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FLUID

diving into the effect of EDCs on gender and the environment



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EDITOR'S NOTE

"THEY'RE TURNING THE FRIGGIN FROGS GAY!"

Yes. These are the words spewed out by Alex Jones, conservative talk show host for the infamous InfoWars. Oh and after stringing together nonsensical words to make this outlandish claim, he proceeded to smash a stack of papers repeatedly against the table like an angry toddler when his mom tells him he can't have any more candy. It's easy to observe the palpable farce from this tirade (not to mention the strong notes of homophobia and transphobia in this rant). Yes reader, what he says is discriminatory. It is homophobic. It is sensationalized…

But, to some extent, there is some truth in this act.

While presented disharmonious, Jones drops a veil of isms on the issue of endocrine disrupting chemicals (EDCs) and its drastic effects on aquatic species such as frogs and fish. EDCs such as EE2, phytoestrogens, and atrazine are chemical products that are characterized by their ability to impair the function of the endocrine system such as hormone production and homeostasis. These substances are leaching into aquatic habitats, causing morphology changes in the species of these habitats These changes cause the development of intersex individuals in fish and frogs.

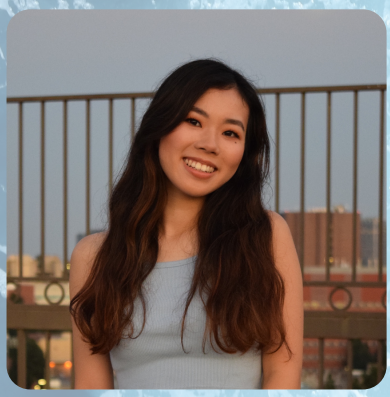
Yet, aquatic species are not the only organism affected by the infusion of these pollutants into their environment. We, humans, face dire consequences with the pollution of these substances in our periphery. Yet, the damage diverges from environmental harm and extends into the perpetuation of structural violence against females and LGBTQIA+ communities. Referring to intersex species as "males that have been demasculinized or feminized" connotes these morphological changes as abnormal from a heteronormative narrative that has been reinforced across generations. Inducing these changes in aquatic animals, birth control medication have been thrusted into the limelight of blame. Emerging from this blame is the use of these products by females, accentuating sexist claims against the use of these products by women. What is more alarming is that scientific literature laced with this transphobic and heteronormative tone is being used to insinuate the replication of these changes in human populations. But there is no scientific evidence to date to suggest this phenomenon. But Alex Jones and conservative media pundits have fabricated science to extend the heteronormative standard to their viewers. Essentially, the pollution of aquatic bodies with endocrine disrupting chemicals and the gendered reporting of resultant intersex changes is enacting discriminatory violence against human populations in an unprecedented manner.

Yet all hope is not lost. We must hold scientific, political, and corporate institutions accountable in hopes of solving this biological and social harm. But we can't just give a vague idea of what we need, so we invite you to explore this issue further with us. Let's examine the chemical changes brought about by EDC pollution, the enforcement of hetero(eco)normatovity, problems of political regulation and gendered scientific pollution. Let's leap into the issue with the spirit of resolution.

Trigger Warning: this material discusses LGBTQIA+ violence, exclusion, and sex reassignment surgeries, which may be a sensitive topic for some readers. Viewer discretion is advised.

Uday Birdi
Luc Lorain
Rachel Chau
Michelle Le
Victoria Luu

MEET THE EDITORS



RACHEL CHAU



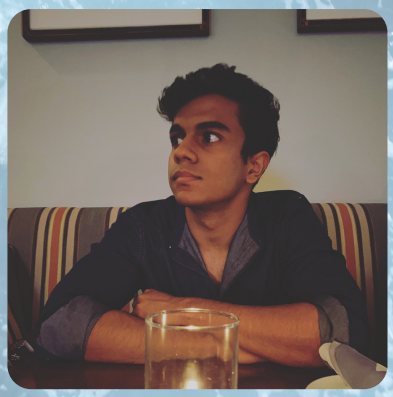
MICHELLE LE



VICTORIA LUU



LUC LORAIN



UDAY BIRDI

SECTION I.



CHEMICAL FASCINATIONS & CHANGING BODIES



ENVIRONMENTAL ESTROGENS

WHAT ARE THEY AND WHERE DO THEY COME FROM?

BY MICHELLE LE

Estrogen. It's the endocrine disrupting chemical on everybody's lips. Estrogens actually occur naturally in living organisms, however, when they end up in the environment, they present a silent, but omnipresent threat to the environmental equilibrium, functioning as a double edge sword. While the term "endocrine disrupting chemicals" (EDCs) is a more specific term to describe a class of chemicals in ecosystems, it is imperative to understand the specific chemicals that fall under these categories. A large portion of endocrine disruption research has focused on environmental estrogens and estrogen-like chemicals due to their high occurrence in urban wastewater [2].

While estrogens produced within the bodies of organisms have the possibility of becoming environmental estrogens, xenoestrogens are a class of environmental chemicals that encompass all estrogens produced outside of the human body [6]. They are divided into two classes: those that are produced synthetically, and those which are produced naturally and are found in plant compounds (phytoestrogens) [2]. All of which are capable of entering endocrine pathways and altering the endocrine system of living organisms, whether they belong or not. This essentially goes to show why and how certain chemicals pose a greater threat to ecosystem health (and by extension humans) than others.

Not all estrogens are bad!

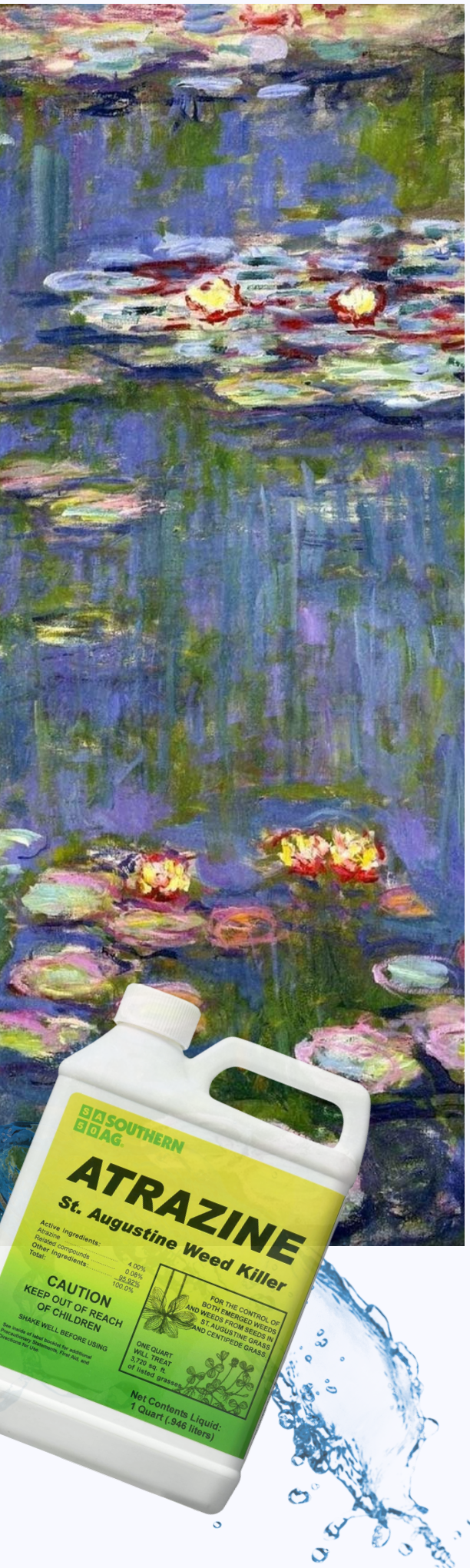
Estrogens produced by humans and animals, including estrone (E1), 17α/β-estradiol (E2), estriol (E3), are also ubiquitous endocrine pollutants of freshwater aquifers globally, though relative contributions vary vastly by locality. E1 mainly is responsible for the metabolism of adipose tissue and adipogenesis, E2 is imperative to the development of the nervous system, heart, and reproductive tract, as well as plays a critical role in female reproductive physiology, and E3 is only produced during pregnancy from E1 in order to protect the central nervous system during pregnancy [1].

But how do these human-made chemicals affect the environment? They actually then enter the environment via human excrement, as E1-3 and similar compounds are naturally excreted by humans of all sexes and leached into groundwater during sewage overflow events.

Humans and animals aren't the only organisms that produce estrogens, and they aren't always harmful to the environment!



Phytoestrogens are then categorized into four main classes: the isoflavones, the coumestans, prenyl flavonoids, and the lignans. As they are found in plant materials and soy products, they naturally occur in the environment and are consumed in the diets of humans and animals. Phytoestrogens play a beneficial role in its ability to regulate gene expression and/or cell growth in cell lines in culture and to influence reproductive functions in animal models. These chemicals have actually shown a protective effect against some cancers, cardiovascular disease, and osteoporosis [1].



Synthetic Chemicals

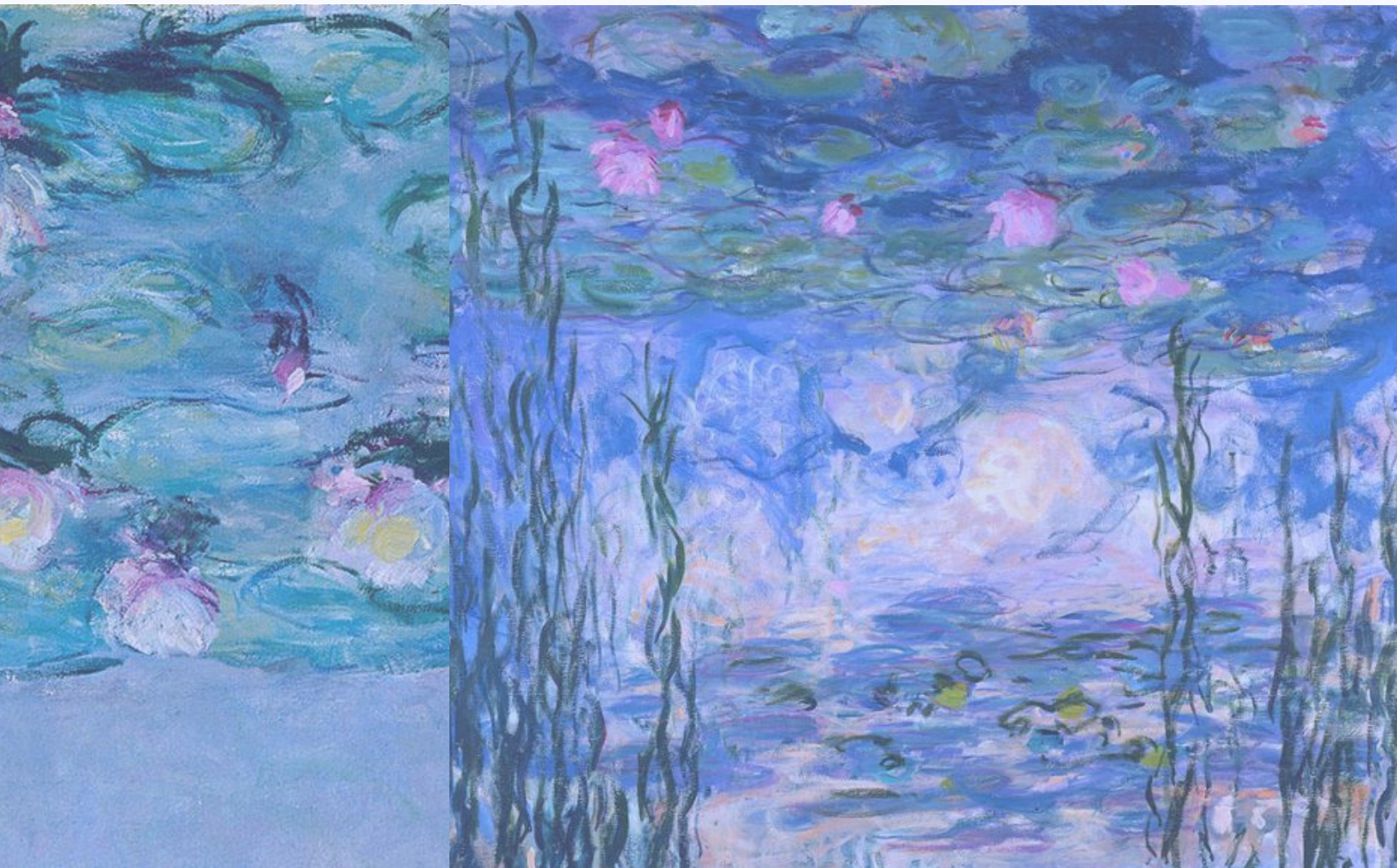
But what happens when there is a synthetic chemical that isn't estrogenic, but can still bind to estrogen receptors? This is the case of Atrazine and Trifluralin, which are commonly used as herbicides in agricultural environments and often make its way into wastewater runoff. The effects of a lack of water filtration from these chemicals are best described in a study published in 2006, where these chemicals were traced back to an industrial waste dumping site in the Llobregat River. These herbicides, often used to treat corn and soy crops, were not properly filtered from the wastewater of an industrial site known to manufacture pesticides. This specific river, the Llobregat river, is known to supply drinking water to the large city of Barcelona— however, this river also receives discharge from industrial plants known to manufacture salts, textiles, leather, and other materials; production industries in general are also among the largest - offenders of EDC pollution in waterways.

The presence of atrazine and trifluralin was first found in the dorsal muscle of dead carps and then in the raw water entering the water treatment facility. Previous monitoring of the water had not found any traces of Atrazine or Trifluralin, but was found 40 km from the source of pollution. The authors claim that the facility producing the pesticides had failed to properly filter their industrial waste and instead dumped it into the river (a common malpractice among production companies), further emphasizing the importance of proper water treatment systems in agriculture and production industries [4]. The water filtration industry is just as responsible for EDC pollution, as seen in the aquatic pollution of synthetic ethinyl estradiol (EE2), which is an estrogenic compound found in oral contraceptives (informally known as "the pill").

However, EE2 does not enter water supplies via industrial sites, but rather via wastewater containing human excretion. Birth control can be seen as an intentional endocrine disruptor, used to prevent pregnancy, but when leaked into water via poor water filtration, the endocrine systems of other living organisms may be disrupted. When chemicals such as EE2 enter the endocrine system, they often compete with bodily-produced hormones for binding to endocrine receptors (ER). When bound, they promote an active conformation of the ERs and are able to regulate genes [6]. Atrazine, in particular, up-regulates the expression of aromatase, which serves to transform androgen into estrogen in mammalian and human cell lines.

This up-regulation can cause an increased response to estrogen in some cases [4]. Because sex hormones are integral in the morphological development (ie dimorphism) of living organisms, imbalances and disruptions in the endocrine system via xenoestrogen exposure can interrupt reproductive development and cause abnormalities in the reproductive system [1].

All this to say, it's clear that estrogens can come from a multitude of sources, and its effects can range from good to not-so-good. In the articles to come, we will delve further into the environmental impact of environmental estrogens, its history, regulations, and much, much more.



The Corn Victim

Keanna (2016)

The leopard frog, also known as rana pipiens, is found in North America and enjoys consuming crops such as corn—however, this corn is treated with pesticides such as atrazine. The atrazine found in this source of food disrupts the leopard frog's ability to reproduce and affects their endocrine system.





WASTEWATER treatment 101

by victoria luu



how do EDCs enter our waterways?

So how exactly do various EDCs such as Atrazine, EE2, and phytoestrogens enter water systems to affect marine life and eventually our own bodies? We can start this conversation by beginning to look at exactly how wastewater is treated. Most EDCs can be traced back to toxic waste from industrial plants that leach into groundwater and drinking water sources or even be sourced from individual households. Thus, we can look into existing water treatment standards and examine exactly how these treatments work to tackle EDC contamination— or perhaps the lack of EDC filtration at these treatment centers.

Wastewater treatment is performed in the lens of public health— by proactively treating water, we can eliminate any water-borne pathogens and parasites found in drinking water and prevent population-wide infection. This frame of prevention has shaped wastewater filtration into three main steps:



SECONDARY TREATMENT

Various systems screen and settle out solids such as large debris, wood, and other materials. About 85% of organic and inorganic solids from raw sewage are separated during this step, and we are left with two categories of sewage: primary sludge and primary effluent (Bitton, 2011).

SECONDARY TREATMENT

- Primary effluent, which is primarily liquids, is sent to Aerobic Secondary Treatment. Here, aerobic microbial communities degrade biomass and reduce the amount of microbes in the water such as e.coli, vibrio cholerae (cholera), salmonella, and many others
- Primary sludge, which is made of solids, is sent to Anaerobic Secondary Treatment. Here, anaerobic microbial communities, which contain fermenting bacteria and methanogenic archaea, reduce the sludge into methane gas, carbon dioxide, and water.

These biogasses are valuable byproducts— methane gas is used to generate electricity, and carbon dioxide and water are essential for various ecosystems (Joakin & Fick, 2009).

Remaining sludge is oftentimes sent to farms in the Central Valley to be used as fertilizer. This is a source of potential contamination of EDCs in farm runoff due to remnant EDCs in the primary sludge.

TERTIARY TREATMENT

This stage varies between treatment facilities, but the most common form of final treatment is to treat the remaining effluent from the Aerobic Secondary Treatment with chlorine to kill off any remaining pathogenic bacteria, phage or parasite. This can also be treated with UV radiation or ozone to disinfect the water. Then, the treated water is sent to the ocean and other facilities to be used by the public.



is treated water 100% pure?

The quick answer is NO.

Certain molecules such as antibiotics, synthetic hormones, and other medications that are excreted through urine are too small to be filtered out through these methods of filtration. In addition, wastewater after filtration will still contain trace amounts of plastics, dyes, and heavy metals such as chromium, copper, and mercury (Bodzek & Dudziak, 2006).

This can be credited due to the fact that there are no existing microbial communities that are capable of breaking down these compounds.

In addition, the breakdown rate of these compounds are much slower than the time spent at the treatment center. Thus, these compounds are not filtered out properly and enter our ground and drinking water sources.





WHAT NOW?

Luckily, there are many researched methods of efficiently and effectively treating water for EDCs, it is just a matter of implementation and education of these extra steps that wastewater treatment facilities can take.

Some suggested methods are:

1. Increasing water treatment to a minimum of 10 days to allow more time for certain compounds to break down. Current systems filter water for around 5-7 days, which is not long enough for certain compounds to be filtered out.

2. The use of nanofiltration to filter out smaller molecules such as estrogen and other steroidal sex hormones. This method uses semipermeable membranes, which will help filter out micropollutants and ions.

3. Additional combinations of chlorination, UV treatment, and ozonation to allow a more holistic approach to wastewater treatment.

However, as of now, these systems are not used because they require more time and resources to implement, and they are not required by any governing body or legislation. Thus, water refinement techniques and wastewater processing plants are still releasing various forms of EDCs into the environment, and inviting them into our bodies and systems.



The New Fish & Frog

INTERSEX CHANGES IN FISH AND FROGS AND THEIR IMPLICATIONS

By Uday Birdi

When it comes to researching pollution, researchers have focused on the detrimental effects that foreign substances have on human health outcomes. High levels of air pollution in metropolitan cities such as Los Angeles have been correlated with higher rates of respiratory diseases. The use of DDT in the post-war era has been linked with multigenerational adverse health outcomes such as hepatic toxicity. Yet, the presence of EDCs in aquatic sources have had pronounced effects on the reproductive health of aquatic species.

To understand these changes, we have to understand what is in these aquatic bodies that may be causing the aforementioned effects.

Originating from poor wastewater treatment and the degradation of estrogen derivatives such as estrone, phytoestrogens such as 17-α ethinylestradiol (EE2) have led to serious reproductive issues in the bodies of male fish species [1]. These estrogen derived molecules are sources from multiple different outputs ranging from livestock waste via runoff and effluents, human waste excretion, and sewage plants [2]. Yet, phytoestrogens are not the only traceable medication that is responsible for gonadal changes in male sex frogs. Research has also placed the microscope on drugs such as metformin, an anti-diabetic drug that induces mRNA transcription of the vitellogenin gene [3].

This process is known as vitellogenesis and is the overexpression of the vitellogenin gene that is expressed due to higher environmental levels of estrogens [3]. The expression of this protein is a biological hallmark for determining estrogen overexposure [3]. However, what makes this phenomenon so convoluted is the interplay and possibility of other biological markers that may indicate vitellogenesis. [4] Research conducted by Dr. Gunnarsson and colleagues mentions the involvement of the ZP3 gene and specifically how exceeding levels of EE2 induces vitellogenesis with the upregulation of the vitellogenin gene [4]. The experiment showed that this response was induced by a dose concentration as low as 10 ng/L [4].

In addition to the changes in protein expression brought about by exposure to EE2 and metformin, atrazine is another synthetic pollutant that is persistent in aquatic environments. There is considerable scientific evidence that attributes the development of gonadal changes in fish species to atrazine. Most notably, Dr. Tyrone Hayes–a renowned amphibian biologist researcher–published research examining the effects of the compound on frog populations.

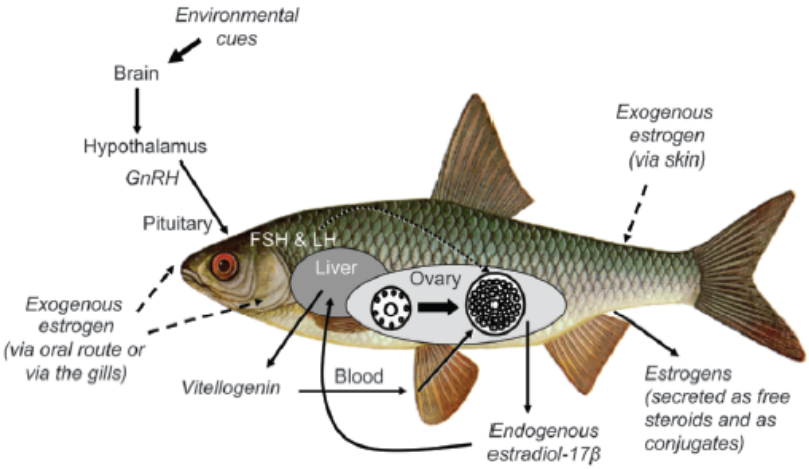
What he discovered was alarming. In African clawed frogs, exposure to the herbicide resulted in hermaphroditism with reported demasculinization of male species [5]. Hayes and colleagues hypothesized that atrazine induces the molecular conversion of testosterone to estrogen, which acts on various tissues in the body, leading to such morphological changes [5]. Macroscopically, this impaired sexual function and development could be resulting in global declines in ambibian populations, a potentially destabilizing phenomenon for ecosystems around the world [5].

Okay so there are these chemicals in the water that cause this genetic response. But what is so alarming about this genetic response?

Vitellogenesis refers to the onset of secondary sex characteristics, namely with gonadal morphology. Male fish or frog species exposed to these substances are characterized by the production of oocytes in the testicular tissue of these organisms.



Feedback mechanisms of vitellogenesis, as described by Tyler and Jobing, 2008.

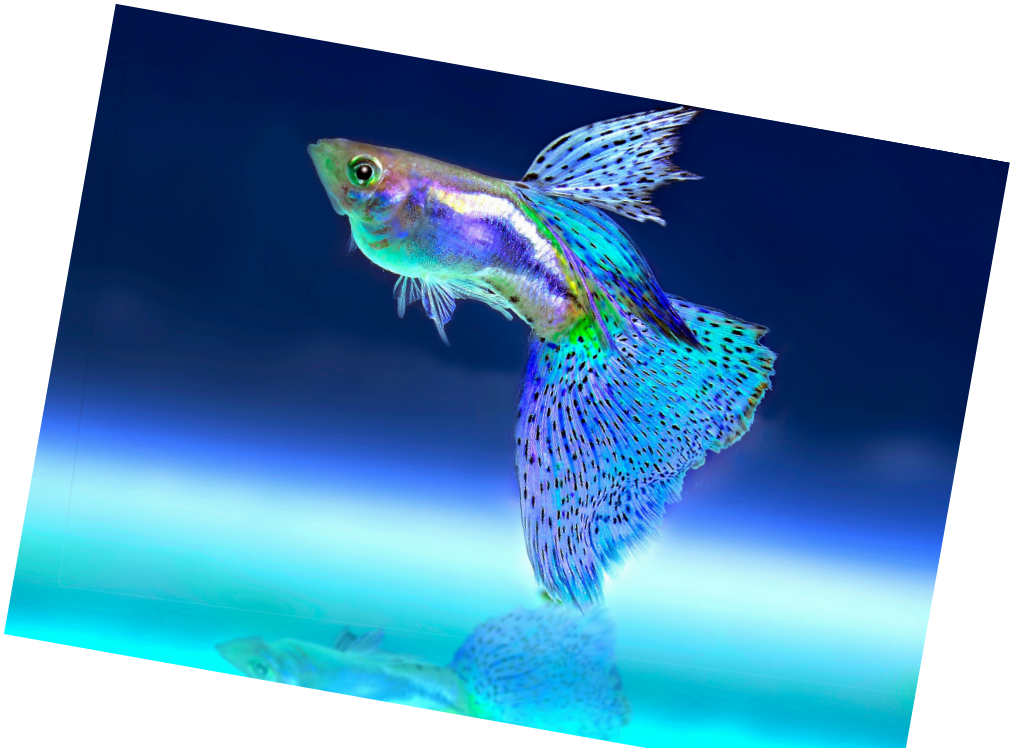


In essence, the influx of estrogens and the exceeding levels of this product in aquatic populations is causing the development of secondary sex characteristics in male frogs and fish. What is most concerning about this phenomenon is the effects that these gonadal changes may have on the reproductive abilities and behaviors of these fish. According to research conducted in the Ecotoxicology Journal, a cross-species and cross-platform meta analysis of Siamese male fish revealed that male fish of this species were less inclined to mate with female fish that were exposed to higher concentrations of EE2 [6]. This phenomenon implies a change in courtship behaviors, which has the potential to destabilize population dynamics in this species [6].

Are these changes to aquatic species to be considered as dangerous? Absolutely. However, we must outline the concern over these changes in the efforts to preserve healthy biological functioning rather than be appalled by the intersex changes brought about by EDC exposure. It is in a repulsive reaction to such changes that we

"We must outline the concern over these changes in the efforts to preserve healthy biological functioning rather than be appalled by the intersex changes brought about by EDC exposure."

embolden elements of societal cisheteronormativity. Essentially, male frogs that are subjected to intersex changes become symbols of pollution and abnormality from a cisheteronormative stance. It is this exact viewpoint we must avoid in order to better focus our efforts towards environmental justice. Otherwise, we empower bigotted viewpoints with yet another supposed “monster” or “alien”.



SECTION II.

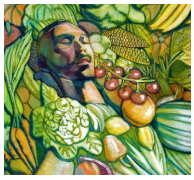
USING NATURE AS A METAPHOR FOR HUMAN HEALTH:



HETERO(ECO)NORMATIVITY

LET'S CATCH UP ON SOME THEORY, SHALL WE?

Queer Ecology



Queer ecology demands that greater attention be paid to how ecological reporting enforces specism, ableism, and biological essentialism in popular culture. A key get of queer ecology lies in elevating the status of the more-than-human world, be it in non-human animals used in experimentation, wild specimens, or the natural environment itself. Queer ecology recognizes that the same oppressive forces that devalue non-human life in relation to humanity similarly replicate binary evaluations of race, gender, and ability, always devaluing "minority" identities to reinforce hegemonic power (Sandilands-

Posthumanism



Knowing biological sex to be intricately modulated by gender, queer theory thus take on the mantle of posthumanist ideology and insist that historically anthrocentric conceptions of "culture," "gender," and "resistance" must be extended far into the more-than-human realm. "More-than-human" in this context refers not just to humanity's closest living relatives, but to all of life and indeed the earth as a whole. Posthumanism accepts that even nonsentient objects may act as agents upon others, and should be treated as such in intervention/care scenarios.

Critical Queer Theory



Critical queer theory approaches issues of gender, sexuality, and ability from a postmodernist perspective, particularly engaged with how multiple simultaneous identities intersect and modulate oppression to an individual. Queer theorists dissect current social norms, including those of heteronormativity-- the presumed universality of heterosexuality/stigmatization of queer identity), ability bias, and the performativity of gender in different scenarios.



BIOLOGICAL ESSENTIALISM AND THE NATURALISTIC FALLACY

By Luc Lorain

A particular failing of mainstream environmentalism has been in its prizing of a certain type of nature (green, undeveloped, and far from human contact) over those seen as tarnished (aesthetically displeasing locations such as swamps, urban landscapes, and dump sites). This narrow worldview hides the fact that modern society takes place in a fundamentally altered world-- whether its citizens enjoy it or not. In order to appease fears of what this pollution may do to human bodies, scientific professionals and mass media alike often fall back to an imagined "pristine" past-- one that is impossible to achieve, no matter how stringent conservation efforts are.

In order to correct these wrongs, we must move to eliminate the demonization of "pollution," along with its many hidden conotations.





Queering the "Natural" Order

Systems of oppression attempt to unite disparate minority identities under the mantle of the “unnatural,” the “monstrous,” and the “queer,” as seen in the frequency with which reports of environmental degradation are described using gendered verbiage in an implicitly negative way. As explored by scholars Mel Chen and Giovanna Di Chiro, female biopower--- the ability to create the next wave of workers-- can explain why certain bodies (especially the infertile, queer, or otherwise nonreproductive) are devalued with respect to the fertile majority (Di Chiro, 2010). The threat of otherwise “normal” individuals becoming disabled and approaching the queer mobilizes decades–old gender and sex panics in Western culture, as channelled in the animal realm through hysteria surrounding “transgender frogs” and intersex fish (Sandilands, 2016).

Giovanna Di Chiro combines the frameworks of econormativity and heteronormativity to create a new eco[hetero]normativity framework for assessing popular discussions of reproduction and development. In essence, the conflation of “lesser” animals with the essence of the “natural” world, modulated by documented instances of male-to-female or intersex gonadal shifts in animals, casts “feminized” animals as a imminent proxy for threats to “normal” human sexual reproduction. Narratives such as these link gonadal abnormality and apparent same-sex behavior in animals to disability, social burden, and the grotesque, epitmozing the 20th century European fears of challenges to heteronormativity and its effects. Through Di Chiro’s eclectic comparison of activists, community groups, and industry-funded research, one sees how appeals to the “natural order” abound in anti-toxics discourse, drawing upon the heteronormative concepts to uphold an idealized and “compulsory social-environmental order.”



UNJUST SOCIETAL BLAME AND THE NEOLIBERALIST PERSPECTIVE



The art exhibition "Museum of Banned Objects" imagines a world without birth control. (Museum of Banned Objects)

Michelle Le *debunks the misconceptions about the environmental impacts of "the pill."*

Throughout the history of EDC exposure, human populations and aquatic ecosystems have been the unfortunate targets of uncontrolled physiological changes. While exposure to toxins such as DES and DDT have resulted in transgenerational changes in human populations, other toxins, such as EE2 and DP, have been associated with reproductive morphologies in fish and frog populations, specifically reproductive changes that are associated with the development of intersex frogs and fish organisms. Yet, the impact on humans from this exposure is not associated with the same magnitude of physiological changes. Instead, human populations (specifically the LGBTQIA+ and women) find themselves being indirectly attacked by the discriminatory language embedded in the scientific literature reporting these findings.

Despite lackluster waste-water treatments and overbearing large corporations contributing the large majority of synthetic estrogens into the environment, academic literature tends to pay most of its attention to the presence of the synthetic ethinyl estradiol (EE2), an estrogenic compound often found in oral contraceptives (informally known as "the pill") that sometimes finds its ways to water supplies via human excretion. Much of the blame regarding the presence of these compounds in our environment tends to fall onto the users of the pill, rather than the large corporations and industries that enable and enforce the production of large amounts of estrogenic compounds. The pharmaceutical industry infamously creates a sense of confusion surrounding the release of estrogen into the environment with its lack of transparency found in the process of bulk drug production and filtration. Studies have found that the release of active ingredients in wastewater is not exactly regulated by governing facilities, and instead is decided by the pharmaceutical companies themselves [3]. A study by Joakim Larsson found that waste water in Hyderabad, India contained high levels of drug waste (specifically broad-spectrum antibiotics)— this water came from 90 bulk drug industries. Combined with the release of drug leftovers from human feces and urine, the amount of active ingredients in the wastewater was of concern to the health and development of living organisms [2]. This is just one example of how much of an impact chemical and pharmaceutical industries have on our environment.

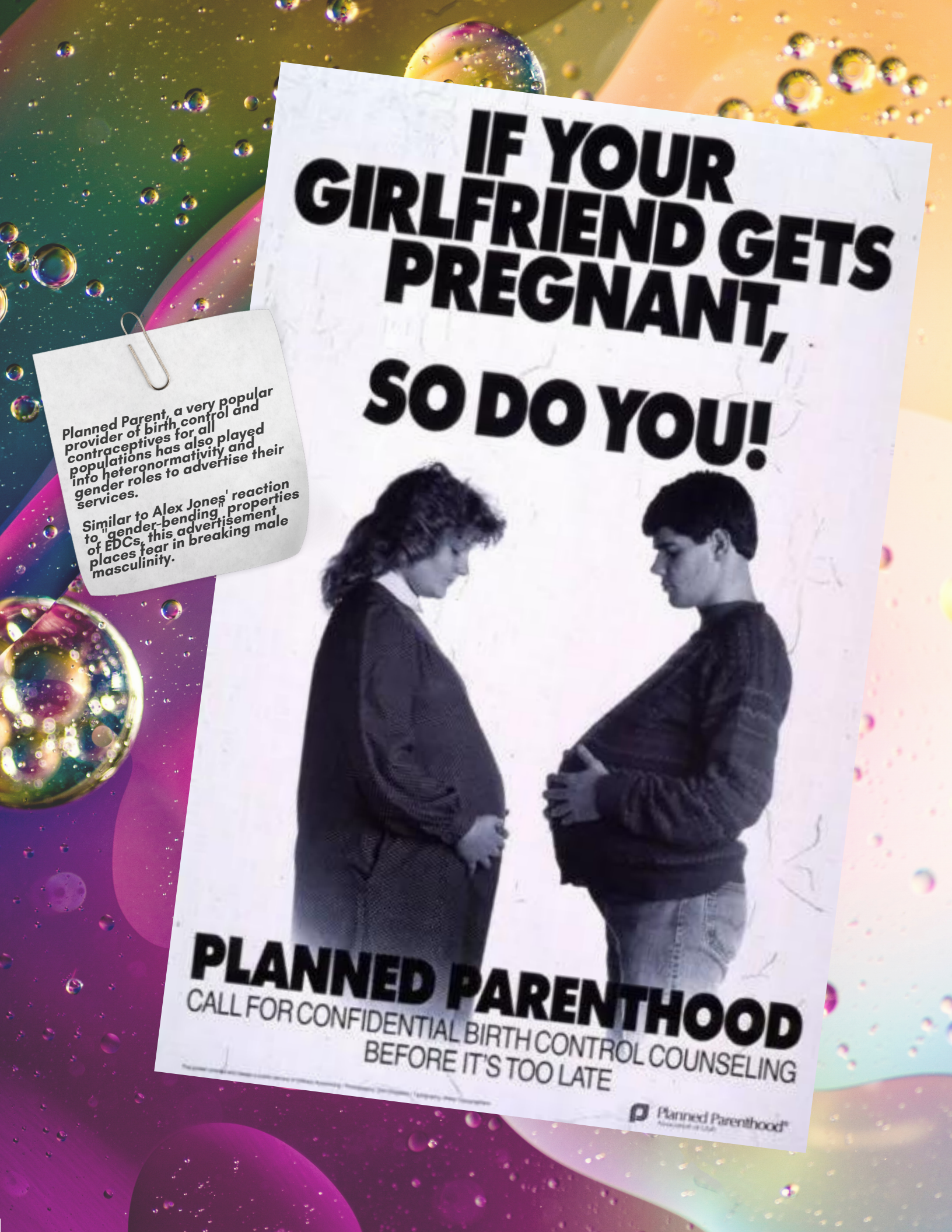
Despite the growing attention on birth control's environmental impact, scientific literature has found that synthetic estrogen from birth control makes up a negligible amount of the total aquatic estrogens found in waterways. EE2s are less prevalent in wastewater than other forms of naturally-produced and medicinally prescribed estrogens, all of which are effectively removed from the drinking water supply by existing chemical treatment processes. Estrogens enter the water table in higher concentrations through surface runoff (due to pesticides, plant and chemical-based industry, concentrated animal farm operations) and effluent dumping (CAFOs and industry). Regardless, EE2s can and should be limited from entering the environment through improved detection, treatment, and reduced prescription of estrogen-based BC.

So who exactly is causing all the fuss? Much of the discourse surrounding estrogen's environmental impact has been overstated by conservative groups fundamentally opposed to women's reproductive autonomy. Birth control is easily politicized and demonized by nonscientific actors, such as Alex Jones (as mentioned in the Editor's Note), who often claim sensational and alarmist harms to the environment to do so. Large institutions such as the Vatican and church officials have been known to target birth control on as many fronts as possible, including in environmental contexts as well.

For example, L'Osservatore Romano (the official Vatican daily newspaper) makes sweeping claims about environmental damage caused by birth control pills without quotations or sources [1]. Such alarmist headlines and discourse tend to distort real scientific inquiry, especially in the scope of intersex identification in some fish. They try to make sweeping statements on the mal-effects of synthetic estrogen in the environment from the pill, which in reality makes up only a small fraction of all environmental estrogens, and overlook the potential role of other chemicals. Their efforts to justify elimination of the pill are very clearly motivated by a disdain for the reproductive rights of women and those who are able to bear a child. Further, even if reduced use of usage of the pill can provide a significant change in estrogen exposure, the greater societal pressure for the responsibility of reproductive outcomes to rely solely on the female in heterosexual relationships necessitates a reconsideration as to how this responsibility can be shared in sexual relationships - and I'm not sure if the world is ready for that conversation.

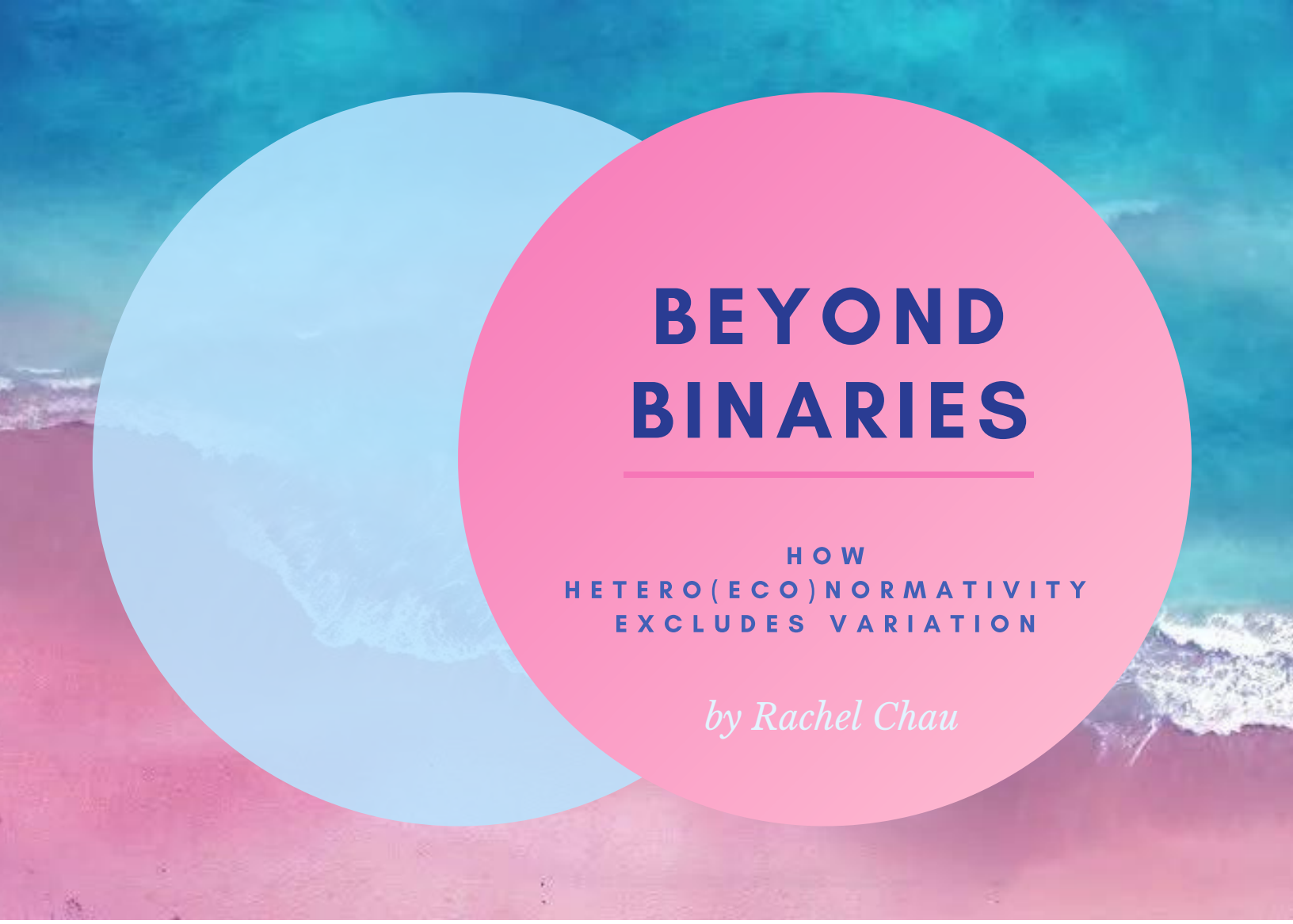


"Removing EE2 from the market will have a negligible effect on the environment, aquatic life, and human health. However, removing oral contraceptives from the market would be detrimental to women's health and their ability to decide the timing and spacing of their children and would have societal and global implications." - Amber Wise, ***Environmental Science and Technology*** **[4]**



Planned Parent, a very popular provider of birth control and contraceptives for all populations has also played into heteronormativity and gender roles to advertise their services.

Similar to Alex Jones' reaction to "gender-bending" properties of EDCs, this advertisement places fear in breaking male masculinity.



BEYOND BINARIES

HOW HETERO(ECO)NORMATIVITY EXCLUDES VARIATION

by Rachel Chau

In efforts to raise awareness about pollution and EDCs, the increasing use of alarmist rhetoric surrounding the effects of EDCs in waterways lead to oversimplified assumptions surrounding sex and sexual differences [1]. Scholars Malin Ah-King and Eva Hayward reflect on the adaptive nature of sex in the context of endocrine disruption.

Intersex is a term used to describe the sex of someone born with a variety of different sex and/or reproductive characteristics [2]. However, intersex conditions are frequently framed as an adverse effect of endocrine disruption, even though a diverse range of animals, including humans, are known to naturally produce offspring with nonbinary sexual morphology [3]. Additionally, biological characteristics, such as genes and hormones, contribute to a wide variation of sex characteristics, inferring that sex operates on a spectrum, rather than dichotomous categories and labels enforced by a binary [1].

While the negative environmental effects of endocrine disruptors are important to note, the alarmist language used to describe intersex or sex-altering conditions that result from EDC exposure often do not properly approach the topic of sex and an organism's respective biological abilities from an objective point of view. The use of problematic language within science frames apocalyptic narratives, which causes what Ah-King and Hayward refer to as "trans-sex panic" [1]. The circulation of harmful rhetoric used gets translated to political and social spheres, which then limits reproductive rights and stigmatizes the LGBTQIA+ community. Trans-sex panic offers a limited perspective on the many possibilities of sex, which ultimately frames sex changes and intersex characteristics as harmful [1]. Societal thinking is shaped by this narrative, where knowledge gets reproduced in politics, classroom settings, and more. and perpetuates heteronormativity. See more in Section III.

Intersexuality has historically been erased and stigmatized with negative connotations that categorize intersex people as abnormal. However, intersexuality explains the complexity of various sex-based traits in different species [1]. Genes and hormones contribute to a wide spectrum of gendered bodies, rather than absolute categories of male and female, where many species can change bidirectionally change their gender [1]. This can partially explain the complexity of understanding and assigning gendered traits in biology and the human body. Notions of sex as binary preclude the complexities and possibilities of sex. Various species of animal from across the evolutionary tree readily demonstrate hermaphroditism, fluid sexual anatomy, and otherwise "intersex" morphology, even in the absence of heavy environmental pollution [1].



This is Not a Frog

THE PROBLEM WITH TRANSLATING ANIMAL STUDIES TO HUMAN HEALTH OUTCOMES

BY VICTORIA LUU

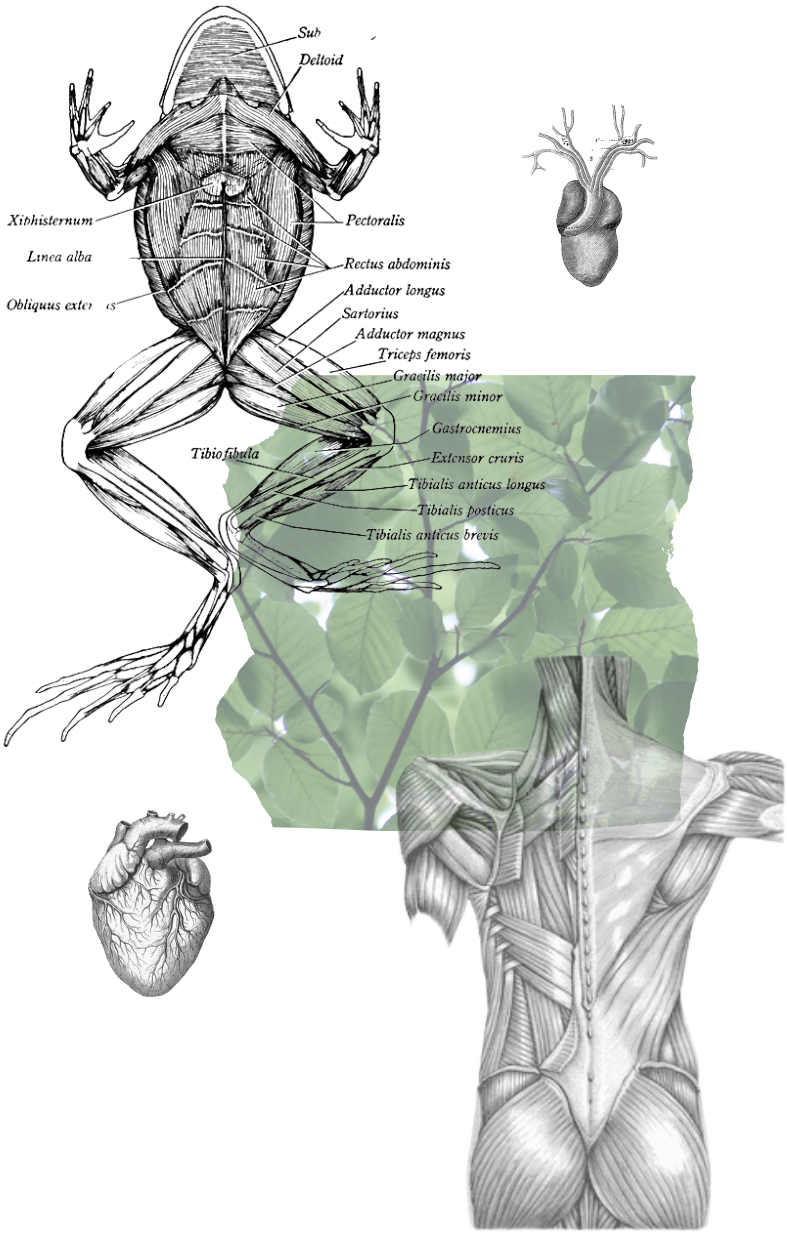
Setting the scene: in the classic sci-fi film Jurassic Park, paleontologist Alan Grant once famously claimed that frogs can "spontaneously change sex" after observing the park's dinosaurs were reproducing despite being all female. These dinosaurs had been injected with frog DNA, which supposedly gave them the ability to change sex. This famous scene in Jurassic Park may have been inspired by scientific findings on the fact that certain species of fish can switch sexes spontaneously as adults, or the fact that gender within fish is very fluid and nonconforming— despite this research, this fan-favorite form of fantasy science has left us with culturally-charged and inaccurate discourse on sex and gender within the scientific community. This act of translating animal studies in terms of sex and gender research to human health outcomes is problematic when we begin to think about its' impact on public health and LGBTQIA+ equity.

Let's talk about Intersex



If you were to launch a quick search on Google for “endocrine-disruptors” or “Atrazine,” you would be met with loaded terms such as “chemical castration”, “gender abnormalities”, and “demasculinized.” It has become the norm within the scientific community to use socially constructed terminology when it comes to research involving changes in sex due to endocrine disruptors— as a result, scientists have a tendency to dismiss “queerness” in animals while celebrating and emphasizing straight sex (Lambert & Packer, 2019). A prime example has been the constant use of the term “intersex” to describe diseased male fish and frog populations that have been found with female sex organs such as ovaries and eggs (Lallanilla, 2013).

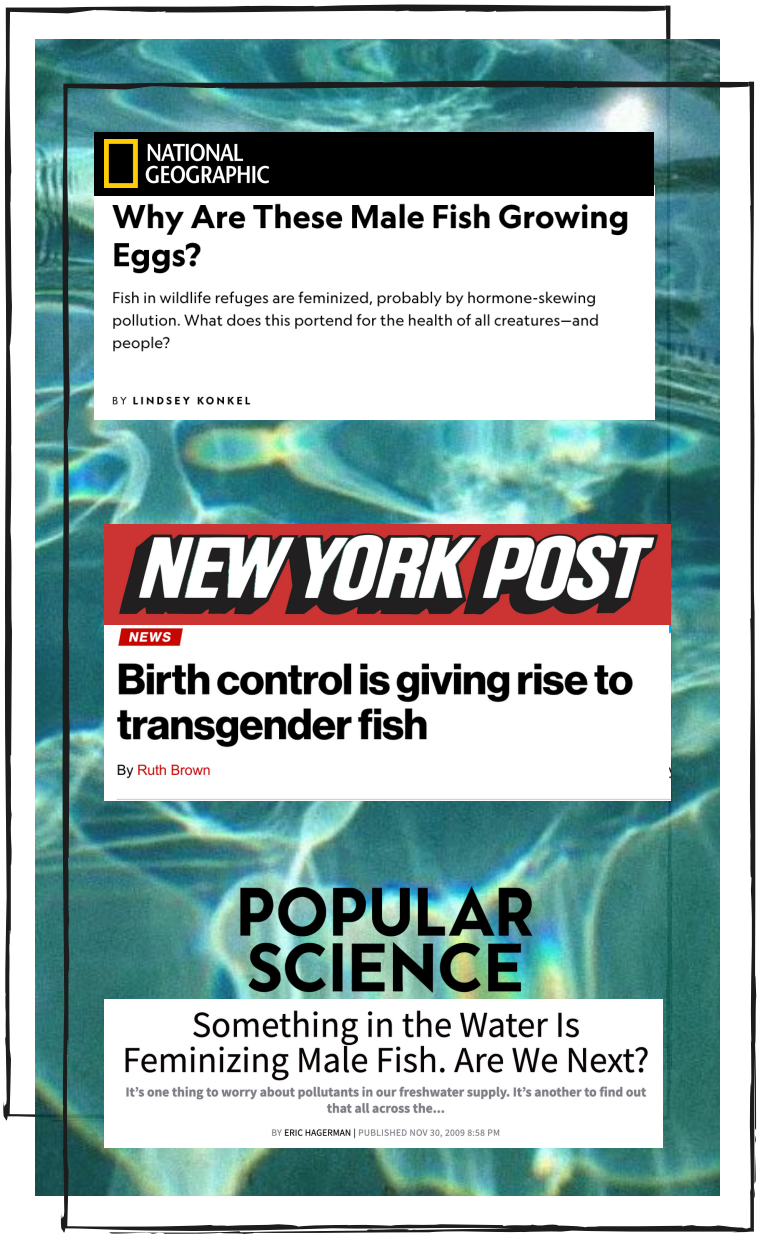
However, the intersex community already faces stigma, misconceptions, and lack of representation in the medical industry, popular media, and in science. To use this word intersex in conjunction with terms like “dangerous,” “deadly,” and “diseased” when talking about a completely different method of becoming intersex poses issues for how individuals perceive the intersex community (Clancy, 2021). For the fish, becoming intersex is indeed an issue that is harmful and dangerous for the health of the community. For humans, being intersex is something one is born with, and not at all dangerous. However, those who are not aware of this knowledge may assume that intersex is a deadly condition for all species, and will cause harmful narratives for the intersex community.



in the news

And that is exactly what has been happening— media outlets such as National Geographic, CNN, and FOX have grappled with this type of vocabulary when “educating” the public on the effects of EDCs on aquatic populations (Lambert & Packer, 2019). Conspiracists such as Lawrence Summers and Alex Jones have pushed these narratives with the intent of presenting scientific justifications for homophobic actions. This use of gendered language has led biology to be a crutch for political debates and narratives that are inherently transphobic and sexist.

The very same language is utilized by homophobic activists when advocating against LBTQIA+ rights towards access of healthcare, bathroom bans, and creating families (Perret, 2020). While the research may be conducted with good-intent and general scientific curiosity, the use of loaded terms such as “feminized” and “demasculinized” when describing amphibian populations have left homophobic individuals with the scientific justification to harm the LGBTQIA+ community.



De-Gendering Us

By translating all forms of animal studies to human health outcomes, we can see how the language used to dictate these findings affect public health as a whole. When scientists use such loaded terminology, the attention detracts from pressing issues such as declining amphibian populations, to say, how male masculinity is being attacked by chemicals in the water or that EDCs are turning individuals gay (Soto & Brilmyer, 2020). By viewing the findings of animal studies with a narrow lens, we ignore intersecting issues of language, political stance, and sexuality— these are all extremely important when approaching preserving public and planetary health.

De-gendering our methods of communication will allow us to break free from our heteronormative foundations, and allow the science to better support our ecosystems, human health, and overall planetary well-being.

As feminist scientist Ana Soto once claimed: “I must communicate the results of my research to them [laypeople]. They have the right to know; I have the obligation to transfer this knowledge, particularly if it has consequences that affect their health and that of their families" (Soto & Brilmyer, 2020). To downplay a scientific concept or finding through metaphors and inaccurate terminology can be dangerous— especially when it comes to human health.



SECTION III.

REGULATIONS & ACCOUNTABILITY

POLITICAL PONDS

BY UDAY BIRDI

With the circulation of endocrine disrupting chemicals like phthalates, atrazine, and phytoestrogens, there is a potential for bodily impact to humans as well. After all, we have already showcased the immediate effects inflicted upon aquatic species. Yet, is this a treatable issue? Better yet, was this something that could have been prevented by institutional action?

It is this exact governmental inaction that we must examine in order to understand the origins of our current predicament.



History of Litigation

In the past two decades, there have been two federal court cases that detail the persistence of EDCs in the environment. In American Farm Bureau et al vs. US EPA, the American Farm Bureau Federation and the Pennsylvania Farm Bureau challenged the EPA and six Chesapeake Bay states on the standardization of chemical levels in the Chesapeake Bay with a metric known as the Total Maximum Daily Load (TMDL) [1]. The crux of the contention from these organizations was based on a federalist divide, meaning that states should have the independent authority to impose their own TMDL levels irrespective of what the federal government imposes [1]. However, the federal courts sided with the US EPA affirming the supremacy of federal bureaucratic organization over state regulatory agencies [1]. Yet, in 2014, federal courts ruled in favor of the corporation Syngenta Corp et al in court case Syngenta Crop Protection LLC vs Greenville, IL. In this case, the plaintiffs (residents of Greenville, IL) contended that Syngenta sold pesticides to farmers of the town while being aware that their product contains atrazine, a chemical substance that has also been linked with the development of secondary sex characteristics in fish and frogs [2]. This phenomenon persists as atrazine is still present in runoff streams into local water sources. Yet, Syngenta was able to justify the inclusion of atrazine by maintaining that these levels were below EPA levels for products [2]. This resulted in the court case victory for Syngenta and their continued use of atrazine containing products.



Deceit and Manipulation: The Corporate Side

While court cases like Syngenta Crop Protection LLC vs Greenville, IL have enabled corporations to disseminate products and waste byproducts that serve as endocrine disrupting chemicals in the environment, these same corporations have utilized a variety of tactics to avert strict regulation. Brett Aho, a business professor at Roskilde University in Denmark, examines the strategies employed by these corporate monoliths in subverting government regulations. He surmises that corporations utilize the primary technique of false engagement with science among other tactics [3].

In an ideal world, corporate engagement with science would typically look like the funding and publishing of independent scientific studies that examine the safety and efficacy of their products for their intended purpose. But in the real world, the story is completely different. Corporations in the chemical industry will oftentimes fabricate scientific studies via “ghost writing”: a process in which an independent scientist will sign onto a study conducted by the company themselves [3]. Moreover, these corporations employ the use of certain “support groups” or seemingly credible organizations that advocate for the usage of these products, but the origins of these organizations are often dubious and do not establish any credible presence in academia [3]. This art of deception seeps into the rhetoric used by these corporations in describing their product for mass consumption [3].

In particular, the language utilized does not capture the toxic nature of these chemicals and is employed for the purposes of bypassing regulations. Bypassing such regulations allows corporations to maintain the steady line of production without delays in recall that may financially harm the organization.

In Syngenta's case, we are able to see the same level of corporate engagement with science, but it is taken to extreme measures. In 1997, Dr. Tyrone Hayes–an assistant professor at UC Berkeley known for his research on endocrine function of amphibians–was approached by Syngenta to experimentally investigate the effects of atrazine on frogs [4]. Hayes accepted, but what he found was concerning. Hayes observed that male frog's exposure to atrazine seemed to impair sexual development to the extent that these males tended to develop eggs in their androgenic tissues [4]. He used these findings to validate his concerns that human concern may yield significant health risk outcomes against human populations as well [4]. What Hayes did not realize was that he was not supposed to find the ill effects of atrazine. Following his report on his studies to superiors at Syngenta, Hayes was subject to harassment ploys by the company in an effort to discredit his work and career [4]. Some internal documents reveal plans such as the publication of third party researchers, the public revealing of all emails, and even the investigation of Hayes' family [4].

The Solution

Corporate bullying, harassment, and intimidation conducted in a manner to obscure the truth from the public, Syngenta perfectly encapsulates the organizational wrongdoing conducted by companies in the chemical industry in an effort to choose profit over public health. So if the chemical industry is getting away with such blatant offenses, is there even a solution towards countering these corruptive methods?

There is. But in order to tackle a systemic issue, there has to be a systemic remedy. In order to impose a public sense of accountability against these corporations, private and public entities must bring these corporations to court. In 1997, Noah Sachs–an author in the Columbia Journal of Environmental Law– stated that under the product doctrine liability, litigation against these companies can be cited under the possibility of these products inducing bodily harm on the public [5]. Action is not only limited to individuals, but also government regulatory bodies that have posed these statutes as well [5]. Sachs states that the EPA has the power in setting regulatory standards under acts such as the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Food, Drug, and Cosmetic Act (FDCA), the Clean Air Act (CAA), the Toxic Substances Act (TSCA) among others [5].

Specifically, there is literature to support the expansion of this regulation under the Clean Water Act [6]. The statute states that law must accommodate emerging trends with legislative changes from time to time [6]. According to a Sustainable Law & Policy Law paper from 2010, the continual disposal of EDC-laden wastewater into water sources is a violation of the Endangered Species Act (ESA) as the author cites the documented harm coming from these chemicals against aquatic populations [6]. What is more concerning is that the report indicated a potentially "significant lag time" between exposure to EDC chemicals and the secondary risks or disorders that are caused due to exposure. The report identified the duration of the delay to be in "decades" [6]. This puts an onus on regulatory agencies such as the EPA to revise their regulations out of protection for the environment as well as the general public. Any efforts to not change the current legal statutes and regulations that allow these corporations to dump toxic chemicals into the environment should be considered egregious negligence.



It is exactly this negligence to change and enable the history of the government that has led to our current predicament. An environment in which synthetic, toxic chemicals seep into the ground and deliver physiologically altering states to aquatic species. For decades, corporations in the chemical industry have fabricated, manipulated, and distorted scientific methods to feed lies to the average consumer while covering up the environmental damage that has incurred. These actions must be halted through the synergistic efforts between private entities' actions in court and the revising of legal regulatory standards. Otherwise, we may be putting the health of our future generations at risk again.



SEX REASSIGNMENT:

A form of eugenics through bodily regulation

By Rachel Chau

Imagine someone making an irreversible decision regarding the form of your body without your consent.



This is the unfortunate reality of many intersex, transgender, and gender non-conforming individuals. With harmful undertones of eugenics normalized by the social binary, forced sterilization and sexual reassignment procedures directly contribute to heteronormativity and perpetuate the marginalization of disabled, queer, and gender non-conforming groups [1].

Read more →

Sex reassignment refers to various medical procedures, like surgery, that help people transition their physical body to match their gender identity [2]. While terms like “sex reassignment,” “gender confirmation,” and “gender affirmation” are used interchangeably, gender affirmation or confirmation is more commonly used. Additionally, it’s important to note that sex reassignment specifically alludes to the surgeries, where as gender affirmation or confirmation is a broader term that encompasses medical procedures and social practices [2]. Sex reassignment procedures are commonly used in gender affirmation healthcare, especially for transgender individuals. Around 1 in 4 transgender and non-binary individuals choose gender affirmation surgery, which can involve a variety of different procedures like facial reconstruction, chest surgery, genital surgery, hormone therapy, and voice therapy [2]. See next page for the specifics of these surgeries.

Unfortunately, there’s also a flip side. It’s not always the case that sex reassignment or gender affirmation processes are desired. Transgender, intersex people, and parents of intersex children are often pressured to submit to medical practices that alters their body, which can inflict physical and psychological harm [1]. These societal pressures result from negative stigma surrounding LGBTQ+ individuals and flawed desires of normalcy. The adherence to a gender binary of male or female and being “normal” leads to unnecessary, irreversible surgeries and procedures on intersex people [1]. This can include the reduction of size or elimination of “unwanted” sexual characteristics without the consent of individual receiving the surgery. These surgeries only do good when the patient is fully informed and consents to it. If not, they can lead to physical and emotional consequences that affect psychological well-being with long term effects such as, hormone replacement, nerve damage, and sexual function or fertility issues, especially if the decision was forced or pressured onto the individual [1].

While sex altering surgeries and treatments are extremely important and beneficial to transgender individuals who choose to use medical procedures in their transition, we cannot ignore the vast historical usage of medical procedures that were wrongfully inflicted on disabled, queer, and BIPOC groups [3]. We tend to think that eugenic practices were a thing of the past, and many have forgotten about the long historical implications of eugenics, but that is far from behind us. Originally framed as a way to improve the quality of human genetics, eugenics is based on flawed scientific evidence that justifies discrimination against those with “undesireable” characteristics [3]. This manifested as political, social, and medical interventions through negative stigma, immigration restrictions, anti-miscegenation laws, and forced sterilization [3]. The goal was to create a society with the most “superior” genes, which meant a society of white, cisgender, neurotypical, and abled-bodied individuals [3].



TYPES OF GENDER AFFIRMATION PROCEDURES AND PRACTICES:

Top or chest surgery

removal of breast tissue or enhancement of breast size and shape [2]

Bottom or genital surgery

removal or reconstruction of primary sex characteristics or genitalia [2]

Name and pronoun changes

changing names and pronouns to fit a more culturally masculine or feminine name [2]

Hormone therapy

increases hormones that influences masculine or feminine characteristics and body function [2]

Voice therapy

adjusting voice or tone based on preference and/or gender stereotypes [2]

The history of these types of surgeries derive from eugenic undertones of shame and stigmatization, where parents and doctors often conceal intersex diagnoses and treatment for the child [1]. Parents may choose to have a life altering surgery for their child without them knowing or wanting it because it would make them “more normal”. They make their best guess on which gender they think their child is, but these decisions would have long-term adverse effects, especially if the decision ended up being the opposite of what the child could have wanted [1]. Many people who experienced this and never knew about their intersexuality faced a shocking discovery when they accessed their medical files as adults [1].

STRAIGHT FROM THE SOURCE:

"They didn’t tell my parents. My parents didn’t know that they had deemed me a pseudo-hermaphrodite. My mother was kept under sedation for three days when I was born until they could tell her what I was." [1]

"When you’ve been lied to thoroughly throughout your life by so many authority figures, including by doctors ... when you’ve been lied to so systematically like that, it’s really hard to know who you are. I have major trust issues because every person who should have been devoted to my care, it turns out they were lying to me—my parents, my doctors." [1]

"It said...male pseudo-hermaphrodite, 46 XY. I was like: ‘oh my god, I am a boy. I’m a f*cking male and I’m a hermaphrodite... So that put on a whole new layer of shame. I was just like: I’m a f*cking monster. I’m a guy that somehow like turned into a girl and that’s also a hermaphrodite, and that’s pseudo and there’s some numbers with XY". [1]

AS SEEN ON TV:

Previously on Grey's Anatomy...

Rebecca “Bex” Singleton is a 14 year old girl... or so they and their parents thought. Bex always felt different from their peers, struggling with mental health issues and not fitting in. When Bex came into the hospital with a hormonal imbalance, the doctors found a tumor, and realized that it compressing a teste, not an ovary. The surgeons and psychologist informed Bex’s parents, but they requested that the surgeons not tell Bex about their diagnosis and to remove Bex’s teste along with the tumor without them knowing. The lead surgeon declines because she does not agree with the ethicality, but other doctors might not have. In the end, Bex finds out and explores the possibility that they could identify as a boy. If they weren’t informed and given adequate resources, they would have continued to struggle with mental health and not fitting in, instead of being able to decide their own fate with gender. [4]

HOW SEX AND GENDER GETS TRANSLATED INTO POLITICS:

EVERYDAY IMPLICATIONS

By Rachel Chau

Bathroom Bills

In 2016, HB2, also known as the "bathroom bill", passed in North Carolina [1]. The now-repealed bill required people to use public restrooms based on the sex listed on their birth certificate [1]. Although the only state to pass HB2, North Carolina is far from alone when it comes to legislative restrictions regarding bathroom usage. Over 71 bills introduced in 2014 to 2018 involve the efforts of the government in restricting bathroom access through legalizing discrimination and criminalization of transgender and gender non-conforming individuals [1]. These restrictions perpetuate and justify transphobic ideologies.

