Dominant Hormone Protocol:
Directed Life and the Biopolitics of Chemical Messages

by

Julie M. Funk
B.A., University of Waterloo, 2016
M.A., University of Waterloo, 2017

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We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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SUPERVISORY COMMITTEE

Dr. Jentery Sayers, Department of English (CSPT)
Supervisor

Dr. Nicole Shukin, Department of English (CSPT)
Member

Dr. Thea Cacchioni, Department of Gender Studies
Outside Member

ABSTRACT

In 1905, Ernest Starling introduced hormones as "chemical messengers" to physicians at the University College London. In his lectures, Starling claimed that hormones "coordinate" the functions of the organs and that the discovery of hormones would allow physicians "absolute control" of the human body. As his paradigm treats hormones as bioinformation in a communications system where hormones are signalled and directed through the body toward target cells, I argue that hormones have emerged as a technology of biopower in scientific and medical practices.

Engaging in intersectional theories of biopower, my dissertation bridges conversations across Feminist Science and Technology Studies, Communication and Media Studies, and Cultural Studies to address how various industries' representations, organizations, and directed flows of hormones produce and manage neoliberal subjects globally. This hormonal management is most starkly felt by those who resist or find alternatives to its many forms, including medical standardizations of gender affirming care, reproductive management, and hormonal pollution. I turn to scholarship across feminist science and technologies studies by Donna Haraway and Michelle Murphy, and to micha cárdenas' work on algorithmic analysis in media studies, to think through the relations between hormones-as-information and directed life. Building on Alexander Galloway's theorization of information protocol as biopower, I offer the term "dominant hormone protocol" to describe a system which directs hormones to and from certain subjects to manage those lives. Through this term, I show how hormones enact power differently across gendered, racialized, and species-distinct subjects. I turn to fictional and nonfictional stories of hormonal relations by Porpentine Charity Heartscape, Barbara Gowdy, and Drexciya as sites for rethinking protocol and countering the bioinformational model of Starling's chemical messenger

paradigm. Ultimately, I demonstrate how stories not only inscribe dominant hormone protocols but can also be speculative sites for imagining counterhegemonic alternatives to the flow of chemical messages.

TABLE OF CONTENTS

TABLE OF FIGURES

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DEDICATION

To the testo and estro junkies, DIYers, hormone hackers and everyone else who lives hormonal lives, which is to say, to everyone.

INTRODUCTION / Circulating Chemical Messages

Navigating Hormonal Relations

Sometime in spring of 2022, around the same time I began writing early drafts of this dissertation, I met with an endocrinologist to discuss a chronic hormonal imbalance. This imbalance of steroidal hormones, which has been present since puberty and which presents itself as clinically low estrogen and slightly elevated testosterone level (when measuring for an adult woman), was attributed to polycystic ovarian syndrome in my early teens. Now, the network of medical professionals I've seen over the last five years think the issue isn't caused by cysts but by chronic and severe inflammation of my ovaries. This inflammation, they figure, is most likely due to the immune disorder I was recently diagnosed with—celiac disease.

The purpose of this appointment was to discuss the following: my chronic amenorrhea, infertility, and low bone density—all attributed to my atypical hormonal profile; how recent diagnoses of a microadenoma in my pituitary gland in addition to celiac disease are likely contributing to these irregular hormonal profiles; and what continued "hormonal management" might look like. For me, hormonal management has historically meant taking oral contraceptive (The Pill) to supplement low levels of endogenous estrogens and progesterone. The management plan the endocrinologist suggests this time is no different. And yet, I push back. In my time spent managing my hormonal profile with the synthetic estrogens and progesterone intended to further femininize my body, I have come to appreciate the ways my hormonal body exists outside of the neatly defined standards of femininity and masculinity.

I explain my perspective to the endocrinologist to no avail. The prescribed protocol doesn't change, although the endocrinologist does suggest I could try menopausal hormone replacement therapy (HRT). These medications usually contain the same synthetic hormones as

The Pill but in smaller doses. Although indicate interest in trying this option, I ultimately leave the medical office without any new prescriptions. What I do leave with, however, is a quiet determination to no longer engage in feminizing HRT protocols.

A few months later I receive a phone call from the endocrinologist. It's a check-up call to discuss recent bloodwork requisitioned during our appointment and how my body has been responding to removing gluten from my diet to treat celiac disease. I tell the endocrinologist that I hadn't gone back on the recommended oral contraceptive, but that it seems that five months on a gluten-free diet had increased the amounts of estrogen, progesterone, and luteinizing hormone my body can produce. The inflammation around my ovaries must have subsided. In an almost confessional manner I say that, in my 30s, I have experienced my first menstrual cycles. I also mention how dysphoric they make me feel and that I don't understand my body as a menstruating one. The endocrinologist is too busy celebrating the regulation of my menstrual cycle—a promising metric of medical normalization— and doesn't seem to hear this last part.

Feeling profoundly hurt and frustrated, I navigate my way through the rest of the conversation, go upstairs to my bedroom, and dig through my shelf of various prescriptions and over-the-counter medications. A surprising number of them are hormonal; a child-proof-capped pill bottle of SSRIs to manage my generalized anxiety disorder, a far less secure bottle of melatonin to put me to sleep when the SSRIs aren't enough or during my more rebellious stints against prescription medications, a half-empty tube of hydrocortisone cream to placate the burning itch of psoriasis on my right foot, and finally a stash of three unopened boxes of the oral contraceptive I've been prescribed for the last decade of my life, Loloestrin®. After checking the expiration date marked on the outside, I open the box with the prescription label that reads "1 of 3" and wade through the layers of packaging, literature, and other contents that subsequently

make their way into the trash. Popping the first blister in the pack, I throw my head back and drop the pink pill in my mouth, swallowing it dry. Despite what it seems, what it often feels like to me, this is not an act of acquiescence. On the contrary, it's my best shot at countering the dysphoria I feel during menstruation.

The phonetic "low/low" referent in the brand's nickname, "Lolo," refers to the low doses of ethinyl estradiol (an estrogen) and norethindrone acetate (a progestin [synthetic progesterone]) in Loloestrin® compared to other oral contraceptives on the market. These low amounts of hormones, combined with its relatively few placebo doses (only two doses are true placebos within Lolo's 28-day regime compared to the seven doses given by other brands), means that many people, including myself, never experience withdrawal bleeds on this brand of Pill. Instead, Lolo's relatively steady dose keeps both my uterine lining and my dysphoria at bay. It's not a perfect solution—not even close—but for now, reinterpreting what it means *to me* to be on feminizing HRT allows me to navigate a dominant medical protocol for hormonal management. Using Lolo for gender-affirming menstrual suppression reorients control over hormonal meaning away from constrained hegemonic interpretations of hormones and towards multiplicitous relations.

It is fascinating to me that the same hormonal molecules circulating from the same sources can result in such different interpretations between practitioner and patient about the value of their mediation on the body—especially when these two interpretations appear somewhat at odds with each other. Hormones are molecules imbued with rich meanings. Not only are they understood as a means of biochemical communication or "chemical messengers" operating at the cellular level, they also are the fodder of cultural interpretations at the social level. Societal preoccupations with the meaning of those chemical messages pervade both

public[1] and private life as hormones are often made scapegoats for behaviours deemed inappropriate—such as some expressions of sexuality, anger, or sadness. This preoccupation with hormonal meaning is not because we humans are innately gifted with an ability to translate chemical structures into social effects. Rather, our tendencies to seek hormonal meanings and organize them as appropriate or inappropriate stem from the emergence of the hormone within a paradigm of communication and control that understands hormones as biochemical media.

Hormones are relatively new scientific objects; at the time of writing, it's been just shy of 120 years since this chemical class was first introduced by British physician, Ernest Starling. In his publications, Starling, along with his frequent collaborator William Bayliss, began likening the chemical reactions witnessed in the body to "messengers" being signalled and received in the coordination of complex functions in a biological communications system. Over a century later, Starling and Bayliss' framing of hormones as chemical messengers remains the prevailing paradigm in endocrine science and medicine.

At the same time, hormones are biopolitical objects with a prominent role in the cultural production of bodies and their meanings. Gender-affirming hormone replacement therapies (HRT), reproductive management, and the toxic burden of exposure to endocrine-disrupting waste—to point to the examples featured in this dissertation—manage lives across distinctions of gender, race, and species as they circulate economically and ecologically. Yet, the cultural significance of hormones' effects on different bodies and their subject positions is often decontextualized from the production of the scientific thought through which these biopolitical

[1] As a Canadian watching from the outside, I recall how assumptions and interpretations of Hillary Clinton's hormonal well-being as a woman in her late-60s dominated political discourse surrounding the 2016 U.S. presidential election in ways I've not seen before or since with male presidential candidates. Suddenly, Clinton's political adversaries and their supporters were all deeply concerned with the endocrinological care of a menopausal woman and the effects hormones would have on her fitness for leadership.

relations arise. This decontextualization is the motivating problem for this dissertation; how then might we think through hormonal biopower without losing reference to the technical model of communication and control from which that power emerges?

Scholars across feminist science and technology studies, gender and sexuality studies, and trans studies have produced rich analyses that begin to trace the relations between the ways hormonal biopower is informed by the scientific practices that produce knowledge about hormones and have pointed to some of the specific ways that power manifests at the social level. This dissertation contributes to those conversations by offering a theory of protocol to think through the ways hormones are controlled and organized as information to manage the subjects they mediate. The story I share at the outset of this introduction is useful in demonstrating some of the ways governing procedures orient hormones towards subjects as a form of management—in my case, the management of gender. In other words, this story offers an example of organizing logics that render hormones biopolitical objects—what I call *dominant hormone protocol*. At the same time, my story also offers an example of how those systems might be reoriented or reinterpreted away from hegemonic hormonal relations. In the analyses of different forms of protocollary hormone power I offer throughout this dissertation, I turn to stories as rich and speculative sites for resisting protocol.

My personal story underscores three major premises that the chemical messenger paradigm[2] presupposes and that inform my theorization of dominant hormone protocol. These premises are that hormones are distributed everywhere and circulate through large (often global) networks, they circulate as biochemical information, and are implicated as objects of control

[2] In this dissertation, I use "paradigm" in the Kuhnian sense, referring to a scientific community's universal recognition of a scientific achievement, its models, and the problems those models produce. See Thomas S. Kuhn, *The Structure of Scientific Revolutions*, second ed. (Chicago, IL: University of Chicago Press, 1970), viii.

within these communication networks. Following these premises, I offer a review of relevant scholarship on hormones as scientific and cultural objects. Though this scholarship is varied across discipline and method, I argue that it contributes to the emergence of a field of "critical hormone studies." From this review, I introduce dominant hormone protocol as an apt theory for understanding how hormones' representation as biochemical information enables these chemicals to be directed in ways that enable control over life. Next, I turn to a discussion of the ways telling stories that involves speculation on alternative hormone relations can disrupt the dominant flows of hormonal biopower. I end this introduction with summaries of this dissertation's four chapters.

Three Premises for Thinking with Hormones

Hormones are Everywhere

Hormones are ubiquitous chemicals. According to some recent market research, the trans gender-affirming hormonal therapy market in the U.S. was worth USD 1.6 billion in 2022.[3] Global markets for other forms of HRT (estrogen and progesterone, human growth hormone, thyroidal, parathyroidal, and testosterone therapies) were collectively worth USD 21.28 billion that same year.[4] Similar data for insulin therapy valued this market at USD 20.35 billion in 2021.[5] It is clear that hormones circulate prolifically in the global economy. In my life, at least four different pharmaceutical hormonal products of various forms and functions pervade the limited surface area of my bedside table. Elsewhere in my house there are other hormonal

[3] Grand View Research, "U.S. Sex Reassignment Hormone Therapy Market Size, Share & Trends Analysis Report," *Grand View Research Inc.,* August 2023.
[4] —, "Hormone Replacement Therapy Market Size, Share & Trend Analysis," *Grand View Research Inc.,* May 2023.
[5] —, "Insulin Market Size, Share & Trends Analysis," *Grand View Research Inc.,* July 2022.

products that are rarely recognized as such, including the vitamin D supplements I often forget to take.

In addition to their ubiquity, these chemicals do not like to stay in one place. Hormones and hormone-like substances (like endocrine-disrupting chemicals) travel freely through aqueous channels such as blood, urine, and water. In this way, hormones are distributed widely and variously across watery networks. Their presence in our lives is not only limited to what our human bodies produce or what pharmaceuticals we swallow, dissolve, inject, insert, or apply topically, but also what we excrete, accidentally ingest, share, and are otherwise exposed to in hormones' global circulation.

In many ways the ubiquity of hormones is simply, and quite literally, a fact of life. Being alive means constantly encountering and being affected, even modified, by these chemicals. However, commercial applications for hormones (including the production of synthetic hormones) and the increasing burden of endocrine-disrupting pollutants warrant reflection on what it means to live amongst such complex, pervasive circulations of hormones and how we might navigate those circulations differently. What does it mean to live amongst and be permeated by ubiquitous biochemical information?

Hormones are Bioinformation

I have suggested that hormones are bound in circulation. While I am certainly talking about political economies of circulation and access (or lack thereof) to pharmaceutical hormones, my use of terms like "transmission" and "circulation" also gestures to the general scientific understanding of hormones as a chemical means of communication. Hormones are biochemical information distributed through the body. When Starling introduced hormones as chemical

messengers to the Western scientific community, he subsequently cemented a paradigm that would take seriously hormones' technicity as biochemical information. While I discuss Starling's "chemical messenger" paradigm more thoroughly in Chapter One, it is worth noting that this framework has persisted as the dominant hormone paradigm. As such, hormones are commonly likened to radio,[6] Wi-Fi networks[7] and the more general "information highway"[8] of networked computing. My body's low estrogen production can be, and has been, modelled as an issue of faulty signalling. Specifically, inflammation around my ovaries from celiac disease hindered the production and signalling of estrogen molecules. Supplementing with oral contraceptive presents an alternative signal source from which to transmit Lolo's chemical message. Of course, information transfer is one thing, but interpretative practices are another; both social and biochemical interpretations of one type of hormone may vary across different bodies.[9] That hormone messages are multiple and variously interpreted is precisely the reason why these chemical messages can be reoriented away from dominant forms of hormone management.

Hormones are Objects of Control

Hormones are objects of control not only because they regulate biological function, but because they are understood as enacting this power through technical means.[10] Hormones' propensity to be directed in ways that exert control over the body is inextricable from the technicity these chemicals have been afforded as chemical messengers. Starling frequently

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[6] Kyla Dunn, "How Do Hormones Work? | Fooling with Nature," *PBS Frontline*, accessed December 23, 2022. https://www.pbs.org/wgbh/pages/frontline/shows/nature/etc/hormones.html.
[7] Salman Khan and Neil Gesundheit, "Intro to the Endocrine System," *Khan Academy*, August 30, 2011. https://www.khanacademy.org/science/ap-biology/cell-communication-and-cell-cycle/cell-communication/v/intro-to-the-endocrine-system.
[8] Theo Colborn et al., *Our Stolen Future*, (New York, NY: Dutton, 1996), 203.
[9] Rebecca M. Jordan-Young and Katrina Karkazis, *Testosterone*, (Cambridge, MA: Harvard University Press, 2019), 33.
[10] Jules Gill-Peterson, "The Technical Capacities of the Body," *TSQ* 1, no. 3 (2014): 403.

emphasized that hormones' primary function is one of chemical coordination and control of the body's organs. In a system where hormone messages are transmitted as chemical information that organizes complex corporeal functions, controlling the circulation and direction of hormones positions these chemicals as technologies of biopower. However, this control often looks, and feels, mundane in practice. My endocrinologist's concern with establishing a plan for "hormonal management" involves swallowing a small pill daily. Every three months I refill my prescription and twice-yearly I make medical appointments to renew those prescriptions when they run out. I cannot *feel* how the "carbon chains…penetrate my [body]," travelling across "blood vessels, nerve endings, glands" as Paul Preciado does in *Testo Junkie*.[11] Yet, when I take The Pill, whether it is interpreted as an act of feminization or as androgynization through my disallowance of menstruation, I am nevertheless caught up in the complex relations of hormonal control.

Reviewing Critical Hormone Studies

These assumptions—that hormones are distributed, meaningful, and biopolitical objects—have informed scholarship on hormones across social sciences and humanities fields such as science and technology studies (STS), gender and sexuality studies, and trans studies. I have come to call this topically motivated yet methodologically capacious area of research "critical hormone studies." Despite the variety in academic approaches and interests across critical hormone studies, prominent contributors to this field generally address how the production, circulation, and mediation of hormones are closely tied to power. Put in conversation together, these scholarly works indicate the emergence of an interdisciplinary field dedicated to the study of hormones as both scientific and cultural objects. Often, these thinkers are just as (if

[11] Paul B. Preciado, *Testo Junkie*, trans. Bruce Benderson, (New York, NY: Feminist Press, 2013), 16.

not more) interested in the ways hormones inscribe and are inscribed with cultural meaning than with any specific biochemical message. My review of this literature is organized thematically, stressing where important thought on hormones converges and diverges on matters of social, economic, and corporeal control. The review surveys analyses of the construction of hormones as scientific objects, as bioeconomic actors, and of hormones' capacity to inscribe subjecthood, including race, on bodies.

Molecular Constructions of the Hormone

More than half a century after Starling introduced hormones to the scientific consciousness, Bruno Latour and Steve Woolgar would take up hormones in their book *Laboratory Life* (1979). This text offers one of the earliest treatments of hormones as a cultural object, rather than a purely biochemical object. By tracing the scientific production of what is now called thyrotropin-releasing hormone (TRH), Latour and Woolgar demonstrate how the hard data of laboratory experiments are subject to cultural and social influences, such as shifting academic networks within scientific fields. In the case of TRH, the authors argue that its emergence as a novel hormone is just as much work of scientific interpretation as it is of TRH's innate hormonal qualities. In their chapter, "The Construction of a Fact," Latour and Woolgar trace how TRH shifted from being perceived by the scientific community as trifling ("just a white powder") to becoming a "tool" with which scientists could further hormone research, and finally to becoming its own object of inquiry and gaining the status of "hormone."[12] By studying major publications on TRH from 1960-1970, the authors detail how TRH gained traction as a primary research object.

[12] Bruno Latour and Steve Woolgar, *Laboratory Life*, (Princeton, NJ: Princeton University Press, 1986), 110.

The eventual isolation and identification of TRH's structure is credited to Roger Guillemin and Andrew Schally, two American neuroendocrinologists working in separate laboratories. Latour and Woolgar argue that changing relationships to the scientific disciplines Guillemin and Schally were working in played a major role in their individual successes. While the work of isolating molecular structures is typically performed by trained chemists, which neither Guillemin nor Schally were, they were both willing to have their lab take on the grueling work of preparing hundreds of thousands of porcine brain extractions for bioassays. For instance, in his Nobel Lecture given on December 8, 1977, Schally describes how Oscar Mayer donated "about a million pig hypothalami" and that only 2.8mg of TRH were isolated from 100,000 samples.[13] Other researchers competing in the race to isolate TRH simply did not have the time or interest to undertake such laborious methods. Latour and Woolgar also attribute Guillemin's and Schally's tenacity to cultural forces, namely their immigrant statuses. The French-born Guillemin came to the U.S. in 1953 after earning a PhD from the Université de Montréal in Canada. Schally, a Polish holocaust survivor, similarly came to America in 1957 after completing his doctoral degree at McGill University in Montreal, Canada. Latour and Woolgar suggest these scientists' "outsider" statuses incited them to work harder than their American colleagues for their successes, even if that meant employing methods typically outside their fields.

Moreover, changing criteria for acceptable scientific proofs discredited other leading scientists working on the search for TRH's structure. Professional networks also influenced these scientists' results. While Guillemin's adoption of bioassay techniques used to isolate thyroid stimulating hormone (TSH) proved successful within six months, Latour and Woolgar argue that this success was largely influenced by Guillemin's hiring of an experienced technician who had

[13] Andrew V. Schally, "Aspects of Hypothalamic Regulation of the Pituitary Gland with Major Emphasis on its Implications for the Control of Reproductive Processes," *The Nobel Foundation*, (1977): 408.

previously worked on TSH. While these social relationships shaped how scientists like Guillemin and Schally worked to produce explanations of TRH's structure in ways acceptable to the larger scientific body, Latour and Woolgar also attribute to the construction of TRH to acts of interpretation.

The bioassay adopted by Guillemin requires two curves: an initial control curve "against which variations can be contrasted" and experimental elution curves produced from purified samples.[14] These curves are superimposed and examined for discrepancy between peak of the control and that of the experimental curve. The presence of discrepancy demonstrates TRH-like activity in the experimental sample. The nature of TRH-like activity is then defined through repetition of the experiment until a pattern is formed in the space between the peaks. In other words, hormones are not a scientific given. In the case of TRH, this hormone was constructed "solely in terms of the difference between two inscriptions"[15]—from what it was *not*. Thus, the construction of TRH is not only a matter of the social and scholarly relations that situated Guillemin and Schally as prominent researchers of TRH, but a matter of molecular legibility inside the laboratory.

In many ways, *Laboratory Life*'s focus on TRH is one of convenience rather than an inquiry emerging from any general interest the authors might have had on hormones. Latour and Woolgar cite the timeliness of research activity occurring on TRH in the decade prior to *Laboratory Life*'s publication and the manageable size of the field as justifications for their focus on the hormone. As such, their work appears peripheral to the later scholarship I consider canon in "critical hormone studies" and in many ways seems to anticipate the field rather than overtly

[14] Latour and Woolgar, 125.
[15] Latour and Woolgar, 127.

contribute to it. Nonetheless, Latour and Woolgar's work marks two important moves in the scholarship of hormones outside of medical and biochemical sciences. Firstly, it introduces hormones as a cultural text worthy of the attention of sociologists, historians, anthropologists, and other theorists. Secondly, the authors situate TRH's hormone status not as a given product of empiricism but as an outcome of precarious relations and the necessity of interpretive acts in scientific practice. While *Laboratory Life* marks an important entry point into the social and cultural study of hormones, it is also perhaps the greatest outlier in the constellation I am drawing around critical hormone studies because of its generally social constructivist approach to interpretative acts that anticipates an eventual Latourian Actor-Network Theory. The following works take more materialist approaches to hormones, affording them not just social but biochemical agency.

Nelly Oudshoorn's "archeology of sex hormones," *Beyond the Natural Body* (1994), offers a critical analysis of the social contexts from which hormones have emerged as both scientific object and pharmaceutical commodity. Like Latour and Woolgar, Oudshoorn traces the production of hormones through an analysis of scientific articles and first-person accounts from endocrinologists, pharmacists, and laboratory researchers. However, rather than looking at a specific molecular construction, Oudshoorn sets her focus on the emergence of "sex hormones" as a broad category. In doing so, *Beyond the Natural Body* suggests that cultural contexts from which sex hormones emerged as scientific objects are inextricable from those conditions which produce the binary model of gender that hormones seek to explain. One of Oudshoorn's most notable contributions is her intervention on the understanding that binaristic "male" and "female" sex hormones are scientific fact. Citing Ludwik Fleck's notion of "prescientific ideas"—social generalizations about the world which become reproduced in scientific knowledge—the text

establishes how the laboratory work of early hormone researchers slowly shifted scientific consensus away from a duality of gendered hormones as "sexual essences" to a complex system of feedback loops across the entire body.

Because the research materials used by early hormone researchers were prepared from (both human and non-human) testis and ovarian tissues, scientists defined the predominant secretions found in each type of gonadal tissue through a model of sexual difference. The secretions became known as "sex hormones." The idea of sex-specific hormones would be challenged by several biochemical and endocrine researchers once the presence of "heterosexual hormones" were found in the opposite sex ("male" hormones were found naturally present in women and "female" hormones were found naturally present in men). However, the dominance of sex-specific hormones prevailed. Oudshoorn attributes sex-specific hormones' staying power to the biologists, physiologists, and gynecologists whose practices concerned the regulation of secondary sex characteristics and reproductive organs. These fields largely maintained a sex-specific view of the hormonal body.

Biochemists, on the other hand, were more concerned with identifying the chemical characteristics of hormones and isolating their molecular structures. Oudshoorn posits that "the hormone of the biochemist is in many respects quite different from the hormone of the biologist."[16] The varying approaches of these different fields of knowledge resulted in practitioners assigning different meanings to hormones, essentially constructing multiple versions of hormones from the same chemical object. Like Latour and Woolgar, Oudshoorn argues that the construction of hormones is contingent on social and discipline-specific contexts, including professional and economic networks within scientific practice. However, with her

[16] Nelly Oudshoorn, *Beyond the Natural Body*, (New York, NY; Routledge, 1994), 36.

broader focus on “sex hormones” as a category, she demonstrates just how much hormonal meaning changes depending on who is doing the inscribing and interpreting.

In the second half of *Beyond the Natural Body*, Oudshoorn turns her attention to a thorough analysis of the ways hormones emerged as a pharmaceutical product in early to mid-twentieth century Europe, with a particular focus on the establishment of the Dutch pharmaceutical company Organon by Ernst Laqueur. Laqueur, who is credited with isolating the testosterone molecule from bull testicles in 1935, becomes a case study for Oudshoorn as she depicts how early endocrinologists established professional networks that facilitated research conducted at a scale and cost necessary to influence scientific opinion and create new pharmacological markets.

As a professor of pharmacology and member of the Pharmaco-Therapeutic Laboratory at the University of Amsterdam, Laqueur shared a similar problem with many of his peers in endocrine research. He had access to research equipment, space, and labour, but lacked direct access to research materials from which he could prepare glandular samples. Lacking access to his research object motivated Laqueur to establish Organon, The Netherlands’ first pharmaceutical company. Laqueur founded Organon in July, 1923. Through Organon, Laqueur signed a contract with Saal van Zwanenberg, the director of a slaughterhouse, to purchase the gonad offal from his abattoir. The partnership between Laqueur and van Zwanenberg was indicative of a larger move toward privatization happening in endocrine research through similar contracts across Europe and North America. Fostering good economic relations with the lab’s primary source of research materials was so necessary to the company’s success that Laqueur opted to set up Organon’s laboratory space inside the slaughterhouse, rather than at the University of Amsterdam where most research faculty had scientific laboratories. From there,

Organon would supply the Pharmaco-Therapeutic Laboratory at the University of Amsterdam with prepared samples. Laqueur would eventually use these samples to isolate testosterone and further advance his scientific career. When making preparations from cow and pig gonads became too costly, Organon began purchasing the urine of pregnant patients from gynecologists to study "female" hormones and the urine from male workers in "Dutch factories, barracks, and male penitentiaries" to study "male" hormones.[17] By creating networks between private and public industries, Organon would not only increase access to research materials, but ensure greater efficiency across the entirety of Organon's pharmacological production.

By the end of her examination of Organon, Oudshorn gestures toward a materialist critique of scientific production by tracing the processes through which hormones became commodities. However, though she frequently cites the various forms of biological material that contributed to the success of the hormonal pharmaceutical market, Oudshoorn's analysis stops short of pressuring the biopolitical conditions from which these lives could be rendered hormonal commodity in the first place. These concerns are further taken up by twenty-first century interrogations of hormones.

Directing Bioeconomic Flows

Celia Roberts' *Messengers of Sex* (2007) presents a major turn in critical hormone studies. Approaching the hormone from a materialist feminist perspective, Roberts fully embraces hormones as bioeconomic actors. By examining the ways hormones (usually as pharmaceutical products) are accessed, blocked, used, or refused, Roberts maintains a critical understanding of hormones' role as meaningful social actors without losing sight of their material

[17] Oudshoorn, 77.

capacity to act at the cellular level. By situating her work alongside the feminist "technoscience" thinking of Donna Haraway and Rosi Braidotti, and within feminist theorizations of the body popularized by Elizabeth Grosz and Judith Butler, Roberts demonstrates how pharmaceutical endocrinology has both biochemically and culturally produced hegemonic understandings of the gendered body.

In a chapter on the use of HRT as a menopausal and post-menopausal therapeutic, Roberts discusses how advertisers promise these hormones will restore femininity and prevent serious health concerns like osteoporosis and heart disease. In this setting, hormones are granted a great amount of power and agency as mediators of age, gender, and ability. For Roberts, these hormonal therapies are not just producing gender through *social* inscriptions of their meaning, they are *chemically* mediating bodies and are "active in the production of moods, cellular changes and feelings of desire within and between historically and geographically located bodies."[18] While Oudshoorn's work argues that hormones emerged from various scientific interpretations of their meaning, Roberts pressures how those hormonal messages vary further across different bodies once hormones are in bioeconomic circulations.

Possibly, Roberts' biggest contribution to scholarship on hormones is her demonstration of how hormones are not only bound within individual bodies but are distributed across species and throughout ecologies. She writes, "Sex hormones are also engaged in significant international (bio)economic flows, carrying particular understandings of bodies and sex in their global movements. These movements create significant connections between groups of humans and animals."[19] Such a sentiment is echoed by Donna Haraway in her chapter "Awash in Urine"

[18] Celia Roberts, *Messengers of Sex*, (Cambridge, UK: Cambridge University Press, 2007), 158.
[19] Roberts, 192.

(*Staying with the Trouble*, 2016) on DES and Premarin—two estrogen compounds troubled by their shifting status in pharmaceutical markets.

In "Awash in Urine," Haraway traces the "multispecies" bioeconomic flows of the synthetic estrogen diethylstilbestrol (DES). Between 1940 and 1971, DES was given to pregnant women as a hormonal supplement before being linked to increased cases of vaginal clear cell cancers in their children. Though Haraway is not a "DES daughter" herself, the companion species thinker comes face-to-face with DES when it is prescribed to her aging dog, Cayenne, to thicken leaky uterine walls and strengthen her weak canine bladder. From here, Haraway invokes another pharmaceutical estrogen supplement, Premarin, with which she does have an intimate familiarity. Through these drugs, the author follows the flows of gestational urine-made-commodity from humans in gynecological offices to mares in the Canadian prairie farms. By "tracking Cayenne's urine spots to out-of-the-way places…into a still expanding conglobulation of interlinked research, marketing, medical and veterinary, activist, agricultural, and scholarly body- and subject-making apparatuses,"[20] the chapter directly situates these endogenous and exogenous hormones in a messy and multispecies network of what Haraway calls "lively capital."

The bioeconomic flows of hormones identified by Roberts and Haraway are exemplary of what Paul Preciado coins the "pharmacopornographic era" in *Testo Junkie* (2013). That is, the hyper-mediation and commodification of the body through chemical means. Unlike Roberts' and Haraway's examinations of specific hormonal markets, Preciado takes a general view of all the economic circulations of pharmaceuticals to focus on the affective realm of hormonal biopower that these drugs generate. From this perspective, Preciado argues that "pharmacopornographic

[20] Donna Haraway, *Staying with the Trouble*, (Durham, NC: Duke University Press, 2016), 114.

biocapitalism"—the productive force driving the economic flow of hormones across bodies, species, and geographies—is not in the business of producing "things," but rather "moveable ideas, living organs, symbols, desires, chemical reactions, and affects."[21] The pharmacopornographic era is driven by neoliberal fantasies of unfettered access to transnational goods and the prescript of total individuality as achieved through biochemical mediation. The mediating effects of these drugs accumulate in narratives about one's subjectivity. Preciado refers to these narratives as "biopolitical fictions."[22] As Oudshoorn's analysis moves from an early Latourian social constructivist perspective to a larger critique of the bioeconomic production of hormones, Preciado's bioeconomic critique likewise marks a new turn in the critical hormone studies by offering a rich theorization of hormones' role in acts of subject-making.

It is important to note that while many of the authors already discussed address the cultural production of hormones and their circulated capital, they do not generally account for racial differences in hormonal interaction. The texts by Roberts and Oudshoorn, for example, are primarily concerned with endocrine knowledge produced through medical and scientific discourse and how these discursive communities have constructed narratives about the gendered body. These texts work diligently to break down persistent issues surrounding hormones, such as binary of male and female hormones, the medicalization of the post-menopausal body, and moral panics concerning the futurity of heterosexual reproduction. However, by setting their focus on the model of the hormonal subject that emerges from the scientific literature, the analyses offered by these authors often assumes and reproduces a hegemony of the medicalized feminine body. That is, both Oudshoorn's and Roberts' texts largely speak to the hormonal experiences of the

[21] Preciado, 54.
[22] Preciado, 388.

cis-gendered, white, heterosexual, woman's body. Their rather flat treatment of hormones and racial difference does very little to address how hegemonic medical practices not only *respond to* nonhegemonic bodies with pathology, but that these practices use hormones to *produce* those very differences.

Constructing Hormonal Subjects

Jules Gill-Peterson's article in *TSQ*, "The Technical Capacities of the Body" (2014) traces testosterone as a (trans)gender-making and race-making technology. Gill-Peterson's work is directly in conversation with media scholarship. Specifically, her *TSQ* article responds to Wendy Chun's writing on race as a technology of subjugation in *Camera Obscura*.[23] For Gill-Peterson, transgender HRT practices demonstrate "the technical capacity of the body to modify its gender" and these practices are inextricably tangled in productions of racialization. After all, "the same endocrinologists who first separated genetic and embodied forms of sex through hormones bound their clinical research to a racialized body."[24] In the process of producing gender, hormones also become tools for inscribing racial difference.

These ideas are extended in Gill-Peterson's monograph, *Histories of the Transgender Child* (2018). *Histories of the Transgender Child* traces the ways Western endocrinology and sexology have disproportionately represented transgender care as a white phenomenon. To demonstrate hormones' role in the construction of race, Gill-Peterson turns her attention to mid-century ideas of the "plasticity" of pre-pubescent gender. Plasticity refers to a theory of sexual and gendered development in neuroendocrinology that understands children's gender as variable

[23] Wendy Hui Kyong Chun, "Race and/as Technology," *Camera Obscura* 24, no. 70 (2009): 10.
[24] "The Technical Capacities of the Body," 409.

and easily influenced by hormone therapies. In the case of the intersex children that take up focus in *Histories*, plasticity was a measure of their bodies' ability to transform from ambiguous, non-binary expressions of gender to binary ones. However, because researchers mainly examined gender variability in the bodies of the white intersex children who had easier access to sexology clinics than their Black, Indigenous, and of colour counterparts, whiteness was seen as more "plastic" than other racial expressions.

One such example offered by Gill-Peterson concerns the use of cortisone to treat congenital adrenal hyperplasia (CAH). CAH is a condition of the adrenal glands that presents with ambiguously gendered primary and secondary sexual development. More gravely, the condition can cause life-threateningly low levels of salt in the human body if not properly treated. By the 1950s, endocrinologists who had previously used estrogen therapies to treat the rapid masculinization in female-assigned children began treating the condition with cortisone. Unlike estrogen therapies, which were *only* used to establish an aesthetic normalization of secondary sex characteristics in patients, endocrinologists found that cortisone treatments reduced the life-threatening risks of CAH and normalized the children's genders into binary expressions.[25] Again, the children accessing these treatments, whose bodies helped produce this new endocrine knowledge, were predominately white.

With CAH, doctors afforded the white child's body a sort of molecular agency to consent to a binaristic result of cortisone treatments, allowing it a certain (although temporary) nonbinary expression of gender through a paradigm of gender plasticity. However, gender plasticity was not the goal of these sexologists. Rather, it was a tool. The presumed plasticity of the (white) child's body enabled gender transition and temporary nonbinary expression, but its ultimate purpose was

[25] Jules Gill-Peterson, *Histories of the Transgender Child*, (Minneapolis, MN: University of Minnesota Press, 2018), 108.

to facilitate the medical coercion of a single and unambiguous expression of binary gender. That race is intimately tied to presumptions of whose bodies are or are not hormonally variable has had lasting repercussions for those outside of whiteness' privileged position of plasticity. Defining expectations for pubertal development based on white children supported theories of racial difference in the hormonal body, such as the racist assumption that Black and brown girls experience puberty earlier and are therefore precociously sexual. Constructing standards for trans and intersex medical practices through a history of research on white children also means that Black and of colour trans youth are more likely than their white peers to be dismissed and disqualified from gender-affirming medical and psychological care.[26]

While the CAH example provides vital insight into how theories of childhood plasticity have served whiteness in gender variability, I find this example equally invaluable in its demonstration of the way that "sex hormones" can be a self-limiting category. By investigating the use of cortisone, a non-sex steroidal hormone, to establish binaristic sexual expression in CAH, Gill-Peterson demonstrates how scholars critically engaged in the social productions of hormones will need to look beyond the roles of typical "sex hormones" like estrogens, progesterone, and testosterone to engage the biopolitical nuances of the hormonal body.

Gill-Peterson's contributions to critical hormone scholarship are essential to this dissertation for two reasons. Firstly, her research demonstrates that generalized treatments of endocrinology's history, such as that by Oudshoorn, cannot account for the ways hormonal management is experienced by *all* bodies—often omitting those already overlooked by scientific and medical research. By situating her historical account of endocrinology at the intersections of sexology and eugenics—such as Paul Kammerer's experiments with "heat rats" in 1920 in which

[26] *Histories of the Transgender Child*, 184-185

Kammerer suggested that hotter climates cause a hypersexualized expansion of gonadal tissue in males[27]— Gill-Peterson establishes hormones as race-making agents in the specific context of transmedicalization. Secondly, Gill-Peterson's analysis of the plasticity paradigm enriches previous scholarly treatments of the chemical messenger paradigm. *Histories of the Transgender Child* demonstrates how the interpretations of hormones do not only change over time, but across subject position. For Gill-Peterson, it matters little what the chemical message of the hormone is at any given time since each message is variable in its possible interpretations; biopower instead manifests in the ability to control the flow of chemical messages at both the biochemical and social levels.

Hormones' capacity to mediate race is also taken up by Rebecca Jordan-Young and Katrina Karkazis in their "unauthorized biography" *Testosterone* (2019). Jordan-Young and Karkazis argue that testosterone is inscribed with signifiers of racial difference through scientific practices that aim to affirm racist thinking. For example, the authors show how testosterone has been leveraged as a political tool to "uphold classical arguments for white supremacy" and give "credence to the notion that Black people are inherently disordered and dangerous."[28] While this text's focus may be on a singular hormone, testosterone, it argues that there are multiple "testosterones" in the public and scientific imaginary. Jordan-Young and Karkazis approach their study of testosterone through a discourse analysis of hormones' role in gendered behaviour across six themes heavily associated (or disassociated, as is the case with the chapter on ovulation) with testosterone in popular culture. These themes include ovulation, violence, power,

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[27] *Histories of the Transgender Child*, 51. See also Cheryl Logan, "Overheated Rats, Race, and the Double Gland: Paul Kammerer, Endocrinology and the Problem of Somatic Induction," *Journal of the History of Biology* 40, no. 4 (2007), https://www.jstor.org/stable/29737516.

[28] Jordan-Young and Karkazis, 70.

risk-taking, parenting, and athleticism. Notably, Jordan-Young and Karkazis position testosterone as a "storyteller,"[29] recognizing the molecule's semantic capacity.

Jordan-Young and Karkazis demonstrate how sociological research conducted in the 1980s through 1990s constructed testosterone as a signifier of masculinity and violence, effectively conflating the two characteristics as inherent to the male hormonal subject. In 1998, sociologists Allan Mazur and Alan Booth employed this understanding of testosterone-driven violence to support racist anxieties about Black men in low-income, urban populations. Without expanding their study to the general population, the researchers suggested that testosterone acted as a reciprocal biosocial molecule. Testosterone could not only stimulate certain behaviours, they argued, certain stimuli, such as receiving insults, could also increase testosterone production. Mazur and Booth believed the networked hormonal relationships between the chemical, the social, and the affective "could explain the problem of violence in the 'inner cities'—a problem they figured narrowly as struggles among young Black men." [30] They supported their hypothesis with the decades-old eugenic claim that Black men have higher testosterone levels than white men. The chemical logics behind these racist inscriptions of Black hormonal bodies erroneously suggest that violent criminality is a biologically-driven tendency in Black men and provide a rationale for increased police violence in predominantly Black neighbourhoods. Like Gill-Peterson, Jordan-Young and Karkazis understand that hormones are not only a "technology for making gender," but that "hormones also make race and class."

This constellation of scholarship I have outlined is methodologically capacious. Sometimes these scholars' approaches to hormones seem resolutely at odds with each other. For

[29] Jordan-Young and Karkazis, 5.
[30] Jordan-Young and Karkazis, 73-74.

example, thinkers from sociological traditions, like Latour and Woolgar, and from anthropological traditions, like Oudshoorn, are mostly concerned with the ways day-to-day scientific practices imbue research objects with social meaning. They afford little agency to the hormone as a bioinformatic object in the production of this meaning. This is quite a different approach than those taken by Gill-Peterson and by Roberts. Both *Histories of the Transgender Child* and *Messengers of Sex* position hormones as technological and mediating objects. Along with sharp analyses of the social interpretations that have shaped hormones, these authors' theorizations attribute agency to hormones in the production of their meaning. As evidenced by the current state of scholarly literature on hormones as cultural texts, there is no question that critical hormone studies recognizes hormones (and particularly sex hormones) as chemicals imbued with meaning—even if their thoughts on how that meaning is produced and circulated varies.

My own approach to theorizing hormones most closely aligns with those of Gill-Peterson in her *TSQ* article and Preciado in *Testo Junkie*. I explore hormones as technical objects that circulate "in the flesh of the human body, modulating the endocrine system…as a politicized and regulated medicine…on markets…as a linguistic signifier…[and] as a chemical index of environmental toxicity."[31] With an emphasis on *circulation*, we can begin to think through the ways hormones operate technically *and* socially at different scales (from the cellular to the ecological) and through different infrastructures (from the chemical to the economic). From this position, I argue that the heterogenous field of critical hormone studies is in need of a theory that accounts not only for *what* hormones' chemical messages may be, but also how those messages organize. This problem is one of the major motivations for this dissertation, and I respond to it by

[31] "The Technical Capacities of the Body," 403.

theorizing protocol as a mode of organizing hormone circulation through technical means and towards hegemonic outcomes. This theory of *dominant hormone protocol* offers a framework for thinking through hormones as simultaneously biopolitical and technical objects. In response to the hegemonic power of dominant hormone protocol, I turn to narrative—stories about hormones—as speculative sites where the signifying power of hormones can be reoriented towards counterhegemonic circulations.

Dominant Hormone Protocol

In general, "protocol" refers to the rules that organize and govern systems. Scientific knowledge production (via empiricism), medical practices, and information exchange are all examples of systems governed by protocol. In this way, hormones are familiar subjects of protocol. The scholarship that makes up critical hormone studies keenly engages how scientific and medical protocols determine which bodies can access which hormones, what amounts can be accessed, and for which purposes. However, I argue that the prevailing model of hormone action—Starling's chemical messenger paradigm—situates hormones in a bioinformational protocol. As biochemical information, hormones are signaled and received by target cells to transmit the messages they carry. In some cases, certain steroidal hormones even follow specific pathways to chemically "recode" into other hormones. For example, through a process of chemical reactions called aromatization, the hormone precursor cholesterol can transform into pregnenolone, then DHEA,[32] then androstenedione, then testosterone before becoming estradiol. The possible pathways that determine these transformations in the "hormone cascade," as it is

[32] Dehydroepiandrosterone.

called, are specific and require specific conditions (rules) to govern the changes that can turn a testosterone molecule into an estrogen.

Protocols facilitate adherence by ensuring that taking the preferred action means taking the path of least resistance. In some cases, protocol may take the form of guidelines or "best practices." In other cases, protocol may manifest as infrastructural barriers to access outside of the dominant pathways. Thus, protocol is central to biopower as a technical mode of producing and organizing subjects. This is no different in the case of hormones. What I am calling dominant hormone protocol certainly includes, but is not limited to, biomedical protocol for diagnostic and therapeutic treatments, or experimental protocol as a collection of the steps, tools, and methods used in scientific inquiries.

In addition to these discipline-specific uses of protocol, a critical inquiry into dominant hormone protocol elucidates the material-semiotic techniques used to create, maintain, and direct certain hormones (and the bodies they mediate) in ways that reproduce cultural hegemony across gender, race, and species distinctions. As such, dominant hormone protocol exemplifies how these strategies of control subjugate by directing hormones in ways that produce hegemonic relations between bodies and bioeconomies. In this dissertation, I explore how protocols encourage industrial management, such as that by pharmaceutical, conservation, and petrochemical industries, over transgendered, non-human, and racialized subjects. My treatment of protocol throughout this project is heavily informed by Alexander Galloway's thinking in *Protocol* (2004). For Galloway, protocols are materially immanent organizations with distinctly embodied effects. Likened to a speed bump, Galloway argues that protocol exerts power to gain acquiescence, not through brute force, but because protocol makes it difficult, uncomfortable,

and often dangerous to work outside of its modes of power.[33] I briefly return to Galloway's theory of protocol as the logical extension of Starling's "chemical messenger" paradigm in Chapter One.

Throughout this dissertation, I frequently refer to the action of dominant hormone protocol as a *flow* of hormones and their chemical messages. Thinking through hormones as flowing is an apt framing of hormone protocollary power for two reasons. Firstly, many hormones move through aqueous channels, literally flowing through water, blood, and urine. Secondly, flows indicate an orientation or current. If dominant hormone protocol directs hormones *towards* something, somewhere, or someone, then it directs hormones *away* from other things, places, and lives. This means that even if hormones are distributed matter, they are often still "severely unevenly distributed"[34] within networks of "power, knowledge, and capital which determine where and how different fluids, tissues, organs, and bodies circulate [to create] differences along gender, sex, race, disability, and class lines."[35] In other words, while protocollary networks are growth-oriented[36] and are often in the business of opening up the circulation of hormones as bioinformatic and bioeconomic commodities, the concentration of hormones one may be exposed to differs greatly across subject position.

Dominant Hormone Protocol as Bioeconomic Circulation

Though he never invokes the term "neoliberalism" explicitly, Galloway's treatment of protocol demonstrates that protocol offers a management system suitable to controlling unfettered growth in the decentralized networks that are essential to neoliberal governance.

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[33] Alexander R. Galloway, *Protocol,* (Cambridge, MA: MIT Press, 2004), 241.
[34] "The Technical Capacities of the Body," 403.
[35] Preciado, 165.
[36] Galloway, 243.

Protocol's goal is to direct action across expansive and continually growing relations (be they informatic, economic, social, or otherwise), not by asserting hierarchical power but by a form of governance that is synonymous with the "sensible."[37] This description invokes the same neoliberal appeal to good sense as Wendy Brown does when she describes neoliberal governance as "sophisticated common sense."[38] Under neoliberal logics of growth, protocol also manages life through strategies of deregulation and open access that foster increased economic value.

Concerns about the production of hormonal capital inform every chapter of this dissertation whether implicitly (Chapters One and Two) or explicitly (Chapters Three and Four). Consider the changes in medical protocollary flows of cortisone used to treat CAH, rather than estradiol, in the case study given by Jules Gill-Peterson. Expanding the therapeutic protocol to include the non "sex" steroidal hormone cortisone did not close the door on sex hormones' role in treating CAH. On the contrary, the use of cortisone helped maintain a medical construction of binary gender. The inclusion of cortisone in this protocol did not negate the general importance of estradiol as a feminizing therapeutic in other applications. Instead, it offered a more efficient construction of the gendered subject while expanding the market for cortisone.

The vast circulation of hormones means that these chemicals mediate across infrastructures and ecologies on a global scale. Biochemical flows are often indistinguishable from the flows of capital. For Melinda Cooper, biology "is as much interested in the limits and possible futures of life on earth as contemporary capitalism," and "any critique of the bioeconomy therefore needs to address itself to the intense traffic of ideas between recent theoretical biology and neoliberal rhetorics of economic growth."[39] This continuous expansion of

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[37] Galloway, 245.
[38] Wendy Brown, *Undoing the Demos*, (Princeton, NJ: Zone Books, 2017), 35.
[39] Melinda E. Cooper, *Life as Surplus*, (Seattle, WA; University of Washington Press, 2008), 20.

hormones' potential to produce capital under neoliberal logics is not limited to human life. Scholars like Oudshoorn, Roberts, Haraway, and Preciado have all engaged hormones as bioeconomic matter circulating through networks made up of both human and non-human bodies.

Likewise, this dissertation attunes to bioeconomic flows of hormones across multispecies lives. While I will continue to refer to the circulation of hormones and the capital they produce as "bioeconomic," my materialist intervention is very much informed by Haraway's notion of "lively capital." Lively capital displaces the human as the only possible subject of economic labour, production, and consumption. Instead, theories of lively capital trace multispecies relations in economic production and circulation, as demonstrated in Haraway's reflections on Premarin and DES. Importantly, a focus inclusive of non-human species need not "flatten" theorizations of life in ways that neglect how biopower is felt differently across human subjectivities. As Haraway states, "gender, race, and class, hardly disappear" [40] in vibrant multispecies thinking. Understanding hormone bioeconomies as a type of lively capital enables richer explorations of the ways all sorts of human and non-human life are yoked together in mutual productions of hormonal meaning, and how these productions of meaning are at once bioinformational *and* bioeconomic. As protocol is "isomorphic" with biopower,[41] the effects of dominant hormone protocol are felt across the many species that are congealed into hormonal capital.

[40] Donna J. Haraway, *When Species Meet*, (Minneapolis, MN; University of Minnesota Press, 2008), 47.
[41] Eugene Thacker, "Foreword" in Galloway's *Protocol,* xix-xx.

Anti-Colonial Protocol

Protocol determines how things (matter, capital, ideas, subjects) flow towards or away from other things. In other words, protocol does not just manage things, it manages relations. By setting my focus on dominant hormone protocol, I aim to emphasize hormones' technicity and demonstrate the ways this technicity is often organized in oppressive and exploitative relations through protocol. However, protocol can also guide relations toward responsible practices that reduce harm to the land and life affected by hormones and hormone-like toxins. Such responsible protocol might even act as "counterprotocol,"[42] redirecting power away from dominant flows.

Importantly, protocol offers an essential guiding structure through which many Indigenous nations and communities organize knowledges and practices necessary for maintaining responsible relations to land and life—what Métis scholar Max Liboiron calls "good relations." Liboiron, who runs the CLEAR[43] lab at Memorial University in St. John's, Newfoundland, incorporates Indigenous community protocols into their research on endocrine-disrupting pollutants in the local Atlantic cod population. By interpreting scientific protocols through the values of Indigenous protocols, Liboiron aims to develop academic approaches that operate through an ethic of caretaking and stewardship.[44] This ethic includes practices that allow for the recirculation of resources within a society[45] and that enable the transmission of non-settler knowledges across future generations.

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[42] Thacker, xvii.
[43] Per its website, the Civic Laboratory for Environmental Action Research (CLEAR) is described as "a feminist anti-colonial laboratory." CLEAR intentionally designs and implements methods that foreground 'values of humility, equity, and good land relations." See https://civiclaboratory.nl/.
[44] Kyle Powys White, et al., "Weaving Indigenous Science, Protocols and Sustainability Science," *Sustainability Science* 11, no. 1 (2016): 25.
[45] White et al., 31.

While I deeply admire Liboiron's approaches to science, their methods for field-based scientific research largely fall outside of my disciplinary scope and are not reproducible in this dissertation as a counter to dominant hormone protocol. So, how might those who research hormones while situated outside the sciences work against dominant colonial capitalist hormone protocols without engaging scientific counterprotocollary methods? I think this is a challenging question for thinkers in the humanities like myself who are rarely trained in the standardized methods of sciences and who tend to do most of their research in conversation with scholarly publications rather than with communities.

I respond to this problem by turning to stories as a method for tracing hormone relations in protocol without obscuring the affective qualities of those relations and the lives that comprise them. After all, stories are well established anti-colonial and counterhegemonic tools. As Dian Million writes, "Story has always been practical, strategic, and restorative. For Million, "story is Indigenous theory" that transmits knowledge and "seeks inclusion" not *despite* protocol, but *because of* and *through* the protocols that maintain the ethics and ethos of the culture from which they emerge.[46] Outside of Indigenous protocols for storytelling, where I am situated, I find stories nevertheless offer tactical and restorative modes for rethinking protocol's power. Stories are perhaps uniquely capable of showing how hormone protocols circulate chemical messages and construct certain subjects under dominant narratives. Stories can also offer speculative grounds on which these dominant narratives may be contested.

[46] Dian Million, "Intense Dreaming," *American Indian Quarterly* 35, no. 3 (2011): 322.

Hormone Storytelling as Method

Telling stories about hormones is this dissertation's methodological response to the approaches in critical hormone studies that aim to trace hormone meaning through their biochemical and social interpretations. Thinkers in critical hormone studies who privilege hormones as socially and politically constructed, and thus variable across time and place, frame hormone meaning as the product of narrative constructions. I understand these approaches through the structuralist framework of narrative offered by Tzvetan Todorov. This narratological model is contrasted with the more technical transmission model of hormone communication that emerges from the purely bioinformational approach of the chemical messenger paradigm. I introduce and discuss the latter in Chapter One.

Tzvetan Todorov's model of narrative identifies "succession" and "transformation" as the key elements of narrative. For Todorov, narrative is a form of communication that operates by tracing changing relations (transformation) across time (succession). Narrative is thus a series of causal relationships in which "every change constitutes a new link in the narrative."[47] These changes disrupt power structures. The conclusion of narrative, according to Todorov, occurs either when the recognized power is restored or when new structures are established. In this way, narrative approaches to hormones do not take for granted hormones' circulatory force in dominant hormone protocol. Instead, they pressure the conditions from which that power emerged as dominant. Critical hormone studies thinkers who trace how knowledge about hormones is constructed from dominant cultural positions are engaged in a Todorovian conception of narrative. Whether emerging from anthropological, sociological, or historical methodologies, the scholarly works I've discussed in my review of critical hormone studies

[47] Tzvetan Todorov, "The 2 Principles of Narrative," *Diacritics* 1, no. 1 (1971): 38.

keenly trace cultural changes to hormone meaning, often adopting the language of "story,"[48] "storyteller,"[49] and even "fiction"[50] to do so.

This narrative approach in critical hormone studies is often employed to account for broad hormonal relations across a matrix of social, economic, and political contexts. However, in this dissertation I move away from using narrative as a tool to trace *cohesive* relations across *broad* settings. I do not offer a singular history like Gill-Peterson or an archaeology of hormones like Oudshoorn. Instead, I turn to stories as sites to examine—and resist—particular representations of dominant hormone protocol.

My use of "stories" and "narrative" strays from definitions in prominent narratological scholarship. The field of narratology understands stories simply as a series of events and understands narrative as the *way* those events are represented.[51] In this sense, "narrative" is often granted more rhetorical quality than "story" because narrative frames the events of a story within literary, formal, and cultural contexts. This definition of narrative is cogent with my reading of narrative's role in providing culturally constituted explanations for hormone meanings and the ways those meanings change over time within critical hormone studies. However, my turn to hormone storytelling as an approach to reimagining hormone relations aims to emphasize how engagement with both fictional and nonfictional narratives can offer a deeply generative mode of representing hormone power across various conditions of life.

What I refer to as "hormone storytelling" attends to narratological concerns about rhetorical framing. However, I make a distinction between the grand narratives of knowledge

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[48] Latour and Woolgar, 149.
[49] Jordan-Young and Karkazis, 5.
[50] Preciado, 433.
[51] H. Porter Abbott, *The Cambridge Introduction to Narrative*, 2nd ed., (Cambridge, UK: Cambridge University Press, 2008), 15.

production traced in other critical hormone studies scholarship and the varied accounts I engage in this dissertation. I approach stories about hormones as sites for tracing hormonal meaning in *specific* settings, across *specific* relations, and in *specific* lives while constructing new relations. Working with particulars does not produce neat, generalizable explanations about the way dominant hormone protocols operate on subjects. This is intentional. Because protocols direct hormones in different ways, moving them toward and away from different subject positions, specific stories become apt tools to survey that difference rather than flatten it into one representation of power. By occupying a position of the particular rather than the general, storytelling can represent specific tactics that reimagine and reorient the relations of dominant hormone protocol towards counterhegemonic organizations.

I also find storytelling a fitting response to the calls made by queer feminist science studies thinkers to "rethink entrenched disciplinary divides," challenge what counts as science studies, deepen understandings of the ways knowing and being are imbricated, "affirm critique as a site for vital world-making work," and to engage debates about power germane to queer feminism.[52] Storytelling foregrounds a subject's affective connections to the flows of power that shape our worlds[53] in ways dominant approaches in science often cannot. Stories offer moments of shared vulnerability between reader and text, reminding us that our bodies (and their representations) are never quite our own.[54] Telling stories about hormones can account for differences across gendered, racial, and species distinction while still pressuring the common strain of biopower that transmits through dominant hormone protocol.

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[52] Cyd Cipolla et al., *Queer Feminist Science Studies* (Seattle, WA: University of Washington Press, 2017), 9.
[53] Cipolla et al., 10.
[54] Judith Butler, *Precarious Life* (London, UK: Verso, 2004) 26.

Though the primary texts in this dissertation are works of fiction, I also situate autoethnographic encounters and reflections throughout this project. Chapter Two begins with a short "autoethnography of mediation" to demonstrate the affective relationship between the production of hormones as literal computer code and the creation of stories.[55] Similarly, Chapter Four begins with a firsthand account of freediving in the Strait of Georgia off the coast of Vancouver Island. In sharing this experience, I place my body in a fluid trajectory of contemporary and historical hormonal biopower organized around the questions of excess, waste, and the alien. I include these moments for two reasons. The first reason is to remind readers that the politics imbued within fictional and nonfictional stories are not exclusive of one another. My unequal focus on fictional stories throughout this dissertation, as opposed to "real" case studies, should not be dismissed as irrelevant to the real and lived conditions that constitute and are constituted by dominant hormone protocol. The second reason I've chosen to put personal anecdotes and accounts on these pages is to acknowledge the ways I am implicated in dominant hormone protocol's controlling flows. Sometimes I find myself in privileged positions that cause me to temporarily forget the ways hegemonic hormone relations make those flows feel easy. Other times I find myself moving "upstream" as I try to negotiate with the regulatory power of dominant hormone protocol. For instance, my anecdote at the beginning of this dissertation provides insight into how medical standards and regulation can be used to control the flow of hormones towards hegemonic expressions of gender in the body.

Chapters Two through Four mainly engage fictional texts to demonstrate the ways dominant hormone protocol manages life across different subjects. The primary texts in these chapters were chosen because they demonstrate three very distinct manifestations of dominant

[55] Julie M. Funk and Jentery Sayers, "Autoethnographies of Mediation," in *The Bloomsbury Handbook to the Digital Humanities*, ed. James O'Sullivan (London, UK: Bloomsbury 2023), 102.

hormone protocol across gender (Porpentine's *With Those We Love Alive*), species distinction (Barbara Gowdy's *The White Bone*), and race (Drexciya's cosmogeny introduced in *The Quest*). I employ the stories in these texts as speculative sites through which we might better understand hormone biopower as protocol and from which we may draw inspiration to counter that power. Notably, these texts all share generic conventions of what Donna Haraway names *SF*— "science fiction, speculative feminism, science fantasy, speculative fabulation, science fact, and…string figures."[56] The anecdote I share at the outset of this dissertation and the account of the toxic violence experienced by Aamjiwnaang First Nation I recount in the first half of Chapter Four demonstrate how nonfictional storytelling can still reorient relations in SF ways. "Real" stories can also be "speculative fabulations and speculative realisms."

My turn to speculative fictional texts is also informed by Samuel R. Delaney's writing on science fiction. For Delaney, science fiction is a tool for rethinking relations and "presupposing different commitments, different beliefs, different efforts…different conflicts, different processes [and] different joy."[57] Speculative fictions, science fictions, and fantasies offer insight into alternative orientations and directions of power that challenge the violence of dominance. This is the case for the Afrofuturist story of the Drexciyans, an aquatic subspecies of humans born from the colonial violence of slavers throwing pregnant women overboard during the Middle Passage, which I explore in Chapter Four. From the estranging vantage point of SF, we can better imagine interventions on the forms of hormone biopower depicted in, and directed through, both fictional and nonfictional representations. As Haraway argues, SF enables a "relaying of connections that matter" through storytelling. These connections are often messy, partial, and rely on "flawed

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[56] Haraway, *Staying with the Trouble*, 10.
[57] Samuel R. Delaney, "The Necessity of Tomorrows" in *Starboard Wine* (Pleasantville, NY: Dragon Press, 1984), 23-35.

translations" across subject positions. Yet, they also point to a "still possible recuperation" of vibrant relations across ecologies. Though each story in this dissertation offers a particular representation of hormones, these thinkers' definitions of science fiction and SF inform this dissertation's project in weaving together the molecular, ecological, and affective values of hormones across varying subjectivities.

Hormone Storytelling as Praxis

In addition to its methodological approach, this dissertation considers the creation and circulation of hormone stories a form of praxis. At first glance, storytelling may not seem as materially impactful as patient advocacy, policy change, and subversive DIY and black market hormone therapies—all practices that can relieve inequities in hormone's protocollary flows. However, as I have discussed, narratives inform interpretative practices about hormone meaning at the social level. These narratives should be taken seriously as part of the discursive practices that draw boundaries around scientific paradigms, as demonstrated by prominent thinkers in critical hormone studies thinkers.

Currently, dominant hormone protocol pervades our reality as it organizes across intersections of gender, race, (dis)ability, class, and species. The benefactors of dominant hormone protocol are the same as those invested in cis-heteropatriarchy, white supremacy, ableism, late capitalist exploitation, and human exceptionalism. These systems of power are sticky, to say the least. I am not so confident as to claim that telling alternative stories about hormones is enough to dismantle that power alone. As protocol grows, it often subsumes the techniques established in its opposition. The alternative hormone relations fostered by stories

may very well be enveloped by protocols and become standardized themselves.[58] However, like protocol, stories grow and re-form through negotiations. In this way, new generations of protocols and stories that reimagine those organizations will continue to be in negotiation with each other. Such negotiations can shift paradigmatic organizations within these systems and work to destabilize their naturalized power. Per science fiction thinker Darko Suvin, stories that engage in both a narrative estrangement of the world while committing to a "cognitiveness" that convincingly adheres to the world's technical organizations of power "implies not only a reflecting *of* but also *on* reality."[59] As stories reflect alternative relations onto our reality, they have *real* power to shift our ontological and epistemological orientations to that reality.

This dissertation calls for a polyphony of voices to tell stories about hormones outside of the old and tired chemical messages we've heard before. Hormone stories span form and genre as the interactive fiction, traditional print novel, and liner notes to a CD album featured in this dissertation demonstrate. Early drafts of this dissertation included analyses of speculative short films about making homebrew hormones from urine,[60] Flash video games about accessing HRT,[61] and one of my physical computing projects, *N(o)vum Organum*. In *N(o)vum Organum*, I reprogrammed a Mira fertility testing device to rewrite my experience with infertility over the device's refusal to recognize me.[62] Effective hormone stories depict ways that dominant hormone protocol simultaneously produces hormonal subjects while decontextualizing the biopower from which those subjects emerge. In doing so, these stories often imagine alternative relations to

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[58] Galloway, 243.
[59] Darko Suvin, "Estrangement and Cognition," *Strange Horizons* 24 (2014): http://strangehorizons.com/non-fiction/articles/estrangement-and-cognition/.
[60] Mary Maggic's *Housewives Making Drugs* (2016). https://www.media.mit.edu/projects/housewives-making-drugs/overview/.
[61] Anna Anthropy's *Dys4ia* (2012).
[62] This physical computing project is featured in the book chapter "Autoethnographies of Mediation" (Funk and Sayers, 2023). A digital version of the project exists on my website: Julie M. Funk, *N(o)vum Organum* (2021). https://www.juliemfunk.com/projects/novum-organum. Headphones recommended.

living in a hormonally laden world that recuperate life as more than bioinformational and bioeconomic.

The more stories that recontextualize what it means to live hormonally by drawing alternative relations, the more voices engaged in both protocollary and paradigmatic negotiations. In this way, stories are the blueprints for other forms of hormone praxis. Engaging in the creative labour of envisioning new possible relations to hormones is paramount to effectively engaging in the forms of activism mentioned above. As readers move through the following chapters, I encourage them to consider how the hormone relations that emerge from these stories might inform both subversive and counterprotocollary organizations of community-run trans health care (Chapter Two), anti-colonial animal stewardship (Chapter Three), and anti-racist environmental activism (Chapter Four).

Chapter Outlines

Dominant Hormone Protocol argues that, if protocol is an apparatus of control that works by directing and organizing distributed information, we must begin to think of hormonal biopower as protocollary to understand how these chemical messengers produce and manage subjectivities at the cultural level. Chapter One, "The Chemical Messenger Paradigm," acts as an intermezzo between the theoretical and methodological approaches outlined in this introduction and the analyses of dominant hormone protocol in Chapters Two through Four. This chapter looks closely at Ernest Starling's framing of the hormone as a "chemical messenger." Through the chemical messenger paradigm, I argue that hormones have always been treated as carriers of biochemical information in the scientific imagination. This informatic paradigm makes hormones apt objects for protocollary circulation. Chapter One advances the discussion of hormones as

bioinformation set up in this introduction before turning to the analyses of dominant hormone protocol that make up the remainder of the dissertation.

Chapters Two through Four engage in analyses of hormone stories across genre and form that depict gendered, racial, and species distinct lives caught up in the dominant flows of hormone biopower. These stories address the pharmaceutical management of transgender lives, reproductive management, and the toxic burden of endocrine-disrupting waste. In Chapter Two, "Hormone Variables," I read hormones as variables akin to those in computer code. In this chapter, I turn to Porpentine Charity Heartscape's hypertext fiction, *With Those We Love Alive* to investigate how the hypertext's encoded hormones reproduce the ways medical protocols might enact on trans lives. Informed by micha cárdenas' thinking on algorithmic analysis as a method of what she calls "trans of colour poetics," this chapter investigates how a single variable in the story's code, $hormone_day, can differently direct the life of the story's protagonist toward either mundane violence or reparative community-based practices of trans care. Ultimately, I suggest that $hormone_day best represents HRT practices that move towards trans liberation when readers engage with the variable outside the interactive fiction's dominant narrative pathway. These practices resemble the DIY medical and care work that occurs outside institutional medical protocol and has historically been taken on by Black, Indigenous, and of colour trans women.

Chapter Three, "Feeling Hormonal," shifts this dissertation's otherwise species-specific focus from humans to African bush elephants in a discussion of the ways hormones and affect are often inextricably linked in biopolitical and bioeconomic productions of hormonal meaning. Hormonal excretions in the form of urine and temporin flow uninhibited from the elephant characters in Barbara Gowdy's novel *The White Bone*. These hormonal expressions often signify affects like joy and grief as the elephants navigate the necropolitical grounds of the East African

savanna during the height of ivory-driven poaching. *The White Bone* serves as a valuable counter example to the other stories in this dissertation that offer reorientations to the dominant hormone protocols they depict. I argue that Gowdy's novel reproduces a narrative form of dominant hormone protocol as it carefully manages the transmission of chemical messages as affect both *within* and *through* its text. The novel not only directs its own characters toward the biopolitical conditions of conservation, but also aims to direct real-world elephants toward similar conditions—specifically those involving reproductive management. The narrative makes the argument that conservation unanimously protects elephant life and attempts to earn readers' endorsement of this thesis by arousing sympathetic responses to the elephants' hormonal affect. In reality, these conservation parks are deeply biopolitical sites imbricated in complex colonial capitalist relations to human and non-human life alike. Many parks situated across a quickly developing savanna engage in practices like culling and contraceptive trials to control elephant populations. These practices problematize the novel's liberally flowing and affective treatment of elephant hormones as a literary management style that intends to direct "real" elephant life towards hormonal containment and control. Ultimately, *The White Bone* acts as a foil to the other chapters in this dissertation as it demonstrates that stories can reproduce dominant hormone power and questions the how we might better account for multispecies hormonal relations.

The final chapter, "Xenohormones" investigates both the alien conditions of living amongst hormonal waste and being rendered as excessive hormonal life through a racial politics of waste. This chapter tells two stories that challenge what it means to live and reproduce in xenohormonal conditions. The first is an account of the chemical toxicity Aamjiwnaang First Nation faces as it is surrounded by dozens of polluting petrochemical industries in Sarnia's "Chemical Valley" on Lake Huron. Decades of exposure to toxic endocrine-disrupting chemicals

(EDCs), or xenohormones, in Aamjiwnaang have threatened fertility and reproductive futurity in this Indigenous community. Thinking through waste as a matter of excess and disposability, I argue that the colonial conditions directing toxic EDCs into Aamjiwnaang not only treat the First Nation Land as disposable, but also render the Indigenous lives occupying it as excess and waste. This is what I call the condition of living "xenologically," and it is the condition from which Aamjiwnaang engages in counter protocols and stories to combat chemical violence.

The second half of this chapter explores the similar xenological condition of Black fertility during the Middle Passages by drawing on the cosmogeny of an aquatic humanoid species born from the pregnant women thrown overboard slave ships introduced by Black, Detroit-based electronic music band Drexciya. I propose that the Drexciyan cosmogeny responds to and reorients the racial violences that deem Black reproductive life excessive, wasteful, and disposable by tactically leveraging the alien-ness of living xenohormonally while refusing its alienation.

This dissertation responds to the prevailing scientific paradigm in which hormones are understood as distributed bioinformation in circulation. As bioinformation, I argue that hormones are directed through protocol, a technical mode of management "isomorphic with biopower." Informed by queer, feminist, anti-colonial approaches to science and technology studies, this dissertation locates possible counterhegemonic alternatives to that power in stories. Like protocol, stories are modes of organizing information. By turning to stories as sites for constructing speculative hormone relations—whether fictional or nonfictional—I aim to demonstrate how dominant hormone protocols can be reinterpreted and redirected by the very subjects they construct. I have traced a constellation around this interdisciplinary scholarship to account for existing critical interrogations of hormones as a cultural object. However, the bodies

of work that make up what I call "critical hormone studies" are often disparate, varying in theoretical and methodological positions. Although this project refocuses hormones' semantic value in stories, it still locates semantic power at the chemical, as well as social, level. Much of the groundwork for thinking through hormones' as biopolitical and technical objects in circulation has been laid by Gill-Peterson and by Preciado through his notion of "biopolitical fictions." *Dominant Hormone Protocol* advances this area of study by responding to critical hormone studies' need for a theorization that can account for the ways hormones' technical organizations are leveraged as tools for subjection.

I. THE CHEMICAL MESSENGER PARADIGM / From Transmission to Protocollary Control

"'What is the difference between an enzyme and a hormone?'…'You can't hear an enzyme.'"

- Kurt Vonnegut, *Jailbird*

Hormones are productive figures in cultural constructions of the body. They are without a doubt objects of interpretation. In popular culture, hormones serve as sit-com style zingers in jokes about angsty teens' questionable behaviour or when emotionally burnt-out women direct their frustration at their dopey husbands. Hormones are punchlines. Perhaps then, the language in the above epigraph is best left as a brilliantly indecorous moment of wordplay offered by the usually sexually repressed Sarah Wyatt, a character in Kurt Vonnegut's *Jailbird*. Yet, against any better judgement to leave a good joke well enough alone, I can't help but to humor a willfully obtuse reading of the pun that suggests the possibility of *hearing* hormones, or at the very least a reading that acknowledges hormones have messages to communicate. This is the fundamental premise of Ernest Starling's chemical messenger paradigm—a premise that has persisted for more than a century and one that I argue facilitates the organization of hormones as information in protocol.

This chapter acts as an intermezzo between the theoretical and methodological approaches situated in the introduction and the following chapters' engagement with stories depicting dominant hormone protocol. In this chapter, I take a closer look at Starling's introduction of the hormone to medical and scientific communities in early twentieth-century London. I argue that Starling's framing of hormones as "chemical messengers" largely adheres to transmission models of communication and follows trends in modernist scientific thought such as the invention and application of radio and telegraphy. This "transmission thinking" was

modelled half a century later by Claude Shannon and Warren Weaver. I use the Shannon-Weaver transmission model of communication to demonstrate the chemical messenger paradigm's framing of hormones as inherently informatic and decontextualized from the subjects they produce. From there, I return to a brief discussion of protocol as the logical organizational mode to emerge from the chemical messenger paradigm. Finally, I remind readers that hormone storytelling is this dissertation's counter tactic to dominant hormone protocol's treatment of hormones as decontextualized bioinformation.

Establishing the Chemical Messenger Paradigm

The first "hormone" was introduced in June of 1905 by British physiologist Ernest Starling in a lecture series given after receiving the prestigious Croonian Medal awarded by the Royal College of Physicians. Prior to Starling's research, numerous scientists had already demonstrated the effects of what we know understand as endocrine action. For example, Western science had already demonstrated sex-determining action occurred at the glandular level when Arnold Berthold (considered a grandfather of endocrinology) observed the feminization of roosters' appearance and behaviour after he removed of their testes in experiments during the 1840s. What's more, folk medicines, traditional Indigenous knowledges, and the many other cultural practices omitted from dominant Western science have developed their own understandings of the hormonal body long before hormone's emergence in scientific consciousness. However, Starling's identification of endocrine action as chemical, along with his coinage of the term "hormone," place hormones' scientific origins in the early twentieth century. This timing is essential to understanding how hormones became bioinformation as Starling's model for hormones adhered to the transmission thinking of the time.

In the years leading up to his four-part Croonian Lecture, Starling had conducted extensive research on the chemical stimulation and secretion of the organs with his long-time collaborator (and brother-in-law) William Bayliss. From 1902 through 1905, Starling and Bayliss directed their studies toward finding a chemical explanation for the digestive process. The pair of scientists performed extensive experiments on vivisected dogs to disprove Ivan Pavlov's prevailing theory that digestion was a nervous response.[1] Aiming to challenge Pavlov's hypothesis, Starling and Bayliss controlled for reflexes of the nervous system by removing, destroying, or otherwise inhibiting those nerves concentrated around the digestive tract. They observed that the pancreatic fluid stimulated by the digestive process was still present in dogs with no nervous capability around the digestive tract. The two physiologists concluded that the production of these pancreatic fluids must be the result of a chemical control mechanism and not nervous stimulations suggested by Pavlov. They argued that the presence of another fluid—some intermediating chemical substance—was responsible for stimulating the secretion of pancreatic fluid.[2] By 1902, Starling and Bayliss had named this intermediating chemical "secretin." Notably, the pair began describing secretin as a "chemical messenger" as early as 1904 when they both received the Croonian Medal from the Royal Society.[3] While 1904 marks Starling and Bayliss' first use of this paradigmatic language, the language of transmission that characterizes the chemical messenger paradigm as bioinformation would not be introduced until the following year alongside the "hormone."

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[1] William M. Bayliss and Ernest H. Starling, "Croonian Lecture: The Chemical Regulation of the Secretory Process," *Proceedings of the Royal Society of London* 73, (1904), 312.
[2] William M. Bayliss and Ernest H. Starling, "On the Causation of the So-Called 'Peripheral Reflex Secretion' of the Pancreas," *Proceedings of the Royal Society of London* 69, (1902): 352.
[3] The Royal Society of London sponsors two Croonian Medal and Lecture awards, one awarded by the Royal Society and one awarded by the Royal College of Physicians. Starling and Bayliss received the former in 1904. Starling alone received the latter in 1905.

Starling's first talk of his 1905 lecture series concerns the scientific definition and classification of secretin as a uniquely acting biochemical that coordinates activity in the body at a level on par with "the drugs of the physician."[4] Thus, he constructed the category of "hormones" to demarcate a type of chemical substance as potent as a drug but "produced in the body itself." Starling names this new category halfway through his address, stating that "these chemical messengers…or 'hormones' (from ὁρμάω, I excite or arouse)…as we might call them…have to be carried from the organ where they are produced to the organ which they affect by means of the blood stream."[5] The advent of hormones as a chemical category left an indelible mark on the scientific understanding of the body over the following century. It fostered the creation of new scientific disciplines, irreversibly shaped medical practices, and facilitated increasingly niche pharmaceutical markets. Despite the success of "hormones" as a category, Starling did not linger on his coinage in his lectures. He does not invoke the word "hormone" again until his final talk given on June 29, 1905. Instead, the physiologist falls back on the language of transmission that characterizes hormones as bioinformation in the chemical messenger paradigm. This is significant because it situates hormones as tools for control, decontextualized from the bodies they mediate, in the scientific imaginary.

Chemical Messengers in Transmission

Starling's lectures further define the hormone as a bioinformational object involved in a complex system of chemical transduction. The audience of physicians at the University College London listened as Starling described a complex chemical system wherein specialized cells

[4] Ernest Henry Starling, "The Croonian Lectures on The Chemical Correlation of the Functions of the Body: Lecture 1," *The Lancet* 166, no. 4271 (August 5, 1905): 339.
[5] Starling, "Lecture 1," 340.

"despatch [sic]…the chemical messengers along the blood stream"[6] where they travel until they are received by target cells. In his second address on June 22, he describes each act of hormonal secretion as contingent on "the *transmission* of a *message* of some sort or other."[7] In his last of the four lectures, delivered on June 29 of 1905, Starling discusses the cellular *reception*, or lack thereof, of stimuli to stop lactation in the mammary glands of rabbits after aborting their fetuses halfway through pregnancy.[8] The language invoked by Starling is on trend with the concerns around transmission shared by his contemporaries across scientific disciplines. It is likely that Starling and Bayliss' understanding of hormones' mechanisms were influenced by the general advancements of communications technologies in the late nineteenth and early twentieth centuries, particularly that of Guglielmo Marconi's contributions to radio technology which were widely covered by national news outlets in the period Starling and Bayliss were first researching chemical secretions.[9]

Starling's chemical messenger paradigm follows the same transmissions model of communication as radio and telegraphy. This transmission model was first proposed by Claude Shannon in a 1948 article, more than 40 years after Starling's introduction of hormones as chemical messengers. Shannon's article was further adapted in Shannon and Warren Weaver's co-authored manuscript, *The Mathematical Theory of Communication* (1949). The Shannon-Weaver transmission model responds to the emergence of electrical communications technologies like radio, telegraphy, and television in the nineteenth and early-twentieth centuries.

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[6] Starling, "Lecture 1," 340.

[7] Starling, "Lecture 2," *The Lancet* 166, no. 4276 (August 12, 1905): 423. Emphasis added.

[8] Starling, "Lecture 4," *The Lancet* 166, no. 4278 (August 26, 1905): 581. Emphasis added.

[9] A lecture given by Ivan de Burgh Daly at University College London in 1966 suggests that Bayliss' archived notes at UCL detail his interest in various topics across biology, chemistry, and physics, including direct mention of Marconi transmitters. See Ivan de Burgh Daly, "The Second Bayliss-Starling Memorial Lecture." Delivered on March 25, 1966, University College London, transcript published in *Journal of Physiology* 191, no. 1 (1967): 5.

As a framework, the Shannon-Weaver model's goal is to generalize the process of communication into infrastructural, rather than semiotic, components. As such, the Shannon-Weaver model understands messages not for their semantic value, which Shannon argues is "irrelevant to the engineering problem," but as information where one message may be "selected from a set of possible messages" bound within a system.[10] Notably, Shannon is drawing a distinction between "information" and "meaning," where the message is simply the unit of information that has been successfully received within the communication system, regardless of any interpretive action that message excites. In the most general version of the model, the successful transmission of a message requires at least five components (Fig. 1); an information source that selects a "desired message"[11] out many possible messages, a transmitter that encodes the message into a signal, a medium through which the signal is transmitted, a receiver that decodes the signal back into a message, and a destination for that message. Shannon and Weaver also include a sixth component, noise, which can intercept and add other, unintended, messages into the channel.

Already, one can begin to see how Starling's early endocrine system, in which hormones are found "speeding from cell to cell along the blood stream," meets Shannon and Weaver's requirements for a transmissions-based communication system. Hormonal messages are transmitted as signals out of cells and received by different cells in another part of the body that have "a specific sensibility"[12] to that type of signal. This transmission occurs through a channel

[10] Claude E. Shannon, "The Mathematical Theory of Communication," *The Bell Systems Technical Journal* 27, no. 3 (1948): 379.
[11] Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana, IL: The University of Illinois Press, 1964), 7.
[12] Starling, "Lecture 1," 341.

of blood. Already three of the five main components of the transmission model can be accounted for in Starling's chemical messenger paradigm.

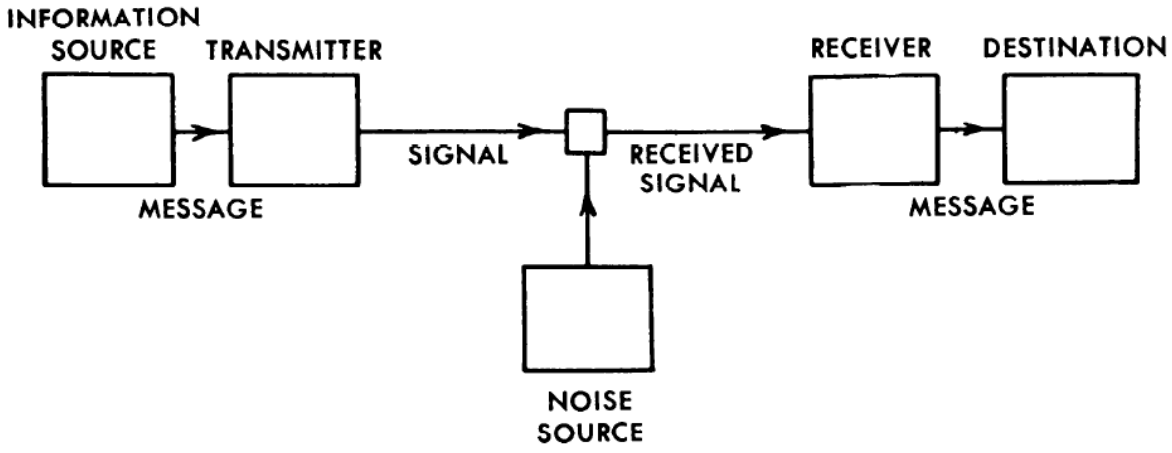

Figure 1:The Shannon-Weaver Model. A symbolic representation of a general communication system as it appeared in Shannon's and Weaver's The Mathematical Theory of Communication.

With Starling, however, the first and the last components of the Shannon-Weaver model, information source and destination, become harder to account for. This difficulty is because Starling's choice of language distinguishes the hormone as a "chemical messenger" from the message itself without identifying what the hormonal message is or where it is located in the hormone. Though he discusses in explicit terms the transmission of a message through its dispatch (e.g., signalling), the message itself remains abstract in Starling's model. The following decades of emergent endocrine science would further develop the chemical messenger paradigm through the transmission model of communication. The race for hormonal identification and isolation in the first half of the twentieth century established that the unique chemical make-up of each hormone is a key component of its messaging ability. That a molecule does or does not contain, say, this oxygen atom and that hydrogen atom completely changes the information it

transmits. The material specificity of a hormone's message is perhaps best exemplified in an anecdote shared by Oudshoorn. When scientists in the 1930s began to understand that the difference between estrogens and androgens might be as small as the presence or absence of a hydroxyl group (an oxygen-hydrogen bond) on the molecule, some male scientists joked "there but for one hydroxyl group go I."[13] The message of the hormone is the action it incites, the measurable, somatically readable outcomes of the ways hormones mediate bodies, and that difference in action is determined by molecular structure. In Oudshoorn's example, the message, which is understood to be either one of femininity or masculinity, is based solely on the presence or absence of a hydroxyl group.

Because Starling correctly presumed many more hormones besides secretin naturally occur in the human body, but did not know their molecular composition, he understood the chemical message of the hormone as immanent to the system in which it is transmitted. In this sense, hormones are both messages and messengers. The distinct roles are attributed to different qualities of their materiality—the meaning of the hormone's molecular specificity on the one hand (the biochemical message) and the hormone's capacity to travel freely through the bloodstream on the other (the messenger). Since Starling's 1905 Croonian Lectures, contemporary endocrinology has fully adopted the language of transmission. While Starling only ever described the "despatch" of a chemical message that would be "received" by tissue with "a specific sensibility," today's chemical messenger paradigm fully invests in the language of signal, transmission, and reception.

Importantly, these chemical messages are not always transmitted with perfect fidelity. For Shannon and Weaver, issues of low fidelity are "unfortunately characteristic" of information

[13] Oudshoorn, 39.

transfer. Though Shannon first stated the irrelevance of semantic meaning to the technical aspects of information transmission his 1948 article, this "semantic problem" appears again in the 1949 book. This time, with contributions from Weaver's, the issue of semantics is described by the authors as "the interpretation of meaning by the receiver, as compared with the *intended* meaning of the sender."[14] In the chemical messenger paradigm, pathology is an issue of fidelity. Fidelity concerns not just the quantity or quality of the message, but whether the intended message is circulating in the system. However, the semantic value of these messages—intended or not—are represented as purely infrastructural concerns in the body (pathology) and often decontextualized from other modes of interpretation. Such decontextualization also works to obscure hormones as biopolitical objects because the subjectivities they produce appear as "natural" or given. Again, I find the anecdote I share at the outset of this dissertation exemplary of the chemical messenger paradigm's decontextualizing power.

When it comes to hormones, the *quality* of the message is quite often understood in terms of the *quantity* of that signal. Hormones are, for the most part, a continuous communication responding to the "continually recurring physiological needs of the organism."[15] Too little of one hormone may result in a lack of adequate physiological action even if small amounts of that hormone are received by their target cells. Such is the case with hypothyroidism. Other issues of low fidelity may occur when receptor cells are too damaged to receive hormonal signals. Conversely, too much of one hormone can overwhelm the system, also threatening the fidelity of the message. Issues of fidelity can also be accounted for by the sixth component of the Shannon-Weaver model—noise. Noise originates externally to the communication system. It intercepts the channel from an outside source, creating variability and uncertainty in communication. Noise

[14] Shannon and Weaver, 4. Emphasis added.
[15] Starling, "Lecture 1," 340.

might intercept the message completely, introducing an entirely new message. Or, it might add additional, perhaps unwanted, information that augments the original message. This is the case with endocrine-disrupting chemicals or "xenohormones."[16]

Though the Shannon-Weaver transmission model of communication succeeds Starling's chemical messenger paradigm by nearly 45 years, the chemical messenger paradigm followed the same trends in transmissions thinking that inspired Shannon and Weaver's model half a century later. The transmissions influence on Starling's thinking is significant because it offered the prevailing scientific episteme a way to think about hormones through regulation and control. Moreover, by focusing on the infrastructural components of transmission, rather than on the meaning of the chemical messages, this paradigm decontextualizes hormones from the lives they mediate. Chemical messages are treated as pure biochemical information. Together, these elements of transmission thinking in the chemical messenger paradigm enable hormones to circulate through protocol.

On Bioinformation and Protocol

For Starling, modelling hormones as a system of biochemical communication was essential to the future of medicine as this technical model allowed physicians to approach hormones through a logic of control. Because Starling already understood hormone transmission as a regulatory process, he saw medical intervention on hormone activity as a mode of "absolute control over the workings of the human."[17] Acquiring such control, he argued, is "the goal of medical science." If the chemical messenger paradigm is invested in establishing control over the

[16] Xenohormones offer an example of noise in hormonal transmission. Xenohormones refer to a category of exogenous (produced external to the body) chemical matter that endocrine receptor cells "read" as hormones. I discuss xenohormones in Chapter Four.
[17] Starling, "Lecture 1," 339.

human (and non-human) body, and does so by rendering hormones bioinformation, then protocol emerges as the mode of that control.

While Alexander Galloway limits his focus to information protocols used to transfer data across the internet and other computing networks, his theorization of power has larger implications for the circulation of bioeconomic and bioinformational matter. It is through Galloway's general theory of protocol that I aim to place the chemical messenger paradigm back into the very biopolitical contexts it obscures. In the foreword to *Protocol,* Eugene Thacker states that "protocol is isomorphic with biopolitics" as it is in the business of inscribing networked bodies through informatic systems which produce "the condition of experience" for those lives.[18] In their co-authored text, *The Exploit* (2007), Galloway and Thacker further attend to the ways the biological is increasingly understood through technical organizations. Thinking the corporeal as comprised of "systems" remains the primary mode of distinguishing feature and function in scientific models of the human (and non-human) body. The authors argue that through this "interrelationality," networked organizations of the biological begin to share the same forms of power granted to the informatic.[19] In this way we can begin to see how protocollary organizations of hormones as technical matter direct these chemical messengers not only as biochemically comprised information, but biopolitically implicated matter rendered bioinformational.[20]

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[18] Eugene Thacker, "Foreword" in Galloway's *Protocol* (Cambridge, MA: MIT Press, 2004), xix-xx.
[19] Alexander R. Galloway and Eugene Thacker, *The Exploit: A Theory of Networks* (Minneapolis, MN: University of Minnesota Press, 2007), 28.
[20] I want to draw a distinction here between my treatment of hormones as "bioinformation" and Thacker's examination of "biomedia." Thacker privileges the digitality of the body in *Biomedia* (2005) by focusing on DNA's role in biocomputation and computational biology. The chemical messenger paradigm treats hormones as informatic, but it does not *necessarily* invoke a digital logic per Thacker's criteria of biomedia. However, this distinction is not always clearly defined. As mentioned in the introduction, hormones have been compared to digital infrastructures like Wi-Fi networks. And, in Chapter Two, I offer a reading of hormones as variables through the code of a hypertext fiction.

Enabled by the chemical messenger paradigm, dominant hormone protocols direct hormones as information decontextualized from their semantic value. This is not to say the chemical messages circulating in dominant hormone protocol do not have semantic value. This dissertation's introduction has demonstrated the many perspectives in critical hormone studies of the ways hormone meaning is produced. However, because protocol often works "against interpretation" as it "does not interface with content, with semantic value,"[21] protocol reproduces the obfuscation of power in the chemical messenger paradigm it emerges from. That is, dominant hormone protocols at first appear to circulate pharmaceuticals with polysyllabic brand names rather than the "ideas, living organs, symbols, desires, chemical reactions, and affects" that Preciado keenly identifies as circulating in hormonal networks. And yet, it is this very semantic value—obscured by the chemical messenger paradigm—that enables dominant hormone protocol's mode of control.

As discussed in the introduction, hormones are subject to various interpretations and constructions of both biochemical and social meanings. It matters what the meaning of the message is because hormones do not just transfer information, they *modulate* lives as biochemical media. Because hormones act on bodies, and differently on different bodies, how we interpret hormones affords these chemicals power. However, in treating hormones as quantifiable objects of control—as information in circulation—this semantic meaning becomes decontextualized and depoliticized from the lives that they mediate. It is only through *tracing* the changing relations made in protocollary flows that this power is made legible alongside hormonal meaning. This is precisely why narratives models of hormones are powerful counters to the chemical messenger paradigm and the dominant circulation of hormones it enables. By

[21] Alexander R. Galloway, *Protocol* (Cambridge, MA: MIT Press, 2004), 139.

tracing hormones' semantic meanings as an interplay of changing relations, a theorization of hormones in and as narrative aims to elucidate the cultural, economic, and political contexts from which dominant organizations of hormones arise.

In the remaining chapters, I engage hormone storytelling as a counter approach to the circulations of dominant hormone protocol. Through the stories recounted in these chapters, I recuperate hormones as material-semiotic actors and demonstrate how these chemicals are differently directed across lively networks. These chapters offer specific examples of the varied ways hormone protocols organize life across gendered, racial, and species-distinctions in both fictional and nonfictional settings. The fictional texts that drive each chapter may at first seem irrelevant to "real world" experiences of hormonal biopower. However, I argue that these stories can offer necessary sites for speculation in which we might reorient dominant hormone relations toward counterhegemonic alternatives as demonstrated in Chapters Two and Four. Even if some stories do not challenge dominant hormone protocol—or perhaps reproduce that power—these stories are still useful for elucidating how protocol manifests in narrative. Such is the case with *The White Bone*'s anthropomorphized elephant life in Chapter Three.

II. HORMONE VARIABLES / Coding Hormone Care in Porpentine Charity Heartscape's *With Those We Love Alive*[1]

"This body is a technoliving, multiconnected entity incorporating technology. Neither an organism or a machine, but 'the fluid, dispersed, networking techno-organic-textual-mythic system.'"

— Paul B. Preciado, *Testo Junkie*

I feel lost, aimless, and tired as I click through the hypertext pages of Porpentine Charity Heartscape's 2014 Twine narrative, *With Those We Love Alive*.[2] Even though the pages all look the same, I know I'm in the city. White text, pink links, sometimes purple ones, and a blue gradient background. I've been here before. To the city, I mean. Was it yesterday? Two days ago? Not sure. I keep clicking. I watch things in the dry canal. Grotesque things. Freak things. Urchins, rat kids, an angel corpse, sewer ooze. I can either continue to watch or look away. I look away. Next, I navigate to the mazelike alley. I've been here before too, it's a dead end with a puddle of green slime and nothing to do or click. Most of this interactive fiction is like that. Nothing to do but sleep and work. Today's different though. Today, "A Slime Kid is here." The next ten minutes or so we spend together are joyful. This Slime Kid, who seems to have leaked in through the cracks in the alleyway stone from nowhere, plays with me, spattering slime and

[1] A version of this chapter is appears as an article in the *Amodern* special issue, Body as/and Procedure. Julie Funk, "She Ripples Happily: Coding Hormone Care in Porpentine Charity Heartscape's *With Those We Love Alive*." *Amodern* 11 (2023), https://amodern.net/article/she-ripples-happily/.

[2] You can play *With Those We Love Alive* on Porpentine Charity Heartscape's website, https://xrafstar.monster/games/twine/wtwla/. I do my best to provide summaries and descriptions of the story when necessary, however, due to the text's deviations from linear, non-interactive fiction, I recommend those unfamiliar with this text and the genre of interactive fiction click through *With Those We Love Alive* before reading this chapter. A standard reading should take around 30-45 minutes.

oozing back together. “Yay.” Where did she come from? I’ve never seen her before. Curiosity gets the best of me as I right-click the webpage to see the program’s source code. A quick page search for “slime” and I see it, “if $hormone_day is 4…A [[slime kid]] is here” (Fig. 2). She came from hormones. She is techno-goo in the “chemical traffic”[3] being distributed across the bio- and technopolitical networks that make up hormone protocol. Once again, I am reminded of the various ways hormones are technical matter capable of constructing novel and multiple relations across bodies, even in the most unlikely of places.

Figure 2: A screen capture from With Those We Love Alive’s source code. When the variable $hormone_day reaches day four in narrative time, the Slime Kid can be found in the maze-like alleyways within the city.

I have discussed how hormone protocols distribute hormones as bioinformation under the chemical messenger paradigm and how those protocollary organizations direct this chemical matter into, out of, and between bodies. As bioinformational matter, hormones “stimulate” or execute certain processes at the cellular level that become interpreted for their semantic value at the social level. Following the Shannon-Weaver model of communication, hormones are both messengers and messages—chemicals travelling through the bloodstream whose very molecular composition comprises the signal it carries. Yet, depending on the social contexts in which these chemicals circulate, their messages can facilitate various modes of interpretation. As such, hormones become *variable operators* across different subjectivities and species.

[3] Paul B. Preciado, *Testo Junkie*, trans. Bruce Benderson, (New York, NY: Feminist Press, 2013), 159.

In this chapter, I explore how hormone protocol's technical organization follows an algorithmic and variable logic, rendering hormones differently operational on different forms of life. At the same time, I demonstrate that changing or variable interactions with hormones can redirect those flows away from dominant organizations and can undermine dominant hormone protocol. To do this work, I turn to Porpentine's critically acclaimed interactive fiction, *With Those We Love Alive*, engaging both in a narrative analysis of the text and in an algorithmic analysis of the variable $hormone_day. Proposed by digital media scholar micha cárdenas, algorithmic analysis aims to trace power relations by engaging in an analysis of instructions-based operations (such as those that make up computer programs) where changing input or values of variables produce different outcomes. In this way, the shared terrain between algorithms and protocol becomes apparent. In *With Those*, the variable $hormone_day is used to count the progression of days in the narrative. On certain days, it triggers events such as requiring the playable character to take femininizing HRT and the appearance of Slime Kid. In the former event, the narrative will not progress until the playable character takes HRT. This relation between the player, playable character, and plot progression makes $hormone_day a key narrative operator. By marrying these two analytical perspectives, narrative and algorithmic, this chapter traces how an encoded variable—one that functions as a measure of narrative time but has been given the namesake of bioinformational chemical messengers—acts as an operator of both alienation and communal trans care in Porpentine's code.

Do not let the syntax fool you into thinking this computer-coded hormone is not as agential as "real" hormones; $hormone_day *represents* the same hormonal power that mediates and directs trans life in day-to-day practices. Bytes or molecules, it matters not, as both these hormones—one representational through the logics and operations of computer code, the other a

chemical operator on the flesh—are sites of protocollary control. By paying attention to the algorithmic organization of the text and the literary presentation of its narrative, I trace how the digital organization of the narrative works to direct both hormone action and player interaction in *With Those.*

Questioning how a hypertext narrative about trans life, standardization, and complacency[4] uses hormones to either reproduce or subvert these politics by coding hormones through a digitally embodied protocol, rather than an explicitly biochemical one, offers a reading of hormones' bioinformational quality without losing sight of their capacity to engage in or resist violent acts of subject-making. This dual method reading I engage in this chapter discerns two flows of hormones in *With Those*. The first directs hormones in ways allegorical of dominant bioeconomic flows of HRT as a commodity—reproducing hormonally-mediated trans lives as inseparable from the practices that construct them as medical subjects. The second flow oozes out of the periphery to offer a counterhegemonic message that celebrates trans care and community as an essential part of hormonal therapy. However, to understand the procedural logic of *With Those* that drives its narrative representation of hormone protocol, I first offer a summary of the game and its technical and literary aesthetics.

Technical and Literary Aesthetics of *With Those*

With Those We Love Alive was developed by Porpentine Charity Heartscape in 2014 and has received much critical acclaim.[5] The "dark fantasy" story, as Porpentine describes it, is set in

[4] Porpentine Charity Heartscape, "Notes," *Electronic Literature Collection Vol. 3*., (Cambridge, MA: Electronic Literature Organization, 2016).

[5] From *Electronic Literature Collection*'s feature of *With Those We Love Alive*: "[Porpentine]'s won the XYZZY and Indiecade awards, had her work displayed at EMP Museum and The Museum of the Moving Image, and been profiled by the New York Times, commissioned by Vice and Rhizome, and she is a 2016 Creative Capital Emerging

the kingdom of a grotesque and tyrannical Skull Empress who indentures the playable character for her skills as an alchemical artificer. *With Those* is one of the many hypertext narratives in Porpentine's catalogue made with Twine, an open-source software for writing interactive fiction that enables storytellers of all levels of programming experience to build their fictions with HTML, CSS, and JavaScript. The narrative interface is nearly entirely text based. Key words and phrases in pink text denote hyperlinks that direct the narrative by allowing the player to move from one page to another in the non-linear story. This is a common component in interactive fiction called procedural linking. Purple text indicates a cyclical link; a link that allows players to click through several text options to customize their narrative experience aesthetically and semantically (Fig. 3). These storytelling features encourage writers to experiment with the literary value of hypertext structures, creating "new poetics of the link."[6] That is, writers of interactive fictions use the procedural affordances of hypertext storytelling to express literary form and style *while* they direct readerly experiences in ways that are not possible in other text-based media such as print.

With Those also features non-textual elements. Brenda Neotomie composed the soundtrack for the interactive fiction. Most of the narrative is accompanied by a looping track of a rather pensive synth melody. The featured track adopts a frenetic sound during high-stakes moments. The graphic components in the game are simple. Text is backgrounded by either a blue or pink vertical gradient, depending on the narrative moment. There are no images, videos, or animations as is common in other forms of digital storytelling. Despite its simple visual design,

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Fields awardee." See https://collection.eliterature.org/3/work.html?work=with-those-we-love-alive. *With Those We Love Alive* was also featured in the 2017 Whitney Biennial.

[6] Anastasia Salter and Stuart Moulthrop, *Twining* (Amherst, MA: Amherst College Press, 2021), 31. This book is considered *the* critical text on Twine and Porpentine's work features heavily throughout it as she's become an integral part of the interactive fiction community, both as a creator and a mentor to those learning the platform.

the world of *With Those* is made vivid and horrific through Porpentine's linked poetics of abjection—a language that often calls to mind both the visual and somatic sensations of living amongst muck, filth, decay, and most importantly for this reading, ooze.

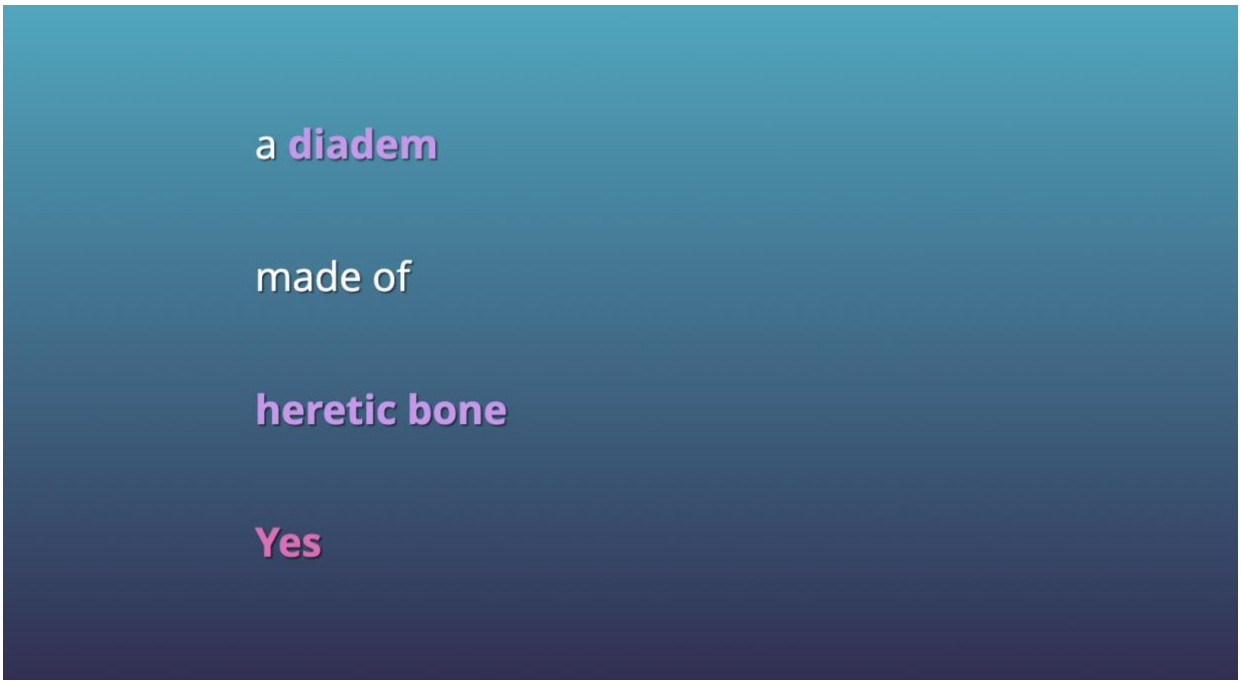

Figure 3:A screen capture from With Those We Love Alive depicting purple cycling links for customization of the narrative's poetics. Non-interactive prose appears in white text and pink procedural links guide players to a different passage.

Players are introduced to Porpentine's grotesque aesthetics from the outset of *With Those* when they are tasked with determining a name for the playable character. This naming process is somewhat complex as it involves the following steps: selecting a birth month from twelve given options (*Five, the Angel's egg*, *Eight, the Snake's milk*, e.g.), cycling through the purple text options of *Petal*, *Tears*, *Mud*, *Machine*, *Fur*, and *Feathers* when asked "What is your element?", and choosing an eye colour by cycling through ten purple text options. Players are told that this information was used by the character's parents to determine her name, but we are never told

what this name was. Instead, the playable character chooses a different name for herself. This new name, always feminine in its prosody, is the name shared with the player.

Like the naming protocol followed by the character's parents, the playable character's chosen name is generated based on the player's responses to the three questions. The birth month chosen determines the character's first name, eye colour determines the first half of her surname, and the element determines the second. Through Porpentine's algorithmic logic, the character's identity is constituted by these three traits whether she is named by her parents or herself. What matters in this naming practice is who is given interpretive authority over the playable character's[7] identity. Importantly, this is the first moment in the narrative to suggest that, as well as being an allegory for the ways mundanity can numb a subject into adapting to and adopting violence, *With Those* is also allegorical of trans survivability under such dominant regimes. It also demonstrates one of the many ways Porpentine uses algorithmic logic as a protocollary mode through which the subjects of her story are constructed.

After completing the algorithmic naming ritual, the playable character is visited by an agent of the Skull Empress, inviting her to work as the Empress' artificer. Most of *With Those* takes place in the kingdom ruled by the "ichorous" Skull Empress, a figure who invokes the ethereal and omnipotent as much as she does the seeping and infected. From inciting mob violence against "princess spores" to maintaining a city filled with urchins who perform rituals of "luck against starvation and luck against police brutality," the Empress is, without doubt, a tyrant. However, her violent authority is not often felt directly by the playable character. Rather,

[7] Because there exist 720 possible unique character names for any given reading of *With Those We Love Alive*, I will continue to refer to the main character as the "playable character" rather than by a specific name or as "the protagonist." "Playable character" emphasizes the interactive nature of the story, such as the use of second person address and asking players to make narrative and aesthetic choices on the character's behalf—in ways that I find other conventions for identifying and referring to literary characters do not account for.

the Empress gains the complacency of the playable character and the game's players alike through a consistently maintained mundanity enabled by the narrative's protocollary organization.

Narrative Protocol in *With Those*

The mundanity starkly felt by players of *With Those* is uniquely constructed through the allowances of the story's form as interactive fiction. Banality is nowhere to be found in Porpentine's highly descriptive language or her vibrant visual style. Nor does it mark the individual plot points that shape her story. Banality is produced through the procedural logics of non-linear storytelling, a logic that, in this case, directs players to find the most efficient path to complete the narrative even if that path reduces the player character's subjecthood to a mere labour force. Similarly, it is through this encoded logic that one function of the variable $hormone_day emerges to constrain hormones within the circulation of pharmaceutical bioeconomies. This constraint produces the transfeminine hormonal subject *only* through pharmacy, isolating her from the affective and communal care practices that have historically been present within transfeminine communities.

There are two narrative events controlled by $hormone_day: the need to re-apply hormones on day '7,' and the presence of the character Slime Kid on day '4.' While the act of reapplying hormones in a narrative inflected with themes of trans experience may seem like a moment of self-actualization and gender euphoria, I argue that taking these hormones is effectively rendered an act of labour and subject management through the story's procedural rhetoric. This procedural rhetoric gains compliance by offering players the most efficient mode for progressing through the narrative. However, the smoothest path to narrative progression is also the path that most

frequently encounters the violence of the Empress and the game's trauma-bound environment. Through the story's use of repetition, these encounters become mundane. In other words, the game invokes a *narrative protocol* that gains tolerance for, and makes mundane, acts of violence. In contrast, Slime Kid, who comes from no pharmaceutical capitalist regime, but is nonetheless a product of hormonal relations in the narrative's ontological framing, is a product of inefficient modes of play that bring moments of joy and reprieve to the reader.

In engaging in an analysis of $hormone_day as a key textual component of *With Those*, I braid algorithm, narrative, and hormones together under a rubric of protocol and proceduarality. This braided approach demonstrates how $hormone_day's protocollary organization subjugates by fostering compliance with dominant forms of power—both the Empress' violence and the bioeconomic circulation of HRT that have been decontextualized from trans community care practices. *With Those* generates a narrative environment where the tyranny of the Empress requires her closest subjects' complacency towards violence that drives her oppressive regime. As an interactive fiction, this complacency is not limited to diegetic storytelling. Rather, it is enacted by the player who is implicated in the game's oppressive narrative because of the procedural affordances of hypertext narratives. Each click the player makes toward narrative progress implicates the player in the Empress' tyranny. From a dual perspective that traces both the diegetic textual components and the algorithmic organization of *With Those*'s narrative, we can begin to see how the interactive fiction quite literally directs readerly experiences through a narrative protocol that is organized around the text's hyperlinking structure.

Algorithmic Analysis

Before addressing the ways algorithmic and diegetic orders are braided together to direct players of *With Those* towards self-alienating readerly practices, I first want to outline why it is necessary to engage the text as algorithmic. Doing so will demonstrate how *With Those* shares a logic of technicity and manageability with hormone protocol. Protocols, after all, are algorithmic as they are procedural organizations of action that direct living and non-living matter within the world.

Twine, the program Porpentine used to compose *With Those*, allows creators to write and design interactive fictions. Twine's interface includes simplified coding tools that help writers integrate components of common programming languages for the web—like HTML, CSS, and JavaScript—into their stories. Critical engagement with interactive fiction requires reading this code as a meaningful component of the narrative itself, rather than as architecture in which the narrative exists. Mark C. Marino calls this literary approach to reading code "critical code studies." While my reading of `$hormone_day` is informed by critical code studies, it is much more informed by micha cárdenas' critical treatment of code through algorithmic analysis.

Algorithmic analysis shares with critical code studies the premise that coded text holds meaning beyond its immediate function or procedure. Both practices recognize that code offers a suitable language through which one can direct action. That is, code is *operational*; it insists on organizing and executing the series of actions that make up its function. Returning to Galloway's treatment of information protocol, we are reminded that these encoded texts are caught up in flows of protocol that direct meaningful action. Cárdenas, however, is specifically concerned with the ways algorithms can be leveraged to *redirect* power through action as a mode of trans and of colour resistance. Thus, the interests and challenges conveyed by algorithmic analysis

align closely with this chapter's inquiry into hormone's variable power in trans lives and the roles Black, Indigenous, and of colour trans women have taken on to reorient that power.

Algorithmic analysis is a practice that has established its political roots widely across critical race theory, trans studies, and media studies. It emerges from the varied movements and operations taken by trans of colour people to survive transphobic ideological and material violences. Traced together by a shared thread of nonbinary and gender non-conforming action and performed by trans[8] of colour actors, cárdenas reads these movements through a poetics of algorithmic operations. Though Porpentine is a trans woman, she is not a trans woman of colour. Nor does *With Those* directly address racial politics within its narrative. The text is often understood as an allegory critical of a general authoritarian and coercive power through which players can make sense of (their own) trauma.[9,10] The political dimensions of this totalitarian world depict imperial power and class struggle. There is a clear hierarchal distinction between those protected by the Empress and the nondescript "urchins" who populate the city streets and gutters. Yet, reading *With Those* as an allegory for trans survival suggests that there are indeed algorithmic operations at play in the narrative that work towards a specific politics of trans hormonal care historically taken up by Black, Indigenous, and of colour trans women.

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[8] "Trans" is perhaps a contentious unifying identity for the subjects of algorithmic analysis, as cárdenas points out because not all people who don't conform to colonial gender binaries consider themselves "transgender." Additionally, many people occupy various nonbinary gender categories that have existed before and outside of colonialism, such as Two Spirit and transvesti. These identities may also hold spiritual roles and thus exist apart from a transgender identity that is understood as having emerged both from a colonial necessity to identify, categorize, and pathologize the other *and* from a continued resistance to the very conditions of power that called us into being as "other." Like cárdenas, I continue to use "trans" as a variable and capacious term to refer to any multitude of possible nonbinary gender expressions so as not to equate trans experience with a white trans experience emerging from the colonial medicalization of the "transexual" or the "transgender." Likewise, I use "transgender" only to describe these forms of historical and current medicalization even though I acknowledge its cultural use outside of and apart from transmedicalization in trans communities.

[9] Alice O'Connor, "Physically Interactive Fiction," *Rock, Paper, Shotgun*, November 14, 2014.

[10] Ian Bryce Jones, "Do(n't) Hold Your Breath: Rules, Trust, and the Human at the Keyboard," *New Review of Film and Television Studies* 16, no. 2 (2018): 178.

Notably, cárdenas remarks that being trans of colour is not a prerequisite for one to perform the operations that contribute to a trans of colour poetics and she cites the works of artists whose identity exists outside of this intersection[11] *Poetic Operations* is founded on an ethos of survivability that is enabled by coded movements, operations, and transformations that shift expressions of race and gender to ameliorate precarity and the threat of violence. These shifts are tactics predominantly employed by trans of colour artists. Cárdenas uses algorithmic syntax as part of her practice to "bring [trans] experiences to life through poetry and performance."[12] I argue *With Those* engages in similar practices as the Slime Kid's algorithmic hormonal origins positions trans kinship and care as a reprieve to the narrative's dominant protocol.

My aim here is not to decontextualize cárdenas' work from its praxis as a survival tactic used by Black, Indigenous, and of colour trans people. On the contrary, underground practices that aim to provide hormonal access, knowledge, and trans care, work—and that have traditionally been taken on by Black, Indigenous, and of colour trans women—are depicted through the character Slime Kid. Like the DIY HRT practices, black hormone markets, and underground clinics set up by of colour trans women to provide care for their community outside of the often trans antagonistic institutional circulation of hormones, Slime Kid represents a redirection of $hormone_day's usually alienating algorithmic logics toward kinship. Slime Kid's role as a carer who emerges from obscured hormonal origins is representative of trans of colour care work located outside of dominant hormone protocol. I will return to a discussion of this care work towards the end of this chapter.

[11] micha cárdenas, *Poetic Operations* (Durham, NC: Duke University Press, 2022), 25.
[12] cárdenas, 25.

$hormone_day: Reading and Writing Algorithmic Alienation

I have already suggested that interactive fictions are procedural texts. They follow rules that determine how, with what, and when players can interact in their stories. In this way, the algorithms that make up an interactive fiction necessarily shape both how the diegetic elements of the story unfold and how players understand their own reading practices within the narrative. Right-clicking on the Twine narrative as it's displayed in-browser and choosing the option to view the page's source code will produce a new window which contains the code for the entire story. This view enables critical engagement with $hormone_day through algorithmic analysis.

The coded variable $hormone_day counts values. Specifically, keeps track of in-game days. The variable's value increases by one when players go to the character's chambers and click "Sleep." Certain events in the story occur on certain days, affording the player and playable character alike new opportunities to interact with the narrative world. Interaction with the narrative world is a key component of *With Those*, but it is not necessarily one that the story encourages in reading practices. While clicking on hyperlinks is the bread and butter of any interactive fiction, $hormone_day's role as a measure of narrative progression, in the form of diegetic time passed, tends to encourage less engagement with the world rather than more.

With Those We Love Alive is mapped across webpages which are referred to as "passages" in Twine's programming. Assuming the role of the playable character, players can follow links to navigate to different areas in the Empire, including a lake where one can practice timed breathing exercises, the city where a dream distillery offers draughts of liquid hallucinations, the playable character's chambers where sleeping progresses the story to the next day, and the playable character's workshop where she is tasked with making war accessories for the Empress. Though players can usually explore these areas indefinitely, interacting with the

story's world and garnering richer readings of Porpentine's poetic language, interactions within most of these passages do not influence future plot elements or move the story forward.

The affordances of such non-linear organization in interactive fiction allow for an emphasis or de-emphasis on certain aspects of language and narrative organization in the story. Inge van de Ven suggests that *With Those* engages players in "a non-linear reading with fleeting attention"[13] to the mechanics that shape both content and form. Indeed, many of the interactive elements of the story foster fleeting attention to the text's language, setting, and other characters when exploring outside of the Skull Empress' fortress. Players soon come upon limitations in the story's scope. Many pages contain one or two lines of prose or poetics followed by a single pink link to move forward. Navigating through the interactive design of *With Those* feels like work. Players are rarely rewarded with new information or options when they revisit sites or interact with objects multiple times throughout the narrative. Interaction exhausts itself quickly with much of the world feeling like an amalgamation of stagnant set pieces, rather than a vibrant, interactive world. Within a few clicks, these new areas quickly return players to the navigational menus they used to arrive at such sites in the first place, indicating that everything outside of the Empress' private domain is a narrative dead-end.

For a non-linear interactive story, *With Those* encourages linear reading modes. Players might navigate through the entire story without ever interacting with the city urchins who live precariously on the peripheries of the Empress' kingdom. Save for a few passages at the beginning and end of *With Those*, all the events necessary to progress through the narrative occur within the palace walls, proximal to the Empress and her violent tendencies. The narrative only progresses when the character sleeps and a new day begins or by completing events triggered on

[13] Inge van de Ven, "Platform-based Rules of (Un)Notice: Digital literature and attentional modulation," presented at the ELO 2021 Conference and Festival: Platform (Post?) Pandemic, Aarhus University, May 24-28, 2021.

certain days. These events require the playable character to craft weapons for the Empress or to participate in crushing her "princess spore" offspring. Often, interacting with the limited passages outside of these events feels like "biding [one's] time"[14] before the playable character is called to labour for the Empress once again and can thus move the plot forward.

The stubby narrative branches set outside of the Empress' fortress may very well be evident of the labour-related challenges independent artists like Porpentine face when producing single-authored digital stories. However, the limited opportunities for interaction also demonstrate how dominance works to gain consensus through a protocollary direction of the very lives that dominance enacts upon. The procedural logics that organize interactive narratives always tell their players something about the politics of that narrative world. *It matters how characters are directed through these procedural texts because the movements within the narrative protocol might either reproduce dominant power or resist it.* This relation between a digital text's algorithmic organization and the way it informs player interpretations of the text's narrative is what Ian Bogost calls procedural rhetoric; the "practice of persuading through processes."[15] In other words, when you connect procedural actions to literary meaning, you begin to tell stories about the kinds of worlds protocols can organize.

In *With Those*, the variable $hormone_day is bound to an algorithmic process that produces narrative meaning through mundanity and alienation. Players who take the most efficient route from beginning to end favour reading for narrative progression over reading for poetics. From an algorithmic perspective, this reading mode aims to push the hormone variable further and further along through the narrative protocol, and, in doing so, produces narrative experiences that not only alienate the playable character in her world, but also numb players to the violence of that

[14] Jones, 177.
[15] Ian Bogost, *Persuasive Games* (Cambridge, MA: MIT Press, 2007), 2-3.

world through repetition. In other words, the most enticing reading mode of *With Those* is also the mode that engages players as agents of a hormone protocol that maintains the Skull Empress' tyranny. Here, players support the direction of hormones as bioinformational matter in ways that end up isolating the playable character from a sense of community and keep her proximal to the Empress' regime of violence.

Thus far, I have argued against a reading mode of *With Those* that numbs players. It is necessary to account for the ways this numbing affect might be a desired outcome for some when reading a narrative about trans survivability. Even if it leads to violent complacency in the narrative, numbness can be an essential strategy for surviving cruel worlds. For trans scholar Hil Malatino, numbness and other flat affects are familiar and strategic responses to the disorientations (between self and body, between self and world) experienced by trans subjects. Numbness is "a means through which we survive such moments by turning down the volume on our sensorium."[16] Trans life is not represented without autonomy in *With Those,* and though the consequences of choosing an efficient reading that produces numbness may be hard to bear, it certainly is a rational choice.

Still, the consequences of such a choice do indeed bear down on the player. Engaging in reading modes that produce numbness in *With Those* does not only result in a narrative of flat affect; these reading practices have negative affective costs for the player as well. Continuing through a text that reproduces the mundanity of a work-sleep cycle under an oppressive force—one that simulates the depressing reality that participating in exploitative labour practices is often necessary for survival under the regime of late capitalism—is challenging, to say the least. When I taught this text in a gender studies class called "Bodies and Critical Media Practices" in the Fall

[16] Hil Malatino, *Side Affects*, (Minneapolis, MN: University of Minnesota Press, 2022), 76-77.

of 2022, many students admitted that they gave up on finishing the story, finding it too difficult, depressing, and impenetrable to slog through. I often wonder if these students approached the text as a resource from which ideas could be extracted, engaging it through reading practices that the neoliberal university so often rewards, practices where efficiency makes for proficiency in completing coursework. If this is the case for these students, no wonder they had a bad time! And it's no wonder they reported *feeling* bad, too. When exercised in *With Those*, efficient reading practices are exhausting, even if they offer the quickest path to the story's resolution. By directing players to engage in an alienating reading mode, *With Those* demonstrates that, like all protocols, narrative protocol is isomorphic with biopolitics.

Yet, despite the negative affects the game engenders, it remains popular among many art critics and casual appreciators of interactive fiction alike. No doubt Porpentine's "dark fantasy" poetics, which are beautifully weird and macabre, are a contributing factor to the wide celebration of the game. But beyond its language, the story of *With Those* offers players something else. It offers an opportunity to reflect on and deconstruct the forms of power it portrays. I suspect, based largely on my own experiences with the narrative, that *With Those* offers many of its players a site to intellectually and emotionally process the seemingly benign ways oppressive power manifests. Moreover, this deconstruction can offer generative disidentification with such power by exposing it through play-based experiences that subjugate readers. This is a strategy familiar to queer games as, for Derek Burrill, the affective and embodied nature of gameplay already offers "prime sites [for] disidentification" with hegemonic power.[17]

[17] Derek A. Burrill, "Queer Theory, the Body, and Video Games" in *Queer Game Studies*, ed. Bo Ruberg and Adrienne Shaw (Minneapolis, MN: University of Minnesota Press, 2017), 32.

With Those is a particularly apt text for understanding how protocols direct hormones towards acts of subjectification because the procedural logics that organize the narrative are amplified through the politics of the world in which the story takes place. In a reading that maps hormone protocol onto a narrative protocol, $hormone_day is not simply a metaphor for the ways hormones are directed to perform certain acts of biopower. $hormone_day *is* digital hormonal information. The variable enacts hormonal operations as digital, rather than biochemical messengers. While the relationships between hormones and the types of lives they mediate tend to be much more difficult to trace outside of *With Those*'s direct causality, they are nevertheless connected. In *With Those*, hormone protocol is organized temporally. Every time players allow the playable character to sleep, the value of the variable increases by '1' until the value is equal to '7.' When $hormone_day is equal to '7,' the next in-narrative sleep will reset the counter back to '1,' mimicking a standard calendar week. On day '7,' players direct the playable character to re-apply hormones before they can access the option to sleep and thus before they can advance the narrative further.

When the variable's value reaches '7,' another variable called $hormone_need is set to 'true' (Fig. 4). Variables that can only be equal to either 'true' or 'false' are known as Boolean variables and are logically equivalent to asking 'yes' or 'no' questions. In other words, when $hormone_day reaches a value of '7' in the back-end algorithmic logics of *With Those*, the front-end mimics another type of procedural engagement with hormones; that is, following pharmaceutical protocol for taking HRT. Put simply, we can think of these algorithmic operations as engaging in the following logical propositions which I will give in plain language.

> Each hormonal cycle is seven days long.
>
> I must reapply hormones on the seventh day of a hormonal cycle.

- What day in the hormonal cycle is it?

It is the seventh day of the hormonal cycle.

- Do I need to re-apply hormones?

Yes, I need to re-apply hormones.

In this example, when the programming that makes up *With Those* checks the value of $hormone_day, it is essentially asking itself the first question, "What day in the hormonal cycle is it?" When the program checks the value of $hormone_need, it is posing the second question. If the answer to the first question returned any value between '1' and '6' inclusive, the answer to the second question, "Do I need to re-apply hormones?" is "No." Of course, it follows that if the value returned is '7' then the answer to "Do I need to re-apply hormones?" is "Yes." Outside of the syntax of computer code, this plain language demonstrates how even banal acts such as taking regular doses of pharmaceutical hormones are still protocollary acts. Here we can begin to see how the social and political imbrications of hormone protocol are nestled deeply in algorithmic logics. Following gender-affirming HRT regimes, or any pharmaceutical course, means following protocol.

Figure 4: A screen capture of With Those We Love Alive's source code. This line indicates that the playable character must re-apply hormones ($hormone_need=true) every time the variable $hormone_day reaches day '7.'

While access to HRT and other forms of medical and pharmaceutical care is essential to those who wish to medically transition, the procedural rhetoric that guides the re-application of hormones in *With Those* suggests that HRT alone is not enough to build communities of care.

Moreover, re-applying hormones is a mandatory action required of the playable character before she can sleep, and players can advance to the next day and begin the seven-day cycle again (Figs. 5 and 6). Re-applying HRT in *With Those* offers neither the character nor the player relief. Tied to narrative progression and its productive logics, taking hormones congeals into labour and time. In other words, in its algorithmic organization, $hormone_day aligns cold, clinical care with the construction of a compliant subject.

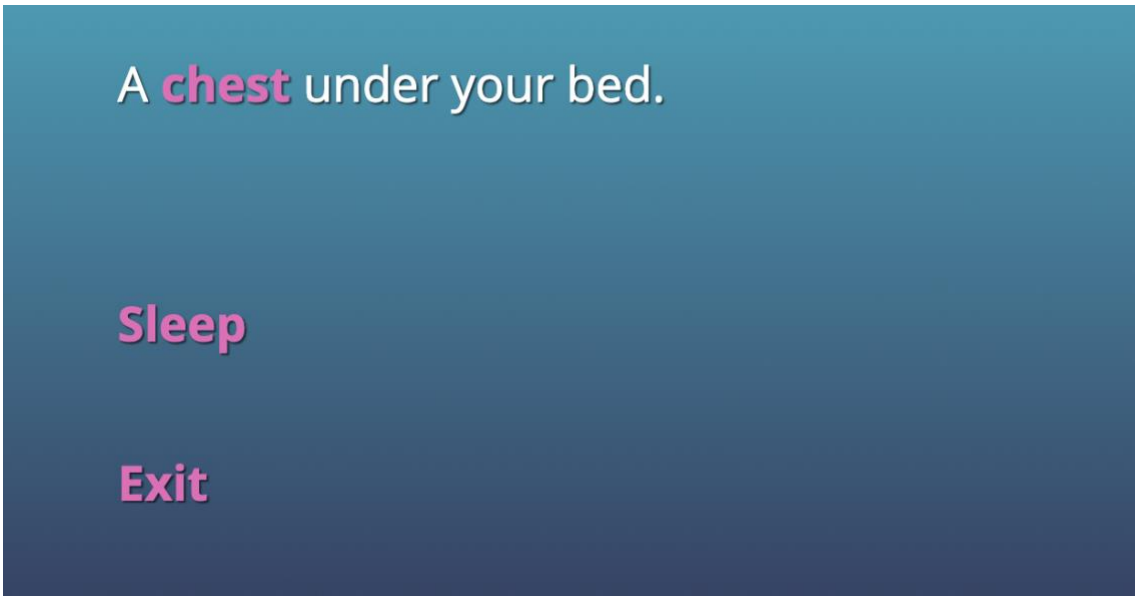

Figure 5: A screen capture of the passage that appears on most in-narrative days when in the playable character's chambers.

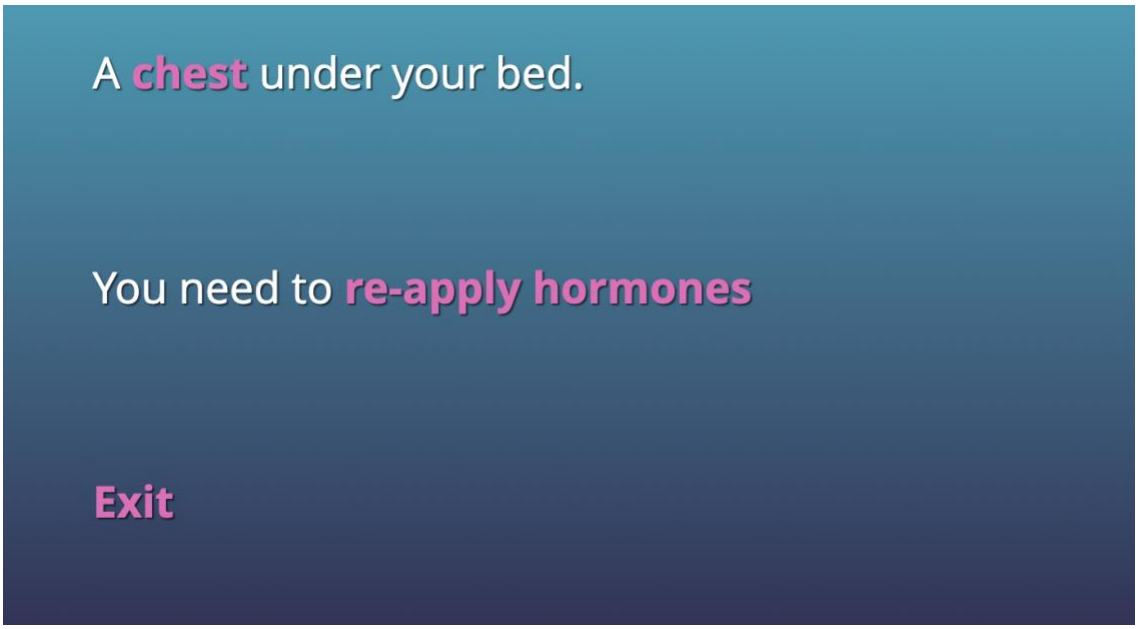

Figure 6: When $hormone_day reaches a value of '7' in With Those We Love Alive, the option to sleep is not available until the player directs the character to re-apply hormones.

Re-applying hormones in *With Those* does not feel like a celebratory moment of gender euphoria. Though players are told the "estroglyphs" and "spiroglyphs" (references to combination estrogen and androgen-blocking spironolactone HRT) are "precious" when looking at the drugs in a chest, the only reaction offered to advance the game after taking the hormones is "okay" (Fig. 7), rendering the act an entirely underwhelming experience. Instead, taking hormones feels like work. This laboured relationship between hormone re-application and affective alienation is exemplary of Preciado's understanding of pharmacocapitalism as the global engine that turns bodies into both commodities and ideal subjects. The estroglyphs and spiroglyphs featured in *With Those* are most transformative for the playable character not as self-actualizing matter, but as a subject-making matter under the Empress' control.

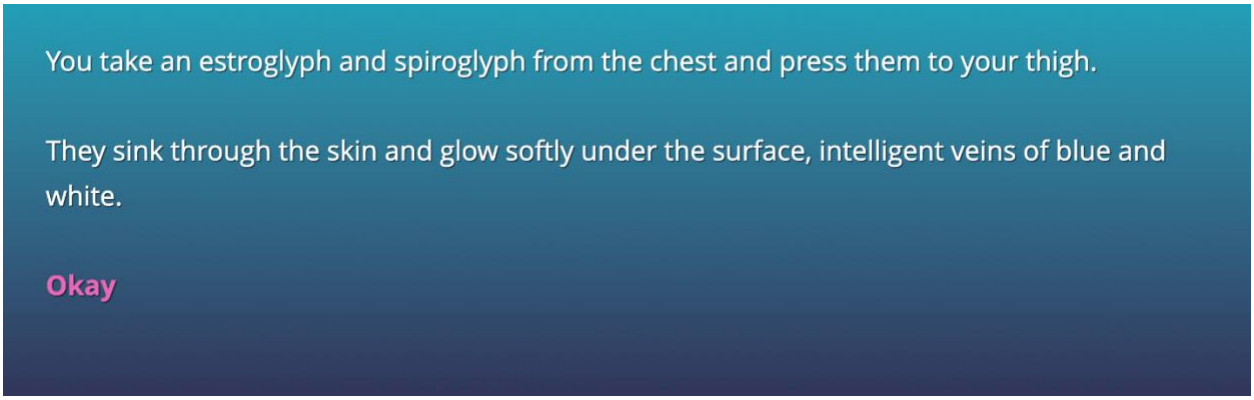

Figure 7: Re-applying hormones in With Those is not a particularly joyful act.

By bridging literary analysis with an algorithmic analysis of $hormone_day's procedural flows of digital-chemical hormone messages, we can see how $hormone_day literally situates hormones as bioinformational in the construction of the trans subject under alienating and oppressive power. This subject-making occurs not (only) because of the Empress' tyranny, but because of the mundane and sterile proceduarality of a reading mode that promises narrative efficiency only to numb players into complacency with subjectification. The dullness of reading for narrative progress, measured in part by $hormone_day's day-counting function, seems then to align neoliberal logics of efficiencies with pharmaceutical regimes of power to not only produce its subjects but to produce those subjects' affects. In this way, a critical reading of power in *With Those* requires a critical reading of the ways hormones, hormonal lives, and hormonal affects are all directed to maintain dominant power relations through protocol.

However, reading this story with privileged attention to hormones and gender-affirming HRT treatments does not necessarily result in a reading of hormone practices that move towards trans liberation through hormonal care work. Quite the contrary, the subsumption of hormone therapies into the labour cycle of *With Those* erodes any presumed sense that HRT *alone* is

sufficient trans care and renders taking HRT as a sort of "minimal [form] of survival"[18] needed to sustain the playable character as a co-operative labouring subject before she returns to work for the Empress.

As a timekeeping variable, $hormone_day is part of a protocollary organization of diegetic hormones which informs how and when players interact with the narrative. *With Those* invokes a procedural rhetoric that encourages players to advance the narrative by performing limited actions which produce an alienating mode of reading the text. This mode of reading reproduces a type of labour embodied by the player clicking the sleep action, and advancing the values of $hormone_day, to reach the next key moment in the text. In this way, $hormone_day creates a contingency between taking HRT and the alienation of progress-oriented reading modes in *With Those*'s trauma-bound setting. Taking HRT becomes a task one needs to complete before they can return to work and further progress the story. However, as with all hormone protocols, there are always ways to redirect the current to flow against the dominant protocol. The variable $hormone_day does not exclusively posit hormones as alienating numbing agents of subjection organized by the dominant power. Porpentine's narrative leaves cracks in the dominant protocollary relations between hormones and complacency with violence. Out of these cracks appears a Slime Kid. As described at the outset of this chapter, the presence of the Slime Kid is also controlled by $hormone_day, making this character hormonal in origin (if not composition?). However, unlike the need to re-apply pharmaceutical hormones to progress the narrative, players can only encounter the Slime Kid when they engage in a reading practice that forgoes the very logic of linearity, efficiency, and progress maintained by the text's procedural rhetoric.

[18] Hil Malatino, *Trans Care*, (Minneapolis, MN: University of Minnesota Press, 2020), 66.

$hormone_day: Coding Hormones as Community Care and Trans of Colour Praxis

The violence of *With Those* is countered by moments of intimacy and care between the two trans-coded, trans-femme characters. Players who are familiar with the plot of *With Those* will know that the ultimate narrative resolution is achieved when the playable character reunites with a long-lost friend and fellow victim of the Empress' violent regime. Together, they restore each other's sense of self, share romantic moments,[19] plan a rebel attack against the Empress, and aid the playable character in finally escaping the Empress' control. These moments are essential to *With Those*'s allegorical position against coercive and disciplinary regimes. However, these are not the only moments that emphasize trans care in the story.

The Slime Kid, who appears in the city's alleys only on days when $hormone_day stores a value of '4,' is similarly a product of the interactive fiction's hormonally determined ontology. But unlike the alienating affects produced by readings toward narrative progression, the Slime Kid is a product of hormone relations who exists outside the logic of efficiencies, hegemonic processes and progress, and pharmaceutical biocapitalist subject-making. The same cannot be said for the pharmaceutical estroglyphs and spiroglyphs taken every seventh $hormone_day, even if they stand in as necessary artifacts of the trans lives represented in Porpentine's work. Narratively, the Slime Kid evades reproducing this numbing logic of efficiency that eventually wears players down towards complacency with imperial violence.

The only way to engage with the Slime Kid is to find her hidden in, or perhaps *oozing* out of, a moment and place within the narrative world where engagement has no consequence on

[19] These characters are romantic but not explicitly sexual. They love each other but are not necessarily love interests to each other. In her notes, Porpentine states "WTWLA is a friendship between femmes. The game's metadata describes itself as a "romance" but nothing sexual happens, they don't really flirt. I wanted to talk about romantic friendship, about intimacy outside of the binary of platonic/sexual."

programmed in-story events. This is not to say that her presence has no consequence on possible readings of the text. Interactions with the Slime Kid interrupt the mundanity of the hypertext, offering players insight into the richness of life still present amongst some of the city "urchins." The Slime Kid's presence in the narrative is an altogether joyful one, a stark opposition to the dark textual aesthetics so thoroughly established elsewhere across the narrative. Her joy manifests in her ability to move by the algorithmic act cárdenas calls "shifting." Shifting is an act of resistance that operates "beyond a binary of visible and invisible" in both transgendered and racialized life.[20] Even on days when she's not in the alley, she is never gone—her presence can be traced both in the code and by the puddle of green slime left in her absence—we simply don't have access to her movements that allow her to *pass* and to *pass through* without detection. In this way, the Slime Kid's variability represents strategies of passing for survivability.

When I describe the Slime Kid as embodying the act of shifting, I mean this literally. Her non-Newtonian form is amorphous. Her movements mediate her constant oozing between multiple shapes of self. When interacting with the character, the player will experience the Slime Kid performing one of fourteen activities. *She gurgles, spraying slime on your boots; She kisses a bug; She shows you a drawing she made. It's very good; She climbs around on the wall for a while, sticking to it like gum; She shows you how to puff up to scare your enemies. Your body doesn't stretch as much, but you promise to study hard; She [digests] a piece of trash; She pops like a bubble, spattering slime everywhere, then oozes back together, giggling; She hugs a snail; She turns into funny shapes then falls over; She [helps] a bug find a home; You teach her some melter tricks; She pretends to be a puddle; She [draws] on the wall with a piece of chalk she found. The whole wall is covered with rain-faded smears of soft pastel; She ripples happily*. The

[20] cárdenas, 74.

only available text reaction to these childlike performances is “Yay” (Fig. 8). The player has no choice but to celebrate and share in the shifting play, compassion, mutual teaching, and love offered by the Slime Kid. This reaction is starkly contrasted with the unenthusiastic “Okay” that follows weekly applications of estrogylphs and spiroglyphs. The Slime Kid’s hormonal presence indicates the necessity of complex and integrated care and aftercare practices “in the wake of profound recalibrations of subjectivity and dependency”[21] of trans hormonal life. These care practices exist, by necessity, outside of the pharmaceutical therapies for which access is so often institutionally controlled by a calculus which pits the bioeconomic return of greater pharmaceutical circulation against the sociomedical allowance of certain hormones to flow transversely through medically gendered bodies.

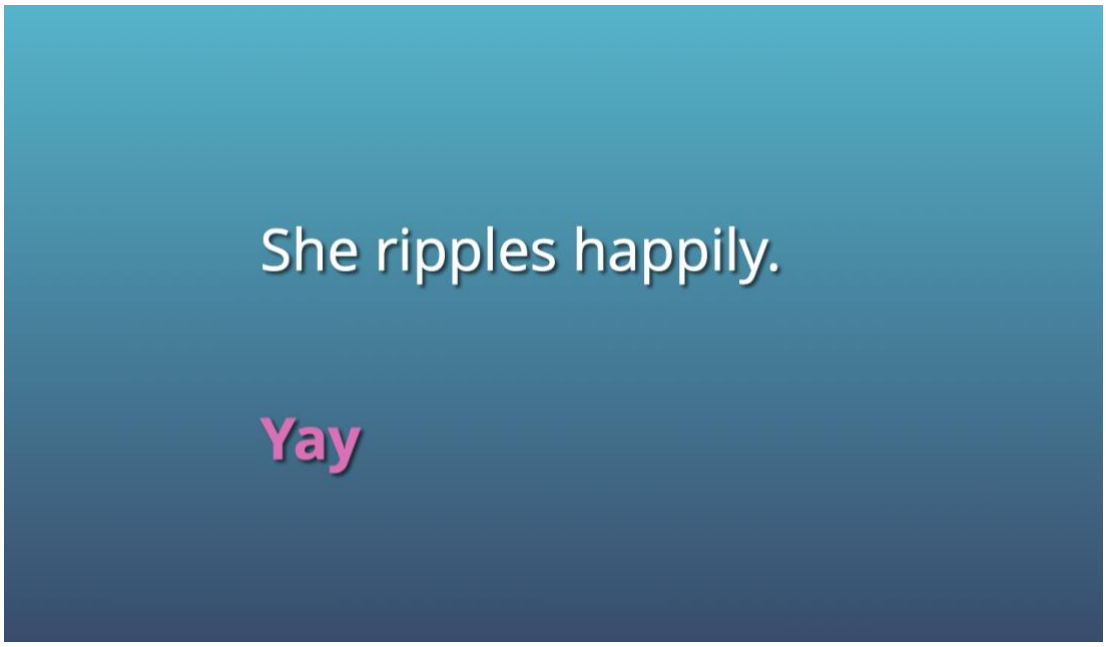

Figure 8:One of the Slime Kid’s reactions to player engagement is simply ‘rippling happily.’

[21] Malatino, *Trans Care*, 3.

Though *With Those* is not considered autobiographical, nor has Porpentine indicated such, one might read the Slime Kid as a sort of cameo or self-insert by the author in an attempt to allow her player a moment of reprieve from the narrative's main focus on trauma, violence, and complacency. Porpentine's online brand and alias during my first encounter with her work was "Slime Daughter,"[22] a slime kid of sorts. However, a more compelling—and historically and politically significant—reading of Slime Kid situates her presence in a lineage of subversive hormonal circulation that exists outside of medical and pharmaceutical institutions and their protocols. As mentioned earlier, the politics demonstrated by Slime Kid's subversive and subterranean movements between front-end narrative and back-end code mimic the shifting movements of trans of colour activists who put their lives in danger to supply their community with safe and effective hormonal treatments.

If players are to take the Slime Kid's hormonal origins earnestly, as I believe they should, the operations she performs as a manifestation of $hormone_day can be situated in a long history of community-based support as well as community-dispensed trans hormone therapies now commonly referred to as 'trans DIY' practices. Today, trans DIY practices often involve accessing hormones through black markets, such as those on the dark web. These hormones might be brand-name pharmaceuticals illegally recirculated in countries and communities that have banned or heavily restricted access to gender-affirming HRT, or they may be "homebrews" synthesized by members of the trans community in makeshift laboratories. Regardless of their provenance, the hormones circulated in these practices actively resist the dominant, neoliberal flows of HRT. In these dominant flows, the genderqueer subject is accepted *as long as* the

[22] Sometime between my first and last versions of this chapter, Porpentine changed her online handles and website domain from "slimedaughter" to "xrafstar monster." Slimedaughter.com redirects to this new domain name as of this dissertation's completion.

hormones that constitute HRT medical protocols are directed towards subjects in such a way that pharmaceutical industries can continue to accumulate capital. Slime Kid is a slimy, oozy, coagulated hormonal mass. She is gel feminized but she is not EstroGel®. Nor is she the multispecies labour and matter congealed within hormonal pharmaceuticals. She is the radical hormonal gelling of somatic and affective mutual care practices.

These DIY trans care practices that recirculate hormones are historically suggestive of, and arise from (in part), the work done by the New York-based Street Transvestite Action Revolutionaries (S.T.A.R.) founded by Marsha P. Johnson and Sylvia Rivera, Black and of colour trans women, respectively. In a 1970 radio interview with S.T.A.R. founders and leaders, Johnson describes how she shifts through public space as a "transvestite." One such shift Johnson talks about is wearing less makeup during the day and more in the evenings to protect herself from transphobic and homophobic attacks. She also comments on the effects of taking hormones. Johnson feels her sexual encounters are safer now that her breast size has increased thanks to hormones.[23]

Importantly for this reading of Slime Kid, Johnson and Rivera also referred to members of the New York ballroom scene under their care as their "kids," further signifying how STAR's care work embraced both the shifting operations of trans while allowing space for playful, at times childlike, exploration in (often) hormonally mediated bodies and spaces. Like Slime Kid's propensity to leak out of the code into the narrative when safe, Johnson and Rivera built and maintained safe spaces in their community by opening their home up to their kids. From this space, Johnson and Rivera could more easily redirect the pharmacological flows of hormones as part of their overall project to ensure the safety and survivability of their community. Rather than

[23] Sylvia Rivera, Marsha P. Johnson, et al., "Interview with Members of S.T.A.R.," interviewed by Liza Cowan, *WBAI Pacifica Radio*, December 12, 1970, digitized by *New York Historical Society*, June 26, 2019.

following "counterprotocollary" strategies that still maintain their dominant roots and routes, such as targeting legislation,[24] these practices undermine the dominant circulation of hormones by employing the slimy logics of oozing and leaking out of sanctioned modes of distribution. Shifting tactics enable one to become a visible agent of hormone redistribution while obscuring these transgressive movements by remaining unseen to those who pose a threat to your existence.

Slime Kid's role as a hormonal variable is strikingly reminiscent of the historical labour of self-appointed doctors of trans DIY communities whose work has been—and continues to be—mostly done by trans feminine and trans women of colour. These women frequently risk their safety to provide trustworthy, compassionate, and effective care for their community outside of dominant medical and pharmaceutical protocols. Jules Gill-Peterson writes of a group of trans women from San Francisco, "poor, many unhoused, and most sex workers who faced unending street harassment from the police, clients, and other Tenderloin residents,"[25] bussing across the US-Mexican border to buy up a pharmacy's entire stock of estrogen in Tijuana in the 1970s. These women would redistribute and inject hormones in apartments and hotel rooms—variable spaces which would shift from safe residences to clinical spaces for community healthcare. These community run clinics operated in direct opposition to the pathologizing, poor-quality, and inaccessible, or otherwise non-existent, care available through licensed medical practices in the United States. Put simply by Gill-Peterson, the story of DIY trans care "is a story in which normal people, typecast as the most vulnerable, made transition possible for their friends, families, lovers, and neighbors, no matter the barriers." In doing so, these women integrated care acts and community into medical practice.

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[24] cárdenas, 173.
[25] Jules Gill-Peterson, "Doctors Who? Radical Lessons from the History of DIY Transition," *The Baffler*, no. 65 (2022).

Like these women, Slime Kid's kinship-based care in *With Those* challenges the presumed efficacy of the narrative's pharmaceutical hormones to provide the best care for both the player and the playable character. This community-based and anti-capitalist ethos is further reinforced by Porpentine's continued use of Twine and her participation in the Twine community. As an open-access tool for designing and telling interactive stories, Twine democratizes modes of visual storytelling that are often considered exclusive to mainstream game-makers[26] through its simple interface and a community of members—including Porpentine—who share techniques for more complex programming beyond the platform's basic documentation.[27] Twine is also known for fostering a community of queer and trans creators. The accessibility of the platform and the 'shareware' fictions and games one can make with Twine has created a space for a plurality of voices[28] to participate in the digital creation and distribution of stories without having to navigate the often-hostile spaces of mainstream game development. The social rules and functions established within Twine's community generally follow a refreshing ethics of care and kinship in the sorts of digital spaces where more often than not, "racism and sexism are part of the architecture and language of technology."[29] The culture fostered by these tools exemplifies a crucial aspect of the political project of trans care practices as argued by Malatino; to demand and create a redistribution of the power enjoyed by those in hegemonic spaces.[30] As such, creators who exist at the intersections of 2SLQBTQIA, BIPOC, disabled, and otherwise queered identities often turn to Twine and similarly accessible and distributable software as favourable tools for producing works that "resist commodification"[31] of mainstream game development.

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[26] Alison Harvey, "Twine's Revolution" *Game: The Italian Journal of Game Studies* 3 (2014): 100.
[27] Harvey, 98.
[28] Anna Anthropy, *Rise of the Videogame Zinesters* (New York, NY: Seven Stories Press, 2012), 8.
[29] Safiya Umoja Noble, *Algorithms of Oppression*, (New York, NY: New York University Press, 2018): 9.
[30] Malatino, *Trans Care*, 70.
[31] Harvey, 103.

The Slime Kid offers players a rare moment to celebrate acts of playful and curious, but also necessary-for-survival, shifting. Slime Kid represents the experience of a certain *jouissance* amidst the agony of coming into adolescence (and perhaps not her first adolescence), as indicated by her status as a 'Kid.' Notably, Slime Kid's youth is presented without the threat of what Edelman calls reproductive futurism.[32] Slime Kid is not given to us as progeny, she is a kid but no one's biological child. Instead, she emerges from a coded hormone message that redirects player action away from the alienating labour and complicit violence enabled by the fiction's dominant narrative protocol. A sort of femme-trash, cyberpunk, Benjaminian figure, Slime Kid resists the futurist promise of progress. A product of hormonal logics recuperated from biocapitalist power; her slimy presence seems to literally leak out of fissures in the otherwise violent organizational structures of the Skull Empire. Leaks expose cracks and create inefficiencies in controlled flows.

Meandering readerly modes that allow players to find Slime Kid in the alley demonstrate a similar sort of inefficiency as they forgo the alienating experience of a teleological reading that directs players to a narrative end or resolution as quickly as possible. In this way, entertaining the Slime Kid's presence is both an act of resistance against readerly tendencies aimed toward linear, narrative progress and a reminder that the complex webs of hormonal care exist outside of and beyond biomedical subjectification. Her presence is always in opposition to the biocapitalist ethos that directs players toward narrative efficiencies and diegetic labour. Her kinship is based in hormone relations that affectively mediate through interaction and interfacing rather than in taking (re)productive routes. The Slime Kid's emergence from $hormone_day underscores a politics of trans care by redistributing hormones through community-guided practices. By

[32] Lee Edelman, *No Future: Queer Theory and the Death Drive*, (Durham, NC: Duke University Press, 2004), 17.

organizing diegetic time as a hormone operation, Porpentine leverages the interactive affordances of Twine to create a world where hormonal interaction determines players' affective experiences with the narrative. While progress-oriented readings of *With Those* must engage with HRT as a routine means to an end, slow careful reading modes that engage with the Slime Kid may come to understand hormonal mediation as a mutable, non-linear, and always incomplete process.

It may be tempting to discount the hormone relations depicted in *With Those* as simply figurative and therefore trivial to any political concerns about hormonal flows and issues of HRT access and administration in our 'real world.' This dissertation's project is, in part, to recuperate counterhegemonic hormone meaning in stories. Porpentine's decision to base her narrative progression on coded hormone variables is not an unrealistic representation of the hormones as procedural matter. Hormones are agential matter that construct subjects through biochemical mediation. Turning to an algorithmic analysis of *With Those* that understands the $hormone_day variable as a political operator, both able to reinforce and resist dominant forms of medicine and care, helps bring to life the mediating power of hormones as biochemical agents.

By building a world where hormone messages determine how time is perceived and when intimate and shared moments of joy might occur, Porpentine's hormone protocol is perhaps speculative in nature, but it is not at all whimsical. I understand Porpentine's text as asking, *What if hormones produced kinship for survivability*? Hormonal trans DIY practices already emerge from these very relations. The hormone-determined variable in her code represents a very real ontological position for folks who depend on hormone therapies and use them to think themselves through time, space, and intimate relations. Porpentine's formal and narrative aesthetics demonstrate how a playful engagement with hormones can enable the telling of stories

that readily attend to trans kinship as a product of hormone relations *while* engaging in inefficiencies of flow to resist neoliberal myths of progress as a product of precarious labour.

III. FEELING HORMONAL / Species, Reproduction, and Expressions of Affect in Barbara Gowdy's *The White Bone*

My body is the opposite of my body
when they hang me up by my hind legs.
[. . .]
A car encased her or an agate. Steamships and
pissoirs, the resinous accretion of pharmaceuticals in her.

– Ariana Reines, "Knocker" in *The Cow*

Elephants, with their big eyes, bigger ears, and prehensile trunks, are often considered some of the most emotionally expressive animal species amongst non-human animals. Elephants even "cry." Though the occasional secretion of fluid from elephants' eyes is not entirely understood by zoologists, it so closely resembles the appearance of emotional tears that it makes it difficult for us humans to read elephant tears as anything *but* affect. Such was the case in 2013 when an Asian elephant cow housed at the Shendiaoshan wildlife park in Rong-chen, China rejected her newborn calf. Now in the primary care of zookeepers, the calf, named Zhuang-zhuang, reportedly "cried for five hours without stopping."[1] The event became a talking point, leading to increased public interest in non-human animal affect and the differences between emotional tears as an affective expression and fluid secretions as a mechanical biological response.[2] Affect, and representations or *expressions* of it, are in many ways a hormonal matter. By this, I mean that affect *matters* when theorizing hormones. Misogynistic stereotypes that equate the changing hormonal levels of the body experienced during

[1] Hayden Smith, "Elephant Tears: Newborn weeps after being parted from mother who tried to kill him," *Metro*, September 11, 2013, https://metro.co.uk/2013/09/11/elephant-tears-newborn-weeps-after-being-parted-from-mother-who-tried-to-kill-him-3959857.
[2] "Do Elephants Cry Because of Sadness?" *George Stromboulopoulos Tonight*, published September 18, 2013, https://www.cbc.ca/strombo/news/do-elephants-cry-because-of-sadness.

menstruation, pregnancy, or menopause with emotional instability make up just one example of how the gendered politics of hormones manifest as a "problem" of affect. Specifically, they manifest as inappropriate management of affect. My use of *expression* also refers to the way excretions of affective matter, such as tears, are hormonal. These expressions are entangled in complex hormonal productions within and without the feeling body. Endorphins, stress hormones like cortisol, adrenaline, and the like are the chemical actors whose quantities and concentrations might determine whether one is emotionally "regulated" or "dysregulated" at any given time. In this way, I find affect and its politics pivotal in the study of hormones across expressive life, including non-human life.

Elephant tears, and other representations of elephants' complex emotional lives, have become tropes across media from journalism to animated film. The Walt Disney Company, an entity responsible for the some of the most prolific and enduring representations of affectively animated or "moving" animals, has made numerous attempts to capture elephant affect in line and colour through their classic and "renaissance" periods of animation. More recently in Disney's *Tarzan* (directed by Kevin Lima and Chris Buck, 1999), an adaptation of Edgar Rice Burroughs *Tarzan of the Apes*, the African forest elephant Tantor is portrayed as the overly-cautious and sentimental foil to what he calls the impulsive gorilla Terk's "emotional constipation." In *The Lion King* (directed by Roger Allers and Rob Minkoff, 1994), the portrayal of elephant death rites, and the suggestion of elephants' innate and ritualistic understanding of consciousness set African bush elephants apart from other species living in the African savanna. The elephant graveyard is the one place Mufasa tells Simba not to go, not necessarily out of respect for a different species' unique cosmology, but because it's dangerous; the elephant graveyard is where the contemptable and morally irredeemable hyenas (who later goose-step to

the orders of the film's primary villain, Scar) spend their time. Opposed to the elephants' understanding of existential events like life and death as sacred, the hyenas are depicted as lesser beings precisely *because* they don't care to, or perhaps can't, muster the empathy needed to respect the affective significance of the elephant species. But perhaps the most faithful portrayal of the affective elephant through the trope of elephant tears is found in *Dumbo* (directed by Ben Sharpsteen, 1941), the tale of the captive Asian elephant calf-made-circus-act whose oversized ears allow him to fly. Jumbo Jr., or "Dumbo" as his bullies nickname him, is regularly verbally and physically abused by humans and fellow elephants alike. Like Zhuang-zhuang, the calf is separated from his mother, though not because of her abandonment but because of her loyalty to her child; she is considered "mad" and is imprisoned by the circus hands and ringmaster after she attacks a human audience for abusing her calf. And, like Zhuang-zhuang, Dumbo is depicted as crying inconsolably with fat tears pooling below his eyes (Fig. 9). So too do "Audiences report crying…when Dumbo and mother embrace trunks" through the barred window of her prison as the elephant calf lets "a few tears slip."[3] These depictions of affective animals are meaningful to humans because they generate a mutual affection and empathy. The trope of the crying elephant works to incite human affective responses towards non-human animals, increasing the perception of social communication between human and non-human,[4] not through 'animalistic' depictions of affect, but through the anthropomorphism of a type of pathos considered deeply and uniquely human.

[3] Eric S. Jenkins, *Special Affects*, (Edinburgh, UK: Edinburgh University Press, 2014), 140-143.
[4] Alfonso Picó and Marien Gadea, "When Animals Cry" *PLoS One* 16, no. 5 (2021): 13.

Figure 9: Left: Zhuang-zhuang under a blanket being comforted by zookeepers after his mother's rejected him. Visible tears stream down is face. Photo credited to CEN, accessed via Metro. Right: Dumbo crying in his mother's embrace during the "Baby Mine scene," Ben Sharpsteen, Dumbo, 1941.

The affective capacities of animals have long intrigued humans. In 1872, Charles Darwin published *The Expression of the Emotions in Man and Animals* in which he turned to observations of weeping Asian elephants captured and abused in Ceylon to argue that emotional expressions of any kind are a universal animal trait. But, when it comes to affective expressions, emotional tears are often considered unique to humans both in composition and causation—two functions of hormones. Human emotional tears are largely comprised of saline and antibodies, but their makeup also includes hormones like prolactin, adrenocorticotropic hormone, and endorphins. Some research conducted on the isolated lacrimal glands (the gland that produces tear fluid) of rats, mice, rabbits, and guinea pigs, suggests that androgens may also play a role in regulating the structure of the gland and its capacity to secrete.[5] In this sense, *feeling hormonal* is a legitimate way to account for the affective conditions of the biochemical functions through which we experience embodiment.

[5] David A. Sulliva et al., "The Influence of androgens and pituitary hormones on the structural profile and secretory activity of the lacrimal gland," *Acta Ophthalmologica* 74, no. 5 (1996): 421-422.

Jeffrey Moussaieff Masson further takes up Darwin's claim of the affective animal in his popular psychology book, *When Elephants Weep* (1995). In his book, Masson responds to both Darwin and to contemporary uncertainty over whether elephant tears are "emotional," and thus a characteristic of psychic intelligence shared with (and previously considered exclusive to) humans, or if they are merely mechanical and thus innately "animal." "In the end," he writes, "it hardly matters whether … elephants weep. Tears are not grief, but tokens of grief…It is hard to doubt that Darwin's sobbing elephants were unhappy, even if their tears sprang from mechanical causes."[6] While I agree with Moussaieff Masson's insistence that we should be critical of ethical structures in which anthropomorphism is a prerequisite for humans to empathize with non-human animals' suffering, the weeping elephant trope *does* matter. Critical deconstruction of the trope reveals much about the ways we humans seek to make non-human expressions of suffering or happiness legible to justify the forms of care and management we might enact on other species. Weeping and other types of elephantine affect are vital to this project because weeping elephants implicate elephant-human relations not only in interspecies affective politics, but in a hormonal politics in which tears and other signifiers of leaky affect are managed to exert control over non-human species.

My turn to the non-human animal in this chapter is informed by animals' longstanding entanglement with and exploitation in the political economy of hormones. What I refer to as "hormonal life" throughout this project has never been synonymous with human life. Non-human species have been long embroiled in the production of hormone knowledge and hormone

[6] Jeffrey Moussaieff Masson and Susan McCarthy, *When Elephants Weep* (New York, NY: Delta, 1995), 190.

pharmaceutical products. Roosters[7], vivisected dogs[8], blue whales[9], pigs, cows, pregnant mares, and "heat" rats[10], among many other non-human species, have been made either experimental objects or raw material in laboratory and industrial productions of hormones and hormone knowledge. For this reason, I find it necessary to include a discussion of the non-human in a project about dominant hormone protocol. In the laboratory and the factory, the dead and partialized (what scientific discourse has called "prepared") flesh of non-human animals and the corporeal waste of living animals (urine, e.g.) mark the rendering of the animal body as inert and nonaffective. Yet, the hormonal concentrations salvaged from these inert samples maintain the liveliness of that flesh as chemical commodity. I always find these interspecies hormonal economic relations fascinating when I encounter them peppered throughout Nelly Oudshoorn's *Beyond the Natural Body* and discussed more directly in Donna Haraway's "Awash in Urine," for example. However, this chapter's treatment of the non-human subject marks a departure from those analyses of the bioeconomies of lively hormones salvaged from dead flesh. Instead, I want to look at how hormone biopower exerted over the living, the whole, and the *affective animal* (both fictional and 'real'), also imbricates non-human subjects in a dominant hormone protocol where "animalistic" hormonal lives are managed by humans to produce *emotional* as well as economic value. In posing questions about the affective lives of non-human animals, we must consider the ways that the very hormonal conditions of being alive are inseparable from the affective economies through which we empathize with non-human species. In this sense, non-human animals are caught up in a "tangle of biopolitical relations within which the economic and

[7] Nelly Oudshoorn, *Beyond the Natural Body*, (New York, NY; Routledge, 1994), 52.
[8] William M. Bayliss and Ernest H. Starling, "Croonian Lecture: The Chemical Regulation of the Secretory Process," *Proceedings of the Royal Society of London* 73, (1904), 313.
[9] Oudshoorn, 68.
[10] Cheryl A. Logan, "Overheated Rats, Race, and the Double Gland," *Journal of the History of Biology* 40 (2007): 692.

symbolic capital of animal life can no longer be sorted into binary distinction."[11] While bovine and blue whale cows' ovaries have historically been economically valuable as research material in endocrinology, representations of elephant cows and their calves weeping *emotional* tears have symbolic value to humans in the affective economies of hormones because they help excite and facilitate human-to-non-human empathic relations. Both biopower and necropower are tightly wound together in these economic animal relations. While the necropower that affords sovereign power the right to determine "who is disposable and who is not,"[12] turns animal life (human and non-human) into capital by *taking life*, biopower renders life economically valuable by maintaining and managing it (what Foucault calls "fostering life").[13] I want to turn a critical eye to the notion that it is far better, far more caring, to control life from the individual cell or gamete, such as in the case of hormonal control over reproduction, than it is to take life all at once and in its whole form.

In this chapter, I turn my attention to the ways the African bush elephant has been rendered both the necropolitical commodity of the ivory trade and the biopolitical subject of care that affords elephants symbolic value outside of, and in opposition to, their corporeal value. Two forms of power over life are at stake here. Poachers treat elephants as fungible resources, as interchangeable units within a species, and have historically threatened the species through the necropolitics of the ivory trade. From these necropolitical relations emerge a biopolitics of care through containment and control. The conservationist efforts to protect the African bush elephants explored in this chapter aim to recuperate the species as a population of individually affective, and vulnerable, members of a complex society. As *Dumbo* has shown, narratives of

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[11] Nicole Shukin, *Animal Capital*, (Minneapolis, MN: University of Minnesota Press, 2009), 7.
[12] Achille Mbembe, "Necropolitics," trans., Libby Meintjes, *Public Culture* 15, no. 1 (2003): 27.
[13] Michel Foucault, *The History of Sexuality, Volume 1: An Introduction*, trans., Robert Hurley, (New York, NY: Vintage Books, 1990), 141.

vulnerability and emotional complexity can generate a mutual affect between humans and the suffering elephants depicted. Such narratives suggest that elephants' cruel anthropogenic conditions necessitate a sympathetically driven form of care that seeks to manage elephant life, including hormonal reproductive management, as an act of love.

One such conservationist effort is found in the 1998 novel *The White Bone* by Canadian writer Barbara Gowdy. The novel follows the remaining members of the "She-S" matriarchal elephant herd as they sojourn to a rumoured "Safe Place" where their family will no longer be killed by poachers. The Safe Place is depicted as a conservation park and was informed by real conservation-safari parks like Amboseli National Park and Maasai Mara National Reserve, both in Kenya. In her portrayal of affective African elephants, Gowdy relies heavily on a variation of the elephant tears trope to generate affect and excite readers towards supporting the forms of human management of elephant life her novel argues they need. More frequently than weeping, the elephants in *The White Bone* are depicted as engaging in all sorts of hormonal leaking.

Emotional and involuntary expulsions of temporin and urine, acts of ovulation and ejaculation, very literally *express* (communicate, convey, but also expel and squeeze out like the expression of a gland) grief, excitement, joy, sexual arousal and other types of elephant affect throughout the narrative. This narrative strategy depicts the novel's characters as animalistic and vulnerable while still demonstrating their plight as sympathetic in a way that remains legible to human readers despite the species difference. However, the affective leaks portrayed in *The White Bone* render the novel's elephants the subjects of a rather neoliberal and anthropocentric notion that the expressive acts of African elephants require management and protection through conservation efforts. That is, in representing the tourist conservation park as the ultimate form of protection for the African elephant, the novel positions its characters as ideal subjects of a

controlling care. A care which, as demonstrated through the novel's inspiration, Amboseli National Park in Kenya, seeks to manage non-human animal life, death, and reproduction in ways that ultimately reproduce a human exceptionalism over non-human life. In Amboseli National Park, a turn to a contraceptive trial study, rather than culling, to manage a rebounding elephant population after the height of the ivory trade demonstrates how dominant hormone protocol shapes the biopolitics of conservation through reproductive control.

By turning to a fictional representation of the African bush elephant's place in the conservation park, I aim to show how such stories are imbricated in the management of the hormonal lives of 'real' elephants. Specifically, I am interested in the way *The White Bone*'s advocacy for conservation is imbricated in a biopolitical regime of care for non-human species within the context of the postcolonial African savanna where the novel is set. That is, I am interested in how a novel written by a white Canadian author uses affect to persuade its readers that conservation is the best and only solution to the necropolitics of the ivory trade and the threat of an increasing population of (presumably) Black, African humans settling the savanna. And, as an effect of this persuasion, the novel advocates for care while obscuring how this care operates through the hormonal control of reproductive management of elephants and the reproduction of colonial relations.

As such, part of this chapter's project is to demonstrate that, while stories *can* offer ways to reimagine and redirect the dominant power structures, some stories work to reproduce that dominant power. In the novel, hormonal leaks like tears, temporin, and urination signify the elephant subjects' capacity for affect and are thus central to the novel's larger biopolitical project. Through these representations of hormones, the novel reproduces a narrative of dominant hormone protocol that manages the transmission of chemical-messages-as-affect both *within* and

through its text toward sympathetic readers. I find *The White Bone* a pertinent novel for this dissertation's exploration of the ways hormone transmissions, leaks, and flows are involved in the subjectification of hormonal life. Gowdy's text offers a particularly novel depiction of the ways non-human species are bound up in protocollary organizations (both representationally and actually) through a biopolitics that aims to recuperate these animals from necropolitical relations by insisting on their status as individuals with rich emotional lives. *The White Bone* offers one story, a fictional account, that seeks to save the African bush elephant through an ethics of conservationist care within which the management of hormonal activity becomes a technology of control.

Despite the novel's generic categorization as fiction, its biopolitical project to direct vulnerable hormonal subjects into captivity through a narrative where care is indistinguishable from control reflects the prevailing narratives that frame "real world" conservationist efforts. Gowdy's novel is closely based on the work of zoological research conducted by Cynthia Moss and Joyce Poole in Amboseli. Moss and Poole, who have published extensively on the complex social organizations and rich emotional lives of African bush elephants, have been the subjects of numerous made-for-TV documentaries that likewise engage pathos-heavy narratives about African bush elephants. These documentaries often tell the story of Amboseli's African elephant population and their sordid relations with humans—both poachers and the Indigenous Maasai people on whose traditional territory Amboseli was established. Gowdy cites one documentary narrated by Poole, "Coming of Age with Elephants," as her inspiration for writing *The White Bone*. "Coming of Age" offers insight into the human to non-human political relations that frame *The White Bone*'s literary use of hormones to direct elephants and readers alike towards a conservationist form of management. The documentary concerns the lives and safety of the

recovered African bush elephant population in Amboseli. Now, the boundary-leaking and crop-scavenging elephants pose a threat to the livelihood of the Maasai. These tensions led to the short-lived trial of elephant birth control, an immunological and hormonal technology intended to disallow new generations of the families fostered in the park. In this chapter, I look at both the stories offered by *The White Bone* and "Coming of Age" as a way of following dominant hormones flows across place, time, race, and species.

Leaking Hormonal Affect in *The White Bone*

The White Bone follows several African bush elephant matriarchal lines as they search droughted plains for a mystical white bone—the sun-bleached rib of a newborn elephant. The elephants believe that, if found, the white bone will direct them to "the Safe Place," ensuring their safety from ivory poachers. The novel tells readers a great deal about Gowdy's imagined elephant society through the narrative perspectives of three elephants: the gestating cow Mud, the cow calf Date Bed who is separated from her herd during a slaughtering event, and Tall Time the bull elephant who impregnates Mud. The elephants are written as fully realized individuals who must negotiate the politics and peculiarities in their matriarchal family organizations. That each elephant is a unique individual is further demonstrated by the naming rites practiced by Gowdy's cows. After a cow is first mounted and impregnated by a bull she is renamed according to her primary affect or behaviour. Mud, who rejects her new name, becomes "She-Scorns." "She-Soothes" is the nurse cow and serves as the She-S family's healer. "She-Screams" is a self-interested cow with a propensity for bellyaching. In addition to naming conventions that privilege each elephant cows' individuality, the elephants in Gowdy's novel embody a profound

spirituality through which they interpret their sense of self and their motivations within their world.

The novel is rife with practices of non-human symbology across species and ecologies in its undefined African savanna setting. While complex acts of elephant signification in Gowdy's sub-Saharan imaginary offer enthralling commentary on theories of non-human animal communication and multispecies affect, my focus on *The White Bone* is not so much on the totemic, sonic, or metaphysical forms of communication the elephants use to express feeling, but on the biochemical. The physiological displays linked to hormonal secretions, such as urination and running temporin—a hormone-rich fluid excreted from temporal glands of bull elephants in musth—also act as important media for communicating affective individuality in the novel. These hormonal expressions excite both elephant-to-elephant affect *within* the novel (grief, sexual arousal, anger, e.g.) as well as elephant-to-human affect *through* the novel as readers, sympathetic to the elephants' struggle, witness these secretions during already emotionally charged moments in the novel.

As a narrative of hormonal leaks, the novel begins with hormonal, specifically pheromonal, omens of trouble. These omens are so apparent to the elephants that even the suggestion that they might miss the portent would be implausible. "I smelled it coming," we are told the elephant cows will say, "Because how is it possible they didn't?" (Gowdy, 3). Yet, Mud's adoptive family does seem to miss this sign as they are preoccupied with renaming the newly pregnant Mud who resents both the calf growing inside her belly and the rite of passage into her new identity. Mud is already intimately familiar with the thin line between new life and death that the novel frequently draws. She was born into unfavourable circumstances when her birth mother of the She-M herd died from a cobra bite "more or less simultaneously" with Mud's

birth. The simultaneity of birth and death is met with a visceral and physiological performance that confuses the joy of birth and the sorrow of death; "Now, from the other cows, came an uproar of trumpeting, growling, urinating and defecating, weeping in deep gurgles that jostled the ground" (9-10). Like the confusion between human tears—tears of joy and of sorrow—Gowdy conflates these displays of bodily secretions and eliminations. Similar scenes appear throughout the novel, literally *marking* moments of intense affect with the hormonal flows of urine, temporin, tears, or ejaculate. The literary outcome of this conflation of intense and emotional responses from the elephants with those elephants' hormonal excretions is a biochemical representation of elephant affect that becomes legible to human readers. Affect becomes a chemical message circulating through the novel.

In my analysis of endocrinologic performances in *The White Bone*, I want to explore how the novel's generation of elephant affect, largely through its representations of urinary and temporal secretions, participates in the logic of dominant hormone protocol. By using literary representations of hormone-bound affect the novel directs its hormonal elephant subjects into a biopolitical space of human management, offering the conservation park as a literal "Safe Place." Yet the logic of a dominant hormone protocol through which affect can be managed is not only an issue of literary *representation* in the novel. As the suffering of Gowdy's elephant society increases, due to poaching, drought, and increased human settlement, the novel seeks to excite a sympathy for the African elephants' plight. That is, the novel seeks to generate human affect from affective depictions of non-human hormonal acts. In an interview about *The White Bone,* Gowdy claimed that, as a medium, "the novel has the power to change lives." As such, it seems that *The White Bone*'s ultimate project is to produce sympathy for African elephants'

vulnerability and to demonstrate the necessity of conservation for fictional and nonfictional elephants alike.

Urine is a ubiquitous yet varied indicator of elephant feeling in the novel. *The White Bone* presents urination as a material expression and affirmation of appropriate affect across all stages of life, representing the joy of new birth, sexual arousal during mating, and grief in response to the many elephant deaths depicted throughout the novel. Urine marks both the birth of Mud and the death of her biological mother. When Mud mates with a bull, Tall Time, she urinates at the height of her oestrous in a sexual "radiance" after he stimulates her vulva with his trunk. Gowdy also mixes bull urine into the hormonal cocktail that is the annual mating ritual observed by all herds. Here, an older and particularly libidinous bull named Torrent is depicted with temporin pouring down the sides of his face as his green penis drips a secretion with a particularly pungent odour (62). What Torrent is secreting may be presumed to be ejaculate discharge, but elephant ethologists will know this is most likely a mixture of both ejaculate and urine. Here, several types of hormonal secretions—temporin, ejaculate, and urine—are entwined in the narrative production that both represents Torrent's sexual feeling while simultaneously establishing the bull elephant as a fertile and pleasure-seeking individual of the species. In other cases, the affect communicated by the hormonal message is not so direct. At the end of her pregnancy, the odour and volume of Mud's urine is what indicates to her that she has entered labour; its clear taste, confirmed by She-Soothes, indicates the baby is healthy and will be born live (320-321). Here urine promises the joy of the endangered species' next generation.

As with urine, *The White Bone* depicts the flow of temporin as an uninhibited emotional response in times of pain, confusion, and sexual desire. When the old bull Torrent loses his memories, goes mad, and becomes defenseless against poachers—a condition of elephant aging

that the novel treats as analogous to dementia—he experiences an uncontrollable and unprompted musth. In a muddle of sexual arousal, confusion, anger, and most likely fear, "Temporin slides down his face" and "His penis dribbles urine" (297). Although urination is an exocrine act experienced by members of non-human and human species alike, it is presented as a resolutely elephantine mode of affective communication in the novel. Temporin, on the other hand, which is an elephant-specific hormonal secretion, becomes a narrative shorthand for elephant tears. After Mud witnesses the torturous murder of her family by a group of poachers, she returns to the site of the slaughter to perform the elephant death ritual of passing a hind leg over the dead body. At the grave site, she is reunited with the surviving members of her family. She reaches up to She-Soothes and "touches the sticky line of temporin under the older cow's left eye" (97). In the culmination of fear and grief and with a focus on the eye, not the temple, it is difficult to read She-Soothes' secretion of temporin as anything other than emotional tears.

Likewise, naturalist and travel sites hosting popular science writing on elephants describe the leaking of temporin as tears or "crying."[14, 15] Though the elephants in *The White Bone* are also capable of weeping, just as nonfictional elephants can secrete tears, the novel endows lachrymal secretion with far less affective importance than that of temporin. Even at the descriptive level, temporin glands "swell" and "sticky" temporin "pours," and "slides" down the faces of elephants. When it comes to crying, however, the elephants simply "weep," sometimes without tears so as not to waste valuable fluid during a drought. In contrast with urine and temporin, weeping is a controlled rather than uninhibited and involuntary expression of affect.

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[14] Rachel Garner, "Elephants Don't Have Tear Ducts," *Why Animals Do The Thing*, June 9, 2018, https://www.whyanimalsdothething.com/elephants-dont-cry.

[15] Natural Habitat Adventures, "African Elephant Facts | Southern Africa Wildlife Guide," *Natural Habitat Adventures and World Wildlife Funds*, accessed December 8, 2019, https://www.nathab.com/know-before-you-go/african-safaris/southern-africa/wildlife-guide/african-elephant/.

The temporal glands' proximity to the eyes, along with Gowdy's emotionally charged narrative, offer a ready opportunity for the conflation of temporin with uninhibited emotional tears. As a result of this conflation, temporin "tears" become a hormonal expression of feeling on par with the affective quality of crying afforded to humans. Despite the similarities between elephantine temporin and human tears, *The White Bone* still preserves some distinctions between the two species by portraying this form elephant affect through a species-specific hormonal secretion.

The White Bone's various representations of elephant affect communicated through hormonal excretions imbricate both its elephant characters and its human readers in complex relations between species. The novel's portrayal of hormone secretions maintains the species distinction between elephant and human while insisting on the non-fungibility of animal life. This depiction of uninhibitedly feeling elephants is an impressive feat of writing the abjection of animal "otherness" without fully reproducing an anthropomorphic (and thus anthropocentric) portrayal of the non-human animal. *The White Bone* works hard to establish the individuality of its elephant characters, each with rich personalities and complex emotional lives. At the same time, these very qualities of animal affect are leveraged by the novel to subjectivize its elephant characters through the fostering of a mutual affect between species. Gowdy herself considers the novel an attempt to represent the emotional lives of elephants "not as an act of science or even as literature, but as an act of love" and aims to "bring her readers to a crucial and sympathetic awareness at a time when so many animals are threatened with extinction."[16]

In her essay, "When Elephants Weep," Ella Soper-Jones reads Gowdy's intentional sentimentality as an anthropomorphic strategy to evoke a species self-awareness that the human

[16] Barbara Gowdy, "An Interview with Barbara Gowdy, by John Bemrose," 8-11.

reader might recognize.[17] At the same time, as Dana Phillips has argued, the novel works to "offset the anthropocentrism and speciesism of human [readers] by positing its equivalent in elephant terms" while maintaining a stark species distinction[18]—one that is communicated primarily through incontinent endocrine acts. *The White Bone*'s elephants are *just as* conscious, *just as* individual, and *just* as feeling as humans, yet differently so. The novel is strategic in its evocation of a non-human consciousness. It engages anthropomorphism enough to ensure the elephants' consciousness and emotionality are legible to the sympathetic human reader, yet it largely depicts these traits of a qualified life through an animalistic portrayal of the elephants as a species overcome by their biological, hormonal urges. In this way, *The White Bone*'s suffering elephants cannot be misunderstood as an allegory for human suffering (a tempting reading of many animal stories). Instead, the novel *must* be read as a portrayal of species-specific suffering brought about by anthropogenic causes. Likewise, the novel's portrayal of affect as something literally expressed through glands in species-specific hormonal secretions like temporin cannot result in a misdirection of human sympathy to any other species *but* the African bush elephant.

The novel's portrayal of affective exocrine performances mark a compelling species distinction between the novel's elephant characters and its human readers because they are informed by zoological representations of elephants as not only emotional but susceptible to hormonal influences on their emotionality. Gowdy has stated that she took much of her inspiration for the novel from the work of Cynthia Moss,[19] a zoologist and African elephant conservationist who has written extensively on African elephants' social and emotional lives. For

[17] Ella Soper-Jones, "When Elephants Weep," in *Other Selves: Animals in the Canadian Literary Imagination*, ed. by Janice Fiamengo (Ottawa, CA: University of Ottawa Press, 2007), 274.
[18] Dana Phillips, "Weeping Elephants, Sensitive Men," *Safundi*: *The Journal of South African and American Studies* 11, nos. 1-2 (2010): 28-29.
[19] Gowdy, "An Interview," 5.

instance, the description of Torrent's "green penis dribbling" urine is strikingly similar to an account of the same phenomenon by Moss and animal behaviourist Joyce Poole in their 1981 article on musth in African bull elephants. The scientists write, "We first noticed individuals with continuously dripping urine, which was accompanied by a strong odour and greenish coloration to the proximal part of the penis and the distal part of the sheath. We referred to this as the 'green penis syndrome' or 'GP' . . . which included a pronounced enlargement of and continuous and copious secretions from the temporal glands" and increased testosterone levels.[20] In addition to the physiological descriptions of musth, Poole and Moss remark on the bulls' behavioural changes. The behaviours they observed include increased sexual activity and increased aggression. These behaviours are also presented in *The White Bone*, tying physiological and hormonal activity of musth to feelings like anger or arousal.

Notably, both Moss and Poole established their careers in Amboseli National Park, a conservation safari in Kenya considered a "safe haven" for the African elephant. Moss' research on one elephant matriarch at Amboseli, Echo, has been the subject of numerous documentaries. Gowdy attributes one such documentary, which she says featured Moss' narration over footage of elephants performing death rites for a lost family member, as the inspiration for the novel. Moss' research on elephant life convinced Gowdy that the elephants she was watching were conscious of life and death, that they had "awareness, sadness, dreaminess, or speculative thought."[21] As such, Gowdy's novel is committed to representing those qualities in elephant life. It matters that *The White Bone*'s portrayals of elephant affect are supported by scientific evidence because the novel's project is not self-contained in its pages, it extends to real elephant lives

[20] Joyce H. Poole and Cynthia J. Moss, "Musth in the African elephant, Loxodonta africana," *Nature* 292 (1981): 830-831.
[21] Gowdy, "An Interview," 6.

outside of its fiction. It is essential to the novel's project that the elephant affect depicted in the narrative can always point back to real elephants because the sympathy this affect excites in readers must ultimately be directed to real world elephants the novel seeks to protect. In doing so, the novel's politics of hormonal affect becomes implicated within both the conservationist and the colonial politics that surround the global ivory trade and Kenya's response to it.

From *The White Bone* to "Coming of Age with Elephants" in Amboseli National Park

I turn my analysis to the conservation park as a site of management over elephant life, including hormonal management through contraceptive technologies. Importantly, this management cannot be separated from the colonial biopolitics that organize life within and without the park's boundaries. In *The White Bone*, each elephant's goal is to reach The Safe Place, a rumored sanctuary from slaughter at the hands of humans. The novel describes The Safe Place as a place of "tranquility and green browse…a safe vicinity for every creature on the Domain" (44). Later in the novel, Mud experiences a psychic vision as the dwindling herd approaches the site where Date Bed successfully found the white bone before dying. In her vision, Mud sees a "plain glint[ing] with the green of new grass…a road pocked with water pools." A vehicle sits just off the road. "Perched in the vehicle's back cavity is a human. It stares toward the swamp. If humans feel emotions, she would say that this one feels amusement" (316-317). Mud is certain this oasis is The Safe Place. It offers its non-human residents clear water, fresh food, and both geographic and political protection from poaching. In a choice between the conservation park and the ungoverned plains of the sub-Saharan, certainly only the conservation park offers the elephants not just a chance at survival but an opportunity to live a life of imbued with positive affects. Although readers never witness any elephant reach The Safe Place in the

novel, we are left to believe that there are only two possible outcomes to the story; either Mud and her dwindling herd will reach The Safe Place and survive, or they won't and will die. There is no chance, no hope, that exists outside of the goal of conservation by the end of the narrative.

To be clear, the critique of *The White Bone*'s conservationist solution to the trouble of elephant endangerment that I'm setting up is not a critique of human involvement in the lives of non-human species. In other words, I am not arguing that humans shouldn't meddle in the affairs of non-human life (more than they already have and continue to do, that is). I take a Harawayan approach to such multispecies relations and refuse to make distinctions between the cultural realm of the human and the natural realm of the non-human. To live as human is to exist in complex networks with non-humans, and vice-versa.

What I find troubling about Gowdy's novel is where the narrative ultimately directs its political will and the incongruity those politics seem to have with much of the story's earlier representations of elephant life. In seeking conservation for its elephant characters, the novel makes clear that their status as thinking, feeling and expressive beings are what makes these elephants worthy of protection. Moreover, the novel establishes species-distinct affect. It reinforces the animality of its elephant characters by representing their emotionality through a hormonal leaking that refuses the prudish anthropomorphism of affect that so many animal stories, such as those Disney flicks, engage in to make non-human characters emotionally legible to human audiences. It would seem that *The White Bone* has a stake in representing non-human animal life, particularly animal pain and struggle, without turning to portrayals of elephants that reproduces purely human relations to the world. Yet, by its end, the novel posits that the protection these elephants are worthy of, not despite of but *because of* their animal emotionality,

can only be offered under a biopolitical regime of subjectification—including the hormonal management of elephants by humans.

By offering political protection to elephants, the novel ultimately implicates its non-human protagonists as subjects in an ironically anthropocentric ontology. Despite working so hard to establish each elephant as individual *outside of* a literary treatment in which elephant consciousness stands in as metaphor for human subjectivity, the novel ultimately insists that these elephants' lives are best protected through an institution that requires their subjection. Put in other terms, there is an incongruity between the novel's project to capture the elephant at the level of representation and its project to capture and contain the elephant at the physical level.

The result is a political dissonance in the novel that strikingly mimics, and extends to the lives of non-human animals, the biopolitical paradox Judith Butler traces between the formation of the self and that of the subject; "the price of existence is subordination."[22] In *The White Bone*'s Safe Place, subordination innocuously takes the form of a caring human's watchful eye. As in the uncontained plains of the sub-Saharan where these elephants are tracked by poachers, the human eye also pursues the elephants in their sanctuary. This time, however, it is not with an intention to render partialized and dead elephant flesh commodity, but to render the whole and living elephant commodity as the *captive* and *captivating* subject of the conservation-tourism industry. The elephant cow's work is now both entertainer and object of research to prominent figures in elephant ethology like Cynthia Moss and Joyce Poole. Here marks the distinction between how capital is generated from flesh in what Foucault names sovereign power, "the right to *take* life or *let* live", and biopower, "the power to foster life or disallow it to the point of death."[23] What *The*

[22] Judith Butler, *The Psychic Life of Power: Theories in Subordination* (Stanford, CA: Stanford University Press, 1997), 20.
[23] Foucault, *The History of Sexuality, Volume 1*, 138.

White Bone suggests about biopower, but does not address explicitly, in its portrayal of "amused" safari-goers, is that the elephants in captivity are just as much objects of spectacle and capital accumulation as the dead elephant's flesh and bone are.

In a 1998 MacLean's interview with Canadian journalist and fellow novelist John Bemrose, Gowdy attributes her enrapturement with the African bush elephant to a televised documentary on the National Geographic channel which, as Gowdy reports, featured Moss' research on African bush elephants at Amboseli. As I will discuss shortly, it is likely that Gowdy is conflating the details of two different televised programs in this interview. Nevertheless, it is clear from numerous interviews, and from the novel's physiological depictions of elephants that the author was strongly influenced by Moss' research.

Moss is the director of the Amboseli Trust for Elephants (ATE), a non-profit research and conservationist project operating primarily out of Amboseli National Park in Kenya. Amboseli operates both as a conservation research park and a safari, heavily relying on tourism to fund its operations. Like the portrayal of The Safe Place as an oasis, the 392 square kilometre park, which is located on underground springs and swamps fed by Mount Kilimanjaro's glacial cap, offers its residents and visitors a respite from the permanently droughted plains outside the park's boundaries. Crediting itself as the "Home of the African Elephant," Amboseli promises visitors the opportunity to view a diverse range of species, and specifically lists "Large Herds of Elephants" under its attractions.[24] "What was once viewed as 'just a herd,'" the park's website proclaims, "must now be respected as a family of individuals."[25] As with *The White Bone*,

[24] Kenya Wildlife Service, "Amboseli National Park," *Kenya Wildlife Service*, accessed June 30, 2023, http://www.kws.go.ke/amboseli-national-park.
[25] Amboseli Trust for Elephants, "Elephant History," *Amboseli Trust for Elephants*, accessed June 30, 2023, https://www.elephanttrust.org/elephant-history/.

Amboseli's conservationist project is inherently tied to exciting sympathy and respect for these elephants from its paying audience by establishing the African elephant as non-fungible.

Because of Gowdy's faithfulness to both Moss' and Poole's work, it is unsurprising that both *The White Bone* and Amboseli leverage similar narratives of elephant individualism and emotionality to argue for the need of the conservation of the species through human management. And, just as *The White Bone* leverages a literary form of dominant hormone protocol to direct oozing chemical messages of affect towards the excitation of conservationist-motivated sympathies in the reader, so too has Amboseli been in the business of managing the hormonal lives of the nonfictional elephants in the park's care through hormonal technologies of population control when rebounding elephant populations conflict with human life. However, before discussing the nonfictional hormonal management of elephants that takes place in parks like Amboseli, a discussion of the politics of the ivory trade in Kenya and the settler pressures put on the Indigenous Maasai people is necessary to contextualize hormones as a technology of control and containment over elephant life.

Managing Human-Elephant Colonial Relations with Hormones

Rampant poaching poses the novel's primary and most visible threat to African elephants. However, human presence threatens these elephants in other, more subtle ways too. The novel implies that increased human settlement on the plains interrupts the elephants' traditional migratory routes as they map their travel around wire fences that they call "Rogue's Web." The elephants never encounter the humans who have erected these fences and what lies inside those fences—houses and other shelters, tools, crops, e.g.—-remains unknown to both elephant and reader. Nevertheless, the presence of the Rogue's Webs remains disconcerting to the herds in the

novel. Yet, the novel does not outright reject the notion of human and elephant co-existence. After all, it's the human's amused gaze toward the elephant in The Safe Place that encourages both Mud and the novel's readers to recognize tourist-driven conservation projects as perhaps the only refuge possible for the species. What emerges from these complex relations between differing species, and between differing forms of containment, captivity, and control in the novel, is a troubling reading of the colonial racial relations brought to bear by conservationist efforts to placate both human-to-human and human-to-non-human tensions. It is from this attempt to placate complex multispecies relations in (post)colonial Kenya that Joyce Poole turned to trial immunocontraception, rather than culling, as a solution to interspecies population conflicts in the mid-1990s.

The novel's treatment of captivity-as-refuge is not unfamiliar to the rhetoric of tourist-driven conservationist efforts. Kenya Wildlife Service (KWS), a state corporation run by Kenya's Ministry of Tourism and Wildlife that oversees conservation parks, summarizes its conservation mission as "Saving the last great species and places on earth for humanity."[26] By suggesting that the conservation of elephants against extinction is important only because these animals can offer something to humanity (fascination, captivation, research data, capital etc.), KWS establishes its project as one founded in the very human exceptionalism that Gowdy's novel initially seems to refuse (only to embrace by its end). Moreover, this rhetoric inherently elevates the roles of the often white and non-African researchers and tourists on which conservation work is economically dependent. The racial and colonial relations imbricated in Kenya's conservation-tourism industry are further depicted in the TV documentary narratives that inspired Gowdy to write the novel in the first place.

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[26] Kenya Wildlife Service, "Species Conservation and Management Division," *Kenya Wildlife Service*, accessed December 17, 2023, https://www.kws.go.ke/content/species-conservation-and-management-division-0.

In another interview,[27] Gowdy once again attributes her inspiration for the novel to a televised program on elephant conservation in Amboseli. This time, she specifies that she caught the programme on television in 1994. Given these details, and as I've already stated, the program was almost certainly the National Geographic Television documentary episode "Coming of Age with Elephants." Of note, "Coming of Age" is narrated by Joyce Poole,[28] not Moss as Gowdy claims in her 1998 interview with John Bemrose.[29] However, some footage in the documentary does shows Poole and her mentor Moss working together. The hour-long documentary details the struggles of Amboseli and its elephant population in the years following the 1989 Convention on International Trade in Endangered Species of Wild Fauna and Flora's (CITES) global ban on the trading of ivory. The documentary traces the interspecies politics of a recuperated elephant population after a government crackdown on poachers, the tension between growing elephant and human populations in competition for resources like food and land, and details Poole's ultimately failed attempt at hormonally managing elephant life through a birth control trial. As Gowdy cites the documentary as one of her primary inspirations for writing *The White Bone* and its proposed solution to save both fictional and nonfictional elephants, I find it generative to read "Coming of Age" in conversation with the novel to demonstrate the "real-world" colonial and hormonal biopolitics in which the novel situates itself and calls readers into action.

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[27] Unfortunately, this interview is no longer accessible on Gowdy's website. However, the *Internet Archive*'s Wayback Machine has cached an accessible version from 2018. There is a note on the link to this interview on Gowdy's website that explains Gowdy cannot remember the name of the interviewing publication, nor does the transcript acknowledge the name of her interviewer: See, Barbara Gowdy, "The White Bone: A transcript of a conversation with Barbara and a British journalist about *The White Bone*," *Barbara Gowdy* via *Internet Archive*, cached August 15, 2018, https://web.archive.org/web/20180815035456/http://www.barbaragowdy.com/interviews/the-white-bone-interview/, accessed July 5, 2023.

[28] Poole wrote a memoir by the same name that was published in 1996, two years after her documentary with National Geographic first aired.

[29] Cynthia Moss, with David Attenborough, narrates a forty-eight episode of BBC's Natural World titled "Echo of the Elephants" that premiered in 1993, but this episode does not contain footage of the herd mourning the death of a family member as described by Gowdy in her interview with Bemrose.

The Racial Politics of Poachers and Conservationists

Through their narratives, both *The White Bone* and "Coming of Age" acknowledge that the matrix between increased human populations and the rampant ivory trade was responsible for the significant endangerment of African bush elephant during ivory poaching's height in the 1970s through 1980s. Likewise, both narratives turn to conservation and management over elephants' hormonal lives as a potential solution to elephant death, either by poaching or culling. Yet, neither story acknowledges the political uncertainty of the postcolonial nation. By 1962, Kenya was developing a political identity as a nation newly independent from British colonization. What followed was a period of civil unrest, lethal ethnic violence, and the influence of U.S. foreign policy to instate democracy in Kenya precipitated by "Kenya's overwhelming dependence on Western capital."[30] As such, these narratives also fail to address *which* class of people in *which* nations were fuelling the global demand for ivory trinkets and how these demographics are much different than that of the people taking on the dangerous and violent work of slaughtering elephants for ivory. Though the novel does not explicitly mark racial difference amongst humans in its prose, one can presume that (as in reality) the poachers in Gowdy's novel are primarily imagined as Black Africans. Likewise, one can imagine The Safe Place as a sanctuary run by people like Moss and Poole—white American and European women, like Gowdy, whose purpose in the Kenyan savanna is to demarcate which lives are worth protecting and which lives are not.

My critique of these narrative portrayals of the ivory trade should not be confused with an apologia for the resolute violence directed at elephants in poaching activities. Despite CITES' ban, the ivory market persists. The same poaching practices that nearly drove elephants to

[30] Samuel M. Makinda, "From Quiet Diplomacy to Cold War Politics: Kenya's Foreign Policy," *Third World Quarterly* 5, no. 2 (1983): 302.

extinction forty to fifty years ago continue to kill elephants to this day, albeit on a smaller scale. In *The White Bone*'s most graphic portrayal of poaching, humans are depicted tortuously prolonging the murder of twin elephant calves, Flow Sticks and Blue. A poacher lassoes a panicked Blue and rides her, brutally kicking her as he does. Out of fear, or love, or both, Flow Sticks runs after her twin sister and the human riding her. The poacher then shoots Flow Sticks from atop her twin, killing her. When Blue reels and turns back to her dead sister, the human dismounts Blue. "He walks away. Keeps walking as he turns and lifts his gun. Points the gun at Blue. Shoots" (88). Though a fictitious account, and one intentionally depicting the viciousness of the ivory trade to elicit affect from readers, *The White Bone*'s portrayal of this violence successfully illustrates the elephants' conditions outside of conservation as necropolitical. However, where both the novel and "Coming of Age" fail in their engagement with the ivory trade is in their refusal to implicate the non-Black and non-African actors who facilitate and fuel the ivory trade and the poaching of elephants through their participation in global politics. These markets include the selling of carved ivory as souvenirs to tourists[31]— the same tourism industry that funds conservation efforts in many African nations.

At this point, I want to remind readers that dominant hormone protocols are also race-making and colonial technologies. Through the novel's politics of hormonal emotionality and affect, including its aim to arouse sympathy in the reader, the narrative engages in a rather colonial and racializing, if not racist, reading of the exploitative economic actions of the ivory trade. All the while, in the flows of this leaky hormonal affect, *The White Bone* obfuscates the ways conservation parks also exert power over elephant life, such as through reproductive management. In this way, conservation is depicted in the novel as not simply a matter of humans

[31] Tom Milliken, Alistair Pole and Abias Huongo, "No Peace for Elephants: Unregulated domestic ivory markets in Angola and Mozambique," *TRAFFIC Online Report Series*, no. 11 (2006): 13.

saving elephants, but as a moral imperative in a dichotomy where good actors lead conservation efforts while bad actors brutally murder elephants. This dichotomy is racialized through the mapping of Moss' and Poole's whiteness onto goodness and the Blackness of on-the-ground poachers onto badness.

"Coming of Age" offers a reading of the interspecies politics of the ivory trade with a bit more nuance than that found in *The White Bone*. The documentary was broadcast five years after the 1989 CITES announcement for a total global ban on ivory trading at a time when the extinction of African elephants seemed not only plausible, but inevitable without strict regulation. Closely in conversation with this history, "Coming of Age" provides a sort of post-mortem on Kenya's ivory trade and a causal explanation for the new tensions elephants and humans face on the sub-Saharan plains. The film commends third-generation English-Kenyan, Richard Leakey for his directorship of KWS. As director, Leakey had garnered the reputation of a no-nonsense authority figure when it came to the conservation of the African elephant. Leakey was appointed director of KWS in 1989 (then called the Wildlife Conservation and Management Department) in direct response to CITES' global embargo on ivory. In his new position, he headed a militia-style response to end illegal poaching in Kenya. Any person found actively poaching ivory was to be shot and killed on sight. Around fifty poachers were killed during the first year of Leakey's leadership of KWS.[32] Similar policies have been adopted across countries in East and Southern Africa, but not without criticism.

In October of 2013, Tanzania suspended a month-long crackdown on poachers after a government inquiry uncovered the "arbitrary murder, rape, torture and extortion of innocent

[32] *National Geographic Television*, "Coming of Age with Elephants," directed by Christine Weber, written by Richard Conniff, featuring Joyce Poole, aired 1994, uploaded to YouTube via user Qemetiel 218 on October 8, 2017, https://www.youtube.com/watch?v=rQuEZI4C8-Y, accessed July 5, 2023.

people" including thousands of unwarranted arrests and the murder of 13 civilians.[33] In the wake of the suspension, Tanzania reported that a total of 60 elephants were killed by poaching in November and December of that year compared to the two elephants killed in October. A more recent editorial published in the Dutch anti-colonial, anti-apartheid magazine *ZAM* argues that shoot-to-kill poaching policies target those humans already in economically precarious positions due to Africa's long colonial histories and affect "only the lowest levels of huge crime networks."[34] Critiques of the ivory trade's treatment of elephant life as fungible and disposable, such as those made by *The White Bone*, ring hollow when one doesn't acknowledge how both anti-ivory trade policies and the kingpins of the trade itself see poachers through the same lens. The necropolitics surrounding the murder of both human and elephant species in the ivory trade are difficult to traverse, to say the least, and are worthy of more critical attention than I provide here. Still, this chapter brings to bear the necessity of understanding the ivory trade as a necropolitical global market where both human and elephant life are more valuable dead. Drawing such relations elucidates how conservation and the hormonal management of elephants emerges as the prominent mode of care and control in both Amboseli's and *The White Bone*'s projects to save elephants from ivory poaching. Leakey's heavy-handed retaliation to poaching is credited as one of the leading actions preventing the total extinction of African bush elephants. Incidentally, this initiative led to Leakey's next challenge—the management of the now stable elephant population threatening the prosperity of the Indigenous Maasai population living in and around the park's borders.

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[33] David Smith, "Elephant deaths rise in Tanzania after shoot-to-kill poachers policy is dropped," *The Guardian*, December 31, 2013, https://www.theguardian.com/world/2013/dec/31/elephant-deaths-rise-tanzania-shoot-to-kill-poachers.

[34] Shannon Lorimer, "Shoot to kill policy claims lives of poachers at lowest level only," *ZAM Magazine*, January 27, 2021, https://www.zammagazine.com/arts/1338-shoot-to-kill-policy-claims-lives-of-poachers-at-lowest-level-only.

Indigenous Relations in Amboseli

Having established Amboseli's stabilized and growing elephant population in the 1990s, the documentary spends much of its run-time discussing issues of human and elephant populations leaking across park boundaries as these species come into conflict once more. "In the very years that the elephant population was being decimated," we are told, "Kenya's human population had doubled." More settlements have been erected and more residential areas developed in the plains surrounding Amboseli. The documentary specifically looks at the conflict between the increasing number of elephant residents of Amboseli and the villagers surrounding the park as these species struggle to exist together in times of food scarcity.

Amboseli is designed to contain elephant life by offering a better option than what can be found outside the park boundaries. However, the park's boundaries are not walled off. African bush elephants are migratory. Herds can and do travel outside of their refuge looking for food along their traditional migratory routes, often foraging from (and trampling) crops in surrounding villages. The documentary sympathizes with the efforts Poole and her research team have made to address the concerns of the Maasai, a nomadic Indigenous population whose ancestral lands include the area on which Amboseli is situated. Initially, Poole's team erected electric fences around villagers' crops. However, the elephants quickly learned to short circuit them and pass through unharmed. Leaking out of boundaries can be necessary for survival during drought seasons when they do hit Amboseli, but it is a dangerous choice; these elephants now risk being killed by poachers *and* by other humans protecting their food lest they are the ones to starve.

It is important to understand Amboseli's relationship to the Maasai people, particularly how it is expressed through the lens of white European settlers like Poole in "Coming of Age

with Elephants." Poole refers to the inhabitants of these villages as "settlers" in her narration. However, the Maasai are a nomadic ethnic group whose ancestral lands span across Kenya and Tanzania. In 1906, the Maasai were granted the land Amboseli is currently situated on by the Kenyan government to be used as a "reserve," a site dedicated to the containment of Indigenous human life. By mid-century, the land transferred to local control and was made into another type of reserve—a game reserve. Amboseli National Park was established in 1974, marking the land's next era in its history of control and containment over life.

The Maasai people's relationship to conservation parks in Kenya and Tanzania is marked by a paternalistic control characteristic to colonial relations. In Amboseli, the Maasai are treated as one of the many species the park protects and are listed on tourism sites as one of the many attractions the park has to offer. In Maasai Mara Reserve in Tanzania, the park Gowdy visited during her research for the novel, the Maasai are fined for grazing their livestock within the park boundaries and the park may seize their herds.[35] According to one 2022 article published in *Le Monde*, the UN estimates "some 150,000 people are at risk of being displaced 'without their free, prior and informed consent'" in an effort to establish more large game safaris and conservation parks.[36] These parks are major international tourist attractions and continue to be reliable sources of national revenue for both Kenya and Tanzania.

Again, neither Poole in "Coming of Age" nor Gowdy's novel seem to identify a shared history in the capital-colonial relations that threaten both the elephants and the Maasai, opting instead to portray these populations in nearly insurmountable conflict. Hormonal mediation

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[35] Katherine Homewood, et al., (eds.), *Staying Maasai?*, Studies in Human Ecology and Adaptation, vol. 5, (New York, NY: Springer, 2009), 72.

[36] Marine Jeannin, "In Tanzania, the Maasai are evicted from their land in the name of wildlife protection and tourism," *Le Monde*, June 23, 2022, https://www.lemonde.fr/en/international/article/2022/06/23/in-tanzania-the-maasai-are-evicted-from-their-land-in-the-name-of-wildlife-protection-and-tourism_5987719_4.html.

emerges as one possible solution to this conflict. The critiques of the ivory trade made by "Coming of Age" and *The White Bone* reinscribe colonial relations on the Kenyan savanna. In doing so, they naturalize or make "common sense" the forms of biopower present in the conservation park, particularly hormonal reproductive management. In this way, these stories work in collusion with dominant hormone protocol and colonial grand narratives about who can or cannot be responsible for, can act responsibly with, land and its species-rich ecologies.

From Culling to Contraception Trials

Throughout the early 1990s, Poole—with Leakey and the KWS' support—authorized the killing of "problem" elephants destroying Maasai crops. In an ironic career twist, Leakey set up another wildlife military force. This time, instead of shooting poachers, the special force was instructed to shoot and kill offending elephants on sight. However, Poole continually looked for other, biopolitical rather than necropolitical, solutions to the issues of interspecies conflict and leaky borders. In 1992, Leakey and Poole headed a trial initiative to use birth control on some of the elephant cows in Amboseli.

The contraceptive method used by Poole was an immunocontraceptive.[37] Immunocontraceptives do not employ the same mechanisms of birth control as the many forms of hormonal contraception used on and by human populations. The pharmaceutical injections trialed by Poole on the elephants were not synthesized hormones like The Pill, the patch, or injections of estradiol and progestin. Rather this contraceptive was derived from specialized

[37] Immunocontraception has become a common and global solution to non-human population management. A situating moment for me; in the small municipality of Oak Bay, not too far from where I write this, some of the Columbian black-tailed deer (*Odocoileus hemionus columbianus*) have been inoculated with an immunocontraceptive in a similar trial to reduce population as they encroach on human settler development. These deer are a native species to the area and have been a traditional food source for the Songhees and Esquimalt nations on which Oak Bay was settled.

glycoproteins in the tissue membranes that surround pigs' ovaries (porcine zona pellucida). These glycoproteins stimulate an immune response. Antibodies form a barrier around the ovum so that sperm cannot penetrate the egg.[38] In this way, the primary mechanism of contraception is mechanical, not chemical. Nonetheless, the *effects* of these injections are still hormonal as they direct hormonal action towards (or away from, in this case) specific biopolitical ends.

In Amboseli, the question plaguing Poole and Leakey's project was not whether elephant life should be managed, but *in which ways* that management should manifest to provide the most ethical form of care to their non-human charges. Unlike electric fences or culling, hormonal management seemed an inconspicuous and relatively harmless form of control as the immunocontraception trial sought to contain elephant life subtly *from the inside out*. Poole's attempt to care for elephant life by avoiding culling at her own hands or death at the hands of others exemplifies how dominant hormone protocol manifests in the reproductive politics of conservation. Elephant bodies are allowed to leak out of the park boundaries of Amboseli. However, when elephants become trouble, only *hormones* are contained so that the body as a whole may remain unconstrained.

In many ways, Gowdy's novel invokes a biopolitics of hormonal leaking and containment that appears an inversion of Amboseli's contraceptive trial.

Not only does *The White Bone*'s portrayal of free-flowing hormonal affect aim to produce a sentimentality in the reader, but these hormonal acts foster, rather than bound, elephant reproduction. By the end of the novel, Mud has birthed a healthy calf cow, Bolt. In addition to the promise of conservation, the novel presents continued and successful reproduction as the only possible mode of survival for African elephants. Though reproduction is a sound strategy

[38] J. F. Kirkpatrick et al., "Fertility Control and African Elephants: A New Paradigm for Management" in *Elephants: Ecology, Behavior and Conservation*, eds. by Maya Aranovich and Olivier Dufresne, (Nova Science, 2011), 7.

against extinction, the hopeful tone the novel strikes after Bolt's birth undermines earlier efforts in the narrative to establish the elephants as not just a herd, but a family of individuals. The reproductive salvation of the elephants suggested by the novel is something of a narratively forced copulation. Afterall, the story begins with Mud regretting letting the bull elephant Tall Time mount her and resenting her resultant pregnancy. Yet the novel's hopefulness for the survival of elephants as a species is predicated on the suggestion that this pregnancy and the calf born from Mud will be the salvation of the herd's matriarchal line—if only they can reach The Safe Place, that is. It is free-flowing hormonal leaking and pooling, not reproductive management like that controlled by Leakey and Poole, that will direct elephants to their survival in *The White Bone*. The novel's celebration, if not valorization, of a persistent matriarchal order and of maternal values, stands in opposition to the real conditions of reproductive management and hormonal containment within the very conservation parks towards which the novel aims to direct both fictional and 'real' elephant subjects.

In Amboseli, a total of six cows were immunized before the trial study was called off[39] following Leakey's resignation from KWS directorship in January 1994. Outside "Coming of Age"'s narrative, Leakey 's resignation is often attributed to increasing amounts of political in-fighting and accusations of corruption under his leadership. Instead, the documentary states that, in an act of loyalty to Leakey against his "political enemies," Poole and many of her colleagues also resigned from their roles at KWS the same day. This decision would leave the trial study unfunded and unmanaged, and the experiment dissolved before any significant data could be recorded. Even with a lack of measurable results, the trial for elephant contraceptive exemplifies how dominant hormone protocols direct lives across species lines. Numerous contraceptive

[39] Kirkpatrick et al., 7.

studies on elephants have taken place in national parks across sub-Saharan Africa. One such study in the Pongola Game Reserve in South Africa examined the effects of vasectomies against those of gonadotropin-releasing hormone (GnRH) suppressants on bull elephants as "cost-effective means of controlling [the elephant population]."[40] That study was funded by the Walt Disney World Elephant Population Management Programme. Disney's participation in elephant population management helps to once again demonstrate how the representational politics of fictional tales are often implicated in and exert biopower over 'real' life. Just as with *The White Bone* and Amboseli, the politics that determine which elephants can leak differ for the Walt Disney Company depending on whether those leaks are narrative expressions of affect or material expressions of hormonal, reproductive function. While Dumbo leaks hormonal affect the 'real' Disney elephants are contained through the dominant hormone protocols of population management.

Although the mechanism of hormonal control used in Amboseli is distinct from the literary form it takes in Gowdy's leaking elephants, I find it necessary to read the immunocontraceptive trial in Amboseli as a precursor to the literary hormone protocol in *The White Bone* that excites human sympathy through hormonal expressions of elephant affect. After all, the stakes of the novel are not self-contained. *The White Bone* is engaged in a real-world politics, both through the sources from which it draws its inspiration and in the novel's conservationist project. Though their treatments differ, both the elephants of *The White Bone* and those in Amboseli are driven by a hormone protocol which seeks to control through acts of human care over non-human life.

[40] L.S. Doughty et al., "The impact of male contraception on dominance hierarchy and herd association patterns of African elephants (*Loxodonta africana*) in a fenced game reserve," *Global Ecology and Conservation* 2, (2014): 89.

Controlling Care and Colonial White Feminism

Care is often theorized as both the affects (concern, compassion, love) and behaviours (tending, protecting, loving) necessary for the ethical treatment of life. In the previous chapter, I discussed care in the context of trans solidarity and joy in *With Those We Love Alive*. In the interactive fiction, the character Slime Kid enacts care through playful moments that subvert the hypertext's dominant flow of hormone code. I argued that Slime Kid's acts of care should be read as allegorical of trans care practices like DIY hormonal therapy practices and mutual aid. It is the mutuality of both care and vulnerability in this relationship that subverts the dominant power relations presented in *With Those*.

However, not all care is subversive. Care can also enforce power and can be leveraged as a form of control over the feeling subject. Nicole Shukin defines care as a form of biopower as the ways "particular kinds of subjects are cultivated within a field of productive and caring rather than repressive or cruel power."[41] Care makes exerting power over the subject seem benign because acts of care require the subject to give up some amount of agency in the process of being cared for. As Lauren Berlant and Lee Edelman have theorized, specifically in relation to sex and intimacy, to be cared for requires one to forfeit something of themselves and to submit to another as nonsovereign.[42] It is in this way that care, as a loving act of fostering life, can be a technology of control.

I have traced how a literary expression (or transmission, if you will) of leaky hormones in *The White Bone* follows a protocollary logic between fiction and reader in an effort to excite a

[41] Nicole Shukin, "The Biopolitics of Animal Love: Two Settler Studies" in *The Palgrave Handbook of Animals and Literature*, ed. Susan McHugh, Robert McKay, and John Miller, (Cham, Switzerland: Palgrave Macmillan, 2021), 543.
[42] Lauren Berlant and Lee Edelman, *Sex, Or the Unbearable* (Durham, NC: Duke University Press, 2014), 14.

sympathetic affect towards elephants threatened by human violence. I have also suggested that in doing so, *The White Bone*, like Amboseli, is engaged in a larger project that seeks to establish human management over elephant life through care as a technology of control. In the final pages of this chapter, I want to unpack how care, love, and sympathy operate to subjectivize non-human life. Doing so will help me situate the literary and material hormone flows that direct elephant life within and without the novel as, according to Gowdy, an "act of love."

Michel Foucault describes *pastoral power* as a form of biopower which ensures individual "salvation" through management of the "flock" or herd.[43] In other words, pastoral power may require one to give up something individual—perhaps even one's life—for the greater good of the community. From Foucault's pastoral power, Annemieke Van Drenth and Francisca De Haan theorize a distinct type of "caring power." Unlike pastoral power, which Foucault theorizes in reference to the masculinized role of the shepherd, caring power primarily manifests as a feminized form of control over feminized gendered life. Caring power allows women to look after "their own sex."[44] In this way, caring is not just "women's work," it is also a form of feminized control that operates through feminized traits such as sentimentality and affective management.

It is no coincidence that the hormonal expressions intended to excite sympathy in *The White Bone* and Poole's turn to experimental birth were employed by two white women whose animal conservationist projects are deeply entangled in the colonial politics of East and Southern Africa. The white North American or European woman has been a long-standing figure of animal research across African ecologies. Figures like Jane Goodall, Dian Fossey, and Barbara Smuts

[43] Michel Foucault, "The Subject and Power," *Critical Inquiry* 8, no. 4 (1982): 782-784.
[44] Annemieke Van Drenth and Francisca De Haan, *The Rise of Caring Power: Elizabeth Fry and Josephine Butler in Britain and the Netherlands*, (Amsterdam, Netherlands: Amsterdam University Press, 1999), 12.

are heralded for their dedication to chimpanzees, mountain gorillas, and olive baboons, respectively, and for the "biological anti-essentialism" they fostered in representations of these animals' gendered behaviours.[45] Likewise, feminist writing on animals by white women often leverages analogies between the gendered other and the animal other in their attempts to establish analogous positions of marked difference. I believe that Gowdy's turn to hormonal expressions of affect and her narrative portrayal of the reproductive politics that shape Mud's life are exemplary of such a strategy in women's writing on animals. Likewise, I believe that Poole's decision to turn to hormonal control over elephants via contraception was, in some capacity, informed by her gendered position in relation to human reproductive politics. However, as Maneesha Deckha points out, there is a tendency in this approach to essentialize the feminist politics of white women as a universal position of gendered difference. Feminist writing on animals that claims its participation in posthumanist approaches must then consider "multiple axes of difference in constituting our ideas of species and our relationships with animals." Specifically, writers must address racial and cultural differences wrought by colonial and postcolonial relations "so as to avoid the charge of essentialism as well as the perception that [animal studies] is a 'white, Western' field."[46]

Approaches to thinking through and writing human to non-human animal relations that seek management through controlling care cannot ever achieve anti-colonial and anti-anthropocentric representations of the animal because they will always be imbricated in the paternalistic—or maternalistic, as the case may be—discourses of care that have historically

[45] Donna J. Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science*, (New York, NY: Routledge, 1990), 374.
[46] Maneesha Deckha, "Toward a Postcolonial, Posthumanist Feminist Theory: Centralizing Race and Culture in Feminist Work on Nonhuman Animals," *Hypatia* 27, no. 3 (2012): 534.

justified colonial domination.[47] While *The White Bone* initially sets out to resist an anthropomorphic and paternalistic treatment of elephant consciousness through species-specific expressions of hormonal affect, it is ultimately an anthropocentric tale of reproductive management. In the end, the novel cannot wrench itself free from a hormone protocol that directs readers towards, and ultimately justifies, the narrative project of a caring power—the very same hormonal expressions that encourage a posthuman reading of elephant affect throughout the novel.

In *The White Bone*, and through the work of Poole in Amboseli, dominant hormone protocols operate as caring power. While the hormonal politics through which these two narratives contain the African elephant may save these elephants from brutal deaths at the hands of ivory poachers, their affective projects do little to refuse the symbolic rendering of the animal into a political economy that nonetheless renders elephant life commodity as spectacle. The elephants in *The White Bone* are not promised salvation from the judicial gaze of the human who adjudicates on matters of life, birth, and death. Instead, they—along with the real elephants the novel seeks to save—are guided towards these biopolitical organizations through a narrative hormone protocol presented as "an act of love." While the political stakes are rather low for a group of fictional elephants whose hormonal management is representational, measured in ink and limited to the page, care as a technology of control manifests materially for the elephants of Amboseli and in other national parks and game reserves across East and Southern Africa. This caring control implicates these elephants in complex human-to-non-human relations shaped by both colonial and hormonal power.

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[47] Uma Narayan, "Colonialism and Its Others: Considerations on Rights and Care Discourses," *Hypatia* 10, no. 2 (1995): 137.

IV. XENOHORMONES / Two Stories of Indigenous and Black Futurity in and as Chemical Burden

Blood, bile, intracellular fluid; a small ocean swallowed, a wild wetland in our gut; rivulets forsaken making their way from our insides to out, from watery womb to watery world:

we are bodies of water.

– Astrida Neimanis, *Bodies of Water*

I am lying face down in the Salish Sea of the North Pacific. Despite the fifteen pounds of lead around my waist, I'm kept afloat by my body fat—encased in seven millimeters of open-cell neoprene—and the salinity of the water. I can hear the roar of motorboats jumping through the waves. It sounds like the boat's propellor is right on top of me, ready to turn me into chum. I look up and see that it's hundreds of meters away from me, travelling across the horizon where blue-green water meets grey sky. Sound carries so freely, so far, so deep in the ocean.

With a wetsuit hood and tightly sealed mask covering most of my face, only my bare lips gripped around my snorkel are exposed to the 12°C water. My teeth gnash at the silicone mouthpiece. Even with this protective gear—a slick prosthetic skin and webbed fin set that render my external morphology more seal-like than simian—I immediately feel the brain freeze begin to settle in when I look down at murky water below me. The emerald expanse is so teeming with phytoplankton and zooplankton that I can't judge the extent of its depth until I am already committed to my descent.

The shock of cold and the critical awareness that *I* (human) do not belong *here* (ocean) hit hard. My body responds accordingly. The hypothalamic-pituitary-adrenal axis, that neuroendocrinological networked channel between the brain and adrenal glands, begins a

cascade of events as a stress response to my unfavorable environment. Hormones like epinephrine and norepinephrine increase the volume of blood flow to my muscles and urge me to breathe while deep underwater in a misdirected attempt to oxygen to all my cells that just kicked it into high gear. But my other reflexes stop me from giving in to the demands of my oxygen-hungry cells. My mouth stays tightly shut, lips pursed, and even with the silicon nose piece on my mask creating a protective barrier between nostrils and sea, my brain refuses to even let me try to breathe into the small air pocket where my nose rests.

The rush of adrenaline lasts only a few moments. My heart rate depresses within minutes of immersion in the cold water.[1] I can sense my heart rate slowing down to a sleep-like rhythm physiologically referred to as *bradycardia*.[2] What I'm experiencing is known as the mammalian dive reflex, a parasympathetic response to cold water immersion. The overall calm brought about by the mammalian dive reflex feels counterintuitive; there are many reasons for one's hear rate to skyrocket underwater, the hydrostatic pressure of 15-20 meters of depth on my organs notwithstanding. Once I reach my target depth and quickly take in the sight of vivid pinks, oranges, purples, and yellows that make up this cold-water reef, my physiology gets the better of me. Deep in my belly, my diaphragm begins its routine spasmodic contractions, begging for air. My muscles violently contract and expand to force air inside of me. I've learned not to panic during these spasms; they do not signify immediate danger, but they are a good somatic reminder that I can't stay in this environment forever. So I begin my assent to the surface, fins taking turns displacing the water below me with a series of swift kicks. I emerge, breaking through the thick tension of a trans-fluid border between water and air. Finally, I breathe again.

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[1] D. R. Pendergast and C. E. G. Lundgren. "The underwater environment: cardiopulmonary, thermal, and energetic demands," *Journal of Applied Physiology* 106, (2009): 297.
[2] Gerardo Bosco et al., "Environmental physiology and diving medicine," *Frontiers in Psychology*, 9, (2018): 3.

What started as an impulsive Covid-19 pandemic hobby has become a fundamental practice for my theorization of hormone protocol. Freediving offers a cold, harsh, and uncomfortable reminder of the ways I'm directly mediated by hormones across environments. I have previously discussed how hormones are often oriented through fluids. Protocols direct the hormones and their chemical messages through flows. This is not a metaphor for tracing the hormones in protocol. Piss, blood, spit, sweat, streams, rivers, and oceans carry hormones as bioinformational and bioeconomic matter.

During a single dive, I will inevitably swallow enough water—laden with endocrine-disrupting microplastics—and will undergo enough water pressure on my bladder that I'm reminded of a common joke in the freediving community. There are two types of people, those who pee in their wetsuits and liars. As I piss and spit into the ocean, trying to regain some semblance of the sodium and pressure levels that my body is used to, I know that in small but measurable ways I am also adding to the hormonal soup; flushing out free estrogens and androgens (among other hormones) no longer needed. These excess hormones become waste, literally. Likewise, as I accidentally swallow an ounce or two of the very salty water that makes me piss and spit in the first place, I ingest exocrine hormones and hormone-disrupting substances that have passed through other bodies—also hormonal waste. These out-of-body free-flowing hormones are sometimes referred to as *xenohormones*. Xenohormones are a type of chemical matter that is produced outside of an organic body but is recognized as hormonal by that body. This chemical recognition allows the foreign matter to interact with a body's "native" biological make-up. In the chemical messenger paradigm, xenohormones are considered noise. They are signals from external sources that overtake communication and alter messages.

Critiquing Xenohormones Outside of Aberrance-as-Abhorrence

Xenohormones are not otherworldly. As a chemical class, xenohormones include both anthropogenic (synthetic pharmaceuticals, e.g.) and biological substances (phytoestrogens and phytoandrogens, e.g.). What earns these chemicals their alien status is their propensity to alter the bodies they encounter as they traverse environments. In *Our Stolen Future* (1996), a book Al Gore declared is "in many respects" the sequel to Rachel Carson's *Silent Spring* (1962),[3] first author Theo Colborn finds xenohormones synonymous with toxicity. Colborn's pop-science "detective story," as she calls it, links various cancers, low fertility rates, and "Disorders of Sexual Development"[4] to toxic chemical pollutants in our environment. While exposure to endocrine-disrupting chemicals has very real toxic effects, Colborn's concern often mistakes the aberrant with the abhorrent. The author revels in the "ugliness" of frogs with physical deformities and masculinized female mice. At one point, *Our Stolen Future* suggests that prenatal exposure to DES increases the likelihood of that child having a homosexual or bisexual orientation.[5] In this schema, any form of pathology, disability, or queerness is worthy of grievance when caused by xenohormones' chemical subterfuge.

Our Stolen Future's tendency to conflate the queer, other, or aberrant body with the abhorrence of xenohormone's toxic effects is an all-too-common approach to critiquing the harm caused by these environmental toxins. This position is often sympathetic towards trans antagonistic talking points and concerns about the environmental "queering" of nonhuman animals[6] that invoke dangerous moral panics closely aligned with eugenic preoccupations with

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[3] Al Gore, "Foreword," in Colborn et al.'s *Our Stolen Future* (New York, NY: Dutton, 1996), v.
[4] Now often referred to as "Differences of Sexual Development" rather than "Disorders" but pathologized and treated towards a conformity to the binary gendered and sexual body nonetheless.
[5] Theo Colborn et al., *Our Stolen Future,* (New York, NY: Dutton, 1996), 65.
[6] Alex Jones' and other alt-right pundit's organization around polluted waters turning the "freakin' frogs gay" comes to mind as one such moment.

somatic purity. While the *alien effects* of xenohormonal toxicity are certainly related to the *alienating power* that directs these chemicals towards subjects, the two cannot be conflated. We need better ways to theorize that alienating power without rebuking or forsaking what I call the "xenological" condition of living in and as xenohormonal matter.

For Malin Ah-King and Eva Hayward, this work requires a reorientation away from perspectives that problematize sexual variation—which the authors see as "neither utopic nor dystopic." Instead, they argue that somatic, including sexual, mediations by xenohormones are reminders of the ways "bodies are lively rejoinders to environments and changing ecosystems, even when those same engines of change provide exposure to carcinogens, neurotoxins, asthmagens and mutagens."[7] Rather than treating xenohormones as problematic for facilitating different expressions of gender and sexuality, the authors argue that critiques should target a political economy that so freely produces toxic xenohormonal material and directs it towards vulnerable, often racialized lives. I follow Ah-King and Hayward's critical redirection in theorizing the xenohormone by turning to a discussion of colonial capitalist logics of excess and waste.

In this chapter, I argue that these colonial capitalist logics seek to render Black and Indigenous life waste through violent organizations of both xenohormones and hormonal life deemed "alien." In places like Aamjiwnaang First Nation (Chippewa), xenohormones threaten Indigenous futurity. In the first decade of the new millennium, Aamjiwnaang experienced a two-to-one female to male live birth ratio in their community. The First Nation attributes this unprecedented gender distribution to living amongst constant petrochemical industrial pollution.

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[7] Malin Ah-King and Eva Hayward, "Toxic Sexes: Perverting Pollution and Queering Hormone Disruption," *Technosphere Magazine*, March 20, 2019, https://www.anthropocene-curriculum.org/contribution/toxic-sexes-perverting-pollution-and-queering-hormone-disruption.

I argue that these industries' unrelenting pollution of Aamjiwnaang not only treats the land as excess and a container for their waste, but that such colonial capital logics extend to the bodies within First Nations community. From these relations, which render racialized hormonal bodies both alien and excess, I adopt a capacious understanding of what it means to live xenohormonally. Understanding xenohormonal life as the condition in which hormonal lives are made alien through logics of excess and waste, I turn to Drexciya as a site for establishing recuperative xenohormonal relations. *Drexciya* [8], the Black electronic music duo, introduced a cosmogeny of subaquatic humanoids born from the pregnant women thrown overboard and killed during the Middle Passage. In this Afrofuturist mythos, Drexciyans reorient xenohormonal protocol by embracing their underwater alien condition without losing reference to their violent origins.

(Re)orienting Xenohormones

As I have stated many times, protocols are technologies of orientation. Dominant hormone protocols are technologies of hegemonic orientations between hormones and hormonal bodies, determining which hormones produce the most value in which bodies, which hormones are wasted on which bodies, and which bodies are wasted on which hormones. As such, orientations matter. As Sara Ahmed reminds us, orientations shape our understandings of our world, who inhabits it, and which relations are worth paying attention to. Orientations are also perspectival as orienting oneself involves "different ways of registering the proximity of objects and others."[9] For Donna Haraway, these perspective-based knowledges, which are produced by

[8] Though not a conventional stylistic formatting for musical acts, to avoid confusion I use the italicized "*Drexciya*" when referring to Stinson's and Donald's creative personas and productions and use "Drexciya" when referring to both the fictional subaquatic civilization and the subcontinent they inhabit.
[9] Sara Ahmed, *Queer Phenomenology* (Durham, NC: Duke University Press, 2006), 3.

various "inflections in orientations," are key components of embodied, feminist knowledge practices.[10] In this chapter, I work to recuperate the alien orientations of the xenohormonal body as a way of rethinking the politics of waste in (economic) production and reproduction. To do this work, I return to the most disorienting environment I know—the aquatic. For fellow thinker-diver Melody Jue, the ocean is a productive site of "sensory estrangement" to the anthropocentric. The subaquatic lends itself to a defamiliarizing "science fictional method of thinking" that reorients relations away from the terrestrial and towards the alien.[11] This reorientation also engages "nontraditional geographies (visible, uncharted, and invisible) that connect Indigenous and Black diasporic thought reparatively" across the spaces where water and earth meet.[12] Such nontraditional geographies challenge settler tendencies to read colonialism as primarily an issue of soil-based relations through assumptions that equate "land" with the continental.

When I descend during a dive there is darkness above my head and sun at my feet. My orientation to the aquatic world is inverted. Likewise, this final chapter offers an inversion in its relation to fictional and nonfictional accounts of dominant hormone protocols. The previous two chapters have introduced fictions as primary texts and have threaded nonfictive examples of dominant hormone protocols throughout to ground their conclusions in "real" hormone relations. This chapter follows the opposite organization. It moves from an examination of the ways environmental racism produces and directs hormonal waste that threatens Indigenous fertility and futurity in the nonfictive environment of Aamjiwnaang First Nation to a speculative investigation of the ways hormonal waste might be reimagined through the speculative

[10] Donna Haraway, "Situated Knowledges" *Feminist Studies* 14, no. 3, (1988), 588.
[11] Melody Jue, *Wild Blue Media* (Durham, NC: Duke UP, 2020), 6.
[12] King, 12.

cosmogeny of the Drexciyan species. As all hormone protocol directs its flows into and out of hormonal bodies through water-based media, [13] water offers a lively and generative site through which I can trace these two accounts.

