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Genetic Engineering: A Threat to Environmental Sustainability in Paolo Bacigalupi's The Windup Girl

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Abstract

This paper scrutinizes Paolo Bacigalupi's The Windup Girl through the lens of the ethical and theoretical dimensions of genetic engineering, corporate greed, and apocalypticism. It examines the novel's exposition of a dystopian future constructed by the rampant adoption of genetic advancements. The paper sheds light on how genetic modification in agriculture, motivated by financial greed, has led to ecological and environmental disasters, including destructive plagues, climate change, and imbalanced biodiversity. The unrestrained corporate monopoly of genetic resources, controlled by companies such as AgriGen and PurCal, is presented as a compelling force behind this apocalyptic dystopia. Furthermore, the research critiques the ethical implications of genetic manipulation and crystallizes the preference for economic gain over ecological sustainability. This paper draws the attention of contemporary society by referencing ecological criticism and ethical theory. It argues that Bacigalupi's work serves as a cautionary tale, warning against the long-term byproducts of exploiting nature and intervening in environmental originality for corporate profit. In a nutshell, The Windup Girl challenges readers, critics, and all human beings to reconsider the moral responsibility and future accountability surrounding genetic technologies and their environmental impact.

Keywords: The Windup Girl, genetic engineering, corporate greed, environmental collapse, biodiversity, ecological criticism, ethical implications, dystopian future, climate change, genetic modification, sustainability.

Introduction

Although genetic engineering is a robust technological revolution essential for humans, it also threatens the sustainability of the environment. Referencing Paolo Bacigalupi's novel The Windup Girl, this essay conveys the message that while

present scientific and technological advancements have undoubtedly eased human life, they have also questioned the future existence of the environment due to ethical insensitivity regarding advanced Genetically Modified Organisms (GMOs). The objective of this paper is to alert today's "financial vampires"—those driven by economic and corporate greed rather than concern for ethical and moral dimensions—while leveraging genetic engineering in industrial production. This argument stands on the foundations of ecocriticism, environmental justice, and the ethical dimensions of genetic engineering found in The Windup Girl. This paper also aims to fill the gap in ethical and moral considerations in real-world practice, which is evident throughout the novel and prevalent in related literature.

Textual Analysis

This essay crystallizes The Windup Girl by Paolo Bacigalupi, in which the novelist highlights both the conveniences and drawbacks of genetic engineering. The ordinary peasants' easy access to "calorie companies," which helps boost food productivity, reignites the hope of sustenance in a world troubled by environmental breakdown. As Verma et al. highlight regarding crops "modified using genetic engineering techniques [...] to improve the growth of these plants to assist in farmers' efficacy [...] in most of the cases the major focus is to introduce a new trait to the plant which does not occur naturally" (20). Furthermore, Schmeink asserts, "gene therapy will make most common surgery of today obsolete, and we will be able to genetically enhance our capacity" (239).

However, the unethical production and excessive, unwise use of such bioengineered substances reflect the long-term threat of environmental collapse. Bacigalupi illustrates the live consequences of dependence on genetically engineered materials. As Volkmann notes, the novel "revolves around the consequences of mankind's abuse of the environment, abuse of science, and genetics" (1). This can be observed in the struggle of Anderson Lake, who gains profit from these genetically modified goods, and in Emiko, who is treated as subhuman despite her innumerable contributions. The pressing concern is that "Genetic engineering opens new possibilities for biomedical enhancement requiring ethical, societal and practical considerations to evaluate its implications for human biology, human evolution, and our natural environment" (Almeida and Diogo 183). The race for invention in genetic engineering has smoothed human life, but it has also posed a threat to nature, ecology, and biodiversity because humans remain unaware of the moral and ethical dimensions of these modifications.

Predominantly, The Windup Girl examines genetic engineering designed to ease human existence. Bacigalupi writes that the production of genetically modi-

fied agricultural products is "another Thai genehacking success, [...] preparing to stride forth onto the land, bearing with him the bounty of history's lost calories" (3). However, King claims this narrative explores a "conjunction of economics, geopolitics, and biogenetics by imagining a dystopian future in which food production is completely controlled by a handful of global 'calorie companies' who have successfully genetically engineered seeds to be non-fertile" (par. 5). Whether "generipped" crops such as tomatoes, chilies, and eggplants appear in neighboring stalls to amplify agricultural productivity or not, the environment should not be hindered. King notes that "environmental catastrophe and food-borne diseases such as 'cibiscosis' and 'blister rust' threaten the world's remaining population" (par. 5). Therefore, I claim that the calorie companies' corporate motives and their lack of concern for the future existence of the environment are completely ignored while producing such genetically modified items.