Jason Gross uses art to express his frustrations as a trans youth in regards to restrictive bathroom policies dictated by many public schools [2].



artdweeb.tumblr.com

"I was really frustrated... I also hated going out in public because unless I was extremely lucky there wouldn't be a gender neutral or single stall bathroom anywhere," he said. "It was a constant source of anxiety for me knowing that if I pass I'll look like a boy in the girls' room, if I don't pass I'll look like a girl in the boys' room, and either way this is inviting confrontation. I didn't want confrontation. I just wanted to pee." [2]

This reinforcement of the gender binary not only conflates gender and sex, but erases intersex, trans, and gender non-conforming individuals [1]. The government's restrictive policies harm and exclude trans and gender non-conforming people, perpetuating stigma and discrimination that invalidates genders that do not adhere to the binary logic of male or female [1]. This also perpetuates and justifies verbal or physical abuse, sexual assault, and violence against LGBTQIA+ individuals. Refusal to acknowledge that inclusive changes need to be made only makes the problem worse by ignoring the experiences and identities of LGBTQIA+ individuals.



"It's not about bathrooms. It's about the humanity of trans people, about us having the right to exist in a public space."[1]

- Laverne Cox

Reproducing Knowledge

BY RACHEL CHAU

‘Don’t Say Gay’ bill was recently passed in Florida [1]. Talk about a step in the wrong direction. This bill is part of a series of Don’t Say Gay Bills, which prevents the discussion of LGBTQ+ issues and sexual orientation [1]. The bills completely prohibit the teaching and considerations of LGBTQ+ issues in public schools [1]. This is especially harmful because those who are experiencing discrimination, bullying, or other mental health problems associated to identity crisis, would not be able to discuss their concerns with guidance counselors, teachers, or other staff members.

Overall, this bill contributes to government restriction on discussions LGBTQIA+ topics and issues, perpetuating heteronormativity, which excludes gender non-binary, trans, and intersex individuals.This is just part of the pervasiveness of heteronormative ideas and how the government circumvents LGBTQIA+ topics in a space where youth are learning and developing their ideas and identities. This contributes to further stigmatization, anti-LGBTQ+ ideals, bullying, and mental health problems, while erasing LGBTQIA+ identities.

These bills have been implemented in many states, but it was first introduced by Tennessee in 2005 [1]. Since then, it has continued to evolve and become increasingly more restrictive. Missouri’s version was introduced in 2012, and is considered more expansive than Tennessee’s [1].



revenge of the frogs





Can you help the "gay frog" get to the Alex Jones as soon as possible?

They have some talking to do :)

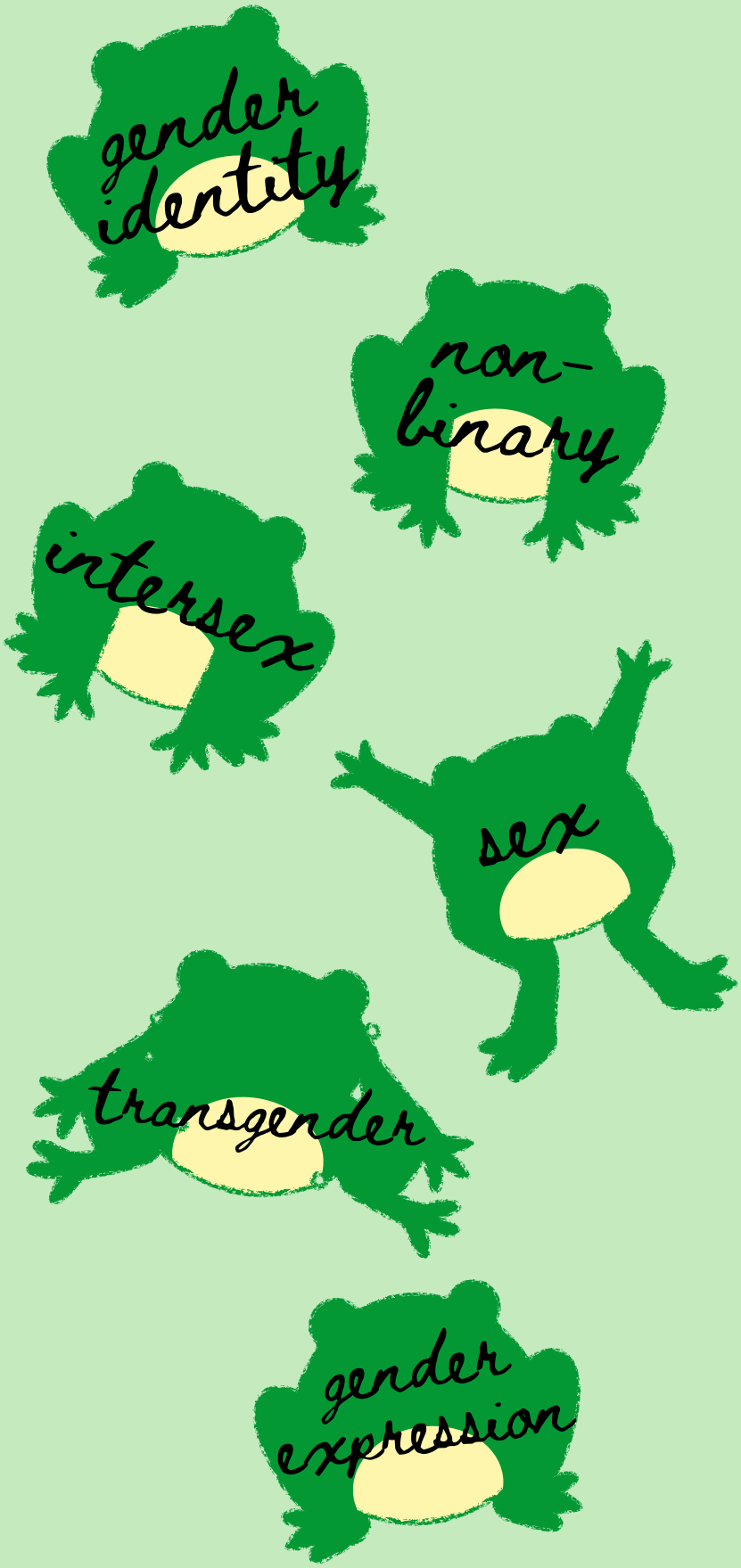
SECTION IV.

RHETORIC



MATCHING GAME

TEST YOUR KNOWLEDGE ON TERMS RELATING TO SEX AND GENDER BY MATCHING EACH FROG TO ITS LILYPAD



umbrella term that describes a person who does not exclusively identify as male or female [1]

a person's inherent sense of self and being as any combination or blend of male or female [1]

someone who is born with various sex and/or reproductive characteristics [1]

how a person chooses to present the gender they identify with; may be with clothes, makeup, behavior, etc [1]

a label of male, female, or intersex assigned at birth based on external anatomy [1]

describes someone whose gender identity and/or expression is different from their sex assigned at birth [1]

MATCHING GAME

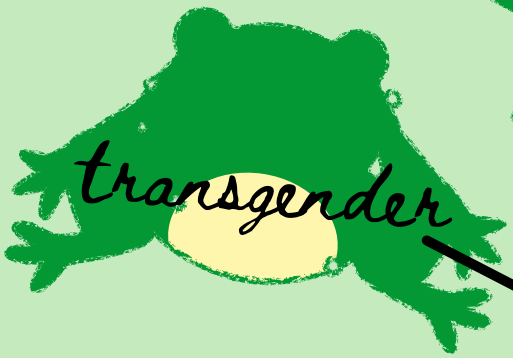
TEST YOUR KNOWLEDGE ON TERMS RELATING TO SEX AND GENDER BY MATCHING EACH FROG TO ITS LILYPAD













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NEW WAVE OF Gendered Metaphors

BY UDAY BIRDI

To dismantle the issue of problematic language use in scientific literature detailing the intersex development of male species, we must search for alternatives that connote inclusivity and acceptance. By doing so, we dismantle the cisheteronormative bias and narrative that has persisted in scientific literature and society at large. After all, it is the promotion of this language that empowers pundits like Alex Jones to spew homophobic and transphobic notions into society, causing the further entrenchment of heteronormativity in the social fabric.

On the issue of reporting trangender fish as “demasculinized” male fish species or “feminized” male frogs, we must understand the manner in which this language is considered problematic. For instance, an article in the *Science* journal described the intersex changes that male frogs went through as frogs that ‘not only became submissive, like females, but also apparently send out come-hither signals to the bro’s in their tank’ [1]. Embodied within this statement are palpables notions of transphobia as well as misogyny, undermining the credibility and strength of the findings. It is hard to believe that this is just one of many examples of gender biased language in scientific literature in regards to the intersex changes brought about by EDC exposure. When analyzing this claim, the misogynist statement of equating submission to females is particularly problematic. By equating feminization with the emasculation of male frog species, we connote the female nature as being devoid of the male character. In particular, due to the entrenchment of cisheteronormative standards, we associate the male character with strength and courage. Thus, the application of the term “feminizing” is perceived as a removal of these traits. In fact, it is in this connotation that we perpetuate sexism and anti-feminist notions.

Yet, what is interesting to observe is the progression of this exclusionary language in contexts outside the scientific literature, which may perpetuate its usage within academia. Discussed in an essay entitled *Polluted Politics? Confronting Toxic Discourse, Sex Panic, and Eco-Normativity* by professors at Indiana University, environmental feminists revive rhetric utilized in historical “sex panics” in order to emphasize the toxic aspects of the chemicals while downplaying the other plenary effects that it may have on the bodies of these fish [2]. In fact, Di Chiro develops a framework that combines aspects of heteronormativity and econormativity to synthesize an (eco)heteronormativity approach to decomposing the language around gendered animal reproduction [2]. Specifically, Di Chironi identifies how the intersex gonadal development of seemingly “lesser” animals are equated with the sexual dangers that may be

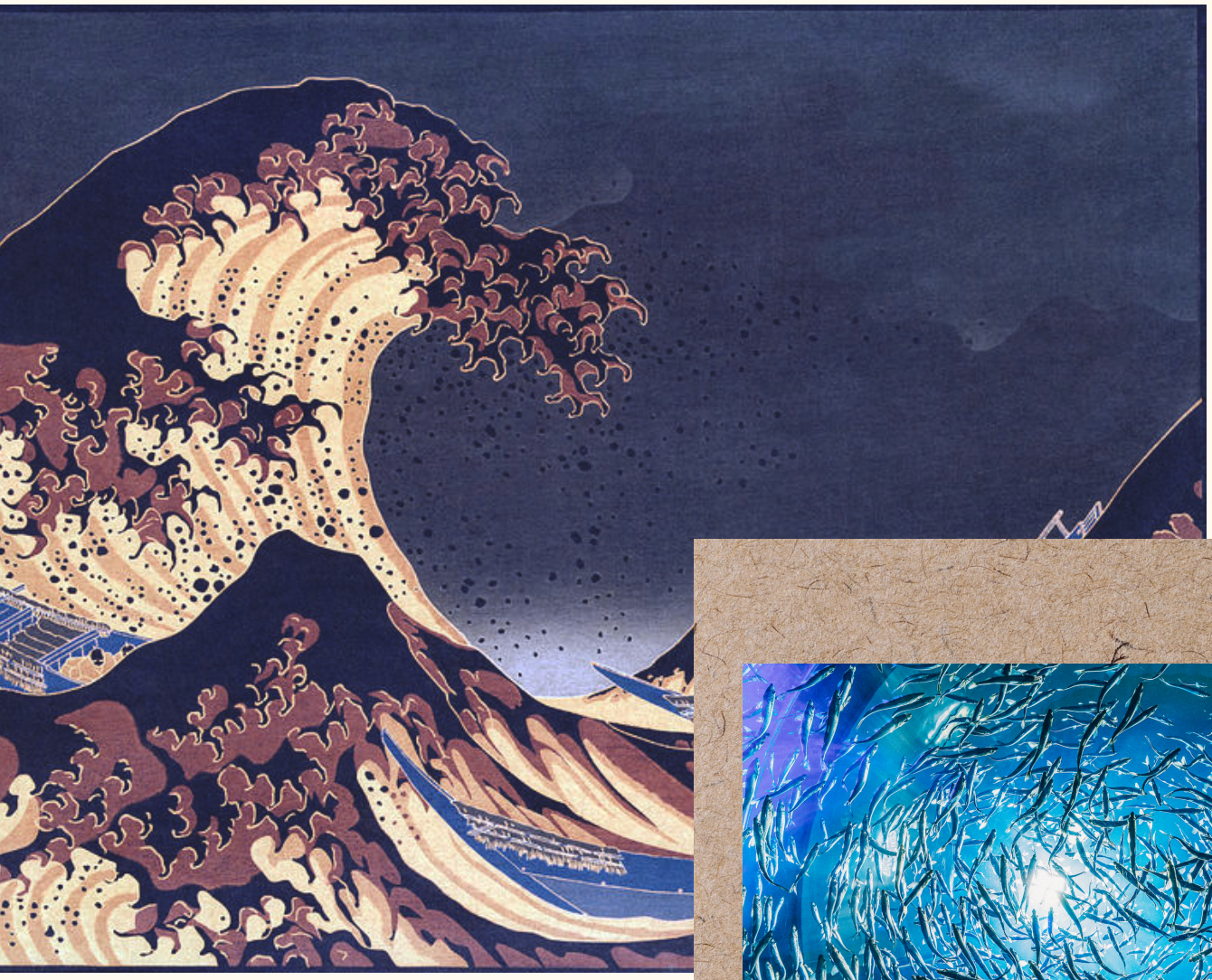
posed to human populations [2]. Framing it in this manner, this language underscores the supposed danger of intersex phenomenon in aquatic species; thus, there is an added emphasis towards a cisheteronormative messaging at the bedrock of this messaging.