Unlike the salty dive sites that I normally traverse, this analysis starts in Great Lakes freshwater. At the basin where Lake Huron and the Black River feed into the St. Clair River, myriad chemical manufacturing plants and crude oil refineries have earned Sarnia, Ontario the nickname Canada's "Chemical Valley." Aamjiwnaang First Nation is situated in the middle of this valley, surrounded by more than 60 plants and the toxic emissions, chemical spills, and other endocrine-disrupting chemical (EDC)[14] waste that continuously leak into the watershed. As Lake Huron drains into the Detroit River, we'll trace these xenohormonal flows to our next destination: Detroit, Michigan. Here, I will introduce you to *Drexciya* and the Drexciyans. Drexciya's Afrofuturist cosmogeny offers a narrative about Blackness, calculations of hormonal excess and waste, and alien reorientations to the xenohormonal condition. To meet the Drexciyans, we must follow the Detroit River into Lake Erie, which feeds Lake Ontario, which eventually drains out into the St. Lawrence River and finally into the Atlantic Ocean. From here, we'll dive into the deep world of the Drexciya, challenging colonial hormone protocols that direct toxicity toward some bodies and dispose of others.

Throughout this journey, I turn to the hormonal politics of *reproduction* as a counter to the endocrine-disrupting waste generated in industrial chemical *production*. Read against each other, these two modes of generating hormonal relations—gestational and industrial—

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[13] My use of "water-based media" responds to and is situated in the emergent traditions of elemental media studies, such as those by John Durham Peters (*The Marvelous Clouds,* 2015) and Melody Jue (*Wild Blue Media,* 2020) who understand environments as media.

[14] Most scientific research refers to hormone-like environmental substances as "endocrine-disrupting chemicals" rather than "xenohormones." This chapter considers "EDCs" as interchangeable with "xenohormones." I use "endocrine-disrupting chemicals" or "EDCs" when referring to literature on these substances and "xenohormones" to theorize the relationship between hormones, alienation, and waste under colonial capitalist power.

demonstrate the ways biochemical economies determine what constitutes waste and where that waste should go. The same discretion is applied to life through biopolitical and bioeconomic determinations of which lives might also be deemed waste. On the other hand, fertility and reproduction offer rich, thick sites for figuring and refiguring xenohormones' role in both Indigenous and Black futurities. By following the downstream flows from Aamjiwnaang First Nation to Detroit and then the Atlantic, moving from Indigenous material geographies to Black speculative geographies and their material histories, this final chapter seeks to reorient the study of hormone protocol toward Indigenous and Black futurities.

A Word on Stories, Power, and Circulation

At the outset of this dissertation, I explained my turn to stories as a method for thinking through and against dominant hormone protocols. Like protocol, I have argued, stories offer a method for organizing relations. Engaging in narrative and algorithmic analyses of the stories featured in this project elucidates hormone's protocollary power. As sites for speculation and fabulation, stories can also redirect power by depicting both real and imagined forms of resistance. However, as with protocol, stories' power is determined by their circulation and direction.

Readers may notice an incongruity between my recounting of the xenohormonal conditions in Aamjiwnaang and that of Drexciya. The account of Aamjiwnaang I present relies heavily on data from national censuses, governmental pollution indices, NGO watchdog reports, scholarly publications on Aamjiwnaang and its members, and local journalism reporting on major spills, flares, and other acute pollution crises in the Chemical Valley. My decision to turn to these forms of representation when discussing Aamjiwnaang and the burden of hormonal

toxicity the First Nation bears is not because I want to suggest that data offers greater veracity in accounting for such conditions than stories can. After all, many of the sources consulted in this section also use narrative to contextualize their data within the larger forms of social, political, and economic trouble plaguing Aamjiwnaang. Instead, my use of data is evident of both my position as a settler scholar and of a stark limitation in my methodological turn to stories—not all stories are intended for circulation to general (in this case, settler) audiences.

As a settler, I have not been granted access to Indigenous knowledges. These ways of knowing are protected by knowledge keepers through their own protocols and counter-protocols that work against dominant and colonial forms of narrativization. I am certain there exist many different stories concerning the toxic burden Aamjiwnaang bears, both circulated publicly for settler audiences and those that stay within the First Nations from which they emerge. Vanessa Gray (Chippewa and member of Aamjiwnaang First Nation) and Michelle Murphy's (Métis) *The Land and the Refinery* is an example of a public, community-led research project that shares stories about Aamjiwnaang that are appropriate to circulate amongst settler audiences. I encourage readers of this chapter to explore Gray's and Murphy's project.[15]

In navigating settler relations to Indigenous stories, I am reminded of an anecdote about settler scholar relations to Indigenous knowledges shared by Max Liboiron (Métis) in *Pollution is Colonialism* (with the permission of the researcher). When a keen graduate student came to conduct ethnographic research in Liboiron's lab, she immediately began taking copious notes. Liboiron asked the settler student if she had already been collecting data on the lab and its researchers (many of whom are Indigenous). When the student affirmed to the lab director that

[15] Vanessa Gray and Michelle Murphy, "Stories," *The Land and the Refinery*, accessed January 20, 2024, https://www.landandrefinery.org/explore-stories/.

she had, Liboiron replied, "That's stealing."[16] Ethical methodologies do not extract, coerce, or otherwise steal from the groups of people they aim to learn more about. Without permission to access other stories in and about Aamjiwnaang, data is the primary mode of representation I can access to account for toxicity in the First Nation. After all, data is the language of the neoliberal governance that enables Aamjiwnaang's toxic conditions in the first place. The differences in my use of sources between this chapter's two sites of inquiry are stark. However, I want to remind my readers that, like written words and oral traditions, data are also tools of storytelling. I consider the following account of Aamjiwnaang one of many stories that can be told about Aamjiwnaang, the petrochemical industry, and the hormonal politics of toxicity, excess, and waste.

Water, Air, and Xenohormonal Circulations in Aamjiwnaang

Sarnia's status as a major player in the Canadian oil and gas industry began in 1857 when crude oil was found southeast of Sarnia.[17] As refineries quickly began popping up in the area, it became clear that the oil and gas industry was there to stay. These refineries would become the namesakes of Canada's "Victorian Oil Towns;" Oil City, Oil Springs, and Petrolia. With the establishment of the Polymer Corporation in 1942, a now defunct crown corporation that used crude oil to produce synthetic rubber to support Canada's WWII efforts, Sarnia became a national hub for chemical refining and manufacturing.[18] The city's proximity to water, situated

[16] Max Liboiron, *Pollution is Colonialism* (Durham, NC: Duke University Press, 2021), 68.
[17] Gray and Murphy, "This Land is Still Sacred," *The Land and the Refinery*, accessed January 20, 2024, https://www.landandrefinery.org/traditional-territory/land-acknowledgement.
[18] Robert Bothwell, "Polymer Corporation," *The Canadian Encyclopedia*, June 24, 2013, archived page accessed via Archive Today webpage capture, accessed November 10, 2023, https://archive.ph/20130624235906/http://www.thecanadianencyclopedia.com/articles/polymer-corporation.

on the shores of the St. Clair River, made it an ideal site for chemical manufacturing. Water is an essential ingredient in the production of many petroleum-based products.

The name "Aamjiwnaang" itself roughly translates to "the spawning stream,"[19] indicating how water has always circulated through land as a rich and vital resource. Water brings nutrients and it determines trade routes. In these ways, water is the medium of economic processes and protocols. Water circulates hormones and hormone-like substances through its bioeconomic protocol. In Aamjiwnaang First Nation, the flow of water is oriented in such a way that it directs billions of dollars in petrochemical industry profits to far away CEOs while feeding the toxic by-products of that profit downstream, seriously threatening reproductive futurity in the First Nation.

These protocollary flows do not always take the form of neatly carved rivers and streams. To understand the omnipresent nature of water's toxicity in Aamjiwnaang, we must also look up in the air to the smoggy skies. In the twenty-first century, around 60 chemical manufacturing plants and petrochemical refineries surround the 850 members of Aamjiwnaang First Nation. These industrial facilities are situated on both sides of the U.S.-Canadian border within a 25 kilometers radius of the First Nation's federally determined 12.58 km^2 territory, referred to as "Sarnia 45 Indian Reserve" (Fig. 10) by the Canadian government. On the Canadian side of the border, Suncor, Imperial Oil (Esso), and Shell are some of the many national and international petrochemical corporations that have settled the lands around the Chippewa community, making it one of Canada's most industrialized and polluted areas.

[19] Aamjiwnaang First Nation, "Welcome to Aamjiwnaang First Nation," *Aamjiwnaang First Nation*, accessed November 14, 2023, https://www.aamjiwnaang.ca/.

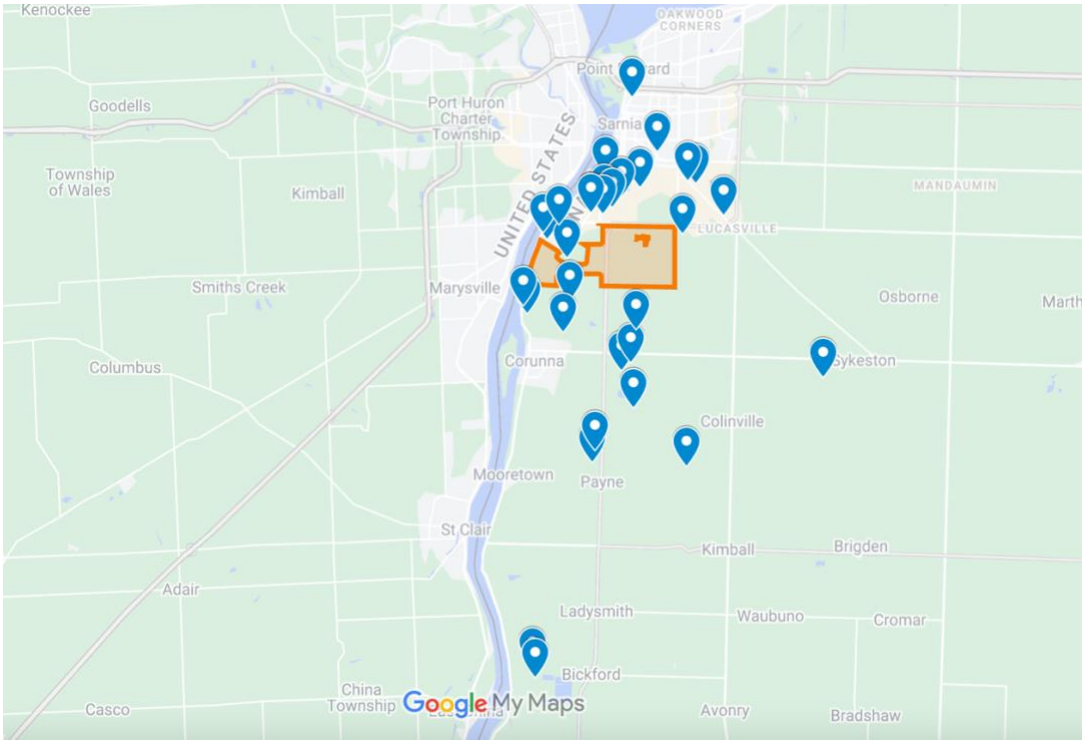

Figure 10: Major chemical manufacturing plants and petrochemical refineries (blue) surround Aamjiwnaang First Nation (orange). Map generated by the author with Google's My Maps based on facility sites listed in Ecojustice's 2019 report.

Residents of Aamjiwnaang First Nation know the somatic effects of these toxins intimately. In a 2021 interview published by Al Jazeera, Aamjiwnaang member Arnold Norman Yellowman describes the ways he's learned to orient himself to the airborne pollutants: "That's the north wind. It comes from Esso or Imperial Oil…If the wind blows from this direction, it's Suncor—used to be Dow. And if the wind blows over this way, it's Shell, ethanol, Dupont. If it blows from the south, it's Nova Chemicals."[20] Other residents of Sarnia note the unique smells[21], tastes, and sounds, that signify the production of toxic waste being pumped out of the

[20] Megan O'Toole and Jillian Kestler-D'Amours, "Toxic Legacy: The Fight to End Environmental Racism in Canada," *Al Jazeera*, December 8, 2021, https://www.aljazeera.com/features/longform/2021/12/8/toxic-legacy-the-fight-to-end-environmental-racism-in-canada.

[21] Barbara Simpson, "Company says "sour water" release contained the chemical mercaptan," *The Observer*, January 14, 2013, https://www.theobserver.ca/2013/01/14/company-says-sour-water-release-contained-the-chemical-mercaptan.

surrounding plants. In Aamjiwnaang, "You can hear the oil refineries of Suncor and Shell rumbling away, and sometimes smell and even taste them in the air."[22] These sensate understandings of one's orientation to the flows of toxic matter are necessary for understanding how to survive in a bioeconomy of accumulated xenohormonal waste.

For more than a century, industrial giants have dumped the toxic byproducts of their production into the surrounding environment. According to a report by the Canadian environmental law charity Ecojustice (formerly Sierra Club), the 46 Canadian[23] facilities surrounding Aamjiwnaang First Nation in 2005 emitted almost 132 million kilograms of recognized air pollutants that year. This report was based on historical data from Canada's National Pollution Release Inventory (NPRI), an index comprised of industries' self-reported emissions data. Of those pollutants, 5.7 million kilograms were considered toxic and included "numerous chemicals associated with reproductive and developmental disorders and cancer among humans."[24] A follow-up report based on 2016 NPRI data also emphasizes that, among many other health concerns, much of the chemical waste emitted by these industries are either known or suspected endocrine disruptors and have been connected to various endocrine disorders and reproductive disorders.[25] However, it is difficult to clearly assess differences between the

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[22] George Mathewson, "Opinion: Ministry has failed all Sarnians," *The Sarnia Journal*, October 15, 2014, https://www.thesarniajournal.ca/top-story/opinion-ministry-failed-sarnians-7963310.

[23] Ecojustice is a Canadian organization and does not report on the 16 facilities in Michigan, U.S. across the St. Clair River.

[24] Elaine McDonald and Sarah Rang, "Exposing Canada's Chemical Valley: An Investigation of Cumulative Air Pollution Emissions in the Sarnia, Ontario Area," *Ecojustice*, October 2007, https://www.ecojustice.ca/wp-content/uploads/2015/09/2007-Exposing-Canadas-Chemial-Valley.pdf.

[25] Elaine McDonald, "Return to Chemical Valley: Ten Years After Ecojustice's Report on One of Canada's Most Polluted Communities," *Ecojustice*, June 2019, https://ecojustice.ca/wp-content/uploads/2019/06/Return-to-Chemical-Valley_FINAL.pdf.

quantity and quality of emissions from 2005 to 2016. [26] Because of changing metrics required by the NPRI, the data between the two reports are not perfectly comparable.

According to the report on 2005 emissions, the largest eight facilities in Sarnia made up a combined air release of nearly 167 tonnes of known or suspected EDCs.[27] Industrial air pollutants like sulfur dioxide, nitrogen oxides (such as nitric oxide and nitrogen dioxide), and particulate matters are some of the major waste products of the crude oil refining process. A Hong Kong-based study of the endocrine-disrupting effects of common industrial air pollutants like sulfur dioxide, nitrogen dioxide, and coarse particulate matters in utero and early childhood suggest these chemicals can influence and delay pubertal development in girls (coarse particulate matters) and boys (sulfur dioxide and nitrogen dioxide).[28] A 2017 study of the role of sulfur dioxide, nitrogen dioxide, and fine particulate matters in traffic pollution demonstrated that these substances negatively affected the quality and quantity of gametes in the study's male and female participants. The article suggests a causal relation between increased rates of miscarriages and infertility and those chronically exposed to airborne toxins.[29] However, the EDCs that make up these toxic emissions are not exclusively a matter of air. In this chapter's attention to the nontraditional and shared geographies through which chemical waste circulates, it is essential to understand the inseparability of air and water.

The endocrine-disrupting waste commonly produced in petrochemical processing—sulfur dioxide, nitrogen oxides, fine particulate matters, and volatile organic compounds—often enter

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[26] When looking at total mass of emissions, the 2019 Ecojustice report only includes facilities that self-reported emitting more than 50 tonnes of pollutants in 2016. This artificially deflates data on total emissions as only 23 of 38 active facilities are included. This is half the number of the 46 facilities included in 2007 report.
[27] McDonald and Rang, 21.
[28] Jian V. Huang et al., "The Association of Air Pollution with Pubertal Development: Evidence From Hong Kong's 'Children of 1997' Birth Cohort," *American Journal of Epidemiology* 185, no. 10 (2017): 918-919.
[29] Julie Carré et al., "Does air pollution play a role in infertility? A systematic review," *Environmental Health* 16, no. 82 (2017): 13.

the atmosphere riding on the steamy water vapour droplets emitted from chemical plants. That the most visible component of plant emissions is often "just water" is a point leveraged by proponents of Sarnia's chemical industry who suggest that these emissions are innocuous.[30] Yet this vapour is a carrier of anthropogenic, bioinformational matter with serious hormonal effects that will inevitably find its way from airborne vapour to groundwater and open water systems.

Particulate matter is comprised of either solid or liquid aerosols that eventually fall into groundwater or surface water where they contaminate aqueous ecologies, human and non-human food systems, and drinking water. Similarly, sulfur dioxide and nitrogen dioxide react with the water vapour in the air to form sulfuric acid, and nitric acid, respectively. These chemicals are components of acid rain, putting further pressure on the contaminated environment from which both Sarnia and Aamjiwnaang source their drinking water. [31] It is ironic that the Government of Canada, which regulates and supports the pipelines bringing in crude oil from Western Canada into Sarnia, has published such a succinct reflection on the inseparability of air and water: "When we pollute our air, we are also polluting the precipitation that falls into water bodies and soils… The flow of water from the atmosphere, through soils and into water bodies unifies these two precious resources."[32] Air pollution *is* water pollution.

In addition to air pollution, these industries directly contaminate water sources. Chemical spills and leaks are not uncommon in the Chemical Valley. Over the last 40 years, reports of

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[30] Dominic Odwa Atari et al., "This is the mess that we are living in": residents everyday life experiences of living in a stigmatized community," *GeoJournal* 76, no. 5 (2011): 490.
[31] Sarnia and Aamjiwnaang's water supply is purchased from the Lambton Area Water Supply System which sources "raw" surface water from the surrounding lakes and rivers in St. Clair River Watershed before treating it. London District Chiefs Council, "Where Does My Water Come From," *Drinking Water Source Protection*, September 16, 2009, www.sourcewaterprotection.on.ca/wp-content/uploads/2014/11/FN-Aamjiwnaang.pdf.
[32] Environment and Climate Change Canada, "Air pollution: effects on soil and water," Government of Canada, July 17, 2013, https://www.canada.ca/en/environment-climate-change/services/air-pollution/quality-environment-economy/ecosystem/effects-soil-water.html.

major spills from companies such as Dow Chemical, Suncor[33] , Imperial Oil[34], and Nova Chemicals[35] indicate that these corporations are responsible for the presence of large amounts of chemicals with known or suspected carcinogenic and endocrine-disrupting effects in and around the St. Clair River. The largest such spill reported happened in 1985 when 11,000-litres of perchloroethylene leaked from a faulty valve on a Dow Chemical pipeline. An estimated 2,000 liters spilled directly into the St. Clair, mixing with other contaminants that had accumulated from previous spills and toxic dumping practices. The melange of anthropogenic chemicals formed a basketball court-sized tarry mass at the bottom of the river known to locals as "The Blob."[36] The cumulative effects of decades of dumping chemical waste into the surrounding environment are felt across species distinctions.

Fish and other wildlife, plant life, and human life all feel the chemical burn of pollution as xenohormonal waste is disproportionately directed towards Indigenous Land[37] in ways that value chemical production over Indigenous reproduction and futurity. The chemical relations to race and Indigenous fertility remind us that the aphorism "water is life" around which many Indigenous activists across Turtle Island and globally have rallied does not only refer to protecting watery environments as they flow through land but also to the ways that water as blood, as amniotic fluid, literally carries life.

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[33] "Suncor finds benzene in ditch water near Sarnia, Ontario, refinery," *Reuters*, August 13, 2013, https://www.reuters.com/article/suncor-refinery-benzene-idUKL2N0GE1QX20130813.
[34] "Water intake shut off for 6 Ontario communities after toxic spill," *CBC News*, February 2, 2004, https://www.cbc.ca/news/canada/water-intake-shut-off-for-6-ontario-communities-after-toxic-spill-1.485576.
[35] Terry Bridge, "Nova Chemicals fined $125K for 2018 brine leak at Corunna site," *The Observer Sarnia*, June 5, 2021, https://www.theobserver.ca/news/nova-chemicals-fined-125k-for-2018-brine-leak-at-corunna-site.
[36] Beth LeBlanc, "The 'Blob' is Gone," *Times Herald*, August 30, 2014, https://www.thetimesherald.com/story/news/local/2014/08/29/blob-gone/14820687/.
[37] For Liboiron, as well as many other Indigenous thinkers and Land Protectors, capital 'L' Land refers to the spiritual elements of place. Specifically, for Liboiron, Land refers "to the unique entity that is the combined living spirit of plants, animals, air, water, humans, histories, and events recognized by many Indigenous communities." I use it here to best represent and contextualize the worldview and ways of being that shape their thinking. See, Liboiron, 6-7.

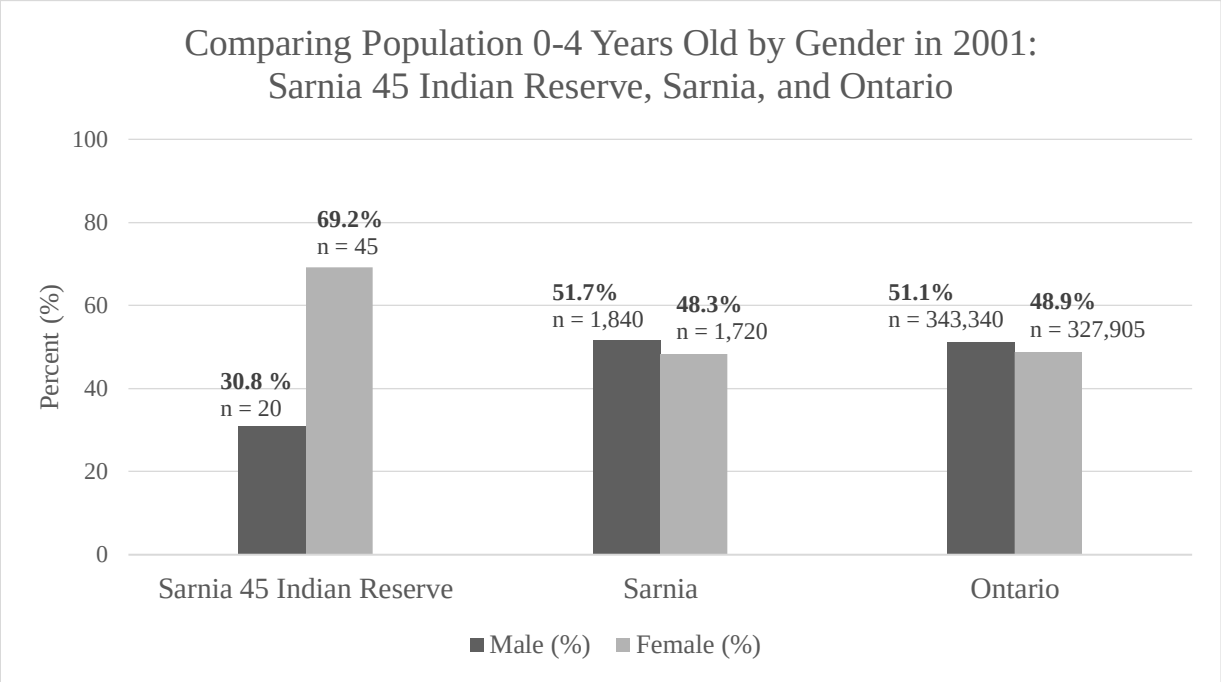

Figure 11: Comparing population 0-4 years old by gender across Sarnia 45 Indian Reserve, Sarnia, and Ontario using Statistics Canada 2001 Census of Canada, Community Profiles data. Chart generated by the author.

The anthropogenic toxins circulating through the Chemical Valley are the suspected cause of the nearly decade-long decrease in male live births witnessed in Aamjiwnaang from 1994 through 2003. In 2005, Ada Lockridge, a prominent environmental activist and member of Aamjiwnaang's environment committee, published an article on Aamjiwnaang's decreasing male birth rate with co-authors from the University of Ottawa and Occupational Health Clinics for Ontario Workers (Sarnia-Lambton). The article demonstrates a significant drop in male births in the five-year period from 1999 to 2003. During this time, live male births accounted for only a third of total live births in Aamjiwnaang.[38] This ratio is also reflected in Statistics Canada's 2001 Census of Canada data for Sarnia 45 Indian Reserve where the number of male children aged 0-4

[38] Constanze A. Mackenzie et al., "Declining Sex Ratio in a First Nation Community," *Environmental Health Perspectives* 113, no. 10 (2005): 1296.

only accounts for 31% of the total population for that age range. This is well below the male births reported at the provincial and municipal levels during the same census year (Fig. 11). The authors of the article suggest that the decreased sex ratio in Aamjiwnaang is a direct effect of their members' cumulative exposure to "environmental contaminants such as endocrine disruptors, either through their close proximity to industrial plants or through other sources such as food."[39] They argue that such xenohormones "can have significant changes in the reproductive ability of the community, including the sex ratio." While the sex ratio has slowly normalized in Aamjiwnaang First Nation over the last twenty years, more recent studies suggest the community remains vulnerable to endocrine-disrupting contaminants such as polychlorinated biphenyls (PCBs)[40] and to heavy metals like mercury.[41] Mercury also has xenohormonal effects and has been associated with thyroid disruption, infertility, and fetotoxicity including miscarriages and stillbirths.[42] Living in Aamjiwnaang means living in the industrial protocollary flows of xenohormonal waste, where Indigenous life is caught in the undercurrent.

Dominant Hormone Protocol and the Racial Politics of Toxicity in Aamjiwnaang

For Liboiron, pollution is not just an issue of the environmental damage it causes, it is a mode of enacting the material "violence of colonial land relations" that assumes entitlement to take from and dispose on Indigenous Land.[43] In these relations, Indigenous life, fertility, and the possibility of future generations become mixed up in a toxic soup that renders all hormonal life

[39] Constanze et al.
[40] Isaac Luginaah et al., "Surrounded by Chemical Valley and 'living in a bubble': the case of the Aamjiwnaang First Nation, Ontario," *Journal of Environmental Planning and Management* 53, no. 3 (2010): 354.
[41] Dianna Cryderman et al., "An Ecological and Human Biomonitoring Investigation of Mercury Contamination at the Aamjiwnaang First Nation," *Ecohealth* 13, no. 4 (2016): 784.
[42] Kevin M. Rice et al., "Environmental Mercury and its Toxic Effects," *Journal of Preventative Medicine and Public Health* 47, no. 2 (2014): 78-79.
[43] Liboiron, 6-7, 9.

therein disposable. This is the openness of protocol in neoliberal economic organizations; the expansive growth and circulation of capital, product, and waste that manifest as "sophisticated common sense."[44] When it comes to dominant hormone protocol, neoliberal common sense takes the form of industrial self-monitoring and self-reporting practices informed by provincially determined risk calculations. The Local Air Quality Regulation, under Ontario's *Environmental Protection Act* (*EPA*), determines the upper thresholds of emission a facility can make within a half-hour for more than 100 environmental toxins.[45] However, Ontario only determines the "upper risk thresholds" of emissions for 38 toxins.[46] These "upper risk thresholds" follow the logic of assimilative capacity which assumes an environment can withstand a certain amount of pollution. Liboiron identifies threshold theories of harm as tools of colonialism used to justify dumping waste into Indigenous land.[47] Even if these thresholds adequately protected the environment from industrial toxicity, they are liable to bend at that will of market pressures.

Individual facilities in Ontario can apply for "site-specific standards" to increase that facility's allowable emissions if a facility cannot meet the province's standards "due to technical or economic issues."[48] Protocol is a regulatory mechanism that operates outside of governmental power, as Alexander Galloway reminds us. However, the ways that neoliberal governance supports protocollary self-regulation, circulation, and management often imbricate governmental regulation and corporate protocols in establishing processes that optimize production (and thus potential capital) over all other variables. While provincial government sets upper thresholds of

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[44] Wendy Brown, *Undoing the Demos*, (Princeton, NJ: Zone Books, 2017), 35.
[45] Ontario, "Ontario Regulation 419/05: Air Pollution – Local Air Quality" *Environmental Protection Act*, schedule 2 (2005).
[46] Ontario, schedule 6.
[47] Liboiron, 6-7.
[48] Ontario, "Guide to Requesting a Site-Specific Standard," March 13, 2017, https://www.ontario.ca/page/guide-requesting-site-specific-standard.

pollution, both provincial and federal government ease the flows of xenohormones by allowing these industries to self-regulate what qualities and quantities of waste they are accountable for.

Industrial facilities are expected to self-monitor and self-report emissions to the NPRI (federal) in accordance with the legal regulations set by the *EPA* (provincial). Likewise, these facilities are expected to self-report spills when they occur. Because each facility can exercise individual discretion when determining what constitutes a spill, industrial spills can go unreported for hours or even days. This was the case with a hydrocarbon gas leak at Plains Midstream in 2014. A facility manager waited 15 hours to report the spill because the gas had pooled *on top of* the tank from which it had spilled. According to the manager, the spill was contained despite the substance being outside of its container.[49] At every step of the way, decisions are being made that direct the flow of endocrine-disrupting pollutants into the air-water systems in which Aamjiwnaang is situated. These decisions are the results of calculations intended to determine the upper allowable limits of pollution that can be released into the environment before causing harm—an act of governance intended to draw a line between "contamination" and "pollution."[50] But questions of *harm to whom?* and *harm to what?* remain largely unaddressed by the self-regulatory practices in place at the industrial, provincial, and federal levels. Accounting only for the variables that produce capital—such as optimized production and maximum possible thresholds of harm—means refusing to be accountable for and to others. In the case of Aamjiwnaang, the petrochemical industry refuses to be accountable for the violence that occurs when xenohormonal toxins are directed primarily towards

[49] Sean Craig et al., "We expected cancer': Are industrial spills in Canada's 'Chemical Valley' making people sick?," *Global News*, October 14, 2017, https://globalnews.ca/news/3796720/sarnia-oil-industry-spills-human-impact-investigation/.
[50] Liboiron, 57.

Indigenous lives. This violence accumulates not just *in situ* but *in utero*, threatening future generations in Aamjiwnaang.

In their article, "Chemical Regimes of Living," Michelle Murphy notes the ways risk calculations work to legitimize the chemical harm that has always been directed towards areas where life is already disenfranchised and devalued within the political economies of biochemical circulation.[51] For Murphy, the chemical regime of living is this condition of living in a political economy that consents to the contamination of the very lives that support it. The chemical regime affects us all—though at different intensities—in the global circulation of capital and chemical. For Stacy Alaimo, exposure to substances like environmental toxins is a precondition of living as a posthuman biopolitical subject under globalized capitalism. To be constantly exposed to and penetrated by toxicity exposes, in turn, the permeability of the boundaries drawn around bodies, species, geographies, ecologies, and so forth. [52] As endocrinology eventually becomes exocrinology and exocrinology at some point becomes endocrinology, hormones and xenohormones are well-positioned agents of posthuman boundary un-making through acts of exposure. However, living in conditions of acute chemical exposure remains inextricably linked to a form of colonial dispossession that not only calculates which xenohormonal matter can and should be considered waste, but which forms of hormonal life can and should be considered waste also.

Aamjiwnaang *in* and *as* Hormonal Waste

Hormonal waste, as a matter of excess in acts of production, is twice signified in the colonial capitalist relations between the chemical industry and Aamjiwnaang First Nation. The

[51] Michelle Murphy, "Chemical Regimes of Living," *Environmental History* 13, no. 4 (2008): 698-699.
[52] Stacy Alaimo, *Exposed,* 5.

most obvious signification of hormonal waste in these relations is that waste is the xenohormonal-laden byproducts of chemical manufacturing and refining. These byproducts are, by definition, excess to the goals of commodity production. When the excesses generated in production can no longer be recuperated through further processing, or when such processing would prove too costly, excess becomes waste. Excess-as-waste, however, is rarely seen as an issue for production in the neoliberal political economy. This economic organization ensures that commodities are nearly always produced in surplus. Waste is an inevitable outcome of mass-scale production, a byproduct that is most valuable when disposed of and directed away from the site of production.

But, as Liboiron reminds us, the idea that there even is an "away" for waste to go to assumes access to Indigenous Land. In industrial production, Indigenous Land is understood as "a place to store waste, so that profits [can] be generated through flows of waste-as-consumer-goods"[53] and through flows of waste-as-excess in the production of those goods. The acute effect of these flows on human health is evident of the ways chemical pollution enacts slow violence[54] toward chemical genocide[55]. However, in calculations that compare the economic value of commodity production to that of Indigenous reproduction, xenohormonal toxic waste becomes leveraged as a tool of reproductive violence and is directed toward members of Aamjiwnaang.

Xenohormones are distributed through flows, yes, but they also accumulate in the areas, (containers, bodies, territories, ecologies) where their flows are directed. Thus, the protocols that have determined the area surrounding Aamjiwnaang First Nation as the ideal site for chemical dumping cannot justifiably separate this "container" from the bodies that occupy the land when

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[53] Liboiron, 8.
[54] Thom Davies, "Slow violence and toxic geographies: 'Out of sight' to whom?," *Environment and Planning C: Politics and Space* 40, no. 2 (2022): 410.
[55] Liboiron, 9.

seeking vessels to hold their xenohormonal waste. As such, the hormonal lives in Aamjiwnaang—their reproductive wellbeing—are also rendered excess and disposable. This organization marks the second form of waste that emerges from colonial capitalist relations to Indigenous Land.

In this second signification of waste, what is considered excess is not the toxic xenohormonal byproducts—these are now primary objects of production in the hormonal bioeconomy—but the lives and potential lives deemed hormonal waste through pollution's reproductive violences. The relationship between rendering human life waste and chemical waste value is expressed by Murphy as "a setup that produces molecular material 'waste' emissions as outside of the calculation of value, on the one hand, and the governing of human 'waste' as integral to the surround that capitalism demands, on the other hand."[56] Protocollary organizations of chemical matter direct xenohormones away from areas that are deemed generative of value (valued land, valued lives, etc.). These organizations identify which hormonal bodies better facilitate capitalist productions of "waste" by allowing toxic waste to accumulate in and around those lives. This secondary bioeconomy of waste, which privileges the chemical production of toxic hormonal matter over the hormonal reproduction of Indigenous life, demands our attention if we are to understand the profundity of the ways dominant hormone protocol is directed as a tool of colonial violence.

Counter-Protocols in Aamjiwnaang

I want to remind readers that not all protocols facilitate hegemonic organizations of power. Some protocols are specifically designed to slow down violent colonial relations.

[56] Michelle Murphy, *The Economization of Life* (Durham, NC: Duke University Press, 2017), 138.

Aamjiwnaang's council and members have established such counter protocols against industrial harm. Any industrial projects that occur within the First Nation must first go through the Aamjiwnaang's Consultation Protocol process. This process upholds Aamjiwnaang's sovereignty in determining how the consultation proceeds and what its outcomes will be.[57] The First Nation has also established citizen science protocols for monitoring environmental toxins.

In 2008, the members of Aamjiwnaang, partnering with the Ontario Ministry of the Environment and Climate Change, set up their own air quality monitoring station that records the volume of at least five different classes of toxins; sulfur dioxide, total reduced sulfur, nitrogen oxides including nitric oxide and nitrogen dioxide, fine particulate matter, and volatile organic compounds.[58] Aamjiwnaang makes their data publicly available and uses it to expedite spill responses when facilities' own protocols result in delayed or ignored declarations of hazardous spills. Bucket sampling is another technique commonly used by citizen science activists to collect and quantify toxic pollutants in samples of water. In Aamjiwnaang, a "Bucket Brigade"[59] offers an affordable way for citizens to monitor their exposure to pollutants. And, as Murphy points out, bucket sampling turns use of petrochemical-comprised plastic buckets against the very industries that profit from making such cheap, disposable products.[60] While these citizen science initiatives do not stop the flows of toxins into Aamjiwnaang, they combine Indigenous knowledges with sovereign practices of data production to target "the common sense" of industry

[57] Aamjiwnaang First Nation, "Consultation Protocol—Aamjiwnaang," *Aamjiwnaang First Nation*, accessed November 20, 2023, www.aamjiwnaang.ca/wp-content/uploads/2018/07/Aamjiwnaang-Consultation-ProtocolExternal.pdf.
[58] Aamjiwnaang First Nation, "Air Monitoring Reports," *Aamjiwnaang First Nation*, accessed November 13, 2023, https://www.aamjiwnaang.ca/environment-department/air-monitoring/.
[59] The Canadian Press, "First Nations exposed to pollutants in 'chemical valley'," *CBC News*, November, 24, 2013, https://www.cbc.ca/news/canada/windsor/first-nations-exposed-to-pollutants-in-chemical-valley-1.2438724.
[60] "Chemical Regimes of Living," 700.

self-regulation that allows toxic chemical substances to flow freely and fatality towards the First Nation.

From Detroit to Drexciya

Following the St. Clair River through Lake St. Clair and into the Detroit River, marks only a slight distance from Aamjiwnaang—about 100 kilometers southwest—but this downstream movement invokes a far greater geographic and historical expanse when attending to the ways calculations of hormonal value deem certain racialized reproductive bodies "waste." Detroit, a site polluted with xenohormones from its own history of industrialization and racial ghettoization, brings us to the home of the musical act *Drexciya*. The musical duo was comprised of James Stinson and Gerald Donald and was active in Detroit's Black techno scene from the early 1990s until Stinson's death in 2002. Stinson and Donald's act was predicated on the mythos of Drexciya: a nation of aquatic humanoids descended from the thousands of pregnant, American-bound, enslaved African women who were thrown overboard in calculations of excess during the Middle Passage. Through *Drexciya*, I follow the headwaters of the Detroit River into Lake Erie, Lake Ontario, out of the mouth of the St. Lawrence River and into the Atlantic Ocean. From here, we can begin to trace the political economy of hormonal value and waste used to manage Black reproduction during the Middle Passage. From this chapter's understanding of xenohormonal life as the condition in which hormonal lives are rendered alien through logics of excess and waste, I turn to Drexciya's cosmogeny as a site that imbricates the alienness of living and dying in xenohormonal conditions with a recuperation of Black futurity.

