

SUMMIT



*The UAS Writing Center's
Collection of Exceptional Academic Works
for 2019/2020*

**The University of Alaska Southeast
Writing Center**

*Summit: The UAS Writing Center's
Collection of Exceptional Academic
Works for 2019/2020*

Academic works from the
undergraduates of the
University of Alaska Southeast,
presented by the UAS Writing
Center.

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Writing Center

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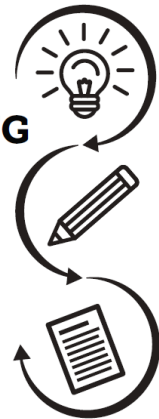
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The UAS Writing Center dedicates this journal to Dr. Michael Collins and Dr. Andrea Lunsford, who created and inspired this project.

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Forward

It is with great enthusiasm that the UAS Writing Center launches our inaugural edition of *Summit: The UAS Writing Center's Collection of Exceptional Academic Works for 2019/2020*. In the Writing Center, we have the privilege of seeing the wide range of talents and interests of our UAS students and the exceptional way that they communicate their research, analysis, and philosophical ruminations through essays, speeches, and written reports. The tutors in the Writing Center engage with their peers in fascinating discussions of historical events, political debates, scientific discoveries, teaching pedagogy, and business theory (to name a few). We celebrate when students receive stellar grades on their assignments, but we also recognize that good writing should be shared beyond the classroom. *Summit* emerged from a desire to highlight and publish the extraordinary writing that we get the honor to see in the Writing Center every day.

This journal, however, is more than just a showcase of undergraduate writing. It has also been an opportunity for the undergraduate student tutors to engage in a collaborative project that required time management, careful communication, attention to detail and leadership skills. The editors and contributors have persevered through unimaginable (until now) challenges including unprecedented budget cuts at the university and a global pandemic that forced us to move our work online. At a time when the present feels chaotic and worrying, the undergraduate students at UAS remind me that our future is in good hands. I am confident in our new generation of leaders as I've watched our students think critically, engage in the community, and work tirelessly for projects they believe in. It is joy to present our first edition of *Summit*!

Allison Neeland
UAS Writing Center Specialist

Ernestine Hayes Award for Excellence in Academic Writing

In order to promote the academic excellence of students at the University of Alaska Southeast and to highlight student writing, the UAS Writing Center launched its first student essay writing contest in 2019. The essay contest was named after Professor Emerita Ernestine Hayes to honor her commitments to student achievement and to the craft of writing. In 2020 the Ernestine Hayes Award for Excellence in Academic Writing is featured in this inaugural edition of our undergraduate student journal. Students were invited to submit exemplary essays they have composed for courses in a bachelors' programs at any campus in the UAS system.

We at the UAS Writing Center congratulate Honesty Zahnd on being awarded the 2019/2020 Ernestine Hayes Award for Excellence in Academic Writing. His essay was selected by the judges because it demonstrates a depth of subject-specific knowledge within a critical analysis of both a text and a time period by presenting an arguable thesis that was supported by well integrated sources and strong use of vocabulary.



Honesty Zahnd is a senior majoring in Anthropology with secondary concentrations in History and Sociology. He was born and raised in Juneau, and is grateful to be able to receive a good education at the university down the street from his house. In his free time, Honesty enjoys reading books and graphic novels, playing video and tabletop games, listening to podcasts, and exploring the wilderness of Southeast Alaska with his two dogs.

Veterans, Veracity, and Depictions of Violence: An Examination of *All Quiet on the Western Front*, Germany's Interwar Period, and the Interplay Between the Two

In 1929 Erich Maria Remarque published *Im Westen nichts Neues*, later translated to English as *All Quiet on the Western Front*, amid a time of great change in European culture. Germans were experiencing a deep-seated dissatisfaction with the outcome of the war and the state their nation had been left in; veterans were struggling in a society which found many of them a hindrance, a political obstacle or a painful reminder of the past, and a growing far-right faction was searching for ways to take advantage of the current socio-political situation. The increased reflection on the war meant that German society had certain expectations about what aspects of a novel were necessary for it to be seen as authentic and thus acceptable as part of the cultural discourse on war.¹ Consequently, Remarque found it necessary to write and market *All Quiet* in a way that rang true to the public but which also effectively argued against the nationalistic, militaristic narratives that dominated war novels and public discourse surrounding the war at the time.² At the same time, Remarque attempted to address the oft-asked questions about what the war had meant and how it had shaped the current era.³ When published, *All Quiet* generated opinions from all sides of the political spectrum and from various international audiences for its depiction of wartime trauma (seen either as humanizing or insulting), its pacifist themes (seen either as inspirational or threatening) and the uncertainty of the novel's authenticity. Remarque's initial success in garnering attention and public discourse was eventually foiled by efforts to prove the novel and author inauthentic and to eventually ban the book in Germany. These tempestuous events represent the broader political and cultural changes surrounding Europe in the interwar period.

In the years prior to the publishing of *All Quiet*, Germans were experiencing a difficult period in their history which lay the groundwork for Remarque's eventual magnum opus. As Eksteins describes, a lingering trauma, a desire to forget and a sense of confusion all permeated society in the decade following the war, and for a time people preferred to live in the present or look to the future rather than dwelling on the past.⁴ However, war media was not entirely in the doldrums; Ernst Jünger, for example, was a contemporary of Remarque and a war novelist who had served on the front multiple times. While Jünger recognized the pain, misery, drudgery, and futility of modern warfare, he saw the harsh conditions not as a pointless march towards death but as an exacting gauntlet which strengthened the bonds between soldiers and made each of them distilled and simplified to their true and essential qualities, prepared to bravely serve their modern industrial fatherland without thought or question.⁵ Remarque acknowledged the connections soldiers form in *All Quiet*, saying "Formerly

¹ Schneider, "The Truth about the War Finally," 492.

² Schneider, "The Truth About the War Finally," 495.

³ Schneider, "The Truth About the War Finally," 495.

⁴ Eksteins, "*All Quiet on the Western Front* and the Fate of a War," 349.

⁵ Hewitson, "A War of Words: The Cultural Meanings of the First World War in Britain and Germany," 760-761.

we should not have had a single thought in common—now we ... are so intimate that we do not even speak,”⁶ but questions the nature of this brotherhood in chapter eleven, calling it “...the desperate loyalty to one another of men condemned to death.”⁷ It was this nationalistic and militaristic tone which Remarque encountered when reviewing books by Jünger and other war authors, and it was that tone which he wrote *All Quiet* in opposition of.⁸

A similarly zealous tone was present in the contemporary political landscape of the Weimar Republic. In 1929 the economy was worsening, coinciding with the tenth anniversary of the Versailles Treaty which many German nationalists blamed for all of Germany's troubles; the government declared that the anniversary of the Armistice, June 28, was to be a national day of mourning.⁹ In spite of this acknowledgment of the pain the war caused, Germany had no central national monuments for those soldiers lost in World War I; Germany was the loser in the Great War, and so it was difficult to honor the nation's fallen heroes in the same way other European nations did.¹⁰ For similar reasons, veterans in Germany were frequently left without support; in France and Britain, as Hewitson outlines: “...Since the post-war status quo was broadly acceptable and the supposed aggressor had been defeated, the sacrifices and blood-letting could be seen to be worthwhile, and soldiers could be thanked and reintegrated...”¹¹ In Germany, however, veterans did not receive ubiquitous national honor and support, and German society's attempts to move forward meant that many preferred not to acknowledge the physical and mental traumas their fellow citizens gained in battle, leaving some veterans lost, frustrated and disillusioned.¹² Remarque expresses this sense of alienation experienced by veterans' return to civilian life in *All Quiet* when he says “I have been crushed without knowing it. I find I do not belong here any more, it is a foreign world.”¹³ At times, the government's willful ignorance of veterans' plights extended to outright vilification of veterans suffering from PTSD, which was known at the time as shellshock or ‘war neurosis.’¹⁴ Many psychiatrists and government officials characterized war neurotics as indolent, nefarious, deceitful, or psychotic and some even accused them of being revolutionary enemies of the state, using these arguments as justification to withhold pensions, treatment, and potentially freedom and autonomy, alienating these troubled veterans further.¹⁵ Nationalists like Adolf Hitler were able to exploit this grief and

⁶ Remarque, *All Quiet on the Western Front*, 95.

⁷ Remarque, 272.

⁸ Eksteins, “The Fate of a War,” 349.

⁹ Eksteins, 359.

¹⁰ Schneider, “The Truth About the War Finally,” 495.

¹¹ Hewitson, “A War of Words: The Cultural Meanings of the First World War in Britain and Germany,” 758.

¹² Eksteins, “*All Quiet on the Western Front* and the Fate of a War,” 346.

¹³ Remarque, *All Quiet on the Western Front*, 168.

¹⁴ Crouthamel, “Mobilizing Psychopaths into Pacifists: Psychological Victims of the First World War in Weimar and Nazi Germany,” 205.

¹⁵ Crouthamel, 209-210.

anger, promising that they knew both the cause and the solutions. The public's new interest in discussing the war and how people had been changed in the aftermath presented Remarque with an ideal opportunity to influence the war discourse.

When *All Quiet* was published, there was a certain expectation in Germany about what qualities a novel needed to be seen as authentic and thus to be allowed to influence the public war discourse. In the age of modern war, it was acknowledged that the heroism of historical wars was long past, and that modern wars were painful, dirty, futile efforts to some degree; as such, for a novel about the war to be accepted, it needed to read as 'authentic,' an accurate, unbiased recounting of real experiences in the war. If a book was fictionalized or attempted to use the war as a means to critique contemporary society, it was viewed as literature and thus effectively outside of the war discourse.¹⁶ It was in this literary climate that Remarque published *Im Westen nichts Neues*. He had originally intended to write a trilogy examining the war's impacts on society and on veterans; however, after *All Quiet* was rejected by one publisher, Remarque worked with the democratic Ullstein Trust, which agreed to publish *All Quiet* but requested that Remarque remove sections of the novel exploring explicit anti-war sentiments and that he add sequences of war violence.¹⁷ These changes to the novel fit the book into the public's perception of true war novels, as did interviews and advertisements Remarque and Ullstein participated in where they implied that the novel was to some degree autobiographical and amateur.¹⁸ While Remarque and Ullstein may have successfully framed the book as lacking any political message, it's clear that Remarque's original intentions for the novel as a pacifist examination of how the war negatively impacted veterans still applies. This is apparent when Remarque, in the opening pages of the book, refers to "...a generation of men who, even though they may have escaped its shells, were destroyed by the war."¹⁹ Thus, *All Quiet*, crafted both to fit the public's definition of an authentic, acceptable war novel and to deliver a covert pacifist message, spread both domestically and abroad and influenced discussion about the war, creating both critical and complimentary responses.

In Germany, with support from government propaganda, many still viewed the war as unfortunate but unavoidable.²⁰ Germany had lost the war, and this left many Germans, particularly veterans, wondering whether their sacrifices had been worth it. Consequently, *All Quiet*'s suggestion that the war had been pointless and millions had fought, died, and lost for nothing was deeply troubling.²¹ German communists were also critical of the novel, but for different reasons; they believed that the trauma many experienced in the war was just an extension of the trauma the proletariat suffered under the oppression of capitalism. They accused Remarque of tacitly supporting fascism and imperialism by promoting pacifism rather than encouraging class warfare

¹⁶ Schneider, "The Truth," 492.

¹⁷ Schneider, 494.

¹⁸ Schneider, 493.

¹⁹ Remarque, *All Quiet on the Western Front*, 0.

²⁰ Hewitson, "A War of Words: The Cultural Meanings of the First World War in Britain and Germany," 763.

²¹ Hewitson, "A War of Words," 758.

against the bourgeoisie.²² While the radical left's ideology may have clashed with *All Quiet*'s themes to an extent, the book was of particular concern to the far-right because, as Eksteins points out, "If the war had been an absurdity, then conservatism as a mentality was an absurdity; then fascism, which glorified the 'front experience', was an absurdity."²³ As such, the novel was heavily criticized in the press; as Kazecki describes, critics warned that the novel "...was about pacifism, the diminishment of soldiers' sacrifices in the First World War, and the subversion of the spirit of the German Army and, consequently, of the German nation."²⁴ Despite this vehement opposition, many in Germany did find value in the novel. The Social Democrats were especially enthusiastic about Remarque's work, praising *All Quiet* for its frank depiction of the psychological damage the war inflicted, an aspect of the book which bolstered their position that war was not a romantic and heroic endeavor.²⁵ The Social Democrats reasoned that the most convincing argument for pacifism was a realistic glimpse of what armed conflict was truly like, and hoped that the unglamorous account of the front experience would have a positive influence on youth who were desensitized and indoctrinated towards violence.²⁶ These brutal depictions of what German soldiers suffered were also appealing to another demographic: people in France and England. During the war, European nations created exaggerated stereotypes of foreign nations as a means to dehumanize their adversaries and remove the incentive to play fair or show mercy; the British saw Germans as possessing "arrogance, barbarity, angularity, Prussianism, bullying, inhumanity, cleverness and many other traits," according to Hewitson.²⁷ In contrast, Remarque's depiction of German soldiers as begrudging cogs in the war machine who fought to stay respectable humans while suffering physical and psychological traumas evoked sympathy in many readers. Eksteins clarifies, "The great discovery that foreign readers said they made through *All Quiet* was that the German soldier's experience of the war had been, in its essentials, no different from that of soldiers of other nations."²⁸ Remarque highlights the tragic bond soldiers from both sides shared in *All Quiet*, saying, "...Why do they never tell us that you are poor devils like us, that your mothers are just as anxious as ours, and that we have the same fear of death, and the same dying and the same agony--Forgive me, comrade; how could you be my enemy?"²⁹ Eventually, critics in Germany began questioning the truth and authenticity of *All Quiet*. Some questioned details, such as

²² Crouthamel, "Mobilizing Psychopaths into Pacifists," 216.

