



# The *Xenopus* Pregnancy Test

## A Performative Experiment

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**Abstract** There is an appreciable distance between the biochemistry of being pregnant and the experience of recognizing oneself as pregnant—a speculative gap that technology can serve to narrow or widen depending on how one chooses to choreograph an ontological state. Conducting an outmoded pregnancy test with live *Xenopus* frogs, we probed the contours of this gap. As we took an antiquated bioassay out of medical archives, we conducted a performative experiment—an intervention that blurred the boundaries between performance art, science, and ethnography. Like queer enactments of gender, performative experiments exhibit the performativity of conventional science and thereby make scientific modes of knowledge production and claims available for critical inspection. Moving beyond the domain of human self-fashioning and debates about the ethics of animal experimentation, our experiment also considered speculation linking the *Xenopus* pregnancy test to the extinction of other frogs. Amphibian biologists once hypothesized that *Xenopus* frogs brought a pathogenic fungus out of Africa. We found that this outbreak narrative projected colonial and racial stereotypes into the domain of animals and limited the scope of the scientific imagination. DNA test kits enabled us to determine that the frogs used in our study were not carrying the pathogenic chytrid fungus. Getting past stigma attached to particular species and locales, we found that parasites are nonetheless emerging within the biotechnology marketplace. Global commerce is generating hypervirulent strains of disease that threaten to disrupt human dreams and schemes.

**Keywords** multispecies ethnography, ontology, science and technology studies, queer theory, pregnancy testing, animal experimentation, extinction, art

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**Environmental Humanities** 8:1 (May 2016)

DOI 10.1215/22011919-3527713 © 2016 Eben Kirksey, Dehlia Hannah, Charlie Lotterman, and Lisa Jean Moore

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On the morning of August 29, 2012, we conducted a pregnancy test at home with a live African clawed frog (*Xenopus laevis*). Under the watchful gaze of interested artists, a radio journalist, and frog enthusiasts who gathered in a Brooklyn cooperative house, we injected a woman's urine into a dorsal lymph node of a frog named Loretta. Held firmly between sterile gloved hands, Loretta did not seem to notice when the fine needle of the syringe pierced her skin. But as a milliliter of fluid entered her body she contracted her legs and extended her claws in an apparent expression of discomfort. A wave of anxiety and mixed emotions passed through the room as Loretta's movements quieted and she was returned to her water-filled tank, where she would be monitored for the following twenty-four hours via a live webcast on Ustream. We generated public field notes on a blog as we settled in to wait for Loretta to lay eggs—an event that would indicate that the woman was pregnant.

At first blush the decision to conduct a pregnancy test in a semipublic forum, to unnecessarily extend its duration over a twenty-four-hour period, and to use a live animal long retired from this particular line of biomedical service appears ridiculous, even unethical. Our performance exhibited human debts to *Xenopus* frogs—creatures that continue to be widely used as model organisms in the fields of developmental biology, endocrinology, and neuroscience.<sup>1</sup> By injecting a frog in a semipublic space, we intended to render visible the ongoing violence taking place in laboratories behind closed doors. *Xenopus* frogs have long suffered so that humans might craft new social realities and science fictions. Starting from a position of noninnocence, confronting the routine violence of experimental practices face-to-face with a captive frog, we considered how humans have become dependent on complex entanglements with animals, ecosystems, and emergent biotechnologies.<sup>2</sup>

The *Xenopus* pregnancy test was used by one of us who wanted an answer to a very personal question: am I pregnant? By restaging this outmoded test, we denatured assemblages of technology, biology, and knowledge that standardize answers to this question. We considered how technology can expand or contract the temporal gap between the biochemical condition of being pregnant and the social experience of pregnancy. We explored this gap with what philosopher Dehlia Hannah calls a performative experiment, an appropriation of conventional scientific practice for purposes of art or parodic performance.<sup>3</sup> Performative experiments take place in contemporary art worlds when material practices of scientific experimentation become aesthetic forms. In addition to drawing on theoretical resources from what has been called the performative turn in science and technology studies, the notion of the performative experiment also

1. Between 1998 and 2009 the number of published studies using *Xenopus* in PubMed, the US National Library of Medicine's definitive database of biomedical research, increased fivefold. Green, *Laboratory Xenopus*.

2. Wolfe, *What Is Posthumanism?*; Haraway, *Modest\_Witness@Second\_Millennium*; Haraway, "Manifesto for Cyborgs."

3. Hannah, "Performative Experiments."

draws on queer theory—particularly the work of Judith Butler.<sup>4</sup> Like queer enactments of gender, these art interventions exhibit the performativity of conventional science and thereby make scientific modes of knowledge production and claims available for critical inspection.<sup>5</sup>

Bringing forgotten twentieth-century scientific techniques into the domain of art, our experiment considered how human existence has become contingent on the use and abuse of animals in biomedical laboratories.<sup>6</sup> Our performance was haunted by what Joseph Dumit calls *implosion histories*—stories, accounts, and connections that were initially paralyzing because of their enormity. Dumit insists that we remain ever attentive to the riot of stories that hover around everyday objects and scenes: “Following connections is the only way to proceed, no matter how worrisome the result.”<sup>7</sup> Rather than stick with a clearly articulated hypothesis, we traced the contingencies of unexpected connections in multispecies worlds. Delving into the scientific literature, we found studies showing that *Xenopus* frogs, which originate from Africa, can be asymptomatic carriers of a deadly fungal disease. *Xenopus* became linked to an out-of-Africa hypothesis of disease emergence that repeated tired colonial tropes about the “diseased continent.”<sup>8</sup> While studying how this outbreak narrative predictably stigmatized individuals, populations, locales, and lifestyles, we became determined to better understand the fungus. While humans are not harmed by this fungus, it has driven amphibians extinct as it spread around the world. As we conducted the *Xenopus* pregnancy test, to learn about our bodies and ourselves, we also used DNA test kits to search for fungal spores. Our mode of inquiry thus remained resolutely empirical, even as we explored the contours of hope and anxiety in biotechnical assemblages.