Stinson and Donald developed *Drexciya*'s subaquatic, Afrofuturist sound and image from 1992 through Stinson's untimely passing a decade later. In 1997, the duo released the album *The*

Quest, which established the mythological origins of the mysterious Drexciyan race. The liner notes of *The Quest*, credited to an "Unknown Writer," speculate:

> *Could it be possible for humans to breath underwater? A foetus in its mother's womb is certainly alive in an aquatic environment. During the greatest holocaust the world has ever known, pregnant America-bound African slaves were thrown overboard by the thousands during labour for being sick and disruptive cargo. Is it possible that [the pregnant women murdered] could have given birth at sea to babies that never needed air?*[61]

The mythos of Drexciya remains lively nearly thirty years after the Unknown Writer introduced the Drexciyan's genesis. Scholars such as Kodwo Eshun (1998, 2003), Ben Williams (2001), Nettrice Gaskins (2016), Mick Harvey (2020), and Katherine McKittrick (2021) as well as visual artists, musical artists, and creative writers such as Abdul Qadim Haqq (2020, 2021), clipping. (2017), Rivers Solomon with Daveed Diggs, William Hutson, and Johnathan Snipes of clipping. (2019) have all meditated on Drexciya's mythos. Per McKittrick, Drexciya offers a "regenerative future" from an ontological perspective that is responsive to the violent abduction and transport of Black life during the Middle Passage from which that future must emerge.[62] By moving across the vertical plane and into the deep, rather than retracing the horizontal planes of slave routes that were used to transport abducted lives from West Africa to Europe and the Americas,[63] Drexciya's aquatic ontology offers a "sonic rupture"[64] in the violent geographies and histories of the transatlantic slave trade. In this way, the band and its mythos are part of the

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[61] The Unknown Writer, "Liner Notes," Drexciya, *The Quest*, 1997, Submerge, compact disc.
[62] Katherine McKittrick, *Dear Science*, (Durham, NC: Duke University Pres, 2021), 55.
[63] Though as Saidiya Hartman demonstrates in *Lose Your Mother*, such retracing can also offer regenerative understandings of Blackness across time and place in the Black diaspora.
[64] Nettrice R. Gaskins, "Deep Sea Dwellers: Drexciya and the Sonic Third Space," *Shima* 10, no. 2 (2016): 70.

network of creative labour that makes up the Black Atlantic[65] in Black diaspora—one of the many syncopations of creative works that can "experimentally structure, destructure, and restructure" narratives of Black generation and regeneration, "mark[ing] the assertion…of radical blackness."[66]

Though Drexciya's cosmogeny does not offer a story explicitly about hormones, its focus on pregnancy indicates that Drexciyan's origin story is rife with underlying hormonal circulations. As with Aamjiwnaang, I find protocollary judgements of value and waste in the bioeconomy of hormones in Drexciya's story. However, I also find reorientations to the alienness of Black racialization and a recuperation of the motherhoods and kinships lost during the transatlantic slave trade punctuated across the entire cosmogeny. Drexciya's narrative speculation on Black futurities directly challenges the fiscal speculation of classically liberal and contemporary neoliberal markets that continue to bet on the value of Black life as an economic object or bet against it as a liability. For these reasons, Drexciya offers a generative and regenerative narrative site for reorienting the bio- and necroeconomic judgements that deem racialized life "waste" towards reparative relations to the xenological.

Calculating Waste and Directing Hormones in Middle Passage

The violent premise of Drexciya's cosmogeny imbricates the fiction in the economic calculations that deemed certain Black hormonal life "waste" and other hormonal life valuable in

[65] Kodwo Eshun has repeatedly read the mythos as Drexciya through Paul Gilroy's concept of the Black Atlantic, a cultural condition in the aftermath of the transatlantic slave trade that networks experiences of Blackness throughout Black diaspora. See, Eshun's *More Brilliant Than the Sun*, (London, UK: Quartet Books, 1998), "Drexciya: Fear of the Wet Planet" *The Wire*, no. 167 (1998), and "Further Considerations on Afrofuturism" in *The New Centennial Review* 3, no. 2 (2003).
[66] Fred Moten, *In the Break*, (Minneapolis, MN: University of Minnesota Press, 2003), 153, 167.

what Saidiya Hartman has called the "libidinal economy of slavery."[67] The libidinal economy of slavery determines whether one's reproductive capacity is rendered an asset, exposing one to the violence of rape, or as a burden and thus justification for murder. Notably, the first condition of this libidinal economy does not preclude the second.

Drexciya's invocation of the murders that occurred during the Middle Passage do not refer to any specific event in the archives of transatlantic slavery. Rather, the Unknown Writer evokes a generalizable event within the archives of chattel slavery as such murders were ubiquitous. However, for Katherine McKittrick Drexciya's mythos can be read through the archival presence of documents covering "the deliberate murdering aboard the slave ship *Zong*" as the throwing aboard of abducted men and women imprisoned on *Zong* is "one of the more studied massacres" of the slave trade.[68] The silence in the archive of slavery on much else other than the "quantitative matters and on issues of markets and trade relations" [69] further renders cases like the massacre on *Zong* subject to forms of speculation and narrativization by Black artists.[70] These acts of narrativization transform the *numerical* accounts of the archive into contextualized stories from Black, polyvocal, transhistorical, perspectives. I follow McKittrick's and Christina Sharpe's respective turns to *Zong* to inform my reading of the economic protocols that organized reproduction and gestational labour during the Middle Passage, rendering Black hormonal life alien and disposable.

In *The Wake: On Blackness and Being* Christina Sharpe looks to the material conditions of the slave vessel and the ship's voyage to trace how the commodification of Black life persists

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[67] Saidiya Hartman, "Venus in Two Acts," *Small Axe* 12, no. 2 (2008): 1.
[68] *Dear Science*, 55.
[69] "Venus," 3-4.
[70] Such as M. NourbeSe Philip's book-length poem *Zong!* comprised entirely of text from the 1783 court case *Gregson v. Gilbert* between *Zong*'s owner and the ship's insurer.

after the transatlantic slave trade. Each chapter, "The Wake," "The Ship," "The Hold," and "The Weather," figures how the language of the ship and its commercial endeavors—shipping, shipping cargo, shipping human cargo—still organize the continued disenfranchisement, displacement, and death of Black people to this day. In the second chapter, "The Ship," Sharpe retells the story of *Zong's* necroeconomy and calculations of excess "cargo"; calculations that deemed Black bodies fungible and disposable commodities. In February of 1781, *Zong* sailed toward Jamaica from the coast of West Africa where slavers had captured and stowed more than twice as many people than the ship had been designed to hold. When supplies ran low, it became clear that many of the enslaved Africans would not survive the crossing—numerous people having died from thirst or from jumping overboard and drowning. Low food and water threatened both the profits that could be made by the slavers and the slavers' lives. Through a necroeconomic calculus, the ship's captain and crew decided to throw 150 enslaved Africans overboard into the Atlantic Ocean, murdering them to preserve themselves and the lives of the remaining Africans in the ship's hold. In this calculation, the Black lives who were once considered valuable surplus (beyond the capacity of the ship) were rendered excess and waste.

Zong enters the archives most notoriously as an issue of protocol and procedure that refuses to afford humanity to the West Africans murdered on the slave ship. These protocols include shipping procedures for disposing of human "waste," procedures for claiming insurance on lost "cargo," and legal procedures to sue when those insurers refuse remittance on the economic loss and damages suffered by the enslavers. The 1783 court case *Gregson v. Gilbert* between *Zong*'s owner (plaintiff) and the ship's insurer (defendant) demonstrates the ways Black lives are rendered as "fungible commodities while retaining the appearance of flesh and blood."[71]

[71] Christina Sharpe, *In the Wake: On Blackness and Being*, (Durham, NC: Duke University Press, 2016), 30.

In death, those lives are further reduced to issues of economic recuperation for lost "cargo." *Zong*'s archival presence also demonstrates how protocols become the framework through which these bioeconomic and necroeconomic calculations are made operational, reminding us that as much as the transatlantic slave trade is inextricable from capitalism, so too is it inextricable from protocollary logics that facilitate that circulation of Black life rendered bio- and necroeconomic matter.

On *Zong*, as undoubtedly in many other slave ships' operations, protocol informed the assessment of the acceptable amount of loss (murders) needed to optimize net profit. The protocol determined by *Zong*'s captain and crew guided the disposal of bodies both dead and alive in the Atlantic once those lives were deemed "waste." Likewise, protocol guided the legal process through which Gregson aimed to recuperate those financial losses (the intentional deaths of enslaved Africans that he intended to sell in the Americas). Again, we see how mathematical organizations of hormones and hormonal life foster biopower through protocol. Such calculations are exemplary of what McKittrick calls the mathematics of Black life. The "seeming neutrality"[72] of mathematics can efface Black life out of economic and political equations. This mathematics justifies the kill-ability, "that throwing overboard,"[73] of Black life through an algorithmic series of "judgments that banished them from the category of the human and decreed their lives waste."[74] In attempting to optimize economic gain by making decisions about the financial loss and possible financial recuperation bound to Black, human life, protocols emerge from these decisions in ways that direct some bodies towards life and others towards death.

[72] Katherine McKittrick, "Mathematics Black Life," *The Black Scholar* 44, no. 2 (2014): 23.
[73] Sharpe, 35.
[74] "Venus," 9.

It is plausible to imagine—though, as with *Zong*'s archival presence, difficult to dwell on—that the slavers implicated in the Drexciyan mythos engaged in similar calculations, followed similar protocols, when determining how to organize reproductive hormonal life into categories of value or waste. Sex, fertility, and reproduction on the slave ship are part of the libidinal economy of violence and pleasure, exerted by and derived from, the "serial rapes and excremental punishments" abducted and enslaved Black women faced at the hands of their enslavers.[75] Sexual violence and the violent exploitations of fertility offered one strategy for captors to produce a larger inventory (on the ship) or workforce (on the plantation) without exchanging capital. Pregnancy, however, can also be a death sentence if one is deemed more trouble than the value of reproduction. Whose reproductive capacity, whose fertility, whose sexuality was met with the violence of rape? Whose gestational labour and pain were met with murder? And whose was met with both? This is the double bind of the sexual violence endured by captive African women[76] in the bioeconomic circulation of hormones during the transatlantic slave trade. This is also the double-bind from which Drexciya recuperates the thick, blood-rich relations of reproductive futurity in alien environments.

[75] "Venus," 6.

[76] My focus on the bioeconomies of fertility emphasizes the ways Black women have experienced sexual violence during the transatlantic slave trade. Violence becomes a strategy for directing hormones in ways that produce more value or to limit loss by determining what forms and conditions of life can be considered "waste." This is not to discount the reality of sexual violence enacted against Black men throughout chattel slavery and its aftermath. I also do not wish to dismiss the presence of West African gender identities that exist outside of the colonial gender binary and the ways that people can engage in gestational labour outside the category of "woman." However, because the colonial archives of slavery have largely omitted non-binary and trans gender categories from the history of slavery, I can only account for women in my reflections on the hormonal bioeconomies of reproduction during the transatlantic slave trade.

Xenohormones in the Deep: Critical Fabulations and Speculative Reorientations

In the stories examined in this chapter, racialized hormonal life is deemed disposable *because of* the very hormones that constitute and reproduce those lives. When racialized lives are deemed excessive and "waste," they are made otherwise, strange, and alien. The transatlantic slave trade imposed the conditions of alienness and strangeness on Black life. Eshun invokes such conditions when he names the capturing of West Africans by European enslavers the "alien abduction of slavery."[77] Similarly, Hartman considers the figure of the slave as a permanent stranger whose domain is always the "elusive elsewhere."[78] The xenohormonal condition of colonial reproductive violence signifies at once the excessive, disposable, "waste" as well as the otherwise, strange, and alien. It is through this double signification of the xenohormonal body that I read the Drexciyan origin mythos as an attempt to reorient Black life, specifically Black reproductive life, from the murderous calculations of excess and alienation made during the Middle Passage toward counter-stories that see the regeneration of Black life without losing referent to, or romanticizing, the violence of slavery.

Xenohormones are not simply a metaphorical framing mechanism for my reading of Drexciya, I find hormones-made-alien a necessary consideration for understanding both the violent bioeconomy of reproductive activity during the transatlantic slave trade and the ways the Drexciyan mythos responds to that bioeconomy by recuperating the alien condition of racialized hormonal life. The Unknown Writer tells us about the births of those pregnant women imprisoned aboard slave ships who were thrown overboard for the "disruptions" of their reproductive labour. What hormonal changes must have occurred in utero to facilitate the

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[77] Kodwo Eshun, *More Brilliant than the Sun* (London, UK: Quartet Books, 1998), 84.
[78] Saidiya Hartman, *Lose Your Mother: A Journey Along the Atlantic Slave Route*, (New York, NY: Farrar, Straus & Giroux, 2007), 4.

transformation from human to Drexciyan? Informed by my own experiences diving where I am alien to my environment, I think about all the ways Drexciyan's hormonal conditions must be alien to my own human hormonal experiences underwater. What are Drexciyans' resting heartrates? What amounts of estradiol and aldosterone, both hormones known to regulate blood sodium levels, circulate through the Drexciyan body in its already-saline environment? How responsive are the feedback loops of blood-pressure-regulating epinephrine and norepinephrine in order to facilitate Drexciyans' movements up and down the changing hydrostatic pressure of the water column? This is not to mention the physiological changes that might occur to the very forms of gestational labour on which this mythos is predicated. Is Drexciyan amniotic fluid as saline as ocean water? From being made stranger to one condition (slavery) to becoming a stranger to the next (murdered by being jettisoned into the inhospitable waters of the Atlantic), Drexciya's mythos imbricates the estrangement of hormonal life deemed "waste" in a regenerative and radical narrative of alienness in Black diaspora apart from, but not outside of, the violence of transatlantic chattel slavery.

In this sense, I read the Drexciyan cosmogeny as a practice in what Hartman calls "critical fabulation." Hartman introduces critical fabulation as a reparative mode of storytelling against the silencing of Black voices in the archive of transatlantic slavery. In "Venus in Two Acts" Hartman examines the ubiquitous, yet inadequately described presence either girls or young women named "Venus" in the archives. The few details noted about the Venuses written into the archives of slavery often tell similar stories. Venus' life is only accounted for in the voice of her enslavers and through the circumstances of the many rapes, beatings, and murders she suffers at their hands. If the archive only captures the death of Black life fiscally and litigiously, how then, Hartman asks, "might it be possible to generate a different set of descriptions from this

archive?"[79] Critical imaginings of the parts of Venus life left out of the archive offer one way to engage in a discourse with Venus without allowing the archive to speak for her.

Critical fabulations offer narrative-based responses to the archive of slavery, an archive that too often reduces Black life to a number in a ledger, a footnote, or an asterisk severed from any qualification of life. These fabulations aim to "do more than recount" and thus reproduce "the violence that deposited these traces [of Black life] in the archive"[80] of slavery. At the same time, Hartman is cautious not to allow such fictive imaginings and recuperations to overwrite or romanticize slavery in attempting to speak for the subaltern.[81] Such narratives can only offer impossible and insufficient accounts, weaving together the fictive and the historical. Still, critical fabulations attempt to recuperate the Black selfhood in the archive without losing reference to the violences of slavery that robbed its victims of that selfhood.

Court proceedings from 1792 concern the murder of two girls aboard *The Recovery* at the hands of the slave ship's captain, John Kimber. The first girl is unnamed. The second girl, called Venus, is only mentioned twice in the trial for her murder. She is merely "another girl" murdered by Kimber. In an attempt at recuperating the lives of these girls through critical fabulation, Hartman begins to imagine their lives beyond the limited stories told by the archive. She imagines the two girls as friends, imagines Venus "speaking in her own voice," and imagines Venus comforting her friend as she dies from the battery she has endured at the hands of her captors.[82] Hartman's fabulations produce a certain realism in their speculations of both the violence endured and the kinship manifested on *The Recovery*. While Drexciya's science-fiction,

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[79] "Venus," 7.
[80] "Venus," 2.
[81] Gayatri Chakravorty Spivak, "Can the Subaltern Speak?," in *Can the Subaltern Speak*, ed. by Rosalind C. Morris (New York, NY: Columbia University Press, 2010), 27.
[82] "Venus," 8.

Afrofuturist generic conventions do not engage a similar realism, *Drexciya*'s recuperation of Black life in the watery aftermath of the Middle Passage engages the same impossible project of speaking back into the archive. For *Drexciya*, the work of recuperating Black life, particularly Black reproductive life through future generations of Drexciyans, is a work of speaking back to the hormonal bio- and necroeconomies that dominate the archive of slavery.

Drexciya's recuperation of Black life is also a recuperation of the xenohormonal condition foisted onto Black life through calculations of excess and significations of alienness. The narrative offers a radical acceptance of the xenological condition through which Black life has been made otherwise. The Drexciyan canon (including the lyric-less music of Stinson and Donald) tells the story of a subaquatic species of humanoids thriving fathoms below the surface of the Atlantic. This speculative story does not shun the alien. Instead, Drexciyans radically *seek to be alien* on their own terms. That is, they seek to be alien to the colonial violence from which they were born. In speculating on the otherwise stories in the archive of the transatlantic slave trade, the Drexciyan cosmogeny the chemical strangeness of xenohormones (here broadly understood here as hormones from another environment) not as threat to futurity, but as a necessary condition for posthuman survival when the generational persistence of anti-Black violence makes the human realm unlivable.

As critical fabulation, I understand Drexciya's radical xenohormonal condition through what Sharpe calls *residence time*. Residence time refers to "the amount of time it takes for substance," such as the chemical makeup of the human bodies cast overboard, "to enter the ocean and then leave the ocean."[83] In its scientific context, residence time can be used to measure the preservation period of sodium molecules carried in the human blood of those thrown away

[83] Sharpe, 41.

into the Atlantic—260 million years. The continued circulation of these sodium molecules is a chemical signifier of both the persistence of Black life and of the violence, commodification, and destruction aimed at it. Sharpe theorizes that, like sodium, "Black people exist in a residence time of the wake" of the transatlantic slave trade. Drawing on the numerous meanings of wake—the disrupted flow of water behind the ship, to witness and hold vigil for the dead, to awaken into consciousness—Sharpe then proposes "wake work" as a form of resistance against the momentum of the ship.

Residence time offers one such site for thinking and doing wake work as the chemical matter stored in oceanic currents now constitutes another sort of archive of slavery. This archive, the chemical archive of the Atlantic, might offer more opportunity for the dead to speak back through chemical messages:[84]

> *But even if those Africans who were in the holds, who left something of their prior selves in those rooms as a trace to be discovered, and who passed through the doors of no return did not survive the holding and the sea, they, like us, are alive in hydrogen, in oxygen; in carbon and phosphorous, and iron; in sodium and chlorine. This is what we know about those Africans thrown, jumped, dumped overboard in Middle Passage they are with us still, in the time of the wake, known as residence time.*[85]

These are some of the chemicals (hydrogen, oxygen, carbon) that largely constitute the molecular makeup of hormones, or that constitute other chemical matter (phosphorous, iron, sodium) regulated by hormonal activity. Sharpe's allusion to residence time reminds us that the lives taken by the transatlantic slave trade must also be understood as chemically constituted and

[84] Chapter Three in Melody Jue's *Wild Blue Media* suggest ocean water is a database and archive for life. I want to suggest that it is also a database and archive for death and what Christina Sharpe calls the "afterlives" of the transatlantic slave trade.
[85] Sharpe. 19.

hormonally directed. Drexciya's recuperation of the hormonal contingencies of Black life in the wake of slavery at once grounds the historical and scientific facticity of chemical residence time while offering alternative, alien modes of being in the networked flows within the diasporic Black Atlantic. That is, Drexciyans live in residence time and members of the Black diaspora *are* Drexciyans; the estranged kin of those lost to the violence of slavery. By embracing the alien encodings of the "xenological" hormonal body, the Drexciyan mythos engages "a kind of inversion, or underside of the colonial system," [86] to assert agency over a system which renders Black life alien in the first place.[87] Drexciyans are the reproductive, regenerative power that persists despite bioeconomic calculations that deem some Black life hormonally valuable and others "waste."

Sharpe's notion of residence time chemically imbricates both Black life and death in an ongoing relation to racialized violence on the one hand, and offers an alternative mode of thinking through collectivity, formation, and kinship in the aftermath of slavery *because of* that violence on the other. This mode of tracing of chemical relations to violence *and* to alternative forms of collectivity and kinship is how I have come to understand the Drexciyan cosmogeny. The alienness of the Drexciyans makes them incalculable, unaccountable as either value or waste in the hormonal bioeconomies of the Middle Passage and chattel slavery. By inverting and reorienting the value of the alien hormonal condition, Drexciya offers a narrative of kin-making in chemically alien conditions. The Drexciyan mythos is one of literal regeneration in the Black

[86] Ben Williams, "Black Secret Technology: Detroit Techno and the Information Age" in *Technicolor: Race, Technology, and Everyday Life*, ed. Alondra Nelson, Thuy Linh Nguyen Tu and Alicia Headlam Hines (New York, NY: New York University Press, 2001), 170.
[87] Mick Harvey, "Harnessed the Storm—Rereading Drexciya with The Black Atlantic," *Studies in Gender and Sexuality* 21, no. 2 (2020): 138.

diaspora without losing referent to the protocollary logics that justify Black death through a necroeconomic calculus.

Xenohormones as Liquid Technologies

While xenohormones are so-called strangers to endocrine system, it is not their strangeness that threatens life. Rather, they pose a threat because they are *similar* enough to maintain their legibility in hormonal bodies and, in doing so, are capable of disrupting communication signaling and thus transforming biochemical meaning. I want to continue to severe the xenological or aberrant from the harm caused by violent and colonial relations that direct hormonal lives.

Xenohormones have become the banner messengers of precarity in what Donna Haraway calls the "*Capitalocene*"[88]—a neologism that destabilizes the deeply entrenched belief that capitalism is immanent to human life. By challenging our basic assumptions about sexual reproduction and fertility, the figure of the xenohormone challenges how we think about futurity across race and species. In Aamjiwnaang, toxic hormone-disrupting waste manifests as chemical violence precipitated by an environmental and economic racism that values petrochemical production over Indigenous life. Myriad health problems, particularly reproductive health concerns, are the effect of industrial protocols that direct toxic waste products towards the First Nation. Bioeconomic calculations that are employed to determine what is or isn't excess in the production of chemical commodities reduce Indigenous life and reproductive potential to "waste." A capacious understanding of what it means to live xenohormonally emerges from these

[88] Donna Haraway, *Staying with the Trouble*, (Durham, NC: Duke University Press, 2016), 47.

relations. I define this condition as one in which hormonal lives are rendered alien through logics of excess and waste.

My reading of xenohormones through the Drexciyan mythos aims to demonstrate how undesirable, threatening, and disposable matter can be recuperated in counter-stories. In its reorientation of the alien quality of hormonal life deemed "waste," the Drexciyan cosmogeny resists the violent libidinal and reproductive economies of the slave trade without losing referent to the historical realities of said violence. The watery currents of the transatlantic become a site *into* which Black reproductive lives are directed toward death but *through* which Black generative life is recuperated. Like the water that channels hormonal matter, I understand xenohormones as particularly liquid in their tendencies to reorient bodies across gendered, racial, and species distinctions. Drexciya's ironic embrace of the non-human "alien" body demonstrates just how liquid xenohormonal bodies can be.

As a channel, water is inextricable from the protocollary and counter-protocollary action of hormones. Water is an organizing theme in this chapter, but it's importance to hormone action is punctuated across this dissertation. I finish this chapter with a brief meditation on water as essential to thinking through careful and regenerative hormonal practices. In *Full Surrogacy Now*, a text that advocates for queer, radical forms of gestational labour outside of the highly exploitative surrogacy industry, Sophie Lewis proposes "amniotechnics" as a way of thinking through the gestational labour's liquid relations to gender, race, and class in their current neoliberal economic organizations. For Lewis, amniotechnics are best described as "the art of holding and caring even while being ripped into."[89] Amniotechnics are techniques of making kin and community, of holding safe, nutritive, livable spaces to hold past, present, and future

[89] Sophie Lewis, "Amniotechnics," *The New Inquiry* 58, (2017), https://thenewinquiry.com/amniotechnics/.

generations, even when the violent caesuras and ruptures of our political conditions threaten to destroy, pollute, and make our worlds unlivable. Lewis reminds readers that "all humans in history have been manufactured underwater, in amniotic fluid"[90] The conditions of reproduction and gestational labour are themselves alien and posthuman as hormonal circulations between the gestating body and the body of the fetus break down anthropocentric conceptions of individual bodies. For instance, the placenta, which is a unique organ neither fully belonging to fetus or gestater, circulates placental lactogen through a shared circulatory system. As the name suggests, this hormone is only ever produced in the hybrid condition of gestation.

Though she is not engaging with hormones as biopolitical, bioinformational, and bioeconomic matter, I agree emphatically with Lewis when she writes, "'Water management' may sound unexciting, but I suspect it contains key secrets to the kin-making practices of the future"[91] The watery conditions of reproduction are critical to a hormonal politics that facilitates life across race, gender, and species distinctions while acknowledging that living hormonally is itself a liquid condition. I do not only mean ensuring the right to access clean water systems, though this is certainly part of such biopolitical work. I am also calling for a greater attention to the hormonal politics of water and the ways those politics determine who lives, who dies, who is born, and who is not. Acknowledging water's role in protocollary organizations of hormones requires us to acknowledge how water is directed as a channel for violence and how water holds onto that violence as an archive. As water is the major medium through which hormonal violence is directed at the material level, fostering liveable relations to water is an act of fostering liveable relations to hormones.

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[90] Sophie Lewis, *Full Surrogacy Now* (London, UK: Verso, 2021), 160.
[91] *Full Surrogacy Now*, 164.

CONCLUSION / The Limitations on and of Hormone Protocol

The primary purpose of this dissertation has been to demonstrate how hormones, as chemical messengers, can be leveraged as agents of control through protocollary means. From their intellectual origins, hormones emerged from a technical transmission paradigm that determined these objects' status as biochemical information and converged biopolitical and technopolitical forms of management into one object. Protocol proves a useful framework for theorizing complex relations with a kind of hormonal power that often doesn't seem to come from any one source or governing body. Throughout this dissertation, I have demonstrated how protocollary organizations of hormone shape gendered, racial, and species relations. This power is pervasive in scope and scale, operating on both the cell and on expansive ecological systems.

While *Dominant Hormone Protocol* begins the work of theorizing the ways protocollary power exerts hormonal control, the breadth and the approaches taken in this dissertation are necessarily partial. This conclusion considers some of the persistent challenges that linger at the end of this dissertation. These challenges include the cultural and disciplinary difficulties in theorizing hormones outside of the category of "sex" hormones, methodological concerns about ethical access to and representations of hormone stories, and a discussion of the ways a theory of hormone protocol *alone* is not enough to account for increasingly restrictive forms of hormone control targeting trans and intersex youth. I consider this latter challenge a necessary and urgent topic for continued thinking on the technical, biological, and governmental manifestations of hormone power. Finally, I offer possible research questions to guide future work.

The Dominance of "Sex" Hormones

Upon my first endeavour in thinking through hormonal biopower for this dissertation, I was committed to producing a theorization that destabilized the steroidal "sex" hormone as the focus of the concomitant scholarship that makes up Critical Hormone Studies. My project in decentering the sex hormone—and particularly the near exclusive focus on estrogens and testosterone—is not because I don't find these hormones rich sites of symbolic and material power. On the contrary, these so-called sex hormones have been the objects of fascinating research that has heavily informed my thinking on the ways hormones not only produce gender, but also construct subjecthood across race, and species distinctions—the same distinctions I pressure in Chapters Two through Four.

However, I often wonder if the dominance of sex hormones presents a limitation to the field and our capacity to imagine how these subjectivities might also be produced by circulations of other hormones. Chapter Three, "Feeling Hormonal," begins this work by imbricating non sex hormones into the politics of interspecies reproductive and population control. Namely, *fictional* representations of temporin become affective expressions that direct *nonfictional* elephants toward reproductive management. Still, it has been exceptionally difficult to think beyond the sex hormone.

Sex hormones often pervade this dissertation in ways I had initially intended to avoid; chapters two explicitly concerns fictional feminizing HRT pharmaceuticals called "estroglyphs" and "spiroglyphs" while chapter four's treatment of xenohormonal substances implicitly concerns xenoestrogens. Still, I do not consider my inability to think radically beyond the sex hormone a failure of this project. Instead, I find this limitation indicative of a deeply entrenched cultural preoccupation with "messengers of sex" that constrains our ability to imagine vital

hormonal relations outside of that category—even when such relations are necessary for life. To this end, more thought on hormone biopower outside of sex hormones is needed to produce to a richer and more comprehensive theory of hormone protocol.

Fostering Hormone Stories

This dissertation turns to stories about hormones as a mode for thinking through counterhegemonic ways of navigating dominant hormone protocol. As suggested in the Chapter Four, story is not always intended for, and thus not always accessible to, all audiences. In the last chapter, I struggled to represent the toxic burden of xenohormones in Aamjiwnaang First Nation outside of publicly available data, scholarly thinking, and local news. While these sources can account for the *quantification* of hormonal violence directed toward Aamjiwnaang, they often do very little to represent Aamjiwnaang and its members through their own accounts of what it means to live in chemical toxicity.

One of the reasons I could not fully account for the members of Aamjiwnaang First Nation's experiences is not because their stories don't exist, but because they are not always circulated toward settlers. Protocols and stories have a lot in common. They are both modes of organizing information and they can direct that information toward certain audiences and away from others. Counter protocols, such as Indigenous protocols, often work to protect sacred and intimate Indigenous knowledges, including stories, from uninformed and irresponsible circulations. Stories are powerful tools. They are powerful in that they can be used to rethink, redirect, and ultimately "restory"[1] hegemonic narratives through acts of co-creation and tactical

[1] Dian Million, "Intense Dreaming," *American Indian Quarterly* 35, no. 3 (2011): 328.

circulation, but stories are also powerful in the sense that they require responsible use lest their circulation work to harm, rather than empower, those to whom the story belongs.

Using storytelling as a mode of representation and as a method of accounting for hormonal power and resistance raises important questions about the ethics of sharing others' stories. Practicing responsible access to and use of stories as a methodology means that not all stories are available to everyone to think with. Following institutional assumptions about the role of methodology in research—assumptions informed by the colonial relations on which academia has been built—this may be seen as a limitation hormone storytelling as a method. A more generative and reparative approach to thinking through these challenges is not to discount hormone storytelling for its limitations, but to engage this approach at the sites of its gaps. Doing this work requires listening to those whose stories need to be protected and supporting the fostering of spaces in which those stories *can* safely be told even if we are not part of that audience.

Considering Political Restrictions on Gender-Affirming HRT

In Chapter Two, "Hormone Variables," I discussed how following dominant hormone protocols can produce a numbing acquiesce to the power that facilitates institutional access to gender-affirming HRT. In *With Those We Love Alive*, I read the variable $hormone_day as a figuration of two forms of access to HRT. In this dual reading, protocollary logics ensure that institutional medical access to HRT appears the easiest path to hormonal therapies while isolating and alienating trans life from community-based care networks. In *With Those*, both figurations of $hormone_day are available and navigable, despite the procedural logics that directing readers away from accessing hormonal care in community. However, for many trans people seeking

hormonal therapies—as well as other forms of gender-affirming healthcare—it is becoming increasingly difficult to enter such protocollary relations with hormones, let alone figure out how to navigate their power.

Increasingly in the Global North, we are seeing the introduction of policies that aim to govern gender-affirming care through centralized and hierarchical forms of control. These transphobic political responses seek to erode protocol as the dominant mode of medical access and hormone distribution in trans care. According to Trans Legislation Tracker, a non-profit initiative that analyses proposed and passed anti-trans legislation in the United States, 185 bills limiting access to gender-affirming healthcare were passed in 2023.[2] This number exceeds that of the past five years combined. At the time of writing, 2024 is well on track to surpass 2023's numbers. The Trans Legislation Tracker does not distinguish the specific forms of healthcare at risk (e.g., surgical procedures from HRT from other forms of medical support and therapies). However, many of these bills specifically include restrictions on hormonal therapies. In Alberta, Canada, the leader of the United Conservative Party (UCP), premiere Danielle Smith, recently proposed a slate of policies that aim to limit trans children's access to many institutional supports and protections. This policy would ban access to hormonal therapies such as HRT and puberty blockers to children fifteen years and younger. It would also require parental, psychological, and medical approval to begin these therapies for youth sixteen and seventeen years old—an age well after many young people have started puberty and developed persistent and sometimes irreversible secondary sex characteristics that make transitioning harder. Although restrictions on

[2] "Tracking the rise of anti-trans bills in the U.S." *Trans Legislation Tracker*, access https://translegislation.com/learn, accessed March 4, 2024.

youth access to gender-affirming care exist in provinces across Canada, the UCP's policies are widely considered the strictest[3] the country has seen in both scope and degree.

As a management style predicated on decentralization and distribution, protocol largely operates outside the sorts of governmental structures that keep powers centralized through hierarchy.[4] In both *Protocol* and *The Exploit*, Alexander Galloway and Eugene Thacker repeat the rhizomatic refrain first offered by Gilles Delueze and Félix Guattari: "we're tired of trees." The success of protocol's informational, biological, and economic circulations suggests, for these thinkers, that hegemony has also grown tired of trees.[5] Galloway and Thacker have aptly identified the ways networks act as the primary conduit for organizing information, capital, and life across a political economy that takes increasingly technological form.[6] So too is *Dominant Hormone Protocol* invested in tracing the networked connections between nodes of hormone biopower. But, even if the systems of control through which our lives are mediated, modulated, and moderated have largely forsaken trees for highways and cable networks (both figuratively and literally), trees—that is, hierarchal organizations of concentrated power—still exist. Legislative and other parliamentary actions, such as those described above, constrain protocol's management style with hierarchical power. These forms of restrictive governance inject a more sovereign control into the lives they target than uninhibited protocol and they are worthy of our continued attention and critique.

It is not the case that hormones no longer circulate through protocollary flows in areas where such governance is enacted. Rather, legislation and policies that seek to ban access to

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[3] Steve Scherer, "Alberta restrictions for transgender youth 'extremely dangerous' -Canada minister," *Reuters*, February 1, 2024, https://www.reuters.com/world/americas/alberta-restrictions-transgender-youth-extremely-dangerous-canada-minister-2024-02-01/.
[4] Alexander R. Galloway, *Protocol,* (Cambridge, MA: MIT Press, 2004), 122.
[5] Galloway, 242.
[6] Alexander R. Galloway and Eugene Thacker, *The Exploit: A Theory of Networks* (Minneapolis, MN: University of Minnesota Press, 2007, 25.

hormones among certain populations inject centralized control into some circulations while allowing other circulations to remain unconstrained. This is the case for many intersex children whose lives will be altered by dominant hormone protocols in areas that prohibit gender-affirming HRT for non-intersex trans youth. For instance, one bill introduced in West Virginia defines biological sex by the presence of "sex chromosomes, naturally occurring sex hormones, gonads, and nonambiguous internal and external genitalia present at birth" in its proposed ban on "gender-altering medications."[7] In effect, this legislation's definition of what constitutes a medical alteration on "biological sex" strategically exempts intersex youth from such bans. Instead, it continues to direct the flow of hormones towards these young people in harmful[8] ways that produce a compulsory binary gender. Beyond questions of trans and intersex access and consent to hormones, the global markets for other forms of HRT continue to circulate uninhibited, demonstrating protocol's staying power.

Future Directions of Hormone Protocol

The theory of hormone protocol presented in this project offers a partial examination of not only the ways hormones mediate life through bioinformational and bioeconomic circulations, but of the ways protocol itself can be mediated and constrained by other forms of power. Further consideration of how hormonal biopower can organize and control life, especially when those protocollary flows are constrained, raise questions such as:

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[7] Article 3. West Virginia Medical Act, H.B. 5187, 86th Leg., of West Virginia, 2nd Sess., 2024 Regular Session § 30-3-20 Prohibited practice, (2024), https://www.wvlegislature.gov/Bill_Status/bills_text.cfm?billdoc=hb5187%20intr.htm&yr=2024&sesstype=RS&i=5187.

[8] Aidan Ricciardo, "Harm Caused by Medical Interventions Which Alter Intersex Variations." *University of Tasmania Law Review* 40, no. 2 (2021): 110-113.

- *In what ways do non sex hormones produce subjects? In what ways do they produce subjects differently than sex hormones?*
- *How might we foster the sharing of hormone stories by those who cannot speak or have been silenced?*
- *What other strategies of resistance are possible when dominant forms of hormonal mediation are controlled more strictly and through more centralized organizations of power?*
- *Can protocollary and non-protocollary organizations of hormone power negotiate in stable relationships?*
- *Is it possible to reign in and centralize a chemical flow that is understood as inherently, empirically, distributed?*
- *How might such constraints on protocollary power make hormones appear less or differently technological in their capacity to manage life?*

At the outset of this dissertation, I identified three assumption the scientific community makes about hormones and upon which my theory of dominant hormone protocol is predicated; hormones are distributed, hormones are bioinformational, and hormones are easily leveraged as objects of control. I stand by the relevance of these premises to future research. Hormones will continue to flow through our world regardless of the various forms of control that organize their circulations. Lives across all species will continue to produce, expel, ingest, and absorb hormonal matter in intricate ecological networks. Hormones will continue to mediate and modulate these lives as chemicals with semantic power. Hormones will continue to control because they are essential to complex regulatory mechanisms within bodies. Yet, I am

unconvinced that protocol, *pure* protocol (whatever that might mean), is somehow part of a natural law of hormonal organization. Protocol as a control logic is precisely that—a logic. And it's a logic that is informed by the cultural and economic inclination towards technicality[9] from which the chemical messenger paradigm first emerged. In the context of the highly politicized and precarious grounds on which many hormonally mediated lives are situated, such lingering questions demonstrate the urgency of thinking through dominant hormone protocol not as an inevitable and stable organization of biopower under neoliberalism, but as biopower in negotiation with both restrictive and regenerative alternatives.

[9] Seb Franklin, *Control: Digitality as a Cultural Logic*, (Cambridge, MA: MIT Press, 2015), 8.

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