

Bioethics and genetic engineering in Margaret Atwood's *Oryx and Crake*

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Bioethics. Genetic engineering. Margaret Atwood. *Oryx and Crake*. Speculative fiction.

In the light of continuous development of genetic engineering technologies, it is apparent that speculative fiction has successfully anticipated various advancements and their applications. As a key method in this genre, the concept of plausibility allows for a realistic prediction of current scientific trends into future possibilities. In her novel, *Oryx and Crake* (2003), Margaret Atwood takes a cautionary approach, depicting a speculative future in which the misuse of biotechnologies leads to catastrophic consequences. This article explores the portrayal of bioethical issues surrounding genetic modification. It underlines the interdisciplinary necessity of addressing these concerns and highlighting ethical responsibilities in connection with scientific innovation.

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The scope of bioethics is not constrained in terms of timeframe. The retrospective approach of understanding ethical dimensions of medical practices in the past (e.g. Lerner and Caplan 2016) is as vital as addressing current, ongoing bioethical issues. There is, however, another perspective to consider, the future-oriented one. The category of impending issues in the bioethical discourse of recent decades (ex-ante ethics) has been predominantly characterized by environmental concerns and the concept of sustainable medicine¹ (Kuře 2008; Schick 2016). While not yet manifested in their entirety, the significance of these bioethical questions lies in the fact that the foundational elements giving rise to these issues are already evident in contemporary society. In order to explore ethical implications of medical engineering or complex technologies that are still in development, such as brain-machine interfaces (BMIs), there has been a demand from bioethicists (Brody 2003; Chambers 1999), literary theorists (Squier 2004; Wald 2008) as well as scholars of narrative medicine (Charon and Montello 2002) for literary representations of such emerging bioethical issues.

This article explores the intersection of bioethics and speculative fiction, focusing on the cautionary elements of genetic engineering technologies as depicted in Margaret Atwood's speculative fiction novel *Oryx and Crake* (2003). The goal of the article is to examine the role of speculative fiction in regard to addressing bioethical issues that emerge from the use of genetic-modification technologies in the novel and outline how speculative fiction may further contribute to wider discussion of ethical, social, and cultural implications of emerging technologies. Margaret Atwood's literary works are characterized by speculative narratives that contain ethical implications of scientific or social changes. *The Handmaid's Tale* (1985) and its sequel *The Testaments* (2019a) depict a dystopian future in which reproductive technology and patriarchal system undermine female autonomy. Other works such as *The Heart Goes Last* (2015) demonstrate Atwood's tendency to combine speculative aspects with social criticism. *The Year of the Flood* (2009) and *MaddAddam* (2013a) expand on the biological catastrophe presented in *Oryx and Crake*; all three novels take place in the same universe and form the MaddAddam trilogy. *Oryx and Crake* provides a creative exploration of genetic engineering and the subsequent social impacts, as well as depicting moral issues surrounding biotechnology, the destruction of the environment and the adverse effects of irresponsible scientific activity. Since it introduces the bioethical issues explored in Atwood's later novels, a focus on this work makes it possible to examine the direction towards which development in genetic engineering technologies might be heading.

GENETIC ENGINEERING IN SPECULATIVE FICTION

Although it is a broad genre, speculative fiction has been extensively analyzed as a platform for experimenting with philosophical and ethical inquiries into societies transformed by advanced technology (Chambers 2016; Chan 2009; Schick 2016). The American philosopher Susan Schneider suggests that “[s]ome of the most lavish science fiction thought experiments are no longer merely fictions [...]. [W]e see glimpses of them on the technological horizon” (2009, 19). The recent surge in aca-

demical works delving into the issue of bioethics as depicted in literary and film works can be attributed to the fact that the foundational elements, or starting points, for the various bioethical issues within these narratives are already manifesting themselves in the contemporary world. Another aspect of speculative fiction to consider, regarding the reason that it complements exploring bioethical issues, is the inherent fluidity of the term. On one hand, “speculative fiction” serves as an umbrella term, encompassing multiple genres such as science fiction, fantasy, dystopian literature, or horror. This broad categorization positions “speculative fiction” as a “super genre”, but at the same time invites criticism for its perceived vagueness and lack of specificity. On the other hand, the term “speculative fiction” is not inclusive: not all science-fiction or horror works necessarily fall under its ambit. What makes a certain work speculative can be summarized by Margaret Atwood, who defines speculative fiction as “stories set on Earth and employing elements that already exist in some form, like genetic engineering, as opposed to more wildly hypothetical science fiction ideas like time travel, faster-than-light drives, and transporters” (2013b). This phenomenon of employing elements from real life and then building upon them correlates to the same phenomenon with future-oriented bioethics dealing with moral ambiguities of issues that may not be present in the contemporary society yet, but whose potential development is already evident. Sławomir Kuźnicki (2017, 17) points out that Atwood – when referring to her speculative fiction works – coins the term “ustopia”, combining utopia with dystopia; she does this to address the genre’s potential to depict both ideal and disastrous outcomes within human society. Atwood does not engage with speculative narratives for the mere purpose of escaping real-world issues, but on the contrary, the speculative scenarios function as a means to present the trajectory that science and technology in the contemporary world are already following.

Since the 2000s, scholarly literature has increasingly explored the relation of narration with ethics (Charon and Montello 2002; Haker 2006), the concept of biopolitics in contemporary fiction (Vint 2021a), or the role of ethics in arts (Macneill 2014; Zylinska 2009). When narrowing the focus down to the portrayal of genetic engineering within speculative fiction, such narratives subject various dimensions of society to criticism, including the exacerbation of socio-economic disparities, environmental degradation through technological exploitation, the increasing commodification of life,² ethical issues regarding the autonomy of genetically modified beings, or the influence of corporate power on scientific innovation. Addressing the ethical issues emerging from these issues shows that the distinction between science fiction and speculative fiction transcends mere semantic differences. According to Taylor Evans (2012), labelling the narratives that portray these critical themes as science fiction means diminishing their relevance to contemporary society. Although the scenarios depicted might seem exaggerated, the issues they convey are either already present in today’s world or can be projected for the near future. Evans further suggests that the refusal to view narratives with genetic engineering as speculative, as opposed to strictly science fiction, indicates a refusal to acknowledge the prevalence of genetic modification and its expected increase in contemporary society (137).

This objection correlates with the viewpoint of John B. S. Haldane, a British genetics professor, who states that biologists, especially geneticists, face strong condemnation for their discoveries. Haldane contrasts geneticists with physicists, whose inventions might be deemed blasphemous but not perverse (1924, 44). Lars Schmeink elaborates that biological or genetic innovations are considered perverse because they strip humans of their natural status and destroy their divine essence (2016, 2). The advancements in genetic engineering challenge traditional beliefs about the inviolability of the human genome, invoking fear of the unknown and concerns about playing God. Additionally, genetic modifications touch on deeply held cultural beliefs about identity, heritage, and evolution, so the reaction to artificial changes may be dismissive.

THE PROPHETIC ORYX AND CRAKE

Despite Margaret Atwood's own admission (2019b) of not being an expert in genetics, ethics, or futurology, her 2003 novel *Oryx and Crake* combines these three specific elements. Following the proposition of Susan M. Squier (2004) and Priscilla Wald (2008) to examine moral complexities in fictional stories focusing on biomedical issues, the following analysis of *Oryx and Crake* highlights the importance of the speculative fiction work, since it reflects and criticizes complex ethical issues emerging from genetic engineering. By creating a speculative narrative – i.e., transforming the hypothetical into the tangible through the use of persuasive language (Winstead 2017) – Atwood had foreseen the use of genome editing technologies before their full potential became apparent. As Sophia McCully (2019) outlines, genome editing, while present in various forms since the 1980s, truly showcased its capabilities with the advent of the CRISPR/Cas9 system in 2012, which brought about with itself new scientific, medical, and ethical questions.³ Subsequently, literary critics started viewing *Oryx and Crake* as prophetic, a description with which Atwood (2019b) has expressed her dissatisfaction, instead asking her readers to interpret the novel as a cautionary tale. Nevertheless, Sherryl Vint (2021b) acknowledges the role of science fiction (sf) in reflecting on social, cultural, political, and ethical conditions in contemporary society, which already contains prerequisites for future developments in these fields:

[M]y point here is not that sf somehow inspired or anticipated this technology, but rather that the capacity to edit the genome emerges in a world that has already been conditioned by sf that expresses a range of hopes and fears about the future of the human body, even the human species. (101)

Therefore, the extrapolation displayed by Atwood is not arbitrary; it stems from her analysis of current conditions as well as the trajectory that developments in the mentioned domains may take; the speculative narrative then explores the potential future states of these domains.

Veronica Hollinger notes that *Oryx and Crake* is “a telling demonstration of how non-genre writers turn to science fiction as a way to characterize the lived experience of technoculture” (2006, 452). The novel, diverging from Atwood's earlier works, employs a non-linear narrative; the story switches between two periods, the pre-apoc-

alyptic past and the post-apocalyptic present, and it is the protagonist, Snowman (formerly Jimmy), who serves as the narrative bridge. Through flashbacks, the reader learns of not only Jimmy's past but also of what life was like before the apocalypse. Atwood depicts this pre-apocalyptic society where science has been commercialized to the full extent: "Profit-making has become the sole engine of society and the goal of scientific practice, regardless of its potential or manifest negative effects on society" (Hernández Nieto and Weingart 2021, 62). The main issue that will be discussed in the present context is that of genetic modification, specifically through the character of Crake and his invention, the Crakers.

CREATING GENETICALLY MODIFIED BEINGS

In the post-apocalyptic world, Snowman navigates through a desolate landscape, struggling for survival as apparently the last human on the Earth. This landscape is inhabited by the Crakers (or the Children of the Crake), a unique, genetically engineered human species created by Crake. These beings are characterized by various modified traits, whether it be "a UV-resistant skin, a built-in insect repellent, an unprecedented ability to digest unrefined plant material" (Atwood 2003, 304), or the ability to heal themselves by purring (156). Contrarily, they also possess traits that could be perceived as limitations: a simple digestive system similar to that of a rabbit or a distinct mating ritual devoid of emotions (303). Furthermore, the Crakers cannot read and lack in-depth understanding or critical thinking skills, as depicted in their interactions with Snowman, and are "programmed to drop dead at age thirty – suddenly, without getting sick. No old age, none of those anxieties. They'll just keel over" (303). What is important to note is that all these characteristics – both advantageous and restrictive – are deliberately crafted by Crake who, in pursuit of a utopian form of flawless society, designs a peaceful, non-aggressive species that will not overpopulate or suffer from old age. Therefore, the apparently restrictive characteristics need to be reevaluated in a broader context, considering their hidden benefits. The Crakers' simplistic digestive system minimizes their dependence on potentially scarce food sources, which in turn increases their self-sufficiency and harmony with the environment. Their mating ritual, viewed solely as a reproductive mechanism, is a strategic adaptation to control population growth. The limitation of the Crakers' intelligence is connected to Crake's belief that all the violence and corruption in society is a product of higher human intellect. This quid pro quo – reducing the cognitive abilities of the Crakers in exchange for their pacifistic nature – highlights Crake's morally corrupted character that is most noticeable with the revelation that he has modified the Crakers to have a predetermined lifespan.

The Crakers represent an extreme form of genetic enhancement, as opposed to gene therapy. Such a differentiation is crucial in the bioethical context since genetic modifications for therapeutic purposes are typically more acceptable than utilizing genetic modifications for enhancement. However, it is important to note that not all applications of gene therapy are equally recognized as ethical: while somatic gene therapy affects only the individual's body cells and has no effect on future generations, germline gene therapy does have this potential and is thus met with differing levels

of acceptance. Gene therapy nonetheless aligns with the core objectives of medicine, to heal and prevent suffering, and it is also why the use of genetic modifications for therapeutic reasons is frequently considered not only beneficial but also morally imperative. In contrast, genetic enhancement is ethically more controversial. It exceeds the bounds of gene therapy by modifying human traits beyond their natural variability. This raises concerns over the alteration of human nature, which could have lasting impact on social, political, and religious landscapes (Sýkora 2015, 334). As a genetically enhanced form of humanoid life, the Crakers disrupt the natural state of humans. In the words of Schmeink, creating them interferes with the “godliness” (2016, 2) that humanity strives towards.

The novel unveils the character of Crake through the mythologized and unsophisticated storytelling of Snowman to the Crakers, who display an innate curiosity about the world of the past as well as the origins of their existence. To satisfy their curiosity, Snowman attributes Crake a god-like status (Marques 2013), making up the story that he created the Crakers, and all of the flora and fauna on the Earth. Despite the Crakers being oblivious to their surroundings – after all, the image of the pre-apocalyptic world is largely distorted for them – it is evident that, although the Crakers exist in harmony, the world they inhabit is profoundly empty. This void is not only physical, marked by the absence of human life, but also extends to emotional, cultural, and moral dimensions. Nevertheless, the Crakers’ demand to understand the genesis of their existence is in parallel with the right to self-understanding. However, the intellectual limitations of the genetically engineered species cause Snowman to talk in naïve, simple language, so he can be understood. Moreover, the ethical dilemmas present in *Oryx and Crake* are not explicitly put forward. It is thus up to the reader to piece the events preceding the apocalypse together, all through Snowman’s simplistic narration. This kind of storytelling also influences the bioethical discourse within the novel; as Hille Haker (2006) argues, narratives are essential to shaping ethical reasoning, meaning that the manner in which Snowman recounts past events has a major effect on interpreting and approaching the bioethical issues that may arise from these events. Crake emerges as a deity figure not only through Snowman’s portrayal but also through his audacious plan to cleanse the world of what he perceives as flawed humanity. This act alone places Crake in a position of ultimate power, invoking the role of a creator who both judges the mankind and brings about a new vision for its successor; it also opens a debate on the nature of possible extremes of scientific rationality and intervention. Despite not possessing an inherent animosity towards humans, Crake’s determination to eliminate what he considers the underlying factors of violence, environmental decline, or overpopulation reflects a negative impact of scientific innovation on a global scale. Crake modifying the Crakers in a way to eliminate imperfections demonstrates the blurred lines between gene therapy and genetic enhancement. Are the Crakers a product of therapeutic treatment (of a flawed human race) or an enhancement of the human species? The technological aspects do not necessarily distinguish between therapy and enhancement, as both techniques may include a genome editing tool such as CRISPR/Cas9. From the bioethical and philosophical perspective, it is difficult to regard a given human

trait as normal or defective (much less as a disease). Crake aims to modify the emotional and behavioral traits of the Crakers, which can be interpreted as either normal human variations or deficiencies that demand correction, depending on one's perspective. Moreover, the potential for genetