

Chapter 9

The Immune Home

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This chapter uses the example of mosquito repellents to reconsider the domestic orientation of global health immuno-logics. Spatial repellency, a volumetric mode of chemical action, seeks to reduce disease transmission by creating atmospheres inimical to mosquitoes and other insect vectors of disease. Unlike insecticides, which are expected to kill on contact, spatial repellency works by creating transitory chemical envelopes that keep potential biological threats at bay. Drawing inspiration from work by Tanzanian colleagues on new repellent products for malaria prevention, we explore the implications of untethering protection from the affordances of a physically enclosed domestic space. In Tanzania's Kilombero Valley, this untethering forces a re-examination of the contained, finished house as the conventional unit of global health action, drawing attention instead to modes of *house-ing* that encompass the spatial and temporal in-betweens of everyday life.

Introduction

It has been a long day. We have been driving around a network of rural villages across the river from the Ifakara Health Institute (IHI)—a Tanzanian center for global health research and a world leader in the study of mosquito-borne diseases. Our Land Rover carries a team of IHI scientists and a group of international collaborators looking to evaluate a new tool for malaria prevention: eave ribbons impregnated with the chemical transfluthrin. Designed by Arnold Mmbando, a doctoral student at IHI, the ribbons are made of ten-centimeter bands of burlap and can be easily affixed to the house's exterior to cover the gaps between roof and walls that are common in

many rural dwellings. Thanks to transfluthrin's spatial-repellent properties, the eave ribbons produce constant emanations that divert female mosquitoes when they approach houses in search of blood. Portable, cheaply made, and aesthetically pleasing, the combination of ribbon and chemical could, Arnold believes, transform the landscape of malaria prevention. It is a hope shared by those who have spent the last seven hours crammed in the car.

For the past two decades, the battle against malaria-carrying mosquitoes in sub-Saharan Africa has relied on two intra-domiciliary interventions: the spraying of interior surfaces with residual chemicals (known as indoor residual spraying, or IRS) and the distribution of long-lasting insecticide-treated bed nets (LLINs). Integrated with antimalarial drugs and rapid diagnostic tests, these measures have significantly reduced the incidence of malaria in many African regions. In recent years, however, case numbers have plateaued, and in some regions have started to rise again. Mosquitoes' increasing resistance to insecticides presents the most obvious challenge, but it has long been clear that the limitations of IRS and LLINs are inherent in their design. Key species of *Anopheles* mosquitoes are becoming behaviorally evasive, displaying a rising propensity to feed outdoors, or at times of day when residents are unlikely to be under the protection of a net. In rural Tanzania, a growing proportion of malaria transmission occurs through bites in peri-domestic areas or during communal gatherings.

There is also the fundamental spatial question of *where* the house *is*, and whether a physically enclosed interior can effectively accommodate a household and all its domestic routines. In regions like Ifakara's Kilombero Valley, the house does not always correspond to a singular, bounded material structure, and domestic activities rarely remain contained within the walls of a single dwelling. Residential space tends to spill out across thresholds, open spaces, and partial enclosures, encompassing multiple buildings in various stages of construction and (dis)repair.

This is where Arnold's impregnated ribbons come in. They are designed to create what he calls "bubbles of protection," invisible chemical envelopes shielding residents from malaria vectors. They work through passive dispersion, emitting into the ambient air vapors that irritate mosquitoes and disrupt their human-seeking abilities. Compared with other steps usually taken to repel mosquitoes—burning coils and herbs, applying topical formulations to skin and clothes—

Arnold's emanators require minimal investment or compliance from the user, work effectively for months on end, and pose fewer health risks. The ribbons also travel light, and IHI researchers are testing their efficacy in a variety of locales; recently, they attached them to the temporary shelters, or *Shamba* houses, where local farmers spend several weeks of the year while tending to their crops. Arnold is also exploring smaller repellent-dipped strips that could be distributed under verandas, partial walls, and outdoor kitchen pergolas¹ (Figure 1).



Figure 1: Arnold Mmbando affixing eave ribbons to an experimental hut, Ifakara Health Institute. Photo by the authors.