The novel suggests that the excessive invention of scientifically generated machines and animals is another revolution in technology. For instance, the Megodont, a genetically generated elephant, is kept by the calorie companies to reduce human workload and expenses: "the megodont wheels and fixes its attention on Anderson, eyes flickering with Pleistocene rage. Despite himself, Anderson is impressed by the animal's intelligence. It's almost as if the animal knows what he has done" (Bacigalupi 19). Anderson, the calorie companies' leading representative, is fascinated with the Megodont as it responds intelligently. While Bacigalupi presents these genetically modified inventions as human property, Kabak offers a different perspective:

Early in the novel, there are mentions of animals called megodonts which are genetically engineered species of mammoth for heavy manual labor. While Fukuyama argued that with the advancement utopic vision that global capitalism or advanced research on biogenetics would deal with the problems of our present condition. On the contrary, as seen from the example of megodonts, biogenetic research is used as an instrument by capitalism to reinstate its power in a changing world. While the fictional world of The Windup Girl changes with global catastrophes and climate change, global capitalism also reconfigures itself into adapting into this new environment. (86)

The extreme corporate profit-oriented aspirations of Anderson Lake are fulfilled by relying upon genetically modified creatures like the Megodont, "an oversized elephant" (Bacigalupi 18), Cheshires, "a different kind of animal, some mindless furry cheshire" (35), and Emiko, a "humanoid being" (Kabak 86). The novel notes, "Hock Seng has heard that Cheshires were supposedly created by a

calorie executive—some PurCal or AgriGen man" (Bacigalupi 25). The excessive dependence on genetic modification is seen to be unethically profit-oriented. Bacigalupi shows how calorie companies rely on these creatures: "Hock Seng's treadle loses its rhythm. 'This is a difficult thing, I think. Even the Dung Lord must bow before the Megodont Union. Without the labor of the megodonts, one must resort to the joules of men...'" (15).

Under certain constraints, these calorie companies have played an admirable role by building seed banks to enhance agricultural productivity. However, Almeida and Diogo reject such reluctant enhancement: "We consider human enhancement, and in particular, we explore genetic enhancement in an evolutionary context" (183). Therefore, I claim that one must not be immoral regarding the production of genetically modified organisms. As King insists:

Paolo Bacigalupi's (2009) award winning science fiction (SF) novel The Windup Girl delves into precisely this conjunction of economics, geopolitics, and biogenetics by imagining a dystopian future in which food production is completely controlled by a handful of global "calorie companies" who have successfully genetically engineered seeds to be non-fertile. Meanwhile, environmental catastrophe and food-borne diseases such as "cibiscosis" and "blister rust" threaten the world's remaining population. (par. 5)

Genetic evolution is a revolution, as it has enhanced access to optimum industrial output. In The Windup Girl, genetically modified crops play a significant role in recovering food shortages in Thailand. Anderson notes, "It amuses him that the Thais, even amid starvation, [...]" (Bacigalupi 61). Through this, Anderson proves that the contemporary Thai kingdom is facing a food shortage. In this situation, AgriGen and PurCal take corporate advantage through the unethical generation of artificial plagues. Opposing this notion, Drake asserts:

But once we discover that Lake is a spy, that initial scene rings false and the character of Lake loses its coherence. All Lake takes from the market is that "a seedbank is close. And with it, the answer to nightshades and ngaw and a thousand other genetic puzzles." But, in point of fact, answers are in his hand and not hidden away in the seedbank. A true spy searching for genetic information to incorporate into crops would send tissue samples and seeds from the market back to AgriGen. (par. 19)

The ethical flaws of calorie company owners and workers are apparent. The novel describes: "In the next room, Sunan and Mali are discussing her uncle, who wants them to smuggle cibi.11.s.8 pineapples, sneaking them in on a skiff from the farang quarantine island of Koh Angrit. Quick money, if they're willing

to take the risk of bringing in banned foodstock from the calorie monopolies" (Bacigalupi 65). Volkmann also assures that The Windup Girl revolves around the consequences of mankind's abuse of the environment, noting that "reserves are depleted, the climate crisis is at an all-time high, resources are scarce, and people are becoming sick from the vast amount of carbon toxins in the atmosphere" (1).

The fundamental message of the novel is to show the lethal consequences of high dependence on gene technology. Kamthan et al. claim:
Laborious and time-consuming conventional breeding methods to meet the worldwide demand for quality foods. GM crops can help fight malnutrition due to enhanced yield, nutritional quality, and increased resistance to various biotic and abiotic stresses. However, several biosafety issues and public concerns are associated with the cultivation of GM crops. (1639)

Bacigalupi tries to alert the "white shirts" and corrupted authorities who are manipulated by corporate greed. He writes, "Somewhere in this city a generipper is busily toying with the building blocks of life. Reengineering long-extinct DNA to fit post-Contraction circumstances, to survive despite the assaults of blister rust, Nippon genehack weevil and cibiscosis" (Bacigalupi 63). This paints a picture of post-apocalyptic global disorder caused by DNA "generippers" who force the world to adopt GMOs through financial greed. Binish et al. comment on this scientific context: "Currently, technique of genetic engineering is a prominent notion in the area of applied science to amplify the natural potentiality of microorganisms for the process of bioremediation" (305-326).