Bringing scientific tools to the art gallery, staging confrontations with complex facets of empirical reality, also opened up an opportunity to imagine how the world might be otherwise. Tim Ingold has recently called on anthropologists to develop their “speculative ambitions.” The task for the anthropologist, according to Ingold, is “to open up a space for generous, open-ended, comparative yet critical inquiry into the conditions and potentials of human life. It is to join with people in their speculations about what life *might* or *could* be like, in ways nevertheless grounded in a profound understanding of what life is like in particular times and places.”<sup>9</sup> Departing from the discipline of anthropology, this article opens up a number of methodological questions: What sort of tactics and techniques must be added to the toolkit of multispecies studies? Rather than pretend to stand apart and aloof from our subjects of study, how might we more

4. Crease, *Play of Nature*; Butler, *Gender Trouble*; Pickering, “After Representation.”

5. Hannah, “Performative Experiments.”

6. Dumit, “Writing the Implosion”; Kirksey, Costelloe-Kuehn, and Sagan, “Life in the Age of Biotechnology.”

7. Dumit, “Writing the Implosion,” 349.

8. Wald, *Contagious*, 235.

9. Ingold, *Making*, 4.

fully embrace the performative aspects of multispecies research practices? How might we use performative experiments to probe speculative horizons?

“There can be no science without speculation,” in the words of Michael Fortun, just as “there can be no economy without hype, there can be no ‘now’ without a contingent, promised, spectral and speculated future.”<sup>10</sup> Speculation in the biological sciences has linked the discovery process to commercial agendas. New findings have resulted in the production of lucrative drugs or biomedical interventions.<sup>11</sup> As human reproduction became technologically mediated, consumers of emergent “hope technologies,” in the words of Sarah Franklin, found new possibilities for parenthood and kinship.<sup>12</sup> But these same liberatory reproductive technologies generated new eugenic trends in humans and produced new forms of suffering in animals. These technologies also generated mass death in ecological assemblages. Working from a position of noninnocence and complicity—inheriting histories of animal experimentation and living with ecologically destructive processes—our performative experiment explored a series of speculative questions: How do biotechnical assemblages structure human hopes? Can we share the suffering created by our hope technologies? As biotechnology and global commerce change the conditions and potentials of life, how might we bring a renewed sense of responsibility to the realm of ontological choreography?

### Ontological Choreography

Working at assisted reproductive technology clinics in the 1990s, Charis Cussins developed the idea of “ontological choreography” to describe “the coordinated action of many ontologically heterogeneous actors in the service of a long-range self.”<sup>13</sup> Thompson described how different actors were “coordinated in highly staged ways” to produce parents and children.<sup>14</sup> This “deftly balanced coming together of things” united actors “that are generally considered parts of different ontological orders (part of nature, part of the self, part of society).”<sup>15</sup> If reproductive technologies now standardize the ways that humans are produced, our experiment with *Xenopus* frogs illustrated how we might choose to destandardize this production process.<sup>16</sup> Delving into the archives, we explored historical alternatives to choreographing the ontology of pregnancy.

The peculiar biotechnical affordances that make *Xenopus* useful in human pregnancy testing were discovered by South African researchers in the mid-1930s. If a potentially pregnant woman’s urine contains human chorionic gonadotropin (HCG), a hormone that is produced by the human body after a fertilized egg attaches to the