Spatial repellents represent a peculiar form of *house-ing*, a practice of prophylaxis oriented toward the domestic routines that unfold across and beyond the house's walls. By strategically positioning transfluthrin-impregnated ribbons and strips, Arnold and his colleagues hope to extend the *oikos* by chemical means, encompassing those peri-domestic locations and inter-domiciliary events where the risk of infection is often highest. A seemingly modest intervention, this reformulation of chemical protection carries nevertheless huge implications. In the long and convoluted history of malaria prevention in sub-Saharan Africa, spatial repellents bring into focus different forms of relationality and propinquity, directing our attention to the socio-material interstices of everyday life.²

Such a reimagining of global health does entail some trade-offs, however. The purpose of the day's road trip is to identify areas with very high rates of malaria transmission where a randomized controlled trial (RCT) could most easily demonstrate the ribbons' protective effectiveness. For Arnold, this minor expedition to some of the poorest and most endemic villages in the Kilombero Valley has been dispiriting. That evening, around the dinner table at the Institute's main house, he recounts to Lina Finda, a social scientist at IHI, a "heartbreaking" tour of houses with backs open to the elements, mud walls crumbling around sticks, children lying sick. Lina, who is researching the local relationship between house construction and malaria risk, nods. "We are just going to go around putting ribbons on these homes?" she asks. "It is shameful." Even if they are effective in diverting mosquitoes, she implies, fixing chemically impregnated ribbons to houses in a state of dereliction will not bring any durable improvement to the residents' living conditions. In fact, by virtue of their very cheapness and ease of application, highly portable products like the eave ribbons might help perpetuate chronic forms of destitution, "solving" the problem of exposure to mosquitoes at the expense of a proper consideration of the material infrastructures necessary to sustain a decent life.³

This chapter takes this ambivalence as its point of departure. What does the moral quandary of using chemo-atmospheric tools to tackle structural challenges tell us about emerging paradigms of immunitary protection? How does it illuminate the relationship between global health interventions, commonly based on the distribution of finished products, and the material

living conditions of the populations those interventions seek to benefit? We begin by describing the history of the enclosed house as a site and instrument of early malariology, focusing on the architectural innovations and socio-material manipulations through which the movement of parasites between humans and mosquitoes was first rendered visible. We then discuss the *domestication* of malaria control—how the house, understood as an interior contained by intersecting planes, made malaria control at scale a viable proposition. The repeated failure to eliminate malaria through indoor interventions provide the backdrop for the current appeal of spatial repellents, and for the promise of grounding protection in a different topology of peri-domestic spaces. We consider how the immune home is conjugated by this new paradigm of atmospheric action, and the degree to which malaria can still be articulated as a problem of “improvement” or “development.” Our interrogation closely tracks Lina and Arnold’s own questioning of the affordances of spatial repellency, and takes inspiration from their vision of *house-ing* to sketch out a more expansive imaginary of immunity in global health.

Domestic Surfacing

There is a close affinity between the organization of malaria control and the conceptualization of domestic space, and it goes back to the very moment the disease was first apprehended as mosquito-borne. Ronald Ross’s dissections of mosquitoes’ Plasmodium-filled gut tissue proved the existence of a microbial pathogen associated with malarial fevers, but it was Patrick Manson’s “model home” that ultimately settled the fundamental question of malaria epidemiology.

Manson conducted his famous experiment along the edge of a half-drained swamp in the Roman Campagna, an area both poor and intensely malarious. Constructed in London and then disassembled and shipped on to Ostia via Rome, Manson’s house consisted of four rooms adjoined by a single corridor. The windows were fitted with clear glass encasements and covered with cotton netting; the eaves, left open for ventilation, were secured with tight wire mesh. The netting-lined doors leading out of the house were further enclosed by a screened porch. A final set of netted curtains encircled each bed. They were affixed to the ceiling and anchored on the floor at a far enough distance to prevent mosquitoes from “biting through the meshes of the

netting any limb which might be extended out of the bedclothes during sleep.”⁴ Four men took up residence in this experimental interior: two researchers from London, their servant, and an Italian artist commissioned to illustrate the experiment. They lived there for three months, moving freely around the swampy grounds during the day, returning home during the evening to be cocooned within its mosquito-proof walls. The study yielded incontrovertible evidence: for the duration of their stay, the four experimental subjects remained malaria-free, while the surrounding population suffered repeated attacks of the disease (Figure 2).