What may be more alarming is that this language is not limited in its heteronormativity, but also inflicts a degree of alienation and discrimination against the LGBTQIA+ community. By portraying intersex gonadal development as an anomaly in the advocacy of environmental justice via EDCs regulation, this language perpetuates elements that inhibit the development of a coalition amongst LGBTQIA+ individuals [2]. Essentially, this language sows distrust into this particular demographic since sexual fluidity is placed under the microscope as a noxious byproduct of contamination. It is also imperative to note that the alarmist attitude given to intersex development is detracting from the dissemination of vital information, such as the potential carcinogenic effects that pollution of chemicals such as DBPs, atrazine, or EE2 may have on human populations. Essentially, the harmful nature of this rhetoric extends out of the discriminatory potential into the realm of dangerous misinformation. Focusing on the intersex changes of fish in this hyperbolic wording and its tangential relation to human reproduction relegates the more serious immediate health impacts of EDC exposure such as potential carcinogenic or immunological effects.

In addition to the (eco)heteronormative perspective that punctuates heteronormativity and transphobic notions, scientific literature has increasingly incorporated a novel type of metaphors that equate environmental and human health. The health metaphor and its application to aquatic bodies and its inhabitants carries attempts to assess the impacts of poor aquatic conditions with those of human health. For instance, researchers have attempted to utilize a “river metaphor” when evaluating the health of aquatic systems [4]. “Diagnosis” of these “river health” problems are reported to be determined holistically and can have traces in identifying issues in human health systems [5]. The intent behind this application is to reduce the rigidity of traditional scientific language in academia in a constructive manner that enables public understanding more effectively. Yet, the use of these metaphors must be taken with a sense of caution. As mentioned before, the application of metaphors equating environmental health with human health is intended to identify indicators of stress and poor health in human populations through the identification of noxious effects in aquatic bodies. However, it must be emphasized that proper health functioning can not be completely equated to the function of a particular organ in the body (this would equate to the workings of a particular aspect of the river such as the estuary). As a result, there are limitations to the application of metaphors such as “river health” that can confound the specificities of aquatic and human health maintenance.



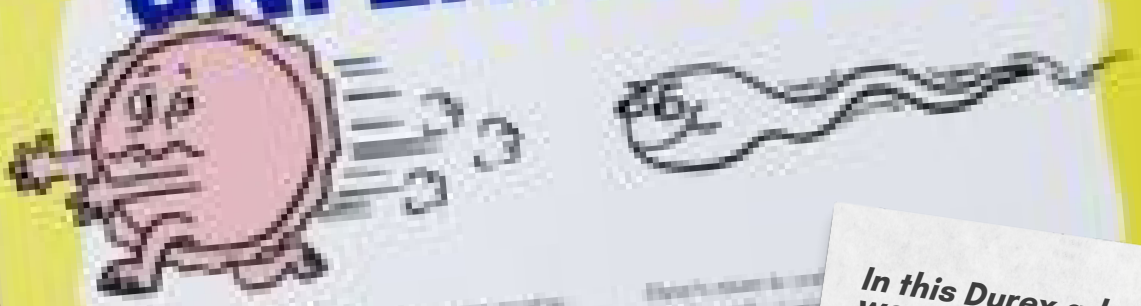
Yet, what is more troubling is the double reinforcement represented by the synergy between gendered language and the use of metaphors. What sort of double reinforcement? If anything, it seems like the average joe can finally understand scientific jargon that PhD students use on the daily? Sure, scientific language may seem simplified. But it's in this simplicity that transphobia, sexism, and misinformation creeps in. As I have highlighted above, there are sources that are riddled with sexist and transphobic notions, but the attempt to equate the complexities of environmental health with human health via dangerously oversimplified metaphors represents oversimplification bordering on misinformation. This is where credible, clear, neutral scientific language must be input to adequately inform the public regarding the dangers of EDC pollution. Otherwise, we must comb through the veil of "isms" that people like Mr. Jones set while parsing through the superficialities of oversimplification.





HOW DO YOU LIKE YOUR EGGS IN THE MORNING?

FERTILISED OR UNFERTILISED?



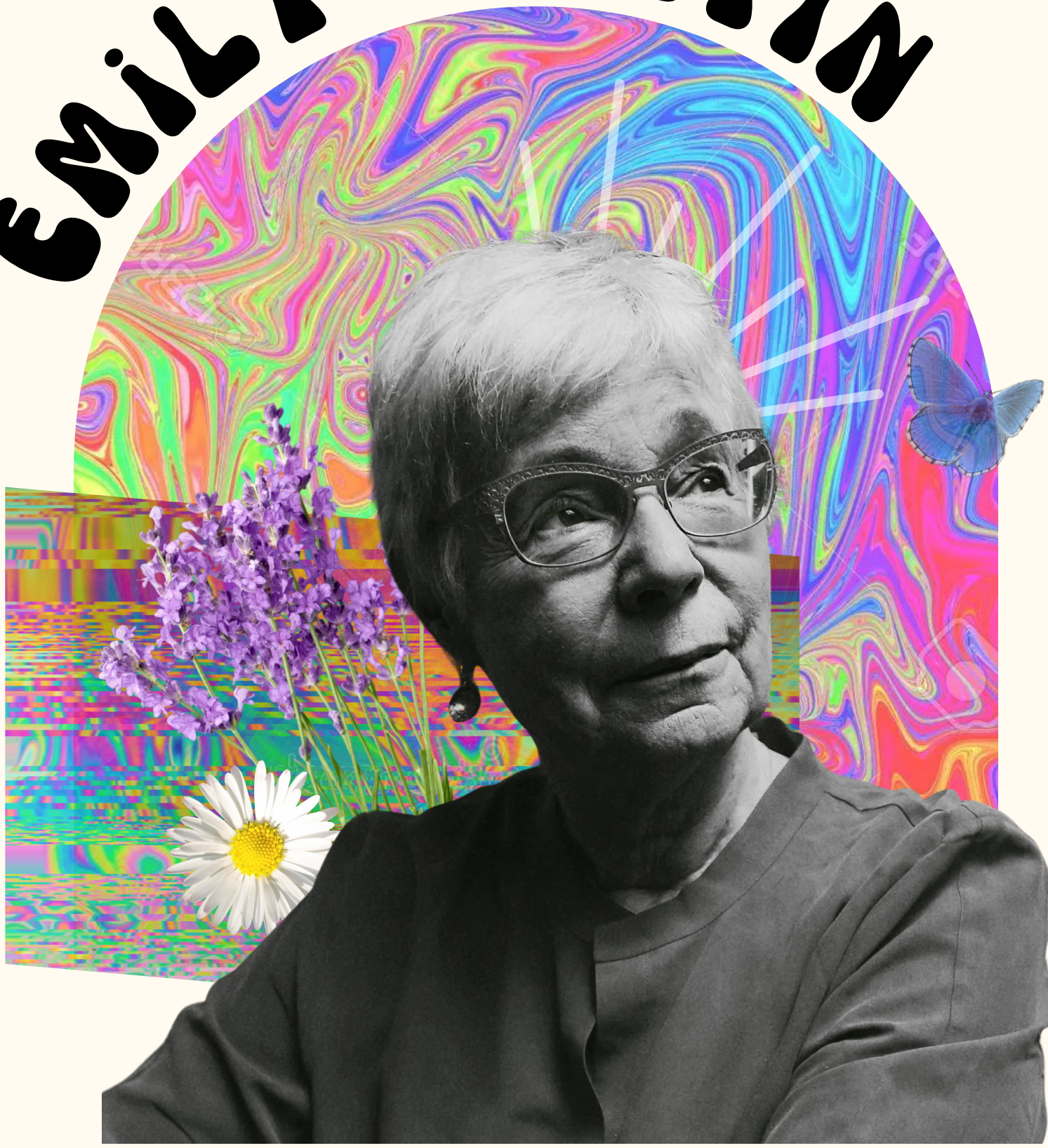
Durex

In this Durex ad, we can see how the egg is depicted as weak & unconfident, running away from the sperm. The sperm is stealthy, sleek, and has a slightly menacing grin.

Mainstream media depictions of the sperm and egg are just demonstrations of how language in science education has shaped how we view male vs. female gender roles in society

KEEP READING TO LEARN MORE! ->

EMILY MARTIN



THE SPERM & THE EGG: GENDERED LANGUAGE IN SCIENCE

BY VICTORIA LUU

Emily Martin is a feminist anthropologist who is currently a professor of socio-cultural anthropology at New York University. Martin has dedicated her studies to analyzing science from a feminist perspective as well as the anthropology of science. When Martin was pregnant with her second child, she noticed a trend in various parenting books that regardied women's body parts as "things [that] weren't part of us." This inspired her to begin her research on analogies used in science education— here, she focused on topics such as menstruation, women reproductive systems, and fertilization (White, Tannenbaum, Klinge, Schiebinger, & Clayton, 2021). Martin argues that the majority of scientific literature is gender-biased, which inherently perpetuates bias and sexism in the way we view women.

Martin's 1991 article, The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles and her book The Women in the Body, highlights the gendered language that has been used when educating individuals on reproductive processes and organs. This has resulted in sexist interpretations of science as well as gender biases that reinforce gender inequality and misogyny.

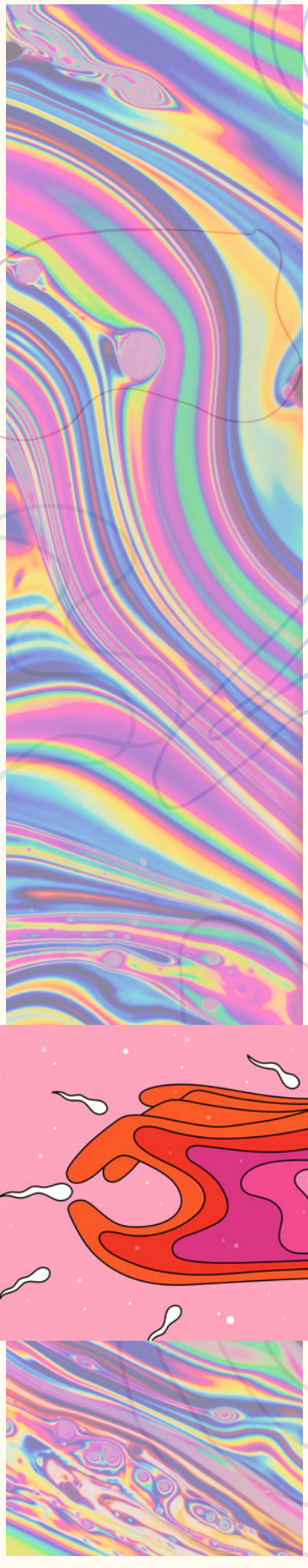
Martin accounts for the fact that in many traditional science textbooks, the egg is painted as a passive, incapable, "damsel in distress" who needs to be saved and penetrated by the active, brave, and magnificent sperm. This narrative perpetuates our culture's view of women, which inherently supports male masculinity and sexism (Aho, 2017). It's quite ironic because the egg is actually not so easily penetrable as commonly taught— the egg's barrier can only be infiltrated through the collective action of multiple sperm after bypassing numerous protection mechanism employed by the egg.

This gendered language goes beyond describing gametes, but also the female and male reproductive system. The female reproductive system is often contorted with words such as "debris", "drying", and ""shedding", whereas the male reproductive system is associated with words like "produce", "resilient", and "remarkable." The act of painting our biological processes creates internal assumptions of how the female reproductive system is inferior to the male, which translates to how women are treated in society (Little, 2017).

Martin's work in the 80's has brought to light the influence of language in science— there is an obligation for scientists to accurately and efficiently communicate their findings to the people, especially when it concerns public and environmental health. This is especially true when we talk about EDC's and EDC prevention (Soto & Brilmyer, 2020).

Oftentimes, EDC prevention is approached through the idea of "precautionary consumption." That means that instead of eliminating EDCs from the market, consumers are told to be cautionary as to what they buy and introduce to their homes and families. This burden is placed on women, who are orientated as the caregivers of the household— thus, they are expected to protect their families by being more selective with what they buy. This form of EDC prevention is inherently misogynistic and falls under the grasps of societal gender expectations.

The use of language within science and media is oftentimes biased and problematic— this allows gender stereotypes and homophobic agendas to be pursued. As Emily Martin concluded, the first step to approaching these historical and institutional issues is to understand and realize our mistakes, and prevent these misconceptions from passing on to the next generation.



