Translated by Steven Rendall. Berkeley: University of California Press.
- Deleuze, Gilles, and Félix Guattari
1987 *A Thousand Plateaus: Capitalism and Schizophrenia*. Translated by Brian Massumi. Minneapolis: University of Minnesota Press.
- DelVecchio Good, Mary-Jo
2007 "The Medical Imaginary and the Biotechnical Embrace: Subjective Experiences of Clinical Scientists and Patients." In *Subjectivity: Ethnographic Investigations*, edited by João Biehl, Byron Good, and Arthur Kleinman, 362–80. Berkeley: University of California Press. <https://doi.org/10.1525/california/9780520247925.003.0013>
- Despret, Vinciane
2013 "Responding Bodies and Partial Affinities in Human-Animal Worlds." *Theory, Culture, & Society* 30, no. 7: 51–76. <https://doi.org/10.1177/0263276413496852>
- Foucault, Michel
2003 "Society Must Be Defended": *Lectures at the Collège de France, 1975–1976*. Translated by Graham Burchell. New York: Picador.

- Franklin, Sarah
 2007 *Dolly Mixtures: The Remaking of Genealogy*. Durham, N.C.: Duke University Press.
- Fremling, Cal R., and Donald L. Hemming
 1965 "A New Method of Taxidermy Using Polyethylene Glycol as an Impregnation Medium." *The American Biology Teacher* 27, no. 9: 697–701. <https://doi.org/10.2307/4441144>
- Friese, Carrie
 2010 "Classification Conundrums: Categorizing Chimeras and Enacting Species Preservation." *Theory and Society* 39, no. 2: 145–72. <https://doi.org/10.1007/s11186-009-9103-7>
 2013 "Realizing Potential in Translational Medicine: The Uncanny Emergence of Care as Science." *Current Anthropology* 54, no. S7: 129–38. <https://doi.org/10.1086/670805>
- Habib, Abdulrazaq G., and Nicholas I. Brown
 2018 "The Snakebite Problem and Antivenom Crisis from a Health-Economic Perspective." *Toxicon* 150: 115–23. <https://doi.org/10.1016/j.toxicon.2018.05.009>
- Haraway, Donna J.
 1992 "The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others." In *Cultural Studies*, edited by Lawrence Grossberg, Cary Nelson, and Paula A. Treichler, 295–337. New York: Routledge.
- Hockey, John, and Jacquelyn Allen-Collinson
 2009 "The Sensorium at Work: The Sensory Phenomenology of the Working Body." *Sociological Review* 57, no. 2: 217–39. <https://doi.org/10.1111/j.1467-954X.2009.01827.x>
- Jespersen, T. Christine, Alicita Rodríguez, and Joseph Starr, eds.
 2009 *The Anatomy of Body Worlds: Critical Essays on the Plastinated Cadavers of Gunther von Hagens*. Jefferson, N.C.: McFarland & Company
- Jun, EuyRyung
 2024 "Grinding the Souls: Politics of Interspecies Pity and the Labor of Care in a South Korean Animal Shelter." *Cultural Anthropology* 39, no. 2: 298–321. <https://doi.org/10.14506/ca39.2.06>
- Kafer, Alison
 2013 *Feminist, Queer, Crip*. Bloomington: Indiana University Press.
- Kirksey, Eben, ed.
 2014 *The Multispecies Salon*. Durham, N.C.: Duke University Press.
- Kirksey, Eben, and Stefan Helmreich
 2010 "The Emergence of Multispecies Ethnography." *Cultural Anthropology* 25, no. 4: 545–76. <https://doi.org/10.1111/j.1548-1360.2010.01069.x>
- Kohler, Robert E.
 1994 *Lords of the Fly: "Drosophila" Genetics and the Experimental Life*. Chicago: University of Chicago Press.
- Kristeva, Julia
 1982 *Powers of Horror: An Essay on Abjection*. Translated by Leon S. Roudiez. New York: Columbia University Press.
- Latour, Bruno
 1999 *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, Mass.: Harvard University Press.
- Latour, Bruno, and Steve Woolgar
 1979 *Laboratory Life: The Construction of Scientific Facts*. Princeton, N.J.: Princeton University Press.
- Lemus, Sergio
 2017 "Performing Power en Las Yardas (at the Yards): The Body, Capitalist Discipline, and the Making of Mexican Yardero Lives in South Chicago." *Anthropology of Work Review* 38, no. 2: 104–12. <https://doi.org/10.1111/awr.12122>