Consequently, the novel asserts that these post-Contraction circumstances have severely impacted ecological order and biodiversity. Anderson observes Emiko: "Anderson takes a shuddering breath, forcing away the memories. She is the opposite of the invasive plagues he fights every day. A hothouse flower, dropped into a world too harsh for her delicate heritage" (Bacigalupi 59). Surrett ascertains the reasons behind such consequences: "His calorie companies critique current laws and practices that allow corporations, driven by short-term goals of bottomline profits and quarterly reports, to bring the world's food supply under the purview of intellectual property rights" (135).

Plagues and frequent catastrophes have almost completely destroyed food sources. Klotz notes that this is why "biotechnology has become dominant, leaving only a few mega-corporations controlling the food supply by producing genetically modified plants" (277). The researcher claims the root cause of environmental corruption is "biogenetic-induced ecological catastrophe" (Klotz 277). This brings socio-economic and political trauma, as Bacigalupi describes: "It's

poor country, genehacked half to death, out beyond Chiang Rai and across the Mekong, but the windups there don't have any patrons and they don't have any owners" (45).

Sreeja et al. define the missing element in this society: "Eco sustainability embodies the ethos of preserving ecological integrity while meeting present needs without compromising the ability of future generations to do the same" (533). Furthermore, Sajena and Nair assert that The Windup Girl highlights "the effects of rising sea levels, bioengineered plagues, and the power struggle between the Trade and the Environmental Ministry" (590). Therefore, the fundamental premise of this essay—that genetic engineering is a threat to environmental sustainability—is supported.

Ordinary people in the novel cannot identify real fruits and vegetables because "all the agricultural productions are genetically engineered." Bacigalupi writes: "Anderson turns the strange hairy fruit in his hand. It carries no stink of cibiscosis... and yet nowhere does he find a helpful signpost that leads him to identification" (4). Consumers are manipulated into using genetically modified foodstuffs without awareness of future hindrances to humans and the environment. Verma et al. state, "However, the use of biotechnology has also raised concerns about its potential risks to the environment and people" (20).

The "white shirts" (authorities) are depicted as corrupted and profit-oriented. Anderson notes: "Most likely, she bribed the white shirts for stamps rather than going through the full inspection process" (Bacigalupi 5). This corruption means that "if cibiscosis breaks out again, these certificates will do nothing" (5). Verma et al. support this by noting that while production increases, "negative effects of gene technology on animals, humans, and the environment should be considered" (20).

The market is overwhelmed by genetic modifications. "The alley bustles with Thais purchasing everything from generipped versions of U-Tex rice to vermilion-variant poultry" (Bacigalupi 5). This demonstrates the never-ending evolution of modification; as Hageman clarifies, "a global agricultural catastrophe has been spawned by disease strains that mutate as rapidly as they devastate crops" (283). The unchecked cycle of genetic mutation is evolving only as a tool for corporate manipulation, leading to the destruction of ecology.

The novel also depicts the physical destruction of Bangkok due to climate change exacerbated by these technologies. Bacigalupi writes, "We are not fighting the rising waters. We are fighting money" (161). The text mentions methane fires and floods: "The houses are all on bamboo rafts currently grounded, but when the

floods come, the houses will float" (146). Ryan argues that "The environmental crisis demands a reconsideration of society's basic values, constitution, and purposes" (5). However, in The Windup Girl, society is driven by profit rather than preservation.

Natural pollination and fertility are also abandoned for corporate gain. Keating notes that "Naturalists have long been fascinated with the practice through which plants lure their insect and animal pollinators" (74), but in the novel, sterility is engineered for profit. A character notes, "The Kingdom still hasn't figured out how to crack the seedstock... I was going to be rich" (Bacigalupi 83). This contradicts the "inclusive manner" advocated by Oyana, where "organisms develop with and through, as well as in, environments" (204).

Critics and theorists play an undeniable role in advocating for eco-friendly conservation. Kerr et al. highlight that researchers should "probe the effects of different community structures on ecological phenomena" (31). Alaimo adds, "The question of who or what is within or without the domain of concern is, of course, the very question of ethics and politics" (4). Eco-deconstructionists believe we must embrace philosophical moral values. As Oliver notes, "It seems as if we can only see ourselves united or whole by imagining we are someone, or something, else" (339). Bacigalupi raises a strong voice for environmental sustainability by alerting the world to the misuse of genetic engineering.

Conclusion

Eventually, the unethical intervention in the environment through genetic technology, the financial greed of calorie companies, and excessive dependence on artificially designed organisms are the causes behind the apocalyptic dystopia of future Bangkok presented in The Windup Girl. The novel is not only science fiction but also a vibrant warning that alerts us to the increasing dependency of humans on genetically modified resources. The plot develops through complex environmental and ecological crises, leading to economic disparity and social instability rather than solutions.

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