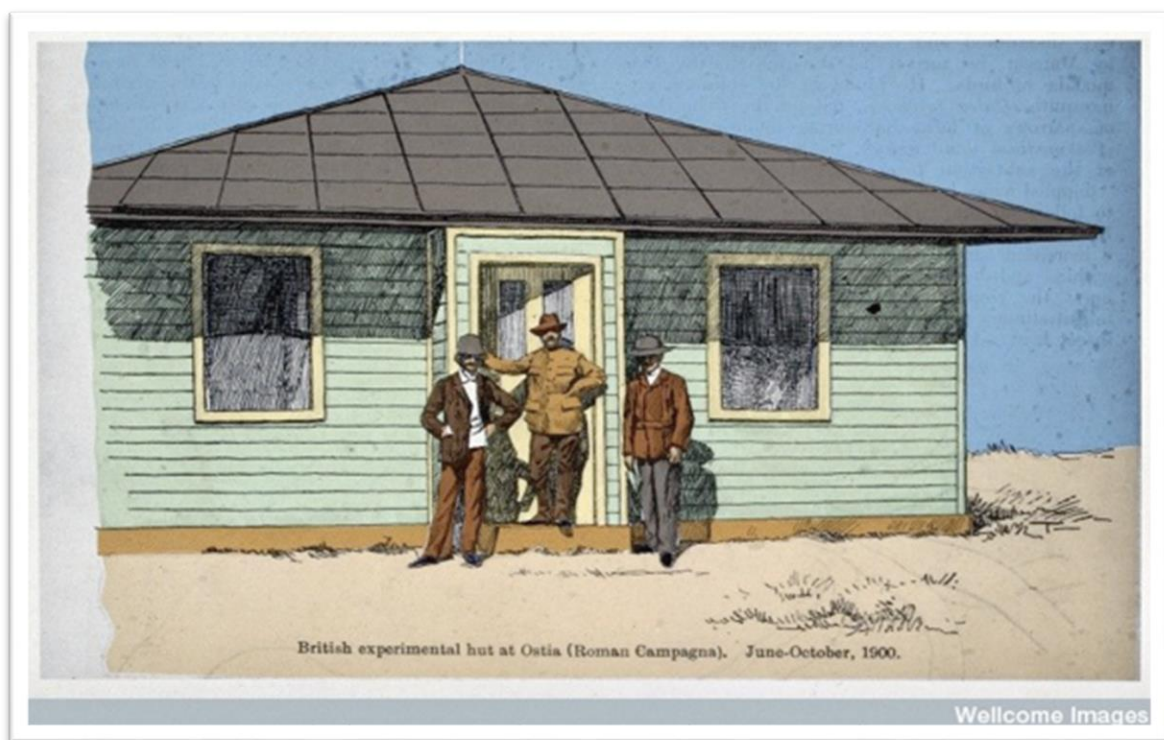


Figure 2: Patrick Manson's experimental hut and its occupants from June to October 1900. Drawing by A. Terzi, ca. 1900. Wellcome Collection. Public Domain Mark..

Manson's experiment was crucial in establishing malaria as a disease acquired predominantly indoors through the bite of female mosquitoes that had entered the house in the evening in pursuit of a blood meal. This understanding of malaria as an intra-domiciliary event would shape disease-control efforts for more than a century. Yet it allowed multiple answers to

the question of how to improve the protective affordances of houses. In Italy, the strategy that would later be known as “bonification” conceived malaria prevention as a consequence of “the improvement of the countryside in all its aspects.”⁵ According to this line of thinking, which was expressed with different nuances in other parts of the world, protection against malaria would emerge as the by-product of a generalized upgrading of the population’s living conditions, specifically of the quality of the housing stock in rural areas. Programs of house improvement were adopted in other notoriously endemic areas, such as the mining towns of the Central African Copperbelt, or the new agricultural areas created under the jurisdiction of the Tennessee Valley Authority.⁶

Support for this sort of broad-based intervention into material living conditions was far from universal, however. Ross had promulgated a very different ideal of malaria control, one predicated on the targeting of mosquito breeding grounds. By systematically treating standing bodies of water with petroleum derivatives or poisons, he contended, it would be possible to suppress the relevant mosquito species and thus impede the transmission of the parasite. In contrast to the promotion of general economic improvement, targeting the aquatic habitats of mosquito larvae was presented as a properly scientific approach, a surgical intervention that would excise the vector of disease and, in so doing, disentangle malaria from a range of social issues that had only an ancillary bearing on its epidemiology. Critics of larval control methods, on the other hand, countered that seeking to uproot mosquitoes from malarious landscapes was often impractical and in many cases impossible. As the British malariologist Colonel Sidney P. James put it in his 1926 report to the UN League of Nation’s Malaria Commission, “malaria should be dealt with in the houses of people rather than in the environment.”⁷ For, regardless of the numbers of *Anopheles* mosquitoes present in any given area, the home was where malaria was typically contracted and should thus remain the central battleground of public health action.

The discovery of DDT in the 1940s radically changed the complexion of this debate. It reinforced the role of the house as the frontline of anti-malarial efforts, but at the expense of a broader understanding of “improvement” or “development.” DDT’s extraordinary residual toxicity made it possible to interrupt malaria transmission by applying the chemical to interior domestic surfaces once or twice a year. DDT’s low-cost efficiency disentangled malaria

prevention from house upgrades or rural progress, while the possibility of concentrating efforts on walls and ceilings made control programs modular and scalable. This was the mode of chemical action that underpinned the WHO's Global Malaria Eradication Programme (GMEP, 1955–1969). "Houses, unlike potential breeding places, are easy to locate," wrote Carlos Alvarado and Leonard Bruce-Chwatt, directors of the WHO Malaria Eradication Programme. "Their area of wall surface can be closely estimated, and it is possible to forecast accurately requirements in materials, equipment, personnel and finance."⁸

The GMEP had its share of successes where homes conformed to the domestic topography of industrialized modernity. It struggled, however, in regions where residence was neither architecturally bounded nor geographically fixed. As WHO experts pointed out, a particularly intractable obstacle to GMEP's operations were those "habits of the population" that unsettled the assumption of the house as a stable material entity corresponding to an equally stable social unit. Recalcitrant behaviors, such as "outside sleeping during the hot season and frequent rebuilding, re-thatching and re-plastering of houses, related to special events (e.g., festivals) but carried out in an entirely irregular fashion," undermined the WHO's eradicationist ambitions.⁹ The vernacular logics that drove these processes of "frequent rebuilding"—the need to rebuild houses made from materials incapable of surviving the rains, the aspiration to a larger family that explained the construction of adjoining rooms, the nature of the "special events" that triggered acts of structural upgrading, or the aesthetic choices that accounted for the "irregularity" of those improvements—went largely unacknowledged. Driven by a relentless preoccupation with the chemical treatment of interior surfaces, GMEP reduced the house to a set of intersecting planes within which a family spends the night—an *oikos* of invariable geometry averse to social or material recompositions.

Peri-Domestic Atmospheres

Transfluthrin-impregnated products partake in the long genealogy of chemical tools against malaria, but index a different paradigm of protection. They reorient disease prevention away from the traditional insecticidal approach and toward the design, through repellency, of protective atmospheres. The site of operation is not the bounded, enclosed space of the physical

house, but the more fluid topography of the peri-domestic, the spatiotemporal in-betweens that play such a critical role in the transmission of malaria in the Kilombero Valley. Key domestic practices that typically occur outside the walls of the house—washing, cooking, sleeping, funerals, and parties—move from the fringes of public health attention to become the very point of intervention. Kinship ties and social groupings external to the nuclear family begin to feature more prominently in public health action. With a strategic positioning of transfluthrin-impregnated ribbons, the ephemeral collective that gathers to watch a football game at an outdoor bar, or to pay its respects outside the house of the village leader, can do so under the invisible protection of chemical emanations. And the eave ribbon is just one among many customized repellent products currently under development in Ifakara—the team at IHI is trialing a range of transfluthrin-impregnated bags, sandals, football socks, prayer mats, and chairs, all capable of creating bubbles of protection around individuals as they go about their daily lives, moving in and out of interiors and joining in diverse social endeavors.¹⁰

As protection becomes more situational, however, the built environment begins to slip from view, and this creates, as we indicated, mixed feelings. The shame that Arnold and Lina felt at the remedial use of repellents in impoverished villages is not due to any inherent limitations of the product, but to their fear that their generalized use would make material living conditions irrelevant to malaria prevention.

It is telling that this moral concern crystallized in the context of preparations for an RCT, when IHI researchers and their foreign collaborators were embarking on the journey of producing robust scientific evidence of the ribbons' protective efficacy. RCT data is necessary to sway the views of the international experts who determine whether a new product should become part of the global toolkit for malaria prevention. In this kind of study, the houses in the very worst shape often have the greatest evidentiary value—their crumbling mud walls and damaged thatch roofs leave their inhabitants so utterly defenseless that any protection afforded by the ribbon will become readily visible. Against a backdrop of constant exposure, the null hypothesis of “no protection” can be refuted by the slightest of interventions. This requires that the houses remain in a state of suspended disrepair while the relevant data are collected (Figure 3).