Nuclear Waste and Extra Limbs

Exploring the Role of Infertility in Dystopia

Luc Lorain



The purported perils of infertility surround us at every corner, and have percolated throughout professional and public American media for centuries. From the earliest phases of the Puritan colonies at Plymouth, apothecaries stressed the moral implications of "barrenness" unto population survival, often citing such inability to conceive as a mark of damnedness. While descriptions of infertility are undeniably transformed from these early pseudo-scientific claims, the influence of the past cannot be understated: distinct patterns in rhetorical approach, qualification of blame, and medicalization of reproduction cycle through popular media in waves, not entirely unlike the fashion trend cycle. The repeat occurrence of various "sex panics" often speak to larger social trends, such as religious revivals, economic restructuring, and war (Grech et al, 2011).

Endocrine disrupting chemicals, and the perils of infertility that come with them, are not entirely separate from these cycles of rhetoric. As a class of nearly universally-present aqueous chemicals, EDCs inspire contradictory feelings of helplessness and a compulsion toward action-- just as childless families grappled between penitence and shame for their own infertility struggles.

Over the next several pages, the evolution of rhetoric surrounding infertility in the United States will be examined, from spiritual beginnings to the scientific paradigm of today. From impure thoughts to fluid pollutants, the sources of inferility rarely remain stable for long.

> ***"My rules for The Handmaid's Tale were simple: I would not put into this book anything that humankind had not already done, somewhere, sometime, or for which it did not already have the tools."***
>
> ***–Margaret Atwood***

From Past...



1651 A Directory for Midwives

In this highly influential pamphlet aimed for apprenticed midwives, the English apothecarist Nocholas Culpeper claims that women become "barren" from their own behaviors and circumstances, often framed in metaphors related to agrarian output and the earth. (Jensen, 2016)



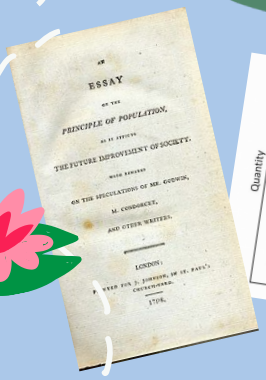


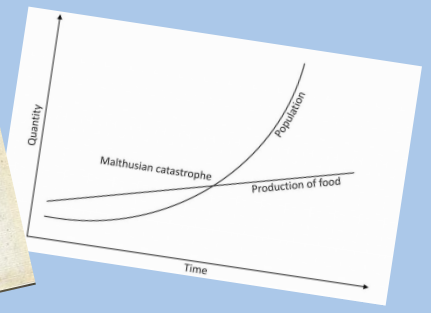
1684 Aristotle's Master Piece

Anonymously published with papal support, this illustrated pamphlet spread awareness of spiritual environmental conditions associated to "barrenness," often those beyond individual control. These matter-of-fact claims were reinforced by so called maternal-impression theory, the pseudo-scientific folk belief that a mother's mere imagination could mutilate or transform their developing baby's body before birth, as depicted in two panels to the left. (Jensen, 2016)

1798 An Essay on the Prinicple of Population

In this review of British census data dating back a full century, economist John Malthus discovered an alarming trend: while food production increases linearly over time, human population numbers rise exponentially. Malthus foretells of a future in which wanton reproduction leads to apocalyptic outcomes, asserting the need to greater regulate sex among those viewed as fecund and irresponsible. Appeals to survival such as these prove increasingly common throughout the centuries to come, including and are intricately tied to modern proponents of eugenics and "population replacement theory".





1867 Clinical Notes on Uterine Surgery: With Special Reference to the Management of the Sterile Condition

Based on his speculatory and nonconcentual probings of enslaved Black women, J. Marion Sims devises a new way of framing female reproduction: as a mechanical, factory-line process prone to break down. Sims developed a slew of invasive tools to scope and dissect the female reproductive tract, under the guise that even infertility could be solved with the proper mechanical intervention. (Jensen, 2016).

1869 Hereditary Genius

In this exploratory book, Sir Francis Galton attempted to translate the core principles of Darwinian natural selection to a human level, culminating in the basis of eugenics theory. As if echoing the words of Malthus, Galton expresse that nature itself does not accept those seen as inferior (typically, those not heterosexual, able-bodied, rich, white, and literate), and that these wasteful elements should be eliminated from society. By framing race as an evolutionary adaptation, Galton transformed nonwhite race, poverty, mental illness, and infertility as new "pollutants" to the gene pool, eerily mirroring modern discourse around chemical exposre. Race had long been used as a metaphor for pollution for centuries, but Galton's work finally provided a means of "cleansing" through the act of eugenics.. The first nonconsensual sterilization laws were enacted at a state-level in1907, and sterilization by the end of the 20th century over 60,000 sterilizations would be completed in the US alone. These invasive surgeries were often completely funded by Medicaid, demonstrating how eagerly state legislatures were to enact eugenic policies (Stern, 2020).





1873 The Psychology of the Sexes

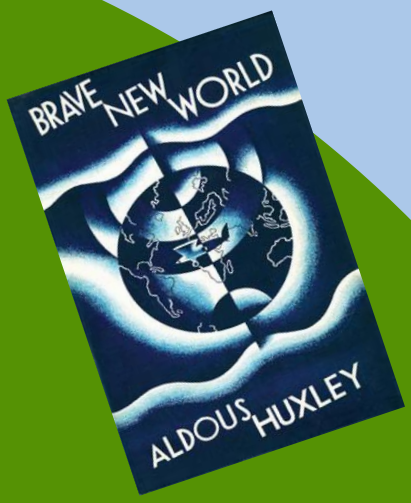
Published by naturalist philosopher Herbert Spencer (the originator of the phrase "survival of the fitterst") to the periodical, *Popular Science Monthly*, this piece theorized that declining fertility rates among Anglo-Saxon women could be explained by greater female educational achievement. According to Spencer, women possessed a finite amount of energy to be split between mental and biological processes, and allowing them to develop one would necessarily destroy the other. This process was linked to early evolutionary theory, and sought to legitimize social expectations of pregnancy with purely theoretical scientific terminology.

1913 Sex Antagonism

Published by the British embyologist Walter Heape in 1913, this work widley popularized the notion that separate "male" and "female" hormones not only determined bodily sex, but that these chemicals worked in direct opposition to each other in a form of biochemical warfare (Jensen, 2016). Proponents of this early reproductive endocrinology used this inherently gendered framework to explain variations in gonadal anatomy, citing an imbalance of the proper hormones as reason for the "deformities" of the genital tract. Similar rationale was established outside of the Heape to explain variations in gender and sexual behaviors-- a key step in the process of pathologizing nonheterosexual identities. While Heape's work may not be common knowledge among a modern readerbase, its metaphors and framings are. For instance, Heape describes the balance of hormones a "chemical war between the male and the female.... a chemical miniature of the well- known eternal war between men and women (Ibid).

1932 Brave New World

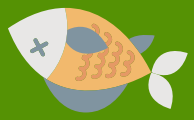
Epitomizing the mid-19th centuries feelings of dominance over chemistry (which in turn was thought to control biology), Aldous Huxley's satirical dystopian novel envisions a world in which every aspect of one's identity and ability can be engineered, making normal reproduction absolete. Rather than pollutants or poisons, chemicals were appraised as the tools to a more utopian-- if somewhat totalitarian-- future, in which eugenic reforms might be realized (Woiak, 2007). In this light, potential chemical interventions could make infertility a moot point, as new inventions and technological discoveries were bound to keep man afloat.



1961 Silent Spring

In her groundbreaking book, longtime popular science reporter Rachel Carson demonstrated to a wide popular audience how pesticides and pollutants trickle up through the food chain and bioaccumulate within living bodies-- including our own. Carson's book is widley credited for raising awareness of the ubiquity of toxins in America's farms, factories, and homes, contributing to the formation of the EPA in 1972 and the eventual banning of DDT in the US in 1972. *Silent Spring* fundamentally changed how the public regarded chemicals: no longer just instruments of scientific advancements. they now signalled imminent extinction.



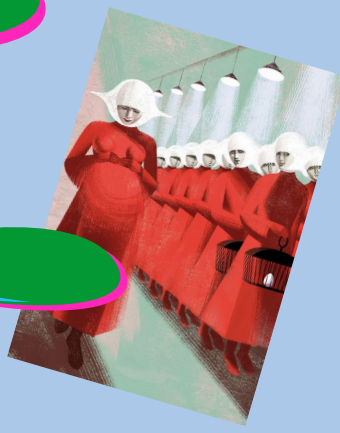




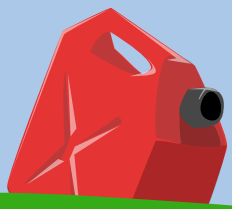
... to Present

1985 The Handmaid's Tale

The Handmaid's Tale is at its core, a treatise on how the patriarchy values and secures female biopower in an ever-changing and polluted world. Drafted at the peak of Cold War Tensions in the mid-1980s, Atwood envisions a world in which rapidly falling fertility rates (implied to be a result of nuclear pollution) spurs the wide scale subjugation of women as laborers, surrogates, and domestics- complete reduction to their biological potential. *The Handmaid's Tale* and its continued legacy in 3rd-wave feminist movements shows how narratives centering the specter of infertility (even if critical of male power) have been present in Western discourse even before the popularization of EDCs in the 1990s, where it exhibits many of the same tropes of ecoheteronormatism as today. Conspicuously absent from Atwood's reproductive dystopia are BIPOC, LGBTQ+, intersex, and disabled bodies, demonstrating the limits of mainstream feminist discourse: infertility is only seen to pose a threat for the white, heterosexual women expected to bear the next generation of (white, male) laborers, soldiers, and politicians (Vassallo et al, 2017). This mindset replicates very real dangers for marginalized communities, as exposures to EDCs and other forms of chemical pollution disproportionally affect those at the intersections of non-hegemonic race, class, ability, etc.

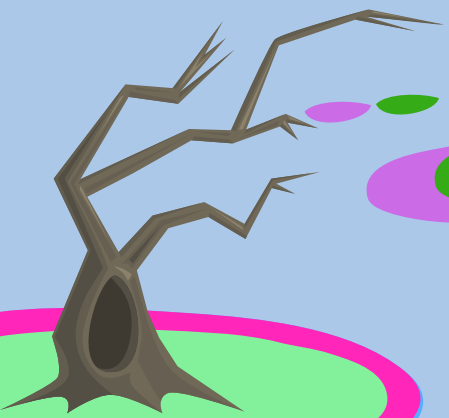






2002 Children of Men

Deeply impacted by the 9/11 attacks, a national anthrax scare, and ongoing warcrimes committed by American troops overseas, Alfonso Cuarón's theatrical adaptation of the 1992 dystopian novel of the same name depicts a world in which a sudden viral pandemic renders humanity permanently sterile. Grossing over $70 million and garnering widespread critical acclaim, the success of this film ingrained a new fear of infertility through the the spectre of bioterrorism. Increasingly from this time forward, immigrants and foreign nationals from the Global South were painted as violent existential threats to the "Western" world-- a clear equivocation of race/nationality, health, and regeneration (Dinello, 2019).





2010 From Silent Spring to Silent Night

After accepting a head research position for Syngenta-funded study on the effects of their pesticide atrazine, Dr. Thomas Hayes made a disquieting discovery: contrary to Syngenta's claims, atrazine exposure appeared to powerfully impact frog gonadal anatomy. Hayes' descriptions of "feminized" male frogs growing eggs in their testicular tissue heightened the perceived danger of estrogen-like aqueous EDCs. Without change, Hayes foretells of a future without frogs due to widespread sterility, with similarly dire consequences for humans.

DR. TYRONE HAYES

"From Silent Spring to Silent Night," to Econormative Fright

by Luc Lorain

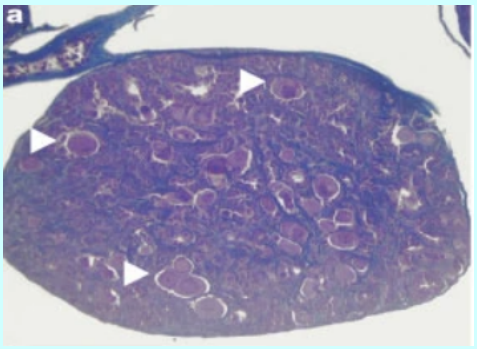
"From Silent Spring to Silent Night" to Econormative Fright



Two intersex frogs are shown in the act of copulation, as presented in Dr. Hayes' 2010 talk, *From Silent Spring to Silent Night*. When describing this photographic evidence, Hayes remarks that "that's his brother" to audience laughter.



Dr. Hayes begins his presentation "Silent Spring to Silent Night" with a dedication to his family-- a framing that centers the normativity of the nuclear family and warns what is at risk due to EDCs. An increasing desire to make research engaging to the "ordinary public," shifts funding to projects that replicate preexisting and thus socially palatable anti-queer narratives. Furthermore, the very backgrounds of scientists uncovering gonadal abnormalities allows for conclusions to be made in very selective directions– for instance, many ecological researchers interested in EDC work joined the field from a hormonal research background, naturally inclining them to observe and prioritize changes in hormonal levels, development, and sexual differentiation.



In the hopes of stressing the threat of atrazine and other estrogenic EDCs, Hayes' lab has used alarmist rhetoric that, while not technically inaccurate, frames the issues of EDC exposure in an unconsciously homophobic way. For instance, in this histological slide from a 2002 paper, Hayes describes the presence of oocytes in male testicular tissue (which has been documented in frogs far from potential sources of atrazine) as "gonadal abnormalities" linked to "retarded development and hermaphroditism" (Hayes, 2010). The focus on the "feminization" of animals further supports chauvinist evaluations of reproduction.

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