²³ Eksteins, "*All Quiet on the Western Front* and the Fate of a War," 355-356.

²⁴ Kazecki, "Laughter in the Trenches: Humour and Front Experience in German First World War Narratives," 135.

²⁵ Crouthamel, "Mobilizing Psychopaths into Pacifists: Psychological Victims of the First World War in Weimar and Nazi Germany," 213.

²⁶ Crouthamel, 213.

²⁷ Hewitson, "A War of Words: The Cultural Meanings of the First World War in Britain and Germany," 749.

²⁸ Eksteins, "The Fate of a War," 360-361.

²⁹ Remarque, *All Quiet on the Western Front*, 223.

overly meticulous questions like whether horses bray or moan when injured.³⁰ More pointed questions were asked about whether Remarque and his publisher's claims - that he was a depressed veteran with no experience as an author and no political opinions to persuade the public with - were in fact true.³¹ In spite of the harsh critique, for a time *All Quiet* did well financially and in terms of changing public opinion; however, the efforts of its harshest critics, the National Socialists, eventually led to the book's downfall.

Perhaps unsurprisingly, National Socialists' critique of *All Quiet* was not based on in-depth analysis of the text of the novel. Twice, National Socialist newspapers received alleged firsthand descriptions of the front experience, which the papers praised as being genuine in contrast to the lies of Remarque; in both these instances, the descriptions were in fact excerpts from *All Quiet on the Western Front*.³² National Socialists critiqued *All Quiet* simply because their political enemies praised it as anti-war, which led them to believe that *All Quiet* was a socialist, Jewish conspiracy to slander the concept of the modern German war hero which had arisen during the Great War and around which Nazism was largely centered.³³ In truth, the National Socialists weren't particularly incorrect in their assumptions that *All Quiet* challenged their ideology; notions which *All Quiet* is centered around, visible in the line "The war has ruined us for everything,"³⁴ are near-opposites of the ideas Nazism was founded on, which could be summed up as 'the war has rebuilt us for anything.' The National Socialists' opposition to Remarque didn't stop with the novel.

All Quiet on the Western Front was adapted into an American film in 1930 by director Lewis Milestone, and was both financially and critically successful, finding popularity in the US, France, and Britain and winning two Academy Awards.³⁵ Like the book, however, the film generated controversy; it was banned by Mussolini's government in Italy,³⁶ and in Germany National Socialists also called for a ban, arguing that the film, like the novel, insulted the nation's image.³⁷ When a heavily-edited version of the film was eventually allowed to appear in German cinemas, National Socialists lead by future Propaganda Minister Joseph Goebbels protested the showing by buying tickets for one-third of the seats in the theater³⁸ and shouting threatening and anti-semitic exclamations fifteen minutes into the showing.³⁹ Goebbels

³⁰ Schneider, "The Truth About the War Finally," 497.

³¹ Schneider, 495.

³² Kazecki, "Laughter in the Trenches: Humour and Front Experience in German First World War Narratives," 150-151.

³³ Kazecki, 136.

³⁴ Remarque, *All Quiet on the Western Front*, 87.

³⁵ Eksteins, "The Fate of a War," 363.

³⁶ Eksteins, 363.

³⁷ Hewitson, "A War of Words: The Cultural Meanings of the First World War in Britain and Germany," 763.

³⁸ Hewitson, 763.

³⁹ Birgel, "Kuhle Wampe, Leftist Cinema, and the Politics Film Censorship in Weimar Germany," 45.

proceeded to stand and deliver a speech in the theater, causing Marxists in the audience to begin brawling with the brownshirts, who released white mice and threw stink bombs. The police arrived and forcibly cleared the riot, which had spread to the square outside the theater, but 6,000 National Socialists continued to demonstrate against the film over the next several days, forcing all demonstrations in Berlin to be outlawed.⁴⁰ Socialists and left liberals critiqued this demonstration, but days later the film was banned by Germany's right-leaning censorship board, supported by the Ministry of Defense and the Foreign Office. By getting the film banned, the National Socialists achieved two things: firstly, they solidified their party's presence in the media,⁴¹ and secondly, they created a reliable strategy to delegitimize the democratic institutions in Germany, which they proceeded to do until 1933.⁴² The Nazi party, which built a great deal of its ideology from the cultural and political climate of the Great War, maneuvered itself into power in 1933. Within months, *All Quiet on the Western Front* - the novel which for many captured the experience of the Great War and which had a major influence on the cultural depiction of the war - was symbolically burned along with other books which were deemed politically and morally un-German.⁴³ At the same time that *All Quiet* was outlawed because it was viewed as disrespectful to those who fought in the Great War, mentally disabled veterans - many of whom had supported their fellow veteran Hitler based on the assumption that he understood their experiences and would fight for them - were completely cut from welfare assistance, again with the rationalization that they were lazy, fraudulent enemies of the state.⁴⁴ Remarque and the National Socialists gained very different insights from their time in battle, but they, German veterans, and the population of Germany as a whole, were majorly impacted by the events that transpired in the Great War; an experience which irrevocably changed Europe and the world.

All Quiet on the Western Front, shaped by the tumultuous social and political climate of the postwar Weimar Republic, was originally intended to be more strongly anti-war, but even after being edited to fit society's perception of an acceptably authentic war novel, it had major influences on public discourse. The book's depiction of the trauma and struggle of German soldiers in the trenches was highly controversial, as were its pacifist themes, eliciting anger from some but empathy from others. Remarque was eventually criticized for his 'untrue' depictions of the war, and National Socialists who viewed Remarque's work as a threat successfully banned the novel and film adaptation. These events share clear parallels with the Weimar Republic's initial postwar impulse to ignore the war and move forward, followed by an increased cultural examination of how the war affected society, and finally by a fascist regime inspired by the war then taking power. While Remarque's novel may not have had the effect he

⁴⁰ Birgel, 45-46.

⁴¹ Kazecki, 136.

⁴² Schneider, "The Truth About the War Finally," 490.

⁴³ Eksteins, "*All Quiet on the Western Front* and the Fate of a War," 363.

⁴⁴ Crouthamel, "Mobilizing Psychopaths into Pacifists: Psychological Victims of the First World War in Weimar and Nazi Germany," 219-220.

originally intended, *All Quiet on the Western Front* had a meaningful impact far beyond the bounds of Remarque's contemporary culture, even influencing our modern understanding of the Great War and the interwar period which followed.

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The Influence of German Societal Changes and Remarque's *Im Westen nichts Neues*
During the Interwar Era

Never before had a war caused such destruction like that seen in the First World War. Not only did this cataclysmic event result in an unprecedented loss of life due to advanced weaponry and the effects of total war, but the drastic cultural and political shifts that resulted would shift Europe into a new era, especially Germany. For those who survived the brutal trench warfare of the Western Front, returning to civilian life in the wake of defeat presented its own challenges. Since the newly established Weimar Republic refused to acknowledge the atrocities that caused such disabilities, the interwar years (1918-1939) became fraught with tensions between veterans who suffered from mental and physical trauma and the government. Thus, Germans attempted to understand the war and its aftermath through the emergence of radical political parties such as the Nazi and Communist parties, as well as through their attempts to replace the Weimar government. Literary approaches such as Erich Maria Remarque's novel *Im Westen nichts Neues* also strove to illuminate the atrocities of the front. However, its publication was met with outrage on all sides of the political spectrum due to its portrayal of psychological trauma, its pacifist message, and its depiction of Germany and her soldiers. Such efforts, both political and social, emboldened public discussion regarding the war, illustrating that the post-war era was a turning point for Germany.

As the Great War came to an end with the armistice of November 1918, a new challenge arose across Europe: recovery. German veterans who returned home found adjusting to civilian life more difficult than anticipated, as mental and physical disabilities inhibited their ability to work and provide for their families. Moreover, the rise in unemployment meant that there were fewer jobs for those who could and wanted to work. Erich Maria Remarque was no exception to this trend, as he was wounded on the front during active duty many times, and monetary need forced him to interrupt his post-war teaching career to become a free-lance journalist.¹ Furthermore, addressing such injuries required the government and the public to take a closer look at the accepted memory of the war.² In order to avoid confronting the emotional hardship of the trenches, or the emerging notion that the war had been pointless, the post-WWI government provided very little means of aid for veterans, even for those who had been injured in their service.³ The little the Weimar Republic did offer was perceived as "disrespectful [...], humiliating, and overly bureaucratic" by those it attempted to aid.⁴ As a result, veteran discontentment and dissatisfaction for the Weimar Republic grew.

This sentiment was not found only in veterans such as Remarque after the war, as German civilians were left feeling defeated and angry at the Weimar government for surrendering before Germany had been invaded and truly defeated. The signing of the Versailles Treaty by German officials in the summer of 1919 only added

¹ Eksteins, "All Quiet on the Western Front and the Fate of a War," 348.

² Crouthamel, 205.

³ Eksteins, *Rites of Spring: the Great War and the Birth of the Modern Age*, 254.

⁴ Crouthamel, 206.

to the outrage, as the conditions laid out by the French were perceived to be a harsh, unjust victimization of Germany and her people, and those who were cowed by French demands were viewed by many as traitors.⁵ Thus, the parliamentary system of government which had been created after the First World War began to receive immediate backlash, and new political groups began springing up in Germany on both sides of the spectrum during the 1920s. Most notable was the far-right National Socialist German Workers' Party (Nazi Party), which promoted nationalism, the belief that people who share a common ancestry, language, and homeland also share a political destiny. On the center-left were the Social Democrats, which would become the largest party in the decade following the war.⁶ While on the far-left the Communist Party, inspired by the Russian revolutions following WWI, also began to grow rapidly after 1918.

Political dissension, however, was just one aspect of post-war change that characterized Germany. In the decade preceding the publication of Remarque's *Im Westen nichts Neues* (translated *All Quiet on the Western Front*), questions about how the Great War should be remembered and commemorated were being asked all across Europe. Certain nations would turn to stately monuments of remembrance. French fields would become dotted with headstones dedicated to the Allied soldier, though no graves would be found beneath. The infamous unknown soldier would be "borne from France and buried at Westminster Abbey" in 1920, and cenotaphs would be constructed and erected.⁷ For nations such as Germany, the answer was in romanticizing the war experience. German literature regarding the war, published both during and after WWI, simply reflected the traditional soldier: a man willing to sacrifice life and limb for the Fatherland and the Kaiser.⁸ Yet while these provided remembrances or idyllic versions of the Western Front, little efforts were made artistically or politically by either the Allies or the Central Powers to understand the war or to question its purpose.

As the 1920s continued, however, and the war became a distant memory, efforts to understand the war were revised. Between 1928 and 1930, Germany underwent a literary transformation as the number of books, plays, and films being published about the war increased dramatically.⁹ Some of the novels published in this era reflected the traditional values of heroism and manhood, such as German war veteran Ernst Jünger's *In Stahlgewittern* (*Storm of Steel*). Others, however, took the cultural shift toward understanding the war in the opposite direction and advocated for pacifism, writing on the negative aspects of trench warfare, especially the element of psychological trauma. The most influential work to come from this decade, Remarque's *All Quiet on the Western Front*, undertook the second approach. Familiar with the works of German nationalist authors such as Jünger, Franz Schauwecker, and Georg von der Vring, Remarque sought to counter these "bland" interpretations of the

⁵ Eksteins, *Rites of Spring: the Great War and the Birth of the Modern Age*, 253.

⁶ Eksteins, *Rites of Spring: the Great War and the Birth of the Modern Age*, 255.

⁷ Eksteins, *Rites of Spring: the Great War and the Birth of the Modern Age*, 255.

⁸ Schneider, 491.