10. Fortun, “Mediated Speculations,” 146.

11. Sunder-Rajan, *Biocapital*; Haraway, *Modest\_Witness@Second\_Millennium*.

12. Franklin, *Biological Relatives*, 258.

13. Cussins, “Ontological Choreography,” 600.

14. Thompson, *Making Parents*, 8.

15. Cussins, “Ontological Choreography,” 600.

16. Rapp, *Testing Women, Testing the Fetus*; Franklin, *Biological Relatives*.

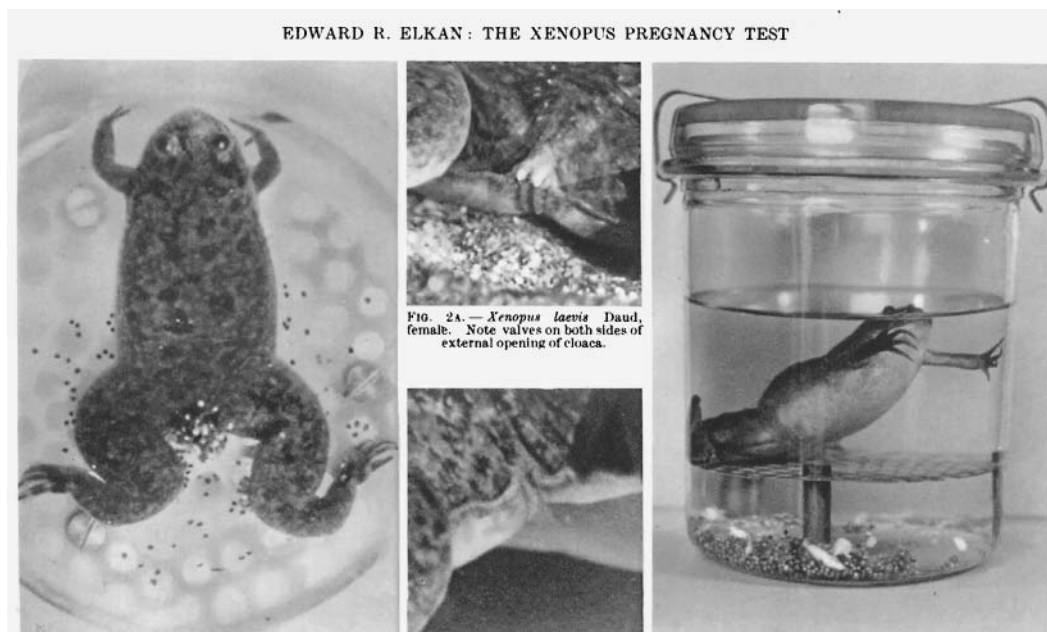


Figure 1. Images from a 1938 article in the *British Medical Journal* by Edward R. Elkan that helped popularize the *Xenopus* pregnancy test among physicians.

uterine wall, then an injected frog lays eggs (fig. 1).<sup>17</sup> The frog pregnancy test became part of standard medical diagnostic protocol, a hope technology for expectant mothers, which was used behind closed doors by doctors throughout the United States and Europe. *Xenopus* frogs can live up to thirty years in captivity if treated well, and each individual frog can be reused for a pregnancy test every two to three months, as soon as the female becomes gravid with eggs. In contrast to other early twentieth-century pregnancy tests, which required killing and dissecting the animals, the frogs were not permanently harmed during this bioassay.

Ontologies of human pregnancy have shifted over time, as multiple species have appeared and disappeared in distributed biotechnical assemblages. Before the *Xenopus* test, in the late 1920s, the “A-Z test” was widely used, which involved repeatedly injecting five female mice with a woman’s urine over several days. The mice were killed, dissected, and then examined to see if their ovaries were enlarged. Swollen ovaries signaled a pregnancy.<sup>18</sup> The Friedman test substituted rabbits for the mice in the late 1920s and led to the association in popular culture of rabbit killing with pregnancy testing. *Xenopus* initially became popular because it offered faster turnaround time and better sensitivity compared with earlier animal models, enabling diagnosis of pregnancy shortly after a missed menstrual period—as early as two weeks after implantation of

17. Elkan, “*Xenopus* Pregnancy Test.”

18. Kelley, “Aschheim-Zondek Test for Pregnancy.”

the fertilized egg.<sup>19</sup> The fact that *Xenopus* did not have to be killed in order to determine the status of a pregnancy also “improved the public face of pregnancy testing beyond the laboratory.”<sup>20</sup>

New kinds of pregnancy tests produced what Franklin calls “biological relativity” in a topsy-turvy world with an oscillating, fluctuating, and unstable sense of normality.<sup>21</sup> Pregnancy tests with animal models were gradually abandoned in the 1970s and 1980s as chemical tests became the norm in laboratories and later in the home. David Lynch, the director of the edgy and uncanny television series *Twin Peaks*, helped popularize the plastic pee-on-a-stick test with his 1997 television advertisement for Clearblue Easy. Lynch took the commission because it involved “the psychological torture of a beautiful young woman, a theme he has explored in other media.”<sup>22</sup> Lynch’s Clearblue Easy advertisement played with the speculative gap that emerges with pregnancy tests—capturing the agonizing suspense of waiting (in private) through a white woman’s face reflected in a bathroom mirror. “When you’re waiting to find out if you’re pregnant or not, nothing else in the world matters until you know,” the narrator of Lynch’s commercial says, while a clock ticks loudly in the background and possible results flash on the screen: “yes, no, yes, no, yes, no. . . .” Sarah Abigail Leavitt’s careful exegesis of this commercial considers the intense affects that bounce around during these sixty seconds: “Though it takes only a minute, it will be the longest minute of this woman’s life, for so much hangs in the balance.”<sup>23</sup> The viewer does not learn whether the smile on the woman’s face at the end of the commercial is one of relief or anticipation.

Time slowed down as we took the *Xenopus* pregnancy test out of the archives. This bioassay requires waiting much longer than the pee-stick test. Results with a frog can take as long as twenty-four hours to emerge. The *Xenopus* pregnancy test also delays the moment in a woman’s cycle at which knowledge is possible. It works reliably only two or three weeks after a missed period, in contrast to a plastic pee-stick test, which can deliver a result even before an anticipated period. While using this test, we viscerally experienced the appreciable distance between the biochemistry of pregnancy and the complex, embodied, and interpersonal experience of being pregnant. *Xenopus* frogs and the pee-stick test both detect HCG. Quantitative tests of HCG, performed after blood is drawn at a doctor’s office, can detect elevated hormone levels even earlier than the plastic pee-stick. The *Xenopus* test is thus slightly less sensitive than the pee-stick, which is itself less sensitive than a blood test. Therefore, the test itself—the chemical technology or animal assay—determines the temporal point in the progression of pregnancy at which a yes or no answer can be given. In other words, these pregnancy testing

19. Elkan, “*Xenopus* Pregnancy Test.”

20. Olszynko-Gryn, “Pregnancy Testing in Britain,” 2–3.

21. Franklin, *Biological Relatives*.

22. Reproductive themes and sexual undercurrents were also prominent in Lynch’s early work—such as *Eraserhead*, a 1977 cult classic that features images of flying sperm creatures and monstrous infants.

23. Leavitt, “Private Little Revolution,” 333.

technologies can serve to narrow or widen a speculative gap, depending on how one chooses or happens to choreograph an ontological state.

