Editorial

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Rachel Carson and Theo Colborn: two pioneering women of science opposing an epoch of toxic entanglement

The Anthropocene is an epoch of toxic entanglement, a web of attritional interconnectedness with anthropogenic pollutants like polychlorinated biphenyls (PCBs), organochlorine pesticides, and per- and-polyfluoroalkyl substances. Despite the carcinogenic, endocrine-disrupting, epigenetic, and often persistent conditions of these anthropogenic pollutants, it has proven difficult to imbue their chemical legacies into popular Western consciousness and its *moral zeitgeist* [1]. These toxicants fall beyond the peripheries of recognition due to the relative indiscernibility of their size, and because of the challenge in appreciating their pervasive yet unspectacular spatial dispersions. As well, there is difficulty in relativizing the mixed temporal unfolding of persistent pollutants and the oftentimes "slow violence" of their exposures [2]. Epigenetic and transgenerational hazards are revealed through "uneven timelines and multiple speeds of environmental terror" [2]. And when the *calamitous repercussions* of anthropogenic violence are "neither spectacular nor instantaneous, but rather incremental and accretive" in this way, its affective or dramatic dimensions are diminished [2].

It was Rachel Carson's *Silent Spring* that first brought the temporospatial expansiveness of anthropogenic influence into a space of dramatic media activism [3]. Published in 1962, it is a pioneering work of creative scientific literature, where the imaginative, rhetorical, and stylistic capacities of the literary arts offer a dynamic supplementation to the analytical and investigative domains of technical scientific research and writing. In the narrative formulations of *Silent Spring*'s cross-disciplinary activism, synthetic pollutants are stabilized into a perceptible spatial framework for readers, with the compositional range of Carson's creative scientific literature better modelling these anthropogenic chemicals and the multiplicitous possibilities they elusively engender.

Rachel Carson's *Silent Spring* is an inventive masterwork because it utilizes this creative scientific format to effectively portray the impacts of anthropogenic pollutants on *both* human and nonhuman life. Carson stands as a forerunner of a modern creative scientific genre that allows a diversity of that nonhuman life – from soil bacteria and fungi to the American robin and white-breasted nuthatch – to exist and suffer alongside humans as more than a detached depiction of numerical data. In this way, the nonhuman is not only an object with numerous parts per million of synthetic pesticides in its tissue, but it's also an active subject whose "intra-actional" [4] life histories articulate a character that is more than a segregated "ecological substrate" [5].

Rachel Carson sets anthropogenic pollutants and their faultless victims into the central space of her work. From the micro- to the macroscopic, *Silent Spring* allows the nonhuman to become storied matter – a self-expressive force and non-abstract presence within the world. In chapters like "Beyond the Dreams of the Borgias" and "Indiscriminately from the Skies," largescale die-offs of animal life and the ruination of birds' nests are detailed to readers [3]. Consequently, the material expression of each nonhuman is translated into a discursive testimony against anthropogenic influence. For what is divined in their dead and despoiled characters is not just a numerical reading of the poisons within their once separate and expendable bodies, but a narrative that illustrates the fallacy of believing in the discontinuity artificially set between humans and every other natural figure.

This is made additionally apparent in chapters like "One in Every Four," which reports on the rising rates of malignant cancers within human populations after exposure to those selfsame synthetic pollutants afflicting the nonhuman [3]. *Silent Spring* thus illustrates the repercussions of imagining these toxicants could ever be "showered down indiscriminately from the skies" and somehow have their afflictions felt only by the substratum of the nonhuman

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world [3]. It reveals that we have only to look as far as our own body burdens to realize we are entirely allied to the nonhuman through our synthetically "altered destinies" [6]. That Carson's soil microbes and birds, along with innumerable human populations, are now united in this "chronicle of loss" called the Anthropocene [6].

Theo Colborn's *Our Stolen Future*, published in 1996, is seen as a succession of Rachel Carson's work through its utilization of creative scientific expression [6]. However, Colborn's work successfully expands upon Carson's scientifically backed emotional aesthetic and dramatic representation of synthetic contamination. It more effectively positions persistent pollutants and the *"longue durée"* of their transgenerational hazards within the literary domain [7]. Colborn takes the imperceptible effects and vast temporal existence of persistent pollutants and endocrine disruption and creates an unconventional style of imaginative scientific writing, which she describes as a "scientific detective story" [6]. By doing so, she not only formulates a narrative that "transcends traditional knowledge" concerning the dangers of persistent pollutants, but she also writes a story that becomes "accessible to everyone, including those without any scientific background" [6].