⁹ Eksteins, "All Quiet on the Western Front and the Fate of a War," 345.

war experience with his own.¹⁰ Published in January 1929, *All Quiet on the Western Front* was an immediate best-seller, with up to 20,000 copies sold a day, and 640,000 within five months of publication.¹¹

Of those copies sold, one of Remarque's greatest audiences were his fellow veterans, with a German braille edition even being published and delivered free to any blind veteran who requested one.¹² Perhaps it was his personal experience with the war that caused the novel to resonate so deeply, as Remarque had been a soldier himself, had experienced the dangers of trench warfare, and had been one of the many veterans who returned to a crippled nation. The pages of *All Quiet*, rife with scenes that broke the illusion perpetuated by the government and far-right political parties that German WWI soldiers were fearless, denied the belief that those who broke under the strain were cowards. With the publication of Remarque's novel, veterans suffering from psychological trauma—along with political discrimination and vilification of character—found that they weren't represented as weak men with “mental shortcomings,” but as honorable Germans.¹³ Therefore, veterans who were “embittered and saddened” at post-war society made their support for Remarque's novel known, and while there were some soldiers who declared that *All Quiet* represented the “[betrayal] of a generation,” its impact was unparalleled.¹⁴

While some veterans favored Remarque's unflinching acknowledgment of the effect of psychological trauma on those fighting on the front, there was also great controversy over the portrayal of such disabilities. For example, Remarque's depiction of German soldiers cracking under the pressures of war contradicted far-right concepts of masculinity, as “real men [...] did not become hysterical under fire.”¹⁵ The label of “hysterical men” given by the Stahlhelm and the National Socialists cannot be separated from the historical association of hysteria being a strictly female disease.¹⁶ By referring to the veteran's condition as hysteria, far-right forces stripped the warrior of his masculinity by diagnosing him with a psychological condition reserved only for the weaker sex. Therefore, the inclusion of soldiers crying in fear during a bombardment, or butting their heads against the walls of a dugout in their panic did not represent the actions of a true soldier, but rather those of an emasculated coward.¹⁷

Furthermore, not only were these individuals unfit to be men, but they were also unworthy of being considered “real Germans.” For the Nazis, war did not cause soldiers to break under the strain of battle but allowed them to emerge from combat strengthened not only physically but psychologically.¹⁸ True Germans wouldn't need to

¹⁰Eksteins, “*All Quiet on the Western Front* and the Fate of a War,” 349.

¹¹Eksteins, “*All Quiet on the Western Front* and the Fate of a War,” 346; Eksteins, *Rites of Spring: the Great War and the Birth of the Modern Age*, 276.

¹² Eksteins, “*All Quiet on the Western Front* and the Fate of a War,” 353, 361.

¹³ Crouthamel, 214.

¹⁴ Eksteins, “*All Quiet on the Western Front* and the Fate of a War,” 361.

¹⁵ Crouthamel, 212.

¹⁶ Crouthamel, 211.

¹⁷ Remarque, 61, 111.

¹⁸ Crouthamel, 212.

be persuaded to fight for the Fatherland, nor would they tremble at the front. Therefore, the scene where Sergeant Himmelstoss is discovered cowering in the trenches out of fear was especially egregious to these nationalist groups, so much so that the German edition of the 1930 film deleted it entirely.¹⁹ The actions of a common soldier could be dismissed as individual cowardice, yet for the far-right, Himmelstoss's actions as an officer represented the German military as a whole. As a result, Remarque was implying that the German army, and therefore Germany, was weak and cowardly, not just the commissioned soldiers.

Not only did the far-right find issue with the depiction of the front as a traumatic experience, but they also believed the novel to be anti-nationalist. One scene that drew considerable controversy was the visit of the Kaiser and the discussion between Paul and the rest of his troop regarding the reason for the war. In wake of the Kaiser's appearance, Katczinsky proposes that "every full grown emperor requires at least one war" in order to become famous.²⁰ Blaming the Kaiser so blatantly for starting the Great War was unthinkable and, as a result, would also be edited from the German film version.²¹ Despite the edits, however, the premier of the American film was still met with nationalist right outrage, and Germans were discouraged from attending the screening. Members of the conservative veterans' organization *Der Stahlhelm* cried out that the soldiers represented were a "perversion" of the front, and encouraged others to read Jünger's *Storm of Steel* for a more "heroic" account.²²

Yet, it wasn't only the far-right who found fault in Remarque's *All Quiet*, as the radical Communist left discredited the novel due to its lack of class representation. Remarque's pacifist novel simply "distracted constituents from the militant war of the proletariat against imperialism and fascism," and in order to understand the atrocities of war, one had to acknowledge the class struggle.²³ Communist leaders stressed the notion that the Great War arose due to a capitalist and imperialist system, and since Remarque failed to directly acknowledge the crucial importance of class, his novel and the Communist agenda were incompatible.²⁴ His novel was little more than the sentimental pacifism of an "imperialist bourgeoisie," and would only distract from the real struggle of the working class.²⁵ While the far-left political groups did not react as loudly as the extreme right, they dismissed the novel's importance as it didn't fit their political focus.

Perhaps the only group which didn't speak as strongly against the novel, and later the film, was Germany's moderate political left. Where the far-right believed that

¹⁹ Remarque, 131; Eksteins, "War, Memory, and Politics: The Fate of the Film *All Quiet on the Western Front*," 63.

²⁰ Remarque, 206.

²¹ Eksteins, "War, Memory, and Politics: The Fate of the Film *All Quiet on the Western Front*," 63.

²² Crouthamel, 212-213.

²³ Crouthamel, 216.

²⁴ Eksteins, "War, Memory, and Politics: The Fate of the Film *All Quiet on the Western Front*," 80.

²⁵ Crouthamel, 216.

the novel was anti-nationalistic and offered an unrealistic portrayal of German soldiers, the Social Democrats believed the opposite. For them, Remarque's unflinching approach to depicting mental and physical trauma offered an accurate expression of the trench experience and was essential to its pacifist message.²⁶ In order for the front soldier and the German civilian to unify and understand the war, Germany needed to recognize that physiological trauma was not the result of cowardice or unmanliness as the National Socialists claimed, but a direct result of the horrific nature of the war; breaking in the face of bombardment, or seeking cover in the dirt as shrapnel hissed overhead did not impugn a soldier's honor. For the Social Democrat, war must no longer be romanticized, and the idea that fighting strengthens a real man through a "baptism by fire" had to be discredited.²⁷ *All Quiet*, with its depiction of the war's "true face," provided ample ammunition for the moderate anti-war cause.²⁸ Thus, the level of outrage regarding *All Quiet on the Western Front* depended on where one stood on the political spectrum.

Despite the novel's popularity when it was first published, the increase in far-right political affiliation resulted in the rise of civilian disdain regarding *All Quiet on the Western Front*, in both the print and film versions. The cultural shifts present in the decade following the First World War presented a window of opportunity for Remarque's story to flourish, and the increased interest on account of the German population to receive an authentic war experience which contradicted pre-war values translated into a captive audience. Even with its controversial status, *All Quiet* was heralded as being the memorial to the German soldier that the present Weimar government refused to erect.²⁹ Yet, as the Nazi Party rose in prominence and nationalism became the prevailing political agenda in 1930s Germany, the anti-nationalist nature of Remarque's novel resulted in its downfall. Thus, by 1930 *All Quiet on the Western Front* was reduced to a false narrative of the war experience, and even Remarque's credibility as a veteran turned author was stripped.³⁰ In May 1933, copies of the novel were gathered and burned at the University of Berlin in a Nazi rally.³¹ Eventually, *All Quiet* would be replaced with newer and more "true" versions of the war experience, reflecting the nationalistic mindset of the nation.

In the interwar era following the First World War, efforts to understand the war were manifested in emerging political parties like the National Socialists and the Communists, as well as in war novels like Erich Maria Remarque's *All Quiet on the Western Front*. Outrage at the characters' psychological trauma, the novel's pacifist message, and depiction of Germany and her soldiers arose on all sides of the political spectrum. Such efforts to understand WWI enabled a public discourse to emerge, and allow one to see how the interwar era sparked a change for Germany. The veterans recovering from the front were displeased with their more centrist government, and the

²⁶ Crouthamel, 213.

²⁷ Crouthamel, 219.

²⁸ Crouthamel, 213.

²⁹ Schneider, 495.

³⁰ Schneider, 498.

³¹ Eksteins, "All Quiet on the Western Front and the Fate of a War," 363.

lack of recognition about how the war was not a glorious event, but a tragic expense of human life. Such anger would allow for the rise in radical political movements and would aid the eventual rise of a fascist regime, and the creation of yet another world war.

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Estrogenic Endocrine Disrupting Chemicals as a Water Pollutant: Sources, Effects and Degradation

Abstract

Certain natural and manmade chemicals have been found to interfere with estrogen receptors and can lead to distortions in the endocrine systems of organisms. These estrogenic endocrine disrupting chemicals (EEDCs) have been found in plastics, pharmaceuticals, foods, and pesticides. Through various experiments using fresh water and marine systems, it has been found that these specific EEDCs can have deleterious effects on aquatic organisms' immune systems, hormonal balances, and fertility. In order to reduce the amounts of EEDCs in aquatic systems, a multi-tiered approach must be used. Research identifying safe levels of EEDCs in freshwater and saltwater can be used to create regulations for concentrations of EEDCs in water. Wastewater treatment facilities can then implement treatments that reduce the levels of EEDCs in effluent that will be released into aquatic systems. Through research, regulations, and use of treatments, the amount of EEDCs entering marine systems can then decrease. This paper describes the sources of these chemicals, their mode of action, their effects on marine systems, and further research focused on identifying safe levels of EEDCs.

Introduction

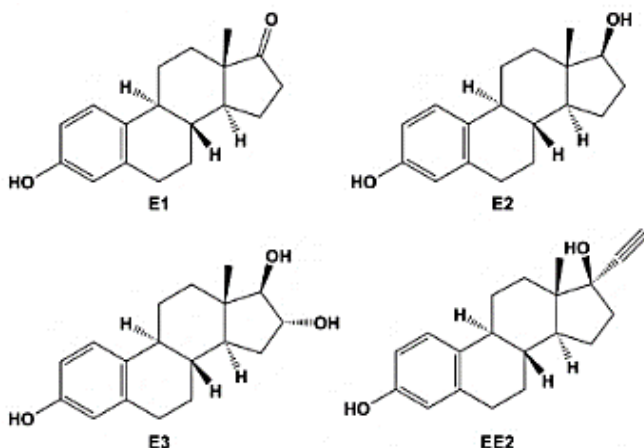
Most organisms naturally produce estrogen, a group of sex hormones that induces sexual characteristics, and maintain different levels of estrogen throughout their stages of life. Within endocrine systems, estrogen binds to estrogen receptors, and the complex then participates in a variety of crucial biochemical processes. In the recent past, it has been found that many chemicals can have deleterious effects on the estrogenicity of organisms. Collectively, these chemicals are identified as estrogenic endocrine disrupting chemicals (EEDCs). Disrupting endocrine systems can affect not only sexual characteristics, but immune systems and ultimately survival of the affected organisms. Certain EEDCs, specifically 17 α -ethynylestradiol (EE2) and bisphenol-A (BPA), have been found to be human sourced from agriculture, various plastics, and pharmaceuticals.

Estrogenic Endocrine Disrupting Chemicals

The endocrine system is a particularly important system within organisms, as it is a mode of communication among cells via the release of various hormones through the circulatory system to targeted tissues. Hormones released by the endocrine system form feedback loops that regulate their amounts present in an organism; these hormones control a variety of things including reproduction, stress, water retention or loss, and the contraction or dilation of blood vessels. Increased use of synthetic and pharmaceutical EEDCs has led to a variety of aquatic issues beginning with their introduction to and their proliferation within freshwater and marine environments.

An artificial change in the environmental levels of hormones can have lasting effects on an organism. The EEDCs discussed in this paper include those that mostly

affect the estrogen receptors of the endocrine system, which are binding sites for



naturally produced estrogens such as estrone (E1), 17-β estradiol (E2), and estriol (E3) (figure 1.0) (Wise & Woodruff, 2011). Synthetic estrogens, like 17α-ethynylestradiol (EE2) (figure 1.0), have been produced and used as an oral contraceptive for women, as it is most similar to E2 (Wise & Woodruff, 2011), but is about 100 times more potent than E2 as shown

Figure 1.0 Structures of estrone (E1), 17- β estradiol (E2), estriol (E3), and 17α-ethynylestradiol (EE2).

by *in vivo* EASZY (detection of Endocrine Active

Substance, acting through estrogen receptors, using transgenic cyp19a1b-GFP Zebrafish *embrYo* assays (Brion et al., 2019). Once an oral contraceptive is consumed, any hormone not absorbed by the body is excreted and enters wastewater, which is treated then released into the environment. The average daily dose of EE2 in oral contraceptives is 30-35µg per pill, with roughly 20-48% of the dose subject to metabolism (Wise & Woodruff, 2011). Annually, roughly 700 kg of EE2 are discharged into wastewaters (Adeel, Song, Wang, Francis, & Yang, 2017).

Another significant source of estrogenic hormones in the environment via runoff is agriculture and livestock. These industries release approximately 83,000 kg/year of estrogens in the European Union and the United States (Adeel, Song, Wang, Francis, & Yang, 2017). Commercial agricultural feed operations (CAFO) have been found to use natural and synthetic steroid hormones, including estrogens to enhance growth and treat reproductive disorders in cattle (Ye et al., 2018). In organic farming, manure is used as a natural fertilizer; however, trace amounts of these steroidal hormones have been found in the manure (Adeel, Song, Wang, Francis, & Yang, 2017). Manure can then affect the growth of crops by being absorbed with nutrients from soil, or become runoff because of heavy rains or storms. Runoff from organic farms and CAFOs are large nonpoint sources of EEDCs (table 1.0), in comparison to the use of oral contraceptives in humans, which has contributed fewer estrogens (Wise & Woodruff, 2011). The synthetic estrogen, EE2 has been found to be one of the most important EEDCs in aquatic environments due to its abundance and high potency (Ye et al., 2018).

species	type	amount of total estrogens excreted in urine ($\mu\text{g/day}$)	amount of total estrogens excreted in feces ($\mu\text{g/day}$)	total estrogens excreted per day (μg)	million heads (U.S.)
cattle	calves	15	30	45	17
	cycling cows	99	200	299	20
	pregnant***	320–104,320	256–7300	576–111,620	43
pig	cycling sow	82	21	103	--
	pregnant	700–17,000	61		--
sheep	cycling ewes	3	20	23	2.5
	rams	3	22	25	0.6

Table 1.0 For cattle and sheep, data are estimated total of E1+E2+EE2+E3 excretion. Number of animals were estimated by USDA in 2001. Table from Wise & Woodruff (2011).

Another EEDC that poses a problem to the aquatic environment is bisphenol-A (BPA) (figure 2.0). The chemical compound BPA is used in plastics, paints, inks and cosmetics (De Coster & Van Larebeke, 2012) and is structurally similar to the natural hormone E2; thus, it could disrupt the synthesis and homeostasis of sex steroid hormones (Negintaji, Zolgharenein & Matroodi, 2019). The primary human exposure route of BPA is its use as a plasticizer in plastics and epoxy resins, increasing stability and inhibiting degradation. Food packaging, drink containers, and aluminum cans are some common items known to contain BPA linings. BPA liners in metal cans are used to prevent contact between the metal and food to be consumed. These linings are subject to leaching of the chemical into the contents. Foods that encounter BPA leached from linings and containers can become a transport vector for BPA by entering sewage treatment facilities or leaching from landfills into groundwater and soil.

An estimated 40,000-110,000 metric tons of plastic debris (2% of the total U.S. plastic waste stream) enters US coastal waters every year (Coffin et al., 2018). Plastic debris from cups, containers, and food wrap tend to break down in aquatic systems and form macro and microplastics. Further degradation of plastics can lead to nanoplastics. Microplastics (<5mm) and nanoplastics (<100nm) in rivers and open waters provide a non-point source of BPA while effluent from factories producing BPA and leaching of the chemical from landfills are point sources. Micro and nanoplastics not only leach BPA directly into water systems but are small enough to be eaten by aquatic organisms and can facilitate bioaccumulation of BPA and contribute to poor health status.

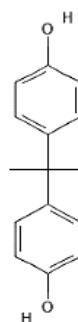


Figure 2.0 The structure of Bisphenol-A (BPA).

Mode of Action

Endocrine disruptors act in a variety of ways as they interfere with the natural production of hormones, including mimicry, antagonization, and blocking (NIEHS, n.d.). Mimicking a naturally occurring hormone, like estrogen, can lead to elevated levels of hormones. Antagonization of a receptor involves a compound binding to the

receptor in such a way that the substrate hormone cannot form a complex with the receptor. By studying transgenic genes in zebrafish in EASZY assays, it has been shown that EE2 is an agonist of estrogen receptors (Brion et al., 2019). BPA mimics estrogens since it models concentration addition, meaning that it can be substituted at constant proportions for other compounds such as EE2, E2 and another EEDC, 4-tert-octylphenol, proven by the additive effects of the protein vitellogenin (VTG) (De Coster & Van Larebeke, 2012). An additive effect is the combined effect produced by two or more compounds, such as BPA and a natural estrogen, being equal to the sum of their separate effects. Being chemically similar and having additive effects, BPA and natural estrogens such as E1, E2, or E3, can be shown to mimic estrogens as it produces the precursor protein VTG, found in female fish prior to the formation of egg yolks (De Coster & Van Larebeke, 2012).

Not only does BPA mimic E2, it also blocks the estrogen from the receptor, which then impacts the homeostasis of estrogen within the organism. Prior to these and similar studies, BPA was considered a weak estrogen, due to its lower affinity for estrogen receptors relative to E2. It has since been found to be equipotent with E1 in its ability to activate responses in cell membranes (De Coster & Van Larebeke, 2012). The effects of BPA and EE2 have been seen in the reproductive behaviors of organisms and have been linked to the chemicals' effects on endocrine receptors that impact neurons crucial to the brain areas controlling reproductive behaviors.

BPA has been shown to disrupt cellular signaling mechanisms even at levels that would be considered toxicologically safe (De Coster & Van Larebeke, 2012). Within the endocrine system, BPA mimics non-estrogenic hormones and forms complexes with their respective receptors. In the hypothalamus, BPA can disturb gonadotropin-releasing hormones (GnRH) that control reproductive function in vertebrates. GnRH binds to receptors synthesizing and releasing luteinizing hormone (LH) and follicle stimulating hormone (FSH). These specific hormones are important sexual hormones, in that they bind to receptors of the ovaries and testes to cause steroidogenesis and gametogenesis.

Aquatic Effects

Estrogenic endocrine disrupting chemicals, such as EE2 and BPA, have been found to have significant effects on fish. Male and female marine medaka (*O. melastigma*) were used in a study by Ye et al. (2018), due to the mapping of the species genome and its use as a model organism for immunotoxicology. Using a low concentration (50ng/L) of EE2 and a high concentration (250 ng/L), as well as acute and chronic exposures, the EE2 effects on *O. melastigma* were studied. In low concentrations, female fish experienced immune enhancements which enabled them to adapt and boost their own resistance to bacterial infections. However, prolonged exposure to high concentrations impaired the immune functions and impacted the output of an F1 generation. It was found that male fish experienced deregulation of immune function genes and decreased reproductive output. Female fish were most affected by the length of exposure to EE2 while male fish were affected by the concentration. In waters with 1250 ng/L of EE2, over 85% of the tested fish experienced mortality; thus, it was found that EE2 is fatally toxic to marine medaka.

EASZY Assay The use of EASZY (detection of Endocrine Active Substance, acting through estrogen receptors, using transgenic cyp19a1b-GFP Zebrafish embryo) assay of zebrafish (*Danio rerio*) has found that EE2 reaches internal organs and the brain, creating alterations to neurogenesis and behavioral changes (Brion et al., 2019). These detections by EASZY assay suggest that there may be a negative impact detected at 0 to 4 days post fertilization. EE2 causes *in vitro* and *in vivo* effects in model organisms at both low and high concentrations and, in acute and chronic exposures, gives some indication of how it may affect a wide range of fish. EASZY assay has shown that the synthetic hormone EE2 is more potent in effectiveness (table 2.0) compared to any natural estrogens, as it has lower EC₅₀ than natural hormones and a relative estrogenic potency (REP) of 96.10 compared to 1 of E2 (Brion et al., 2019). Other research has indicated that higher levels of EE2 and other estrogenic compounds have led to the finding of more intersex fish and organisms in not only localized areas, but global waterways (Wise & Woodruff, 2011).

Substance	Assay		EC ₅₀ nM (ng/L)	REP
17β-estradiol (E2)	EASZY	<i>in vivo</i>	0.62 (168)	1
	ERα-CALUX	<i>in vitro</i>	0.008 (2.26)	1
	MELN	"	0.015 (4.19)	1
	ER-GeneBLAzer	"	0.102 (27.81)	1
	Hela-9903	"	0.024 (6.56)	1
Estrone (E1)	EASZY	<i>in vivo</i>	0.97 (254)	0.64
	ERα-CALUX	<i>in vitro</i>	0.287 (77.6)	0.01
	MELN	"	0.053 (14.3)	0.29
	ER-GeneBLAzer	"	1.32 (354)	0.08
	Hela-9903	"	1.37 (371)	0.02
17α-ethinylestradiol (EE2)	EASZY	<i>in vivo</i>	0.007 (2.01)	96.10
	ERα-CALUX	<i>in vitro</i>	0.006 (1.96)	1.30
	MELN	"	0.018 (5.34)	0.79
	ER-GeneBLAzer	"	0.056 (16.67)	1.67
	Hela-9903	"	0.016 (4.71)	1.18

Table 2.0 *In vivo* and *in vitro* EC₅₀ values in nM and ng/L, and relative estrogenic potency (REP) for the steroidal estrogens in the *in vivo* EASZY assay and *in vitro* cell based assays. The REP for E2 was set to 1 in each assay. Table from Brion et al. (2019)

Production of VTG Indicators of estrogenic activity due to EEDCs is the regulation of vitellogenin (VTG) protein, which is produced in the liver of oviparous fish (Negintaji, Zolgharenein & Matroodi, 2019). VTG is a precursor protein to egg yolk and has a sensitivity to estrogenic activity within the endocrine system of an organism. VTG is also present in male organisms, but normally not expressed due to the low concentrations of estrogens in blood. Thus, VTG has been found to be a great biomarker for estrogenic levels. Some fish experience sequential hermaphroditism and change sex throughout their life span, from male to female or vice versa.

In these fish, EEDCs can have an abrupt affect in their typical life history. An example is *Acanthopagrus latus*, or commonly known as the yellowfin seabream, which experience protogynous hermaphroditism, or are born male and later transition to female. Other protogyny and protandry marine organisms include clownfish (*Amphiprion percula*), the flatworm *Hymanella retenuova*, and shrimp within the genus *Lysemata*. Hermaphroditic organisms tend to have a critical period of sexual differentiation within their life span, and exposure to estrogenic endocrine disrupting

chemicals, like BPA, may endanger that period (Negintaji, Zolgharenein & Matroodi, 2019).

In Vivo Effects of BPA In the Persian Gulf, researchers have studied the effects of BPA on yellowfin seabream, as they have economic values and have the potential to become an important marine model for hermaphroditic species. With Iranian petrochemical plants along the Persian Gulf, and a lack of efficient sewage treatment plants, there may be large quantities of untreated sewage from these plants entering marine systems. Negintaji, Zolgharenein, and Matroodi (2019) performed experiments on juvenile *A. latus* locally caught in the Persian Gulf, injecting randomly selected individuals with BPA in olive oil at levels of 0, 1, 10, 50, and 100 µg/g/week. Selected fish were sampled 7 and 14 days after exposure, and it was found that longer exposure to BPA increased the response of VTG. The testosterone levels of immature male *A. latus* were significantly lower on day 14 when treated with 100µg/g/week, compared to control groups. These results may support the hypothesis that exposure to EEDCs at a critical period in sexual differentiation of hermaphroditic fish can endanger the typical life cycle.

De-Adsorption of BPA In aquatic environments that tend to have slow flowing water, such as estuarine systems, the abundance of macroplastics and microplastics have raised concern (Coffin et al., 2018). Due to the size of macroplastics, it is likely that marine life will not ingest them. However, problems arise from compounds that desorb from the plastics, not the plastics themselves. Common plastic items found in freshwater and saltwater systems include: braided twine, bottle caps, polystyrene foam, straws, balloons, upholstery insulating foam, plastic cup fragments, and comb fragments (Coffin et al., 2018). Slow flowing waters, like estuarine systems and embayments are extremely important habitats for the rearing of young fish, such as salmonids. These plastics tend to absorb contaminants such as persistent organic pollutants (POPs) and transfer them through water systems or leach contaminants (Coffin et al., 2018). In low flowing water, plastics tend to stay in certain areas for longer periods of time and can leach more POPs or constituents, such as BPA.

Research by Coffin et al. (2018) has collected plastic samples from the North Pacific Gyre, and comparing UV irradiated virgin, or raw, plastic and non-irradiated virgin plastics that have been incubated in salt water for 30 days, in order to produce water samples similar to those of plastics possibly leaching constituents and POPs in marine systems. The research indicated that the weathering from the saltwater and environment, combined with UV radiation has led to plastics releasing EEDCs plasticizers, and that plastic possesses the ability to be mode of transportation for absorbed POPs. These released EEDCs have been found to have effects on the reproduction of Japanese medaka (*Oryzias latipes*), fathead minnows (*Pimephales promelas*), and Atlantic salmon (*Salmo salar*) (Coffin et al., 2018). Due to UV radiation enhancing the desorption of plasticizers, plastic items in waterways should be considered significant sources of EEDCs, based off experimental results.

Degradation of EEDCs

Estrogenic endocrine disrupting chemicals have a vast range of degradation times, spanning from hours to more than one thousand days depending on the environment. While in river waters, BPA has been found to have a relatively rapid half-

life, averaging below 5 days (Kang & Kondo, 2005). Due to aerobic conditions and the presence of bacteria, it seems that the combination enhances the degradation of BPA. In contrast, BPA levels in sea water were unchanged for 60 days at all conditions in an anaerobic environment. Due to powerful UV radiation being able to encourage the breakdown of BPA, it is possible that BPA degrades best in aquatic systems versus soil.

Much like BPA, EE2s degradation in the environment spans a wide range, from 2-81 days under aerobic conditions (Adeel, Song, Wang, Francis, & Yang, 2017). In groundwater systems, EE2 did not degrade over 10 days in aerobic conditions, but the concentration decreased from 1-0.62µg/g (Adeel, Song, Wang, Francis, & Yang, 2017). EE2s half-life depends on the location and the environment, as it can be 3-4.5 days in aerated soil, or 24 days in anaerobic soil.

In order to control the contamination of EE2 in aquatic systems, certain bacteria, such as *sphingobacterium sp.*, can be used to convert EE2 into the natural estrogen E1 under all conditions but nitrate reducing conditions. Other plants, like *Scirpus validus* and *Populus deltoides nigra*, reduce the concentrations of natural and synthetic estrogens by uptake of the EEDCs and trapping them in vacuoles (Adeel, Song, Wang, Francis, & Yang, 2017). The uses of bioremediation of EEDCs may be the best option in breaking down EE2; however, plants like *S. valdus* and *P. deltoides nigra* could potentially biomagnify EE2 if they are the basis of food chains.

Prevention

Sampling Techniques In order to decrease the amounts of EEDCs present in waters entering aquatic systems, it would be useful to know the important values of the contaminants that may have lasting effects on marine life. Research indicates that EEDCs like EE2 can be lethal in relatively large concentrations, and BPA has an acute toxicity to freshwater and marine species in the range of 1-10µg/mL (Kang & Kondo, 2005). Lethal limits can act as a guide for future regulations on these contaminants, but only relate to the mortality of species. Discovery of effect-base trigger values (EBT), or the concentrations of a compound that ignite negative impacts on species, would be useful in the protection of marine species (Brion et al., 2019). EBT values that take *in vivo* and *in vitro* stages of life into effect would be the most valuable as EEDCs produce lasting effects on both embryos and juvenile/adult stages of marine organisms.

To determine EBT values, the concentrations of EEDCs must be tracked in water systems through passive and spot sampling techniques. Spot sampling is a widely known and used technique for water sampling, but it only takes an instantaneous measurement of the concentration of pollutants present rather than monitoring concentration levels over a period of time (Zhang, Hibberd, & Zhou, 2008). However, passive sampling is a newer technique that aims to continuously monitor levels of contaminants. A specific device that has proven to detect sensitive levels of EEDCs in sewage effluent and rivers is the polar organic chemical integrative sampler (POCIS). The POCIS has been developed for polar compounds, as other sampling techniques such as semi-permeable membrane devices (SPMD) do not sample polar compounds do to the impermeability of the membrane for the compounds (Zhang, Hibberd, & Zhou, 2008). The use of spot sampling and passive sampling via POCIS can record the

environmental values of EEDCs like EE2 and BPA in order to designate levels of pollution for use in regulations.

Sewage Treatment The compounds EE2 and BPA are two EEDCs that can have limited interaction with marine systems if treated correctly. EE2 contaminants stem most from agricultural runoff and wastewater due to the domestic excretion of EE2 from oral contraceptives; therefore, the amounts present in the influent of wastewater treatment facilities (WWTF) and sewage treatment facilities (STF) should drastically reduce before exiting facilities. BPA contamination has been primarily due to effluent of BPA producing factories and leaching of plastics present in water systems. Through a combination of effective STFs and reduction of plastic items being introduced to freshwater and saltwater environments, BPA levels can be controlled.

Sewage treatment plants have proven to remove quantities of EEDCs from sewage and wastewater influent. With 700 kg/year of EE2 being released into wastewater, efficient sewage treatment is exceptionally important (Adeel, Song, Wang, Francis, & Yang, 2017). Steroid estrogens, including E1, E2, E3 and EE2, are removed from sewage during primary treatment by being removed via sorption onto primary sludge. The solubility of natural estrogens tends to be 13 to 13.3 mg/L which is much more soluble than EE2 with a solubility of 4.8 mg/L (Adeel, Song, Wang, Francis, & Yang, 2017). Low solubility of EE2 and a relatively low octanol-water partition (K_{OW}) indicates how sorption onto primary sludge is one of the best treatments for the EEDC.

The sludge then goes through biodegradation by microbes in secondary treatment (Ting & Praveena, 2017). In CAS treatment systems, the removal rate of EE2 is 67%, much lower than natural estrogens (Ting & Praveena, 2017) with 23% of EE2 remaining. Other processes can be used to further lower the concentration in effluent. In later stages of sewage treatment, chlorination and ozonolysis has proven to further remove EE2 from effluent. Treatments including chlorine removes between 80-95% of EE2 and ozone treatment removes 95-99% of EE2 (Wise & Woodruff, 2011). Treatments have reduced the BPA load in wastewater, as one study found levels at 0.13-3.6 µg/L in untreated water and 0.16-0.36 µg/L in the treated water (Wise & Woodruff, 2011).

Sewage treatments seem to have proven to be effective, but the lack of these efficient systems throughout the nation and planet can continue to lead to elevated levels of EEDCs in marine systems. In Brazil and Spain, roughly 75% of all estrogens found in wastewater are EE2, which can produce a serious pollution threat (Wise & Woodruff, 2011). In studies such as Negintaji et al. (2019), the lack of efficient sewage treatment along productive coastal waters can be detrimental to hermaphroditic fish. Treatment of estrogen, especially EE2 as it is 96.10 times more potent than E2 (Brion et al., 2019), is proven to work via activated sludge; however, it has been found that the biosolids produced, are released into the environment and may discharge the sorbed EE2 (Adeel, Song, Wang, Francis, & Yang, 2017).

Bioremediation Other options for treatment of EEDCs may include bioremediation via plant life. *Lemna* species, commonly known as duckweed, have been used in STFs in eliminating estrogens (Adeel, Song, Wang, Francis, & Yang, 2017). Studies have included sandbar willow (*Salix exigua*) and *Arabidopsis thaliana* actively removing estrogens from waste waters, eliminating 86% of EE2 in 24 hours (Adeel, Song, Wang, Francis, & Yang, 2017). The use of activated sludge in the removal of EE2 in sewage

waters has proven useful and effective; however, the removal of estrogenic compounds via bioremediation of plants may be the most cost effective and available treatment to areas that lack efficient sewage treatment with high levels of EE2.

Conclusion

Estrogenic endocrine disrupting chemicals (EEDCs) have been found to have a profound effect on marine systems. Based on prior experimentation, there is significant evidence that EEDCs negatively affect the immune system, sexual hormones, and reproductivity of model organisms, including: zebrafish (*Danio rerio*), yellowfin seabream (*Acanthopagrus latus*), and marine medaka (*Oryzias melastigma*). Low levels of EE2 and BPA have been found to have both *in vitro* and *in vivo* effects on specific fish, which can lead to lifelong impacts that may be irreversible. The EEDC 17 α -ethynylestradiol (EE2) has been used in oral contraceptives, as well as aquaculture and agriculture as steroidal hormones to promote growth. Bisphenol-A (BPA) is an additive used in the production of plastics, which then leaches from plastics into aquatic systems when particles begin to degrade or is directly added to rivers as wastewater from production facilities.

To decrease the presence of EEDCs and their effects, the use of EE2 and BPA should overall be reduced, or their concentrations should be limited at treatment facilities. Replacements for EE2 in oral contraceptive drugs include the use of intrauterine devices (IUDs) that do not use any sort of hormone or physical barriers. The uses of BPA have been reduced; however, the replacement for BPA, Bisphenol-S (BPS), has some indications of being just as toxic to organisms as BPA. Reduction of EE2 and BPA in sewage treatment facilities can efficiently be done using activated sludge in primary treatment or ozonolysis. The use of plants in phytoremediation has also been found to be an efficient way to remove EEDCs from wastewater. Research covering the effects of EEDCs on invertebrates would be invaluable in helping to decide future regulations on the levels of EEDCs in wastewater entering aquatic systems.

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Presence and Effects of Per- and Poly- Fluoroalkyl Substances in the Environment

Abstract

Perfluoroalkyl substances are a class of organic chemicals containing carbon and fluorine that are extremely persistent in the environment, hydrophobic, and resistant to high heat. Primarily comprised of carbon and fluorine, these compounds rely on very strong covalent bonding to make substances that are incredibly resistant to degradation in nature. Because of these properties, there is growing concern about their persistence in the environment, with current research showing that these substances are now found in nearly every corner of the earth. In this paper I am going to look at what these chemicals have been used for both past and present, what makes these substances so persistent in the environment, how their presence impacts aquatic environments, and what the future may hold for these chemicals.

Introduction

Polyfluoroalkyl and perfluoroalkyl substances (PFAS) were discovered accidentally in 1938 by 3M Chemical, and soon after marketed as Scotchgard, a stain repellent spray for clothing and upholstery. Since then, these compounds have been used in the production of electronics, carpet, cookware, and as aqueous firefighting foam (Müller, 2015). These compounds have been found to cause birth defects, kidney and liver disease, endocrine disruption, and testicular cancer (Alaska DHSS, 2019). Until recent years, little regulation on these chemicals existed, and even today, there is still a steady stream of per- and polyfluorinated chemicals making their way into the environment.

PFAS were discovered in the 1950's, and have been used throughout the world in many industrial applications, with perfluorooctane sulfonate (PFOS) being the first of these to see widespread use with the production of 3M's Scotchgard. This aerosol could be applied to clothes to make them water and stain proof. This product quickly took off, with Scotchgard becoming a \$300 million dollar a year brand by 2000, when 3M took the product off the shelves to reformulate it (Renner, 2006). The original formula was based on PFOS, an 8 carbon chain, saturated with fluorine with CF_3 at the tail, and sulfonic acid at the head (see Fig. 1). The hydrophilic head and hydrophobic tail, which are present in all PFAS, give them excellent stain repellent abilities, and allow them to function very well as surfactants and as key components in polymers. The carbon-fluorine bond is also extremely strong, making it virtually impossible for these compounds to be broken down in natural systems.

PFAS can be broken down into two main types: short and long chain. In the case of perfluoroalkyl sulfonic acids, the hydrocarbon chain is a molecule containing six or more carbons, and a short chain PFAS contains a hydrocarbon chain of fewer than six carbons. For perfluoroalkyl carboxylic acids, a long chain is seven or more carbons with a short chain having fewer than seven carbons (see Fig.1) (Brendel et. al, 2018). Early PFAS were usually of the long chain variety and were based around a C_8F_{17} chain (Renner, 2006). Long chain PFAS were regulated in the European Union under Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulations in 2006 due to the persistence in the environment and toxicity of these chemicals. Long chain PFAS also have an increased chance of bioaccumulation because

the bigger molecules adsorb strongly to sediments in aquatic and terrestrial environments (Ahrens, 2014).

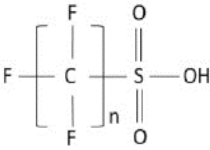
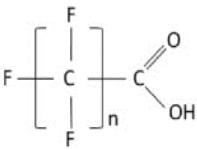
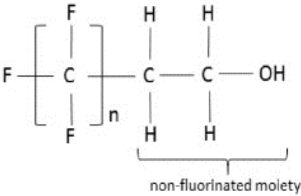
Perfluoroalkane sulfonic acids Long-chain: $n \geq 6$ Short-chain: $n < 6$ Example short-chain representative: PFBS ($n = 4$)	
Perfluoroalkyl carboxylic acids Long-chain: $n \geq 7$ Short-chain: $n < 7$ Example short-chain representatives: PFBA ($n = 3$), PFHxA ($n = 5$)	
Example of short-chain precursors 4:2 fluorotelomer alcohol ($n = 4$) 6:2 fluorotelomer alcohol ($n = 6$)	

Figure 1. Graphic showing structures of the basic building blocks of PFAS (Source: “Short-chain perfluoroalkyl acids: environmental concerns and a regulatory strategy under REACH”)

Short chain PFAS have been used more in recent years as regulations have pushed manufacturers away from the long chain molecules. Originally thought to be a less harmful alternative, there is now mounting evidence that the short chain PFAS may also be detrimental to the environment. Short chain PFAS are much more water soluble, which makes them more capable of spreading through ground water (Ahrens, 2014). Unlike long chain PFAS, which can be removed from water using activated charcoal, short chain PFAS are much harder to remove from large volumes of water, so the techniques that are being tested are only effective at a small scale and cost prohibitive on a large scale (Ahrens, 2014).

On top of their stain and water repelling characteristics, PFAS are also high performing surfactants. An application that takes advantage of this characteristic is aqueous film forming foams (AFFF), a type of firefighting agent. The foam is used in fires where the fuel source is burning hydrocarbons that water on its own would just spread around. The addition of fluorinated surfactants in the foam tend to form a blanket over the burning fuels and smother the fire by cutting off oxygen (Place & Field, 2013). These foams are also sources of groundwater pollution, with few to no steps taken to minimize entry into the environment following fires or firefighting drills. In the country of Sweden alone, there are 34 individual AFFF training sites that are within less than a

mile of water protection sites, which are areas of surface water that are protected to maintain clean drinking water for communities (Marko et. al., 2014).

Another common use for PFAS is in non-stick cookware.

Polytetrafluoroethylene (PTFE), also known as Teflon, has been used in cookware since the 1960's because it possesses a fairly high heat tolerance and its hydrophobic tendencies, which keep oils and foods from adhering to the cookware (Sijad & Ilyas, 2017). Although generally considered a stable chemical compound at standard conditions, above 260°C it starts to release polymeric resin fumes into the atmosphere. As temperatures continue to rise, this compound releases more gasses, until about 400°C, when the PTFE starts to noticeably decompose (Baker & Kasprzak, 1993). PTFE is decomposed into tetrafluoroethylene (TFE) and fluorocarbon diradicals (RCF_2) (Sajid & Ilyas, 2017). The production of PTFE also frequently uses PFOA as a feedstock, which has caused localized PFAS pollution at sites producing Teflon. Although PTFE is not per se a source of environmental PFAS contamination, and it is mostly burned off during the production process, it is still present in the production facilities producing this cookware, potentially exposing workers and others that live in the surrounding areas.

The effects of PFAS on humans and the environment were first observed in areas around production facilities of PTFE. The first of these facilities in the United States was DuPont Chemical's Washington Works plant in West Virginia on the Ohio River basin. This plant used ammonium perfluorooctanoate (APFO) as a primary chemical in the production of Teflon. When dissociated in water it forms PFO^- , which when in the presence of an acidic solution forms PFOA (Shin et. al., 2011). Effluent from this plant was discharged into the Ohio River, spread into watersheds surrounding the plant, and PFOA was quickly found to be present in associated ground water (see Fig. 2). PFOA in a fine dust form, released during transfer of feedstock within the production facility, also contributed to widespread distribution of PFAS throughout the region.

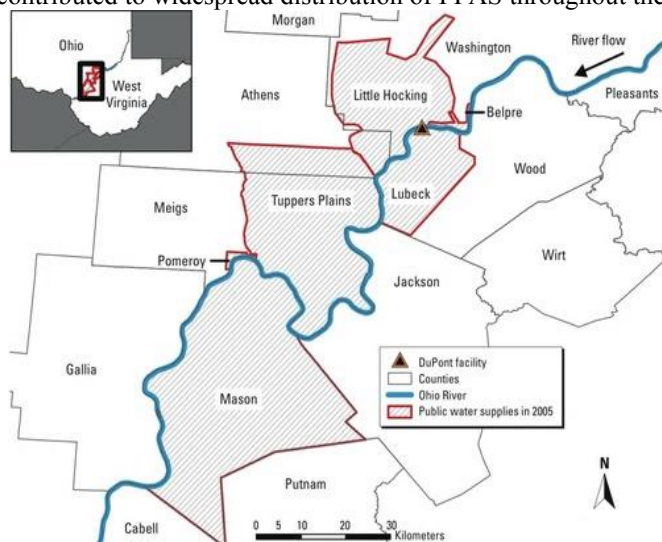


Figure 2. Map showing areas downstream of the Washington Works plant (Source: “Perfluorooctanoic Acid Exposure and Cancer Outcomes Contaminated Community: A Geographic Analysis”)

There have been multiple negative health effects in both animal and human systems linked to PFAS, including cancer, endocrine system disruption, and birth defects. These become much more apparent in areas closest to chemical plants that manufacture PFAS. The C8 Health Project, which took place from 2005-2006, sampled over 32,000 individual's blood, including over 4,000 people who worked for DuPont at various chemical plants. During this study, it was found that cases of kidney and testicular cancer were more prevalent in those that had higher levels of PFOA in their blood (Nicole, 2013). Another study links increased PFOA levels with prostate cancer, ovarian cancer, and non-Hodgkin lymphoma (Viera et. al., 2013).

PFAS have also been tied to birth defects and decreased birth weight in both humans and other mammalian systems. It is suggested that exposure to PFAS before and during pregnancy lead to disruptions in lipid metabolism and glucose tolerance (Matilla-Santander et. al., 2017). PFAS are mainly fat/lipid soluble, meaning that they can also be passed down to infants that are breastfeeding, and PFAS have been found in higher concentrations in mothers who frequently snack, eat out, and drink milk (Lee et. al, 2017). There is also a clear gender difference in half-life of PFAS between males and females, both in human and other mammalian systems. Males have been found to hold onto PFAS in their body longer than females. In animal studies, it's been found that males can retain these chemicals in their bodies up to 70 times longer, meaning that women often have lower blood levels of PFAS (Knox et. al., 2011).

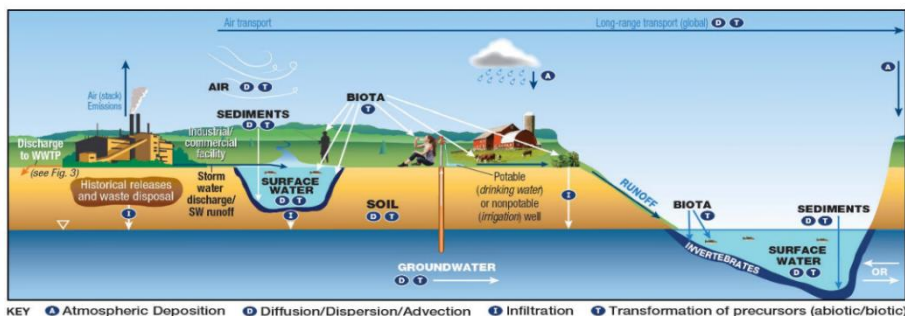


Fig. 3. A basic illustration of the paths PFAS can take to get into the environment. (source: ITRC)

Although existing for fewer than one hundred years, PFAS are now considered ubiquitous all around the earth. In a recent study looking at soil samples on every continent, perfluoroalkyl carboxylates (PFCA) were found in all samples, and perfluoroalkane sulfonates (PFSA) were found in all but one sample. These were taken from areas that hadn't been impacted by humans, which shows that PFAS are capable of being transported through atmospheric long-range transport (LRT) (Rankin et. al., 2016). While many PFAS are not very volatile, their release into the atmosphere from industrial exhaust is a large source of airborne PFAS. When suspended in the atmosphere, some of these compounds are subjected to photooxidation via UV light, which can break down

certain PFAS into smaller constituent molecules that can then settle into soil and sediments (ITRC, 2018).

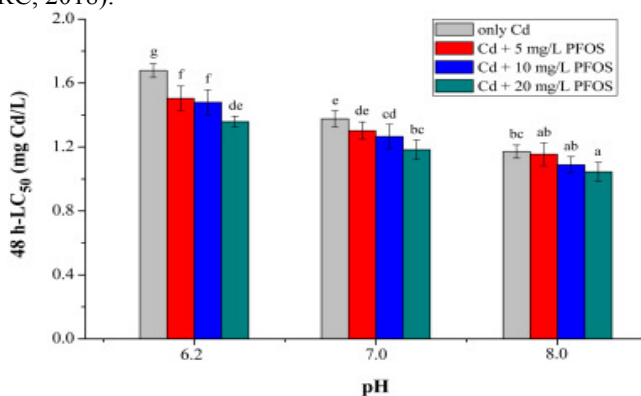


Fig. 4. Table comparing 48h-EC₅₀ in *Limnodrilus hoffmeisteri*, showing effects that increased PFOS and pH have. (Source: Qu et. al., 2016)

As well as being ubiquitous in terrestrial environments, PFAS are also found worldwide in aquatic environments. PFAS can be introduced into aquatic environments through point-source pollution such as the dumping of effluent into a river or through wastewater treatment. Nonpoint sources of pollution can be through deposition of PFAS that have been involved in LRT (Ahrens, 2014). In aquatic environments, the dominant PFAS are short chain, which are typically more hydrophilic, and more soluble in water than long chain PFAS, which makes them much more mobile in aquatic environments and in ground water. The long chain PFAS are more likely to bind to suspended sediments in the water column, which increases their abilities to get into the food chain and opens the door for bioaccumulation to occur (Ahrens, 2010).

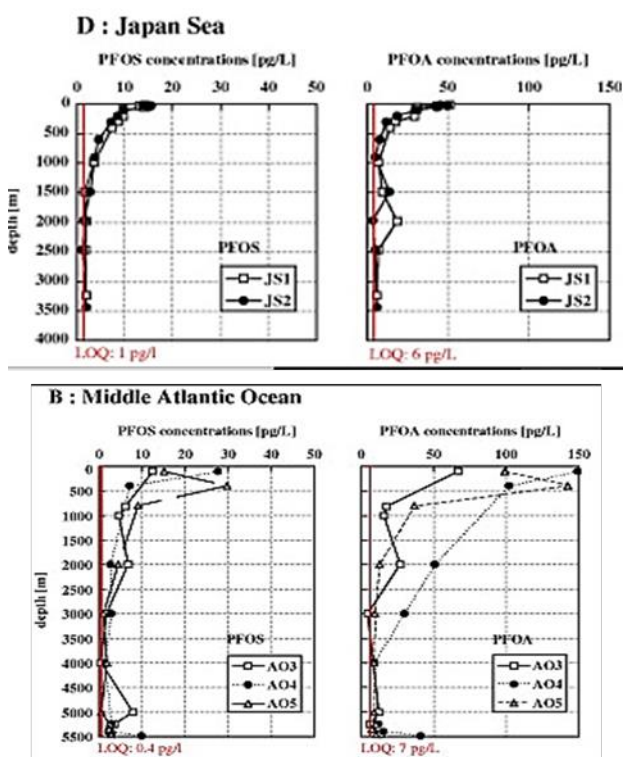
Algae have recently become a species of interest when looking at the impacts of PFAS on aquatic ecosystems. When exposed to different PFAS, blue-green algae, *Geitlerinema amphibium*, there was a direct correlation between levels of PFAS and the amount of indigestible cellulose in the cell walls of the algae (Latała et. al, 2009). This lowered nutritional value can have impacts going throughout the entire trophic structure of the aquatic environment, and means that PFAS can have unforeseen secondary impacts on organisms. There was also a relationship between the chain length of the PFAS and the impact it had on the algae, with every perfluoromethylene group in the chain increasing the toxicity of the compound by twofold (Ahrens, 2014).

Although there is not a lot of research on the toxic effects of PFAS on marine organisms, it is clear that their production and subsequent release into marine environments is not showing any signs of slowing down. It is estimated that there has been between 6,800 and 45,300 tons of PFOS and its precursors released into the environment, with over 95% of that going directly into aquatic ecosystems (Ahrens, 2014). On top of the toxicological effects of PFAS on their own, there is mounting evidence that they can work with other toxic substance as compounding stressors, worsening the effects of both pollutants. For example, when cadmium was combined with varying levels of PFOS in an experiment looking at *Limnodrilus hoffmeisteri*, a type of worm, the 48h-EC₅₀ of cadmium decreased. This means that although the PFOS/PFAS

may not be directly or clearly impacting organisms, it can make them more susceptible to other contaminants (Qu et. al., 2016).

Although ubiquitous all over the planet, there is an amount of variance in spatial distribution. For example, the Northern Hemisphere, where most of the production of these compounds has taken place, has a notably higher average concentration in soil and water, and air samples than the Southern Hemisphere (Rankin et. al., 2016). There is also an uneven distribution of PFAS throughout the water column. When PFAS concentrations were measured on the Pearl River Estuary and in the bay surrounding it, PFAS concentrations were found to be in much higher concentrations in the water near shore than in the waters near the mouth of the bay (Gao et. al., 2015). When concentrations of PFOA and PFOS were measured in the North Atlantic and the Sea of Japan, there was a clear gradient of PFAS concentrations throughout the water column, with concentrations being higher in the upper water column (Yamashita et. al., 2008). This could be due to the structure of the PFAS and its surfactant abilities, which preferentially form surfactant foams at the surface of the water (Ahrens, 2014).

Fig. 5. Graphs of PFOA and PFOS concentrations throughout the water column in the Middle Atlantic and Japan Sea. (Source: Yamashita et. al., 2008)



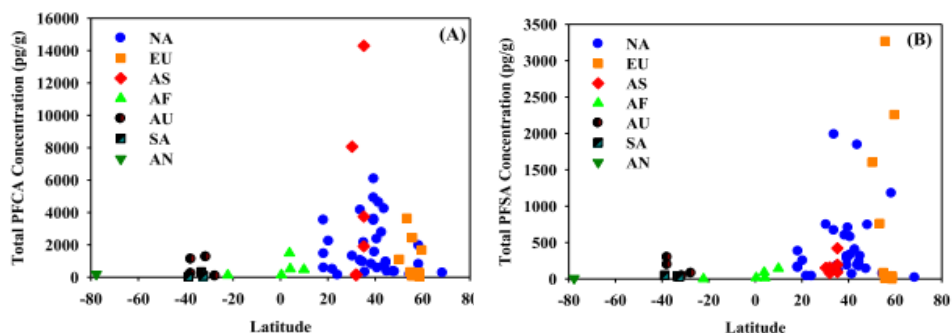


Fig. 6. Graphs of PFAS concentrations plotted against latitude. (Source: Rankin et. al., 2016)

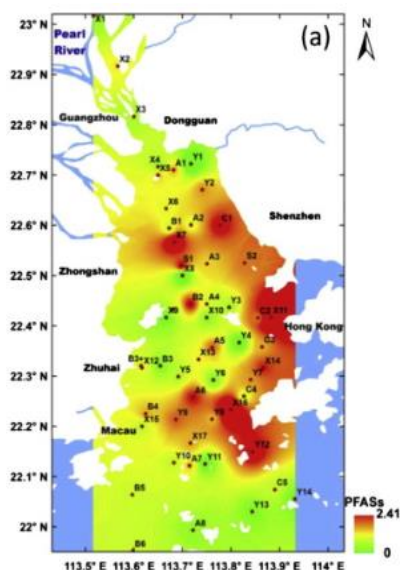


Fig. 7. Map of the Pearl River Estuary showing the gradient of PFAS concentrations as the distance from shore increases. (Source: Gao et. al., 2015)

The persistence of PFAS is driving researchers to find solutions to these compounds in the environment by finding ways to break them down. Although it is not thought that there are any natural cycles that can break down, there are systems being put in place to treat municipal water supplies to remove PFAS. In North Carolina, communities downstream of a chemical plant owned by a DuPont spinoff, Chemours, which produced PFOA until 2015, and has produced a new replacement for PFOA, known as GenX, have implemented activated carbon as a treatment for PFAS in drinking water (Hogue, 2018). Although effective, this method is not 100% effective, and still leaves a detectable amount of PFAS in water. Plasma reactors are also being researched as a way to break down PFAS. Using argon gas to draw the PFAS to the surface of the

water, plasma is then generated at the surface and the chains are broken down carbon by carbon, leaving only single carbons and fluoride ions (Jansen, 2019).

PFAS have now been found in nearly every corner of the world, both on land and in oceans. Although not necessarily detrimental to organisms in their current levels, there is no indication that the input of PFAS into the environment is slowing down anytime soon, there could be a yet unknown threshold where concentrations become harmful. There are currently no effective methods to break down these chemicals in the natural environment, but it is still a relatively new field of research, and there are new developments coming out regularly. There are still many unknowns about the possible effects that PFAS will have in the future, but they have become a cautionary tale of how pollutants can spread worldwide with little knowledge of the impacts that could come from them, and can hopefully lead to improved management of persistent pollutants in the future.

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Rayne Billings (she/her) and Olive Brend (zie/hir/they/them) currently live and work in Juneau. They are most interested in Animal Studies, Cultural Geography, and multispecies relationships. This summer, they are presenting at a conference in Kelowna, British Columbia, on killer whale-human relationships, focusing on music and emotions. They hope to one day be members of a queer, multispecies commune, but for now, they spend their time hiking around Southeast Alaska and the rest of the Pacific Northwest.

Authors' Notes

Before we start in on our essay, we would like to take a few paragraphs to explain the story behind this work, its nontraditional qualities, and why we chose to write in such a manner.

Throughout the essay, we use “human” and “animal” (with the quotes) because of the human-animal binary imposed by the Western culture.¹ Other terms are in quotes for the same reason: dominant ideologies focus on binaries, which can each be problematic (but that would be an essay on its own... We'll stick to milk here). Also, we have chosen to capitalize Nature and Culture throughout the essay for similar reasons.

As far as traditional academic writing goes, we followed some — but not all — traditional rules. Those we don't follow are in protest of the racist, sexist, homophobic standards of academia, submitting to the cisgender, heterosexual, white male gaze. Some rules we do not follow include strict citation guidelines (see below...), avoiding contractions, a traditional essay structure, and first person (especially first person plural) narration. We also use the singular “they” pronoun for those who are anonymous or unidentified, which goes against some style guides, as it is easier to understand, a normal part of the Standard American English vernacular, and more inclusive. Furthermore, we are aware that it is impossible to move away from these standards completely — we are white, English-speaking “humans,” studying and working on land that we have stolen, and focusing on interactions with “animals” who cannot speak for themselves.

Finally, much of this essay is based on our own lived experiences, so there are some “missing” source citations. It is difficult to find “reliable academic” sources that match up with and understand our lived experiences in t sexist, homophobic moment. We will indicate such ideas with “(personal experience)” as the in-text citation.

We hope this essay is, at the very least, interesting; it sure was fun to write and research. Our goal, however, is to educate and to pose questions and theories that might incite further research and intensive thinking. Nonetheless, enjoy the following few pages as we venture through radical love, multispecies relations, and the politics of milk.

With Love,
Rayne Billings and Olive Brend, Winter 2020





































¹ Other suggested terms have their own issues. For instance, “more-than-human” is imprecise; it can mean multiple things, and clarity is important. “Non-human” implies that there is something missing — if you're not “human”, then you're missing humanity. Humanity is important to “humans”, and “non-human” simply reinforces the binary. Besides, this would be like saying “non-woman” or “non-heterosexual.” There are (or should be) better terms that allow for multitudinous binary breaking but still make full, coherent sense, but we have chosen this one as the best option for our work at this time.

A Study in Milk

As infants, one of us was breastfed, while the other was not. And yet, we've wound up in pretty much the same place. So... does breastmilk really matter?

Of course it does. Milk is a basic multispecies relationship: a few of us grow up drinking from our parents, while others don't. Some of us drink it from other people — mothers, fathers, those who aren't our parents or anyone's — while others of us are more like cyborgs, growing up on factory-produced and reproduced formula. And yet, even after our parents stop lactating, we still drink milk: milk from goats, milk from cows (bovines). In a recent marine mammalogy class, while we were covering whaling, a fellow classmate even asked about whale milk and "human" consumption of it. All mammals have the ability to make milk, and many do — Karin Bolender calls those of us who lactate "femammals," quite a cissexist take on the action (Bolender, 2014).² Furthermore, lactation and breastfeeding often provide primal love to infants — that motherly bond comes from a release of oxytocin that both mother and child get a healthy dose of during breastfeeding (Lee, 2018). Their eyes dilate, their hearts race, and they feel, for the first time, love. Lactation brings those of us who do it together, and yet, we "humans" have a very skewed relationship with it: we drink our mother's (or other's) milk until around a year old (though sometimes for a few months, sometimes for decades), and then we move on to cow milk, goat milk, or, perhaps, killer whale milk, if you're in marine mammalogy class. These multispecies interactions — the former of which comes from and creates love, the latter of which is a wholly postmodernist disconnection — are contradictory, though nonetheless connected through radical relationships between space, time, "humans," "animals," and individuals.

² Mammals are often differentiated from other phylogenetic taxa by the presence of the mammary gland; similarly, the ability to breastfeed, often, though wrongly, is used to differentiate women from men (Lee, 2018). The use of the word "femammals," while not entirely incorrect based on the logic of the rest of this note, forgets that just about anyone with nipples — regardless of gender identity or gender assigned at birth — has the ability to lactate with simple stimulation and basic hormone supplements (Lee, 2018).

Zodiac : Tropical				Placidus Orb : 0			
 Sun	 Virgo	14°30'	I ASC	 Sagittarius	3°06'		
 Moon	 Sagittarius	26°43'	II	 Capricorn	4°59'		
 Mercury	 Virgo	28°08'	III	 Aquarius	12°02'		
 Venus	 Libra	8°10'	IV	 Pisces	18°32'		
 Mars	 Leo	23°33'	V	 Aries	18°51'		
 Jupiter	 Gemini	10°23'	VI	 Taurus	12°53'		
 Saturn	 Gemini	0°57'	VII	 Gemini	3°06'		
 Uranus	 Aquarius	17°50' R	VIII	 Cancer	4°59'		
 Neptune	 Aquarius	4°12' R	IX	 Leo	12°02'		
 Pluto	 Sagittarius	10°10'	X MC	 Virgo	18°32'		
 Lilith	 Capricorn	21°08'	XI	 Libra	18°51'		
 N Node	 Cancer	23°17'	XII	 Scorpio	12°53'		





































Zodiac : Tropical				Placidus Orb : 0			
 Sun	 Leo	18°22'	I ASC	 Leo	24°44'		
 Moon	 Leo	18°30'	II	 Virgo	20°41'		
 Mercury	 Leo	0°10'	III	 Libra	20°25'		
 Venus	 Virgo	2°09' R	IV	 Scorpio	22°37'		
 Mars	 Scorpio	16°51'	V	 Sagittarius	24°51'		
 Jupiter	 Taurus	4°41'	VI	 Capricorn	25°39'		
 Saturn	 Taurus	16°53'	VII	 Aquarius	24°44'		
 Uranus	 Aquarius	14°40' R	VIII	 Pisces	20°41'		
 Neptune	 Aquarius	2°34' R	IX	 Aries	20°25'		
 Pluto	 Sagittarius	7°47' R	X MC	 Taurus	22°37'		
 Lilith	 Sagittarius	7°25'	XI	 Gemini	24°51'		
 N Node	 Leo	12°59'	XII	 Cancer	25°39'		

Figure 1: Our astrological natal charts. Olive’s is on the left and Rayne’s is on the right. (“Birth Chart”)

It’s important to explain our moment of relationship compatibility which we occupy to get our bearings and yours set for the essay ahead of us. Astrology, based on the locations of the stars at specific birthplaces and birthtimes, occupies a boundary between simple binaries of science and religion. At once, it relies on complex mathematical calculations, a deep understanding of physics (both traditionally scientific), and blind trust in the theories of the past (traditionally religious). It is a pan-chronological field, with little being discovered in the moment, but plenty being calculated and catalogued; astrology is largely based on the past tense.

Besides occupying an enigmatic part of both space and time, astrology defines relationships. It defines, perhaps, every breath we have taken, or will take. Astrology defines fate. Do we believe, then, in fate and/or its alternative, free will? That’s a difficult question.

The two of us, both from different familial backgrounds and different areas of the same country, were pushed together in both conventional and unconventional ways. Sure, we grew up within the same space and the same time, occupying the same few-thousand-mile radius and the same 20 years before our ultimate meeting; we both had an interest in the ocean, the West Coast, traditional science. But still, by some dumb luck (fate...?) we looked for similar colleges at the same time, and had to choose between the same three. We, of course, found ourselves at the same institution in the end, working the same job, members of the same clubs, studying the same things. Is this simply a product of two queer misfits wanderlusting their way around the country until they run into someone compatible? Or did fate draw the two of us together? As believers in astrology (though with no Western scientific backing...) we would say yes. We are friends — colleagues — because the stars designed us to be such.

The following passage explains how Olive's Mars in Leo and Rayne's Ascendant in Leo interact. This relationship is an exact aspect.³

"When one person's [Rayne's] Ascendant conjuncts Mars of the other [Olive][...] They can motivate each other into action in a very personal manner. Both of them may share many activities, work matters included. On the flip side, they may have harsh behavior, be irritated and impatient with each other and be mutually motivated into immediate and hasty actions."
("Love Compatibility Calculator")

This passage explains many of the similarities we have, as well as some of the issues we sometimes encounter while working together. Besides being an exact aspect, this relationship is also considered a key or "crucial aspect of your [our] life" ("Love Compatibility Calculator"). This simple astrological relationship, written by the stars as we each were pulled from our mothers, describes so much of our relationship. The alignments of the planets, moons, and suns around us pulled our intrigues and tastes into their gravitation, and eventually pulled us together.

Astrology is a boundary science, made up of two not dissimilar philosophies: the natural science of astronomy and the unnatural science of fate. At once, it combines modern Western scientific understanding and ancient customs from across the world. Killer whales — indeed, the whole of the traditional Cetacea taxon — also occupy a similar boundary. They bridge the gap between "human" and more-than-human, seen as both a product of the Natural world and an entity of "human" Culture. We both had our introduction to the binary-breaking killer whales through whale watching in the San Juan Islands of northwestern Washington State.

The act of boat-based whale watching is inherently oppressive — as well as being an entirely manufactured experience, it relies on the othering and exotification of "animals." However, shore-based whale watching (which only one of us has participated in) more easily develops meaningful multispecies relationships. Furthermore, the experience does not rely on "animal" commodification, nor is it as manufactured as boat-based whale watching.

To further explain the oppression of boat-based whale watching: built off of human-made watercraft and within human-made Nature, boat-based whale watching is a wholly manufactured experience. Interactions with whales and other "animals" one might encounter while whale watching are highly fabricated — to move close to (or touch) another entity is an altogether emotional and intimate experience, but whale watching takes the viewer away from the interaction. Given the non-diegetic voiceover and easy access to a plethora of snacks and heated indoor cabins, they may as well be watching a nature documentary at home. The boat stands in for the camera, directing attention to the whales and interacting with them in place of human-animal interactions.⁴ The passengers simply watch. Lost in the shadows by overpriced hot

³ Exact aspect refers to two celestial bodies at a very close angle to each other. In this example, Olive's Mars in Leo is at 23° 32' and Rayne's Ascendant in Leo is at 24° 43', 71' apart.

⁴ Vsevolod Pudovkin, an early 20th Century Soviet film producer and critic, claims that the camera must stand in for the eye of the of the observer; the camera angles and

cocoa and annoying undergraduate naturalists, the whale is merely a signpost within a broader ecological journey manifested by the un-Natural experience of boat-based whale watching.

Shore-based whale watching, however, relies on the whales' desire to interact, and therefore involves less spatial domination. It typically leads to physically closer interactions, which fosters more intimacy on both ends. To encounter another entity in such close proximity, and for it to be a mutually-founded interaction, is altogether less oppressive and much more endearing. Shore-based whale watchers (typically from the shores of Lime Kiln State Park on San Juan Island) occupy a defined subgroup of "whale insiders." Though the shore-based watchers are not immune to oppressive and problematic multispecies relationships, they are, inarguably, more aware and understanding of the systemic issues of whale watching.⁵ Through the forced understanding, mutual desire for interaction, and closer spatial connection, shore-based whale watching is much more intimate and fosters more emotional bonding between those involved. Shore-based whale watching is also love-based whale watching.

This "love-based whale watching" is embodied through what is known as the "Human Peak Experience": a situation described as being "the most ecstatic, joyous, happiest, blissful moments in one's life" (DeMares, 2000). The study "Human Peak Experience Triggered by Encounters with Cetaceans" examined several peak experiences that occurred when "humans" and cetaceans interacted, with several participants describing encounters with the Southern Residents (DeMares, 2000). For example, a participant named Judy described the following encounter:

"And it didn't take but a couple of seconds before I started to have a feeling that I've never had before at this level. It was love, exponentially enhanced to a point that I can't describe..."
(DeMares, 2000)

This feeling of "exponentially enhanced love" is known to "whale insiders" as an "orcagasm" — an oversexualization of multispecies encounters and relationships. These relationships are often misunderstood by both insiders and outsiders due to their nontraditional qualities.

Queer people, too, have an undeniably nontraditional relationship with love.⁶ Every part of our love life is sexualized, built off of the cis het male gaze, based in

directions thus control the viewer's psychological understanding of the film (1926). Boat-based whale watching is the same, controlling the passengers' and the whales' views and interactions.

⁵ Many avid whale watchers (especially women, from both boats and from shore) choose a specific whale whom they have a strong preference for and refer to them as their "whale boyfriends," a dismal heterosexual understanding of multispecies relationships.

⁶ The term "queer," while often regarded as a slur in queer and non-queer spaces alike, is a catch-all term that first arose in the 20th Century, referring to members of the LGBTQ+ community. We have reclaimed this word for ourselves and often use it for groups, and sometimes for ourselves, though we personally hesitate to get rid of labels altogether for fear of over-inclusivity. We have chosen to include this term, though

centuries of persecution and villainization.⁷ Not to mention, sexism, racism, and colonialism are built into the adverse experiences that diverse queer people face on a daily basis (personal experience). However, it may be difficult to imagine a world based on queer people, built out of queer ideology and out of post- and anti-colonial rhetoric. A non-misogynist, non-homophobic, non-racist world is so opposite our own that it is nearly impossible to picture perfectly. Queer anarchy and relationship anarchy can be early steps to imagining this world.

“QUEERS READ THIS” is a pamphlet written by a self-identified anonymous dyke, published by Queers, and passed out at a pride march in New York in June of 1990. This groundbreaking text lays the structure for both queer anarchism and relationship anarchism, each advocating for liberation from hierarchal relationships built on capitalism, amatonormativity, heteronormativity, colonialism, and the patriarchy (The Thinking Aro, 2013).⁸ The relationships we have with each other (queer-queer, queer-straight, human-animal) are complex and transcend traditional relationship views. Not only is platony often defined as strictly for heterosexuals, but queerness is inherently anti-hegemonic in our current social world (Amir, 2001). This is where anarchism comes in.

The Thinking Aro, an anonymous blogger focused on queer theory (and especially that pertaining to aromanticism and asexuality) explains that relationship anarchy “...is not a lifestyle...[but] a philosophy of love,” which believes that all types of love are equal, and that love is “...abundant and infinite...” (2013).⁹ As is the case with anarchy, relationship anarchy rejects heteronormativity, monogamy, amatonormativity, and many other aspects of traditional relationships by establishing instead nets of relationships focused on individual pleasure (sexual or otherwise...) and communal harmony (The Thinking Aro, 2013). Relationship anarchists do not label relationships (i.e., platonic friendships, romantic relationships, sex or sexual

controversial, because of historical use and our own use. In the words of “QUEERS READ THIS,” “We use queer as gay men loving lesbians and lesbians loving being queer... it is also a sly and ironic weapon we can steal from the homophobe's hands and use against him” (1990).

⁷ The term “cishet” refers to cisgender (those whose gender identity match with the gender they were assigned at birth) and heterosexual (those strictly attracted to the “opposite” gender) people. This term, while not entirely professional, is common in many queer-written texts from plain conversation to information pamphlets to the occasional traditionally-reliable and -academic source, so we have opted for its inclusion.

⁸ “Amatonormativity” refers to the societal pressure to engage in traditional romantic relationships, to hold these relationships higher than most/any others, and the idea that everyone is looking for such a relationship (Brake).

⁹ It is important to note that this particular blogger is no longer active; they have said that much of their content from the past decade or so is no longer theory in which they believe. However, since the information is accurate and explains the concepts we are trying to incorporate well, we have opted to leave this source in.

relationships) and may be intimate in many ways with many people at the same time.¹⁰ Here is an example: Jesse (he/him) lives with his two roommates, Gwen (she/her) and Matt (he/him). They often all share beds together, and when they go out, they usually go together. However, Gwen and Jesse do not have sex together, while Matt and Gwen sometimes do, and Matt and Jesse sometimes do as well. Gwen also has a “partner,” Lynn (she/her), with whom she holds hands, cuddles, and kisses, but does not have sex with.

These politically-based theories are important to modern queer people and their understandings of relationships; anarchy, especially, is a huge part of today’s queer culture (personal experience). Our love is nontraditional; our love breaks boundaries. Like astrology, like killer whales, our love transcends traditional (Western, colonialist) ideologies.

With the Second Wave of Feminism — vaguely cissexist, based on female (and we mean *female*: think vagina hats and little to no regard for racism, transphobia, and colonialism) empowerment — fading, the Third Wave, Intersectionality, elicits different responses not only to queer relationships, but multispecies relationships, as well.¹¹ Earlier, we briefly mentioned the powerful role that milk plays in our lives. So what about intersectionalizing lactation? As two lesbians, one of us cisgender and one of us trans, what does lactation look like for us? Neither of us will likely ever be pregnant nor give birth (due to lack of functioning ovaries/uteri in both of us), and though it is possible that we could breastfeed other people’s children, or donate our milk, our tits are functionally useless.¹² However, we recently stumbled upon *The Multispecies Salon*, which has a recipe for “human” cheese (Simun, 2014). Struck by inspiration, we immediately began research, and it turns out, despite being unable to give birth, we both can lactate! Via a special fennel root tea, Traditional Medicinals® Organic Mother’s Milk® (available at Fred Meyer and Safeway), and simple suction devices often used by pregnant people, we are able to create our own milk, and thus, our own cheese. Not only is this a protest against the state of the dairy industry, but it also gives us a closer connection to the food we are consuming. Conceivably, we could make many products and meals mostly or entirely from our own milk. This not only gives us a greater appreciation of where milk we have *not* created comes from, but also connects us more with our own bodies.

From a young age, many of us drink milk from one of our parents, and many of us from factory-created formula; a small percentage of the population drinks from

¹⁰ While often mistaken for polyamory, romantic anarchy is often described as anti-monogamous rather than non-monogamous. Polyamory is still somewhat built on traditional relationship hierarchies — labels such as “girlfriend” or “platonic” apply in polyamorous relationships, but don’t in relationship anarchy.

¹¹ Intersectionality includes race theory as well as feminist and queer theory. However, we are not discussing race theory to any great lengths in this essay because, as white people, we do not feel that we are qualified to make any significant claims or contributions.

¹² Though the specific uses of breasts (breastfeeding only, sex and fetish only, both) could be another essay entirely...

donated milk (“Milk Donation and Sharing”). Then, for the rest of our lives (assuming no milk allergy, lactose intolerance, or veganism gets in the way), we drink the milk of cows and goats. These multispecies relationships are quite complicated, a bit muddled by the woes of alienation from products and built on strange, three-dimensional power structures: we almost never know the individual (or, in the case of large-scale commercial milk manufacturing, individuals) from which we drink, nor do we have any emotional connection to them. To milk your own cow, for example, one that you’ve raised since she was a heifer, who has known you all her life, is an altogether different experience than to simply walk into Walmart and buy a carton of milk with a smiling, fat-uddered bovine on the front.

However, there is an alternative to this strange multispecies relationship: “human” milk. When “human” lactation combines with queer and relationship anarchy, communities (also called communes in some circles) become prevalent.¹³ These communities — “human” or “animal” — are built up by collective giving and reinforcement by members. Children are raised collectively, food gathered collectively, and, often, milk distributed collectively (personal experience). These communities often embody relationship anarchy, with many members engaged in unlabeled relationships ranging from shared living spaces to sexual encounters. Of course, in “animal” communities, relationships never have labels the way “humans” do; relationship deviance is common and, as far as we can tell, accepted among “animals” (Bagehmil, 1999). An important part of these communities is child rearing, which, for infants and some toddlers, includes breastfeeding. Many adults in the community may participate in breastfeeding, rather than just a single birth parent, and sometimes, members lactate for reasons other than breastfeeding a child, such as milk-product production and fetishes (personal experience). Communal breastfeeding is seen in many types of communities and relationships, from “humans” to killer whales.

Killer whales, along with many other toothed whales, live in stable, life-long groups composed of mothers and their offspring. They regularly partake in what is known as alloparenting — when community members besides the biological parents take care of the children (“Alloparent”). Similar to a “human” commune, killer whale societies are based around the idea of the collective: group needs are placed above that of the individual. This is readily seen through several ways: extensive sharing of food, even among non-biologically related community members; regular babysitting/alloparenting; synchronous breathing and sleeping times; and suspected (though not confirmed) communal nursing (Balcomb, 1994). It has even been suggested that killer whales are so group-oriented that they do not have a philosophical sense of the “self” in the same manner as “humans”; they instead have a collective identity that is shared among the group (*Blackfish*, 2013). This commune helps give their groups harmony, living and working together their whole (or most of their) lives.

¹³ These communes are specific locales where members gather together to live in the same area. In “human” groups, the members support each other financially and emotionally, often through tight-knit, communal relationships (personal experience). In “animal” groups, the support is much less financially-based, and much more emotionally-based (Bagehmil, 1999).

Besides sexual behavior involving multiple individuals, many male killer whales have been known to have favorite “partners” who they return to year after year. Their relationships are both individualistic and communal, for individual pleasure and communal harmony. Killer whales reproduce via heterosexual encounters, but they also have encounters strictly for pleasure (Bagehmil, 1999). While we’ve been busy working on capitalistic ventures, entrepreneurship, and calculus, killer whales have been mastering relationship anarchy.

In a classic multispecies relationship built from both individual pleasure and communal harmony, Karin Bolender, an artist, makes soap from the milk of her travelling companions — American spotted asses. Karin grew up in the Midwest and Appalachia, with farming parents and a deep connection with her ecological surroundings, so it was only the stars that led her to living and travelling with American spotted asses. The ass that started it all is named Aliass, and in 2002, while Aliass was pregnant, Karin took her as a travelling companion across the American South. They traveled mainly in rural areas, though there were unavoidable Walmart parking lots and Interstate highways, stretches of pavement dotting the land that they had to travel through. At the end of the trip, Aliass gave birth to Passenger. Three years later, Karin, Aliass, and Passenger founded Rural Alchemy Workshop Assmilk Soap (R.A.W. Assmilk Soap), which, as the name might suggest, makes soaps from the milk of asses. However, Karin’s special ingredients include ass hair and, unavoidably, persistent organic pollutants.

Persistent organic pollutants are pollutants that are organic and persist; they are different at specific times and places, so persistent organic pollutants in Tallahassee in 2002 are far different from those in Juneau in 2020 (Bolender, 2014). Karin explains how anyone lactating responds to ecological changes, and how “all milk must hold the story of places her [their] body has been and her [their] various encounters with other species on the way—millions of interactions in every breath and bite and suck...” (Bolender, 2014). The persistent organic pollutants are a part of lactated milk in the same way, via outside interactions. They become a part of the milk through ingestion and inhalation. Similarly, milk contains the biochemicals that are produced from internal interactions (i.e., thoughts and emotions).¹⁴

Through these responses — internal and external — milk is inherently tied to the place and time of production, as well as the individual who is producing it. Similarly, astrology is tied to place, time, and individual: the birthplace and the birthtime are what define the astrological chart and the produced milk. A natal chart, thus, might as well also describe the breastmilk created soon after. Sun and moon signs are to the individual what persistent organic pollutants are to the milk; relational abilities are to the individual what emotional hormones are to the milk. Milk is connected to space and time in much the same way as astrology. The astrological and

¹⁴ Specific thoughts and feelings create an internal response through chemicals and vice versa (chemical changes create thoughts and feelings). Much like the persistent organic pollutants, these chemicals become a part of the milk, and are similarly ingested or applied by anyone using milk products (Bolender, 2014).

ecological surroundings intermix in the post-natal hours and days, and they intermix in the individual — mother, child, other, from spotted asses to “humans” to killer whales.

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