### Speculative Gaps

Playing with speculative gaps, the uncertain and difficult space between the present and the imagined future, can yield unnerving results. As one of us began trying to conceive a child, the speculative ambitions of this project took a very personal turn. We experimented with possibilities of queer kinship and self-fashioning while pushing the work of participant observation into uncomfortable realms—exposing private dreams to public inspection and critique. Dreams of fostering a potential human life were harbored by one of us who was partnered in a lesbian relationship. The imagined child took shape in the couple's eyes and minds as they bought clothes and toys suitable for various stages of life—tiny shoes that she would outgrow before she could walk, a dress that would be out of style by the time she grew into it, a fierce fuchsia ski jacket that they agreed would only work for a boy. They looked around at the children of heterosexual friends and neighbors, envying the ease with which biology helped to decide for them the shape of their eyes, the color of their skin, whose relatives they resembled. Every male friend became a candidate in the category of “uncle” or bio-daddy, whose influence in the imaginary child's family constellation they would chart with quick back-of-the-envelope calculations. Men on the street were reduced to their genes. Potential sperm donors were everywhere, and nowhere, to be found.

Amid indecision, a tattooed dyke doctor told the couple “whatever you'll do, you'll regret it—so just get some sperm and get on with it!” Ultimately, the couple purchased sperm in the summer of 2012 from a commercial bank, a queer marketplace where genetic material is coded by markers of race and class. The business plans of these facilities involve adding value to raw DNA—making it better by enhancing associations with the genetic inheritability of desirable phenotypes and social traits.<sup>24</sup> A relentless onslaught of choices presented themselves for queer self-fashioning. In the end, the couple chose a donor with whom neither of them shared ancestry simply because they thought he was the most beautiful. As their reproductive project proceeded, the couple embraced relations of kinship and affiliation that extended beyond their monogamous partnership.

Biological ties are often decentered in gay and lesbian notions of kinship, according to Kath Weston's book *Families We Choose* (1991), since they are based on choice and love rather than shared genetic inheritance. Likewise, multispecies families—which involve companions like birds, dogs, cats, or frogs—involve queer sensibilities because they involve relations of care and love that reach beyond fixed blood ties.<sup>25</sup> Power asymmetries among species, like the power asymmetries that bind children to parents in

24. Moore, *Sperm Counts*.

25. Kirksey, *Emergent Ecologies*, 135–36.



Figure 2. An African clawed frog (*Xenopus laevis*) resting underwater in an aquarium at Ueno Zoo, Tokyo. Photo by Peter Galaxy. Creative Commons Attribution-Share Alike 2.5 Generic, 2.0 Generic, and 1.0 Generic license.jpg

human families, meant that Loretta had no choice but to participate in our experiment. We purchased her with a credit card from 1-800-*Xenopus*, the toll-free hotline for a specialty laboratory animal supply company (fig. 2). Still, Loretta helped illustrate a deep kinship shared by humans and frogs—a similar biochemical makeup shared across divergent evolutionary lineages, with reproductive functions triggered by shared hormones. Once viewed as primitive creatures by experimental biologists, *Xenopus* frogs were formerly thought to be unable to experience feelings of pain or fear. But recent research has led to the revision of these earlier assumptions. According to a laboratory manual published in 2010 by the Taylor and Francis Group, “*Xenopus* have all of the neuroanatomical pain pathways as seen in mammalian species, and thus, like mammals, they are capable of experiencing pain.”<sup>26</sup>

Sharing suffering, according to Donna Haraway, involves paying attention to lab actors in precarious situations and “the practical and moral obligation to mitigate suffering among mortals.”<sup>27</sup> With this in mind, we injected ourselves with saline solution

26. Green, *Laboratory Xenopus*, 110.

27. Haraway, *When Species Meet*, 70.



before beginning our experiment with Loretta. The injections stung a little. They felt like a tuberculosis test, where a little bit of liquid is injected under the skin. By involving our own bodies in this art project—by being on the receiving end of saline injections, and by turning a potential pregnancy into a public spectacle—our intention was not to celebrate the heroics of self-experimentation. Rather than harbor a fantasy of ending all suffering by laboratory animals, or even claiming to “feel the pain” of the individual frog in our care, our intent was to situate human modes of self-fashioning within long legacies of animal experimentation. We experienced disquiet as our own bodies were turned into art objects. Our disquiet redoubled as we imagined and speculated, across species lines, about Loretta’s own subjective experiences during our experiment.

Pulling Edward R. Elkan’s 1938 article out of the archives, we carefully followed his instructions during our performative experiment. We purchased our equipment—syringes and rubber gloves—from a corner drug store in New York City, no questions asked. State law mandates that anyone in New York can buy up to ten syringes a day, even without a prescription. Rather than protect us from any infections that Loretta might have had, the gloves were to protect her from any toxic soap or detergent lingering on our skin. After we collected urine from our potentially pregnant team member in a clean cup and suctioned up the urine in a syringe, we injected Loretta. After placing her back in her tank and starting a live public webcam feed on Ustream, we went our separate ways to await the results. The prospective parents sent out an e-mail to friends and family, inviting them to become part of an expanding public witnessing the experiment:

Dear Friends,

Please join us in an extended moment of suspense: two weeks ago, X was artificially inseminated with sperm from an anonymous donor and she may be pregnant. This morning a small group of academics, artists, journalists and frog enthusiasts convened in Brooklyn to stage a historical reenactment of a pregnancy test that was developed in the 1930s. We injected one cubic centimeter of X’s urine into a pet adult female *Xenopus laevis* frog named Loretta. If she is pregnant, the frog will respond to the presence of human chorionic gonadotropin (HCG) in her urine by laying its own eggs within the next 24 hours.