- Lien, Marianne
 2015 *Becoming Salmon: Aquaculture and the Domestication of a Fish*. Berkeley: University of California Press.
- Marcus, George E., and Erkan Saka
 2006 "Assemblage." *Theory, Culture & Society* 23, no. 2–3: 101–9. <https://doi.org/10.1177/0263276406062573>
- Mol, Annemarie
 2003 *The Body Multiple: Ontology in Medical Practice*. Durham, N.C.: Duke University Press.
- Moore, Simon J.
 1999 "Fluid Preservation." In *Care and Conservation of Natural History Collections*, edited by David J. Carter and Annette K. Walker, 92–132. Oxford: Butterworth Heinemann.
- Parreñas, Juno Salazar
 2018 *Decolonizing Extinction: The Work of Care in Orangutan Rehabilitation*. Durham, N.C.: Duke University Press.
- Petryna, Adriana
 2009 *When Experiments Travel: Clinical Trials and the Global Search for Human Subjects*. Princeton, N.J.: Princeton University Press.
 2013 *Life Exposed: Biological Citizenship after Chernobyl*. Princeton, N.J.: Princeton University Press.
- Puar, Jasbir K.
 2007 *Terrorist Assemblages: Homonationalism in Queer Times*. Durham, N.C.: Duke University Press.
 2017 *The Right to Maim: Debility, Capacity, Disability*. Durham, N.C.: Duke University Press.
- Puig de la Bellacasa, Maria
 2017 *Matters of Care: Speculative Ethics in More Than Human Worlds*. Minneapolis: University of Minnesota Press.
- Quet, Mathieu
 2023 "Non-Standard Nature. Venoms, Serum, and Serpentariums in the Uneven Fabrication of Global Health." *Social Science & Medicine* 332: 1–8. <https://doi.org/10.1016/j.socscimed.2023.116113>
- Rader, Karen
 2004 *Making Mice: Standardizing Animals for American Biomedical Research, 1900–1955*. Princeton, N.J.: Princeton University Press.
- Ratnarathorn, Napat, Nipit Sanunsilp, Panithi Laoungbua, Tanapong Tawan, Montri Sumontha, Chalita Kongrit, and Phakhawat Thaweevoradej
 2024 "Species Richness, Seasonality, and Mortality of Snakes in Human-Snake Conflicts in Thailand: Insights from Citizen Science Data." *Biological Conservation* 294: 1–11. <https://doi.org/10.1016/j.biocon.2024.110603>
- Saethre, Eirik, and Jonathan Stadler
 2017 *Negotiating Pharmaceutical Uncertainty: Women's Agency in a South African HIV Prevention Trial*. Nashville, Tenn.: Vanderbilt University Press.
- Sharp, Lesley A.
 2011 "The Invisible Woman: The Bioaesthetics of Engineered Bodies." *Body & Society* 17, no. 1: 1–30. <https://doi.org/10.1177/1357034X10394667>
 2018 *Animal Ethos: The Morality of Human-Animal Encounters in Experimental Lab Science*. Berkeley: University of California Press.
- Sibunruang, Suda, Suchai Suteparuk, and Visith Sitprija, eds.
 2013 *Manual of Practical Management of Snake-Bites and Animal Toxin Injury*. Bangkok: Queen Saovabha Memorial Institute, Thai Red Cross Society.
- Stonington, Scott
 2020 *The Spirit Ambulance: Choreographing the End of Life in Thailand*. Berkeley: University of California Press.

- 2022 “Ontological Collateral: The Entanglement of ‘Cancer Pain’ and ‘Chronic Non-Cancer Pain’ in Thailand.” *Cultural Anthropology* 37, no. 1: 99–124. <https://doi.org/10.14506/ca37.1.09>
- Street, Alice
 2014 *Biomedicine in an Unstable Place: Infrastructure and Personhood in a Papua New Guinean Hospital*. Durham, N.C.: Duke University Press.
- Suchonwanich, Netnapis, and Winai Wananukul
 2018 “Improving Access to Antidotes and Antivenoms, Thailand.” *Bulletin of the World Health Organization* 96: 853–57. <https://doi.org/10.2471/blt.18.217075>
- Svendsen, Mette N.
 2021 *Near Human: Border Zones of Species, Life, and Belonging*. New Brunswick, N.J.: Rutgers University Press.
- Svendsen, Mette N., and Lene Koch
 2013 “Potentializing the Research Piglet in Experimental Neonatal Research.” *Current Anthropology* 54, no. 7: 118–28. <https://doi.org/10.1086/671060>
- Thompson, E. P.
 1967 “Time, Work-Discipline, and Industrial Capitalism.” *Past and Present*, no. 38: 56–97. <https://doi.org/10.1093/past/38.1.56>
- Tsing, Anna Lowenhaupt
 2015 *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton, N.J.: Princeton University Press.
- Van Dooren, Thom
 2015 “A Day with Crows: Rarity, Nativity, and the Violent-Care of Conservation.” *Animal Studies Journal* 4, no. 2: 1–28.
- Viveiros de Castro, Eduardo
 2014 *Cannibal Metaphysics*. Edited by Peter Skafish. Minneapolis: Univocal Publishing.
- Warin, Megan
 2009 *Abject Relations: Everyday Worlds of Anorexia*. New Brunswick, N.J.: Rutgers University Press.
- World Health Organization (WHO)
 2016 *WHO Guidelines for the Production, Control, and Regulation of Snake Antivenom Immunoglobulins*, Annex 5. Technical Report Series, No. 1004. Geneva: World Health Organization.
 2023 “Web Annex A. WHO Model List of Essential Medicines—23rd List.” In *The Selection and Use of Essential Medicines 2023: Executive Summary of the Report of the 24th WHO Expert Committee on the Selection and Use of Essential Medicines*, April 24–28: 1–67. Geneva: World Health Organization.