Figure 3. Village dwelling, southern Kilombero Valley. Photo by the authors.

Dereliction as empirical baseline is not an uncommon feature of malariological, or indeed of global health research more generally. Over a century ago, in another foundational study, the preeminent Italian parasitologist Angelo Celli was confronted with a similar predicament. Working in parallel to Manson, Celli's research focused on the high rates of malaria infection among families of railway workers in the outskirts of Rome. In order to demonstrate the effectiveness of screening domestic dwellings, Celli affixed thick muslin strips along the windows, chimneys, doors, and porches of a select group of workers' houses. His results were as impressive as those obtained by Manson in Ostia. "It is as if in a book we had a white page and a black page, the first would represent our protected dwellings and families, the second would represent our unprotected dwellings and families."¹¹ The choice of which houses to screen and which ones to leave unprotected was not random, however. "Old dwellings," he wrote, "do not lend themselves to have protective modifications made, and as a consequence were left as controls."¹²

There is a ruthless scientific logic in these decisions, as trials are designed to produce evidence that can travel far and wide, contributing to the assessment not so much of interventions but of *commodities*, standardized objects that can be deployed in a variety of contexts and situations. Precisely for this reason, however, because they are oriented towards the epistemic needs of distant audiences rather than the material concerns of their participants, controlled trials tend to sharply delineate the moral issues at stake. When the matter under consideration is that of domestic living conditions, these concerns probe the boundaries of global health as a field of practice focused on the deployment of “scalable” solutions. The effort to prove the effectiveness of transfluthrin-impregnated ribbons as a generalizable solution thus confronts Tanzanian researchers at IHI with a version of humanitarianism wedded to what Peter Redfield describes as “minimal modernism,” a preoccupation with the development of “replacement technologies meant to substitute for infrastructural norms.”¹³

Windows-in-Waiting

In the end, and after much preparatory work, the planned RCT did not go ahead, as it failed to secure the necessary funding. The problem, it transpired, was the proposed scale of the trial. The funders were worried that the study would be too small to power a statistically significant effect.

Arnold has since pursued other avenues for his doctoral research, and this has involved him in the evaluation of a different approach to the immune home. The Star Homes is a series of prefabricated, single-family houses designed by a Danish architecture firm with the purpose of reducing entry by disease-carrying insects. Originally inspired by the design of rural homes in Southeast Asia, the two-story structures use a prefabricated lightweight gauge steel framework. Erected on a raised concrete foundation and with mesh wire paneling for walls, construction is relatively fast, and requires far less concrete than houses with a typical cement block design. The mesh provides shade and facilitates airflow, keeping the house cool during the day and inhibiting mosquito entry by reducing indoor levels of carbon dioxide. Doors fitted with springs provide an additional layer of security against mosquitoes and other disease-carrying invaders. In contrast to most rural homes in the Kilombero Valley, the Star Homes have an elevated sleeping area, a dedicated cooking space fitted with a chimney, and roof gutters to collect rainwater and drain it

into PVC water tanks. Each house also comes equipped with an outdoor latrine and a fly-proof septic tank.¹⁴

A randomized controlled trial to measure the public health benefits of this design has been underway for several years in Mtwara, a coastal region in southern Tanzania. While the trial is still in its early stages, the results look promising. Arnold's entomological work suggests that the number of mosquitoes entering the houses is dramatically lower than in common dwellings. Additional architectural features meant to reduce smoke and to harvest and protect clean water seem to have a positive impact on the incidence of diarrheal and respiratory diseases as well.

The project has not been without its challenges, however, and these are mostly due, once again, to those ever-unpredictable "habits of the population." Of the approximately five hundred families in the trial area, one hundred and ten received identical Star Homes. The new houses were free, but the gift came with the expectation that participants would take up residence with their children for the duration of the trial. Such generosity generated suspicions, and it took the research team considerable effort to convince residents that nothing untoward would befall them in their new homes. The houses also required significant changes to domestic routines: high tables for cooking, screens between bedrooms, and the expectation that animals would not be kept inside the house. For some, these accommodations were too costly. Unapproved alterations were made to screens and doors, cooking continued to take place outside the designated area, and children were secretly sent away at night to sleep with kin.

Hearing Arnold recount some of the project's challenges, Lina is not surprised. Over the past few years, she has worked with homeowners, masons, and builders to study local construction practices: what improvements residents prioritize and which ones they defer, and what are the trade-offs between cost and quality they face. As her research makes clear, building a house is a stepwise process drawn out over many years—if it can ever be said to be complete – directed and financed by the residents themselves, who source most of the materials locally and regularly postpone structural work until cash becomes available.

Lina, who has just completed her own house in Ifakara and is familiar with masonry costs per square meter, notes that many residents lay foundations that are far too large for what they can afford to build. Rather than a mark of imprudence, this appears to her as a show of

commitment, care, and ingenuity; evidence of residents sketching out a future home that matches their aspirations, if not their current means. Many of these houses-in-the-making boast steeply pitched roofs—the kind you might associate with a Swiss village—while their interiors wait empty until a propitious windfall brings the resources necessary to build up the walls. In the meantime, they sometimes serve as allotments for growing crops and vegetables (Figure 4).



Figure 4. House on the outskirts of Ifakara Town. Photo by the authors.

Here, as elsewhere, construction provides the primary idiom through which the home is articulated: a marker of adulthood and personal growth, social status, and economic advancement for which “affective materials” like baked bricks, cement, or corrugated iron are as

salient as the built form they take.¹⁵ The shells of houses that dot the landscape across the Kilombero Valley stand as a testament to those dreams, and reflect the tactical sacrifices residents make in the face of fluctuations in the costs of raw materials, crop failure following a drought, or changes in family composition. These “inside-out” houses, to borrow Caroline Melly’s term, index ideals of the modern house—a large dwelling with large windows, brick walls, and screened doors—and the long and bumpy journey to get there.¹⁶ They materialize what Claire Mercer, in her study of middle-class construction in Dar es Salaam, describes as “the familiar rhythms of cash flow, materials acquisition and the faster and slower phases of the development of the building.”¹⁷



*Figure 5 (a and b). Completely or partially blocked windows in the Kilombero Valley.
Photos by the authors.*

The incremental process of house-building is perhaps most visible in the awkward squares that hover mid-wall in many otherwise seemingly finished houses (Figure 5). These are windows-in-waiting, future apertures blocked for the time being while the house owner awaits an inflow of cash to install frames, grills, and screens. The temporary brickwork that fills in the space often

remains in place for years—in many cases, forever. In the meantime, light and ventilation are secured by creating brick lattices or leaving eaves open. These windows-in-waiting exemplify the ebbs and flows of aspirational *house-ing*. They also link vernaculars of house construction with the preoccupations that animate the search for better measures of chemical protection.

Homes in the Meantime

Arnold's experience with the Star Homes has reinforced his sense of the importance of spatial and temporal in-betweens in the fight against malaria. The fact that the new houses looked very different from traditional ones mattered, of course, as people struggled to adapt to novel features and predetermined designs. But more than any uncanniness residents felt about their form, it was the alienation from processes of incremental improvement that made these houses such a challenging proposition for many. Erected in a short period of time from materials of unknown provenance, the gifted nature of these houses, and their disassociation from everyday strategies of self-realization, made it difficult to grant them the status of proper homes.

These insights have renewed Arnold's optimism for his eave-ribbons. Rather than operating as a "fix" for poor or derelict houses, they could be used, he believes, to mitigate the specific mosquito-borne dangers that are introduced by the drawn-out, stepwise nature of construction and improvement. Transfluthrin-impregnated ribbons and other portable repellent products could be deployed tactically during those periods in a house's extended life history when its inhabitants are particularly exposed to malaria. They would provide yet another temporary adjustment as residents strategize the next steps in the ongoing upgrading of their living conditions. In this way, the portability and lightness of the ribbons would be enfolded into a larger and longer-term project of material amelioration, rather than providing a justification for its abandonment. Affixed around a not-yet-finished window, for example, tranfluthrin emanations would reduce the risks created by brick lattices or the eaves used for ventilation. Rather than an outline that registers an absence, the window-in-waiting could in this way acquire a double purpose—an opening not just to the outside, but from the house onto the world and its contingencies; a platform for progressive *house-ing* to which the ribbons will meaningfully contribute.¹⁸

This volume reminds us that the house is a drawn-out vital project, a sustained endeavor—shaped by material constraints—to upgrade living conditions.¹⁹ It also suggests that the *oikos* comes about through intensive boundary work, a product of social coordinations enacted through domestic space but independent of any permanent demarcation between the interior and the out-of-doors.²⁰ How we understand the home has a direct bearing on how we imagine the scope for solidarity within the immunitary configurations that constitute human existence. Peter Sloterdijk likens modern domestic architecture to “a spatial immune system” whereby individuals live adjacent to, yet insulated from, neighbors defined by a situation of co-isolation. “Residence is, immunologically speaking, a defensive measure designed to demarcate a sphere of well-being from invaders and other agents of unwellness.”²¹

Yet while they might appear inoculated from the kind of intricate comings and goings that characterize the home, these “co-isolated associations” generate new connections, dependencies, and exposures by virtue of their sheer physical proximity and reliance on shared infrastructures. As we learn time and again when the private dwelling becomes our last line of defense against a common threat, the immunitary paradigm at the core of the high-modern security regime is inequitable, fragile, and ultimately dangerous.²² When total seclusion is the price of safety, the most immediate danger may be refracted for a while, but new threats will emerge in the meantime. Lasting immunity cannot result from compartmentalization and exclusion but, as Roberto Esposito writes, from “something more complex that implicates and stimulates the common.”²³

The question we started this essay with is whether spatial repellents can conjugate a different vision of the home, one attuned to forms of mutual obligation that cut across physically bounded domestic enclosures and are congruent with the gradual, aspirational nature of house construction. In the morally charged endeavor to assess the value of transfluthrin-impregnated eave ribbons, we can observe an effort to calibrate the diffuse power of this slight yet far-reaching innovation. By virtue of their atmospheric effects, and of the ease with which they can be installed, the ribbons project protection into the spatial and temporal in-betweens of social life. Chemically active in the peri-domestic areas that prolong the private dwelling, and across the extended temporalities of houses in the making, repellent products intervene into the

interstices of everyday life—those interim situations and circumstances that have historically been ignored by malaria prevention programs but are increasingly central to malaria epidemiology. Lina and Arnold’s fear that this chemical power would be used to (yet again) discard more permanent forms of improvement or development speaks to the long legacies of material neglect that have often accompanied global health interventions. Their desire to integrate the ribbons into vernacular strategies of collective upgrade expresses the hope that these in-betweens can perhaps become spaces of *communitas*, moments of collective care and improvement, rather than simply gaps where danger lurks.

¹ Swai et al., “Protecting migratory farmers”; Mmabndo et al., “Eave ribbons.”

² See Zacka, “What’s in a Balcony? The In-Between as Public Good.”

³ Scott-Smith, *Fragments of Shelter*, 2024.

⁴ Sambon and Low, “Report on Two Experiments on the Mosquito-malaria Theory,” 520.

⁵ Longobardi, *Land-Reclamation*, 8; See also Evans, “European malaria policy in the 1920s and 1930s” and Snowden, *The Conquest of Malaria*.

⁶ Packard, *The Making of a Tropical Disease*; Wilson et al., “The importance of vector control.”

⁷ James and Shute, “Report on the First Results.”

⁸ Alvarado and Bruce-Chwatt, “Malaria,” 90.

⁹ Bernard, “Remarks.”

¹⁰ Masalu et al., “Potential benefits.”

¹¹ Celli, 1900, cited by Ferroni et al., “Angelo Celli,” 37.

¹² Celli, 1900, cited by Ferroni et al., 37.

¹³ Redfield, “Shacktopia,” 18.

¹⁴ Mshamu et al., “Assessing the impact”; Knudsen and von Seidlein, *Healthy Homes*.

¹⁵ Archambault, ““One beer, one block.”” Degani, “Air in Unexpected Places.”

¹⁶ Melly, *Bottleneck*, 100. See also Bronwell, *Gone to Ground*,. Bofu et al., “The needs and opportunities.”

¹⁷ see Mercer, 2024, *The Suburban Frontier*, p.113.

¹⁸ Biehl, “Insurgent Archivings.”

¹⁹ See Motta, “The Dying Home”; Neiburg, “Multiscale Home.”

²⁰ Douglas, “The Idea of a Home.”

²¹ Sloterdijk, *Foams*, 535.

²² Sánchez-Criado, “Immunity beyond the home.”

²³ Esposito, *Immunitas*, 18.