We invite you to follow a live-streaming video of Loretta as she sits in a tank in Brooklyn. You’ll see the white amphibian with distinctive little black claws doing very little. (That doesn’t mean the link is broken; it just turns out that the frog doesn’t do much.) If you see anything odd in the tank, please feel free to comment on the blog—or better yet, call us!

We thought this would be a more interesting, communal, and differently synchronous way to think through animal labor, reproductive history, gender norms, and the many other different constellations of kinship, human and animal alike, that get formed in the process of reproducing. And it was a lot more stimulating and interactive than dropping ten bucks at our local drug store for a home pregnancy test.

With anticipation,

X & Y

The e-mail excerpted above initiated the transformation of a private query into a participatory public spectacle. The eighteenth-century experimental demonstrations of London's Royal Society—where, for example, birds expired within the vacuum of a glass jar—also involved staging spectacles for a live human audience.<sup>28</sup> If these earlier experiments were performed for a restricted public of “modest witnesses,” white adult males of the upper class, our own enactment of the *Xenopus* pregnancy test was open to the more democratic and unruly public space of the Internet.<sup>29</sup> While a restricted public gathered to witness the injection of Loretta, the public webcast circulated among an extended network—which included some of our colleagues and children, their friends, and friends of friends—some 130 people according to Ustream's viewer statistics. Our performance brought the typically private matter of conception to an experimental arena where approaches to witnessing competed with social norms for engaging with art, colleagues, roommates, friends, and strangers.

As we all followed the Ustream webcast in real time, a riot of questions emerged: Who is watching, and who may witness? How are desire and aversion informing the scene? How easy will it be to achieve consensus about the mechanical operations observed? With the e-mail imploring friends and family to “call us if you see anything,” the couple was redistributing the authority to witness, bringing queer eyes to scientific territory that has historically been dominated by straight guys. The first blog post, just hours after Loretta was injected, opened up technical issues: “OK, so we've found images of the frog eggs on Google and they are not easy to miss. Look for little tiny marble-like formations at the bottom of the tank. If you do see anything, text and let us know!! Eager eyes be on and offline all night awaiting Loretta's produce.” Others quickly chimed in:

“Is that something?”

“No wait, I think that is a smudge on the screen”

“Move Loretta! See if she moves then we can tell. I wish she could hear me.”

“Did something just happen on the live feed?”

“That looks like egg mass . . .”

“WAAAAAAAAAAAAAAAAAAAAAAAAAAAA!!!!!!!!!!!!!!!”

At this point the expectant couple placed a call to Grayson Earle, a new media artist who was looking after Loretta and the live video feed. They asked Grayson to “ground truth” the online observations. After taking a peek in the tank, Grayson reported that there were no eggs: “There's a little algae in there though, not sure. I'm so glad you two decided, after all, to take the traditional route to having a baby. :-)” After waiting overnight, the couple consulted with a medical doctor who advised that they take a home

28. Shapin and Schaffer, *Leviathan and the Air-Pump*.

29. Haraway, *Modest\_Witness@Second\_Millennium*.



Figure 3. The negative pee-stick tests used by the couple after their performance of the *Xenopus* pregnancy test.

pregnancy test. “Once we knew we’d have to do it, we ran over to a friend’s house as fast as we could to find out,” the couple wrote in a blog post.

Sadly, after peeing on three sticks, we had to accept that Loretta had been right all along. It was shocking, somehow, after such a wonderful day of waiting, and it was hard to know that we now would have to share our disappointment with so many others who’d come along for this wild ride with us. But all things considered it was quite amazing to have shared this moment of hope with everyone who turned up and tuned in to this process.

Plastic sticks can produce loneliness, isolation, and alienation—when used in a bathroom, separated from friends and family (fig. 3). Turning one’s private life into a public spectacle certainly also involves issues and dilemmas. Pee-stick tests can also afford women much-needed freedom from scrutiny. The lesbian couple at the center of this particular performative experiment had the difficult experience of sharing their disappointment with an emergent public that had come together around a moment of hope. Even still, the results of our performative experiment include not only a negative pregnancy test but the emergence of a constellation of enduring intimacies—a breaking down of barriers that usually separate species, academic disciplines, and private/public distinctions in interpersonal and professional spheres. As the speculative space containing the couple’s fragile hopes collapsed into disappointment, our performative experiment explored stories about ecological entanglements that were initially paralyzing because of their enormity. We began to investigate speculation that the *Xenopus* pregnancy test had gone wildly awry to cause the mass extinction of amphibians.

### Multispecies Migrations

Drastic declines in frog populations were noticed worldwide starting in the 1970s—particularly in Australia and the Americas. Upward of 165 species of amphibians are believed to have already gone extinct. About 1,895 amphibians, more than one-third of all described frogs, salamanders, and caecilians, are formally listed as threatened or endangered.<sup>30</sup> Scientists described a new species of fungus in 1999, a kind of chytrid called *Batrachochytrium dendrobatidis*, and identified it as a key threatening agent responsible for frog declines. Biologists immediately began to search for a mechanism facilitating the global spread of this chytrid fungus. Ché Weldon, a South African scholar, published a peer-reviewed article in 2004 linking the *Xenopus* pregnancy test with the emergence of this deadly amphibian disease. Taking tissue samples from amphibian specimens in South African museum collections going back to 1871, Weldon found that the earliest frog testing positive for pathogenic chytrids was collected from the Western Cape in 1938, just as they were being exported from this site for use in pregnancy tests around the world. By transporting *Xenopus* around the planet, Weldon surmised, humans inadvertently helped spread a plague among frogs.<sup>31</sup>

Weldon's out-of-Africa hypothesis of disease emergence followed the predictable script of an outbreak narrative by stigmatizing particular locales and lifestyles as dangerous, dirty, and diseased.<sup>32</sup> Africa, long imagined as the "diseased continent" in popular culture, often appears in the epidemiological literature as the source for diverse maladies—like the Ebola virus and HIV/AIDS.<sup>33</sup> Histories of colonialism and Cold War politics have produced the idea of the Third World as an epidemiologically risky space. While popular films and fictions paint Africa as a diseased continent, dominant narratives often fail to account for the global political and economic arrangements that foster health and well-being in so-called civilized nations and allow for the proliferation of illness in underdeveloped countries. With Weldon's out-of-Africa hypothesis, *Xenopus* frogs were stigmatized in the scientific and popular literature. The name of this creature means "strange foot" (*xeno* = strange, *pus* = foot) in Latin, and it began to feature in xenophobic outbreak narratives that wove mythic colonial tales together with the authority of science.<sup>34</sup> *Xenopus* was branded as the "Typhoid Mary of amphibians."<sup>35</sup>

30. "Frightening Statistics," Amphibian Ark, [www.amphibianark.org/the-crisis/frightening-statistics/](http://www.amphibianark.org/the-crisis/frightening-statistics/) (accessed September 14, 2004).

31. Weldon et al., "Origin of the Amphibian Chytrid Fungus."

32. Wald, *Contagious*.

33. The familiar phrase "there is always something new coming out of Africa" originated in Greece no later than the fourth century BC. Whereas *something new* meant strange hybrid animals to Aristotle, twentieth-century writers and filmmakers began using the phrase with a sense of admiration. Feinberg and Solodow, "Out of Africa," 255.

34. Wald, *Contagious*.

35. Lisa Brenner Katz, "An Animal Once Used as a Pregnancy Test May Be 'the Typhoid Mary of the Frog World,'" May 16, 2013, [www.scpr.org/blogs/news/2013/05/16/13693/an-animal-once-used-as-a-pregnancy-test-may-be-the/](http://www.scpr.org/blogs/news/2013/05/16/13693/an-animal-once-used-as-a-pregnancy-test-may-be-the/) (accessed January 14, 2016).

Working to disrupt dominant scientific accounts and popular outbreak narratives, Eben Kirksey designed a performance art piece to think with care about how *Xenopus* is helping generate ongoing changes in distributed ecological assemblages. This piece, called “Multispecies Migrations,” was part of a group exhibit at Proteus Gowanus gallery in Brooklyn probing how “movements are affecting our future on the planet, bringing crisis and calamity aplenty.”<sup>36</sup> Living *Xenopus* frogs, purchased for \$2.88 each from local pet stores, were displayed in mason jars alongside pictures of microscopic spores of the pathogenic chytrid fungus. Posting a free classified ad on *Brokelyn*, a web magazine for New York City residents, Kirksey offered to demonstrate basic laboratory skills that would enable ordinary people to conduct pregnancy tests in their own homes:

New York City pet stores sell *Xenopus laevis* frogs for cheap. In the 20th century this frog was widely used as a pregnancy test. Unbeknownst to anyone in this era, *Xenopus* can carry a deadly frog disease, the chytrid fungus. Help us discover if *Xenopus* is spreading chytrid around New York City. Please visit your local pet shop and buy a frog! Sold under the common names of “Underwater Frog”, or “African Clawed Frog”, baby *Xenopus* are available for just a few dollars in stores in all five boroughs. Choose the color you’d like—white albinos and speckled brown frogs are both available. Write down the phone number and address of your local store and bring a frog along to the Proteus Gowanus gallery. We’ll test to see if your frog has the fungus, and show you how to treat your new friend if it is a carrier. We’ll also show you how to do the frog pregnancy test in the comfort of your own home. This crowd sourced research project will be part of an academic study. All participants are potential coauthors of a paper that will be submitted for publication.<sup>37</sup>

This artwork, in part, had a didactic intent: the gallery performance explored speculation about the technological and ecological assemblages that were resulting in the extinction of amphibians. Using DNA test kits from the Amphibian Disease Laboratory at the San Diego Zoo, we also checked the microbiomes of all the frogs—a total of twenty-one animals, including Loretta—for pathogenic chytrid fungi. We used the DNA test kits to test outbreak narratives orbiting around *Xenopus* frogs. None of the frogs in our crowd-sourced fungal survey tested positive for chytrid spores. All of the frogs collected from New York City pet stores and the 1-800-*Xenopus* hotline were free of this pathogenic fungus. This performative experiment in Proteus Gowanus thus added a new twist to the entangled tale of frogs and their chytrid companions.

The empirical evidence from this experiment helped destabilize the story about an outbreak from the “diseased continent” facilitated by a pregnancy test gone awry.<sup>38</sup> Biological scientists have since argued against Weldon’s hypothesis with their own evidence. For example, one team found the deadly chytrids on the skin of a Japanese giant

36. “Migrations,” *Multispecies Salon*, [www.multispecies-salon.org/migrations/](http://www.multispecies-salon.org/migrations/) (accessed January 14, 2016).

37. The ad was posted on [brokelyn.com/](http://brokelyn.com/), July 15–August 15, 2012.

38. Wald, *Contagious*, 235.

salamander collected as a museum specimen in 1902, much earlier than Weldon's specimens from South Africa. Widespread and low-level infection patterns in Asia suggest that this chytrid species has been there for a long time, which would confound the out-of-Africa scenario. Genome sequencing data, from a study published in March 2013, reveal much genetic variability and ontological indeterminacy within different chytrid strains. One strain of these dynamic microbes, the global pandemic lineage, is highly pathogenic and has been killing frogs in Europe, Africa, Latin America, and the United States. Other chytrid strains are relatively benign and restricted to particular locales—one is isolated in Brazil, another is restricted to southern Africa and Spain, while another is found only in Switzerland. This study of pathogenic chytrid genomes reports that "it is premature to conclude a geographic location for the origin of *Batrachochytrium dendrobatidis*."<sup>39</sup>

While Weldon's hypothesis was wrong in some of the details and was shot through with tired colonial narrative tropes, perhaps he was on the right track with his speculative ambitions. By noting the possibility that a twentieth-century biotechnology scheme might have gone wildly awry, Weldon helped focus attention on how the life sciences are inadvertently contributing to ecological problems. Promiscuous liaisons in marketplaces for biomaterials and live foodstuffs, involving the mixing and mingling of cosmopolitan animals from diverse corners of the globe, have likely become places that have generated new deadly kinds of chytrids. Global capitalism has intensified the speed of chytrid spread. Specialty food markets—involving the global trade of live bullfrogs (*Rana catesbeiana*) for frog legs as well as Louisiana crayfish (*Procambarus clarkii*)—are constantly whisking chytrids around the world.<sup>40</sup> The global pandemic lineage likely emerged as a result of human commerce.<sup>41</sup> Researchers "predict the evolution of further hypervirulent fungal lineages across a diverse range of host species and biomes in the absence of tighter biosecurity."<sup>42</sup>

The velocity of the biomaterials marketplace and the vested interests promoting the global circulation of chytrids along with multiple species of live animals are paralyzing. We find it difficult to imagine a plausible future when government regulations will definitively bring the tighter biosecurity needed to stop the spread of pathogenic fungi.<sup>43</sup> By reenacting the *Xenopus* pregnancy test, we situated ourselves within worrisome histories, producing a confrontation with surprising, intolerable, and unbearable consequences of contemporary political and economic arrangements. As power continues to function predictably, perhaps it is time to scale up the scope of our imaginings while engaging in concrete practices of care in multispecies worlds.

39. Rosenblum et al., "Complex History," 9385.

40. Schloegel et al., "Novel, Panzootic, and Hybrid Genotypes"; McMahon et al., "Chytrid Fungus *Batrachochytrium dendrobatidis*."

41. Rosenblum et al., "Complex History."

42. Farrer et al., "Multiple Emergences," 18732.

43. Ibid.

## Conclusion

Science fictions and speculative fabulations, as Haraway has eloquently demonstrated, can engender the capacity to care for “critters of technoculture” rather than just “point toward future utopia or dystopia.”<sup>44</sup> Even though the deadly chytrid fungus did not originate from Africa, and the frogs in our own study were fungus-free, *Xenopus* can still harbor asymptomatic fungal infections. This fact led some national and state governments to propose final solutions. Xenophobia led to xenocide. After finding escaped *Xenopus* frogs in Golden Gate Park, the California Department of Fish and Game initially proposed to drain the park ponds, killing the ecosystem along with the “fiendish amphibians.”<sup>45</sup> Instead, park workers began using nets and traps baited with chicken, euthanizing some twenty-five hundred frogs with nerve poison after yanking them out of the pond.<sup>46</sup> Despite this eradication campaign, chytrids and wild *Xenopus* frogs continue to proliferate in California, Europe, and beyond. Escaped *Xenopus* frogs now live in unusual circumstances all around the world: drainage systems along the US-Mexico border, the canals of Holland, and underground water cisterns of Welsh castles.<sup>47</sup> Thinking with care about these errant critters of technoculture should avoid the perils of apocalyptic visions as well as the seduction of proposing final solutions.<sup>48</sup>

We live in a time when a multitude of terrifying and paralyzing stories compete for our attention. Global climate change is outpacing all attempted solutions. Capitalist enterprises that are rapidly destroying forests and wetlands in diverse corners of the globe may well be unstoppable. Social and economic inequalities—structured by pervasive racisms and legacies of colonialism—are being exacerbated in metropolitan centers of power and on the margins of the modern world system. Technologies continue to promote the reproduction of some kinds of people and certain charismatic species while pushing others toward death. These facts have led many to feelings of futility and complacency. Performative experiments, which need not be confined to the domains of biology and technology, can help address the imaginative dimensions of these problems. Staging performative ethnographic interventions in multispecies worlds, in the words of Kirksey, can help transform “feelings of futility into concrete action, cynicism into happiness and hope.”<sup>49</sup>

Our present study used an experiment to diagnose problems—related to changes in ecological dynamics in distributed assemblages, animal experimentation, and the choreography of pregnancy and queer kinship. Looking beyond this particular intervention, our research practice also offers an opportunity to speculate about how other

44. Haraway, “Speculative Fabulations,” 248–49.

45. Matier and Ross, “Killer Frogs of Lily Pond.”

46. Ibid.

47. Tinsley and McCoid, “Feral Populations of *Xenopus* outside Africa.”

48. Haraway, *Modest\_Witness@Second\_Millennium*; Haraway, “Speculative Fabulations.”

49. Kirksey, *Emergent Ecologies*, 219. See also “Desert,” *Anarchist Library*, [theanarchistlibrary.org/library/anonymous-desert](http://theanarchistlibrary.org/library/anonymous-desert) (accessed September 19, 2014).

inherited technologies might also be reconfigured with a reflexive do-it-yourself spirit.<sup>50</sup> Scholars working in the field of multispecies studies have the opportunity to design and implement their own future performative experiments to imagine what life mediated by technoscience *might* or *could* be like.<sup>51</sup> Performative experiments offer an opportunity to study elusive facets of life and multispecies contact zones with new techniques and dispositions.<sup>52</sup> Collaborations with experts from other fields, or even other species, can help multispecies scholars pursue a range of epistemological and political aims: sensing the world in new ways, interacting with other modes of being, and animating emergent modes of flourishing in multispecies worlds. Frontier practices of the twenty-first century are always announcing new worlds, proposing the novel as the solution to the old, figuring creation as radical invention and replacement, rushing toward a future that wobbles between ultimate salvation and destruction but has little truck with thick pasts or presents.<sup>53</sup> Conducting performative experiments against this backdrop might help generate responsible science fictions and speculative fabulations.

Our experiment explored the contours of hope and anxiety in personal and biopolitical worlds. We found that technology can serve to widen or narrow speculative gaps, depending on how one chooses to choreograph an ontological state. Pregnancy testing technologies come prepackaged with different speculative affordances. While promising speedy results and early detection, contemporary tests inadvertently prolong a state of indeterminacy—yes, no, yes, no—spreading out feelings of uncertainty over the course of several weeks. These tests have made it possible to detect early biochemical changes in a woman’s body, making the social and psychological experience of miscarriage more common. Reproductive technologies have thus put women into a difficult social state that Barbara Katz Rothman describes as a “tentative pregnancy.”<sup>54</sup> These technologies produce provisional, unsettled, and speculative states of being.<sup>55</sup> Contemporary pregnancy tests are thus just the beginning of a long period of indeterminacy, or being “a little bit pregnant.”

Standardized reproductive technologies impose biopolitical norms: legions of unborn disabled children with chromosomal anomalies and neural tube problems have been eliminated from the human population by technical procedures that prompt parents to abort nonnormative fetuses.<sup>56</sup> Reproductive technologies foster certain kinds of bodies while pushing others toward different conclusions such as termination.<sup>57</sup> Against the backdrop of scholarship about how technological standards produce different kinds of humans, our enactment of the *Xenopus* pregnancy test extends the rights of

50. da Costa and Philip, *Tactical Biopolitics*.

51. Ingold, *Making*.

52. Hodgetts and Lorimer, “Methodologies for Animals’ Geographies.”

53. Haraway, “Speculative Fabulations.”

54. Rothman, “Tentative Pregnancy.”

55. *Ibid.*

56. Rapp, *Testing Women, Testing the Fetus*.

57. Casper and Moore, *Missing Bodies*.



reproductive choice beyond women's bodies. Women now have the opportunity to choose among distinct biotechnical assemblages with distinct ontological and ethical affordances. By choosing the *Xenopus* pregnancy test, women can opt to minimize the uncertain and indeterminate state of the tentative pregnancy.<sup>58</sup> Choice, however, can be as much an ethical burden as an opportunity for forms of freedom. Women can choose to come face-to-face with animal laborers, to learn how to care for living diagnostic technologies, to experiment with modes of living differently within multispecies assemblages.<sup>59</sup>

The *Xenopus* pregnancy test can be enacted responsibly only when one uses frogs that are certifiably fungus-free. Even if these frogs are not involved in an out-of-Africa story of disease emergence, they can still be asymptomatic carriers of pathogenic chytrids—reservoirs of microbes with the potential to kill other species of frogs. DNA testing technologies that can detect pathogenic chytrids are relatively cheap and can be purchased online from Pisces Molecular.<sup>60</sup> Infected frogs can be easily treated with a diluted solution of over-the-counter antifungal cream.

The *Xenopus* pregnancy test illustrates how humans have become fundamentally “prosthetic creatures” with an ontology that has “coevolved with various forms of technicity and materiality, forms that are radically ‘not-human’ and yet have nevertheless made the human what it is.”<sup>61</sup> The animal familiars who make us what we are, the companion species that have helped stabilize our bodies and our selves, inherit complex entanglements.<sup>62</sup> Taking the *Xenopus* test out of the medical archives and reanimating it in the present offers an opportunity to learn new technical skills—to acquire knowledge of unfamiliar bodies and epidemiological networks that might allow for more responsible modes of living with others in multispecies worlds.

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58. Rothman, “Tentative Pregnancy.”

59. Haraway, *When Species Meet*.

60. Pisces Molecular, LLC, [www.pisces-molecular.com](http://www.pisces-molecular.com) (accessed January 14, 2016).

61. Wolfe, *What Is Posthumanism?*, xxv.

62. Haraway, *When Species Meet*.

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### Acknowledgments

Tammy Pittman of Proteus Gowanus gallery and Krista Dragomer opened up a generative space for experimenting with ideas in formation. Grayson Earle offered tactical support in the Treehaus when our intervention proved too controversial for the art world. Michael Khadavi, formerly the director of the Amphibian Steward Network at Tree Walkers International, helped us with the crowd-sourced fungal survey. The *Cultural Anthropology* editorial collective—namely, Cymene Howe, Dominic Boyer, and James Faubion—offered up generative feedback on an earlier draft of this essay. Leigh Claire La Berge participated in the critical conception of this performative experiment in more ways than one and provided substantial feedback on its transformation from an event into a paper. Above all we thank Loretta, and a multitude of chytrids, for playing a role in our performative intervention. The authors were able to meet to draft and revise the manuscript as a result of travel and fellowship grants provided by the Thomas A. Barron endowment to Princeton University and the Australian Research Council (DE140100918).

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