Our Stolen Future takes those "uneven timelines and multiple speeds of environmental terror" discussed previously and relativizes them, making them "vivid" and "readable" [2]. It allows the gradual yet attritional implications of anthropogenic entanglements to be imaginatively rethought and for the "'hushed havoc and injurious invisibility that trail[s] slow violence'" to become originally and compellingly perceived [2]. Colborn, like Carson before her, pushes for a reconceptualization of injury. She recognizes that two serious spectacles of cancer and the sudden die-off of terrestrial animals through immediate mutagenic harm had, until then, been the leading health concerns in the studies of these organic pollutants. In Rachel Carson's *Silent Spring*, what had so moved the author's popular readership were the visual manifestations of these injuries through the sudden death of birds and humans and the rising rates of degenerative illness in their populations. But Colborn begins to consider the "human and biotic communities that lie beyond our sensory ken," and which exceed the "instance of observation" [2]. In other words, Colborn looks at the persistent and less spectacular injurious effects of these enduring pollutants, which happen outside the present moment of contamination.

Colborn composes an extended narrative around these persistent pollutants. She formulates a character or subjecthood for each synthetic chemical, which relativizes their chronological complexities through a creative storyline that imaginatively represents the astounding temporal dispersions of their violence. Entire chapters are dedicated to the long-term story of one single polychlorinated biphenyl molecule, which she aptly names PCB-153. And through this narrative, Colborn undoes the representational challenges of the deep timeline of synthetic contamination, providing "imaginative definition to the issues at stake while enhancing the public visibility of the cause" [2]. The temporal sublimity of these contaminants is arrested and relativized in Colborn's chronicle of PCB-153. And audiences are afforded a critical consideration of the agentic antagonism of endocrine disruptors as they read about a single PCB molecule existing forever in various states of matter, about it poisoning countless entities in its entanglements, and about it accumulating indefinitely in the bodies and fetuses of humans and nonhumans alike.

Reading Colborn's creative scientific detective story provides that dramatic tension, that fear of precarity from both analytical research and aesthetic experience. Just like Rachel Carson in *Silent Spring,* Colborn seeks to produce dissonance through this mixed genre. She hopes to provide readers with a moment of disorientation where personal temporospatial capacities are extended and new meanings are formed through the semantic and narrative disjunctions of the story [8]. From the *longue durée* of their transgenerational violence to their unstoppable spatial transference, the unbounded otherness of the anthropogenic pollutant expands the limits of readers' individual quotidian worlds. And as each contaminating character is afforded new meaning and offered a space within humanity's imaginative and collective being in this way, the temporospatial brutality of their toxic bindings is more meaningfully understood.

But what of creative scientific representations of these anthropogenic pollutants beyond the pioneering work of Rachel Carson or Theo Colborn? Where are the continued imaginings and developing realizations of their entanglements and hazardous conveyances? What does it mean when *Our Stolen Future*, published nearly three decades ago, still stands as the leading creative scientific work on PCBs and other persistent organic pollutants? Why has no other definitive publication on these synthetic contaminants so compellingly captured the destructive inheritance of endocrine disruption since? Though many creative scientific writers have provided rarer glimpses of anthropogenic harm, a larger and more expressive platform is necessary to wholly engage the mutagenic and genotoxic "chemical legacy" of the anthropogenic pollutant in present and future moments [6].

Rachel Carson and Theo Colborn's creative scientific offerings are pinnacles of oppositional engagement with anthropogenic pollution, but they must not remain as the

leading literary testaments against the mutagenic and transgenerational ruination of these toxic subjects. For the harms of these contaminants may continue to unfold in the environment and in the "materials of [our] heredity" indefinitely, with that slow violence revealing itself anew for each and every generation to follow [6]. Whether present formulations are to be made, or whether successive generations will choose to continue reproducing a space of articulation for these anthropogenic pollutants, is difficult to say. But any failure to speak out against these toxicants is beyond reckless considering the inescapable risks of their ominous entanglements. And it'd be a failure that would reveal the same lack of prescience and repercussive thinking that first allowed the anthropogenic pollutant and the vast temporospatial dispersions of its toxicities to be unleashed upon the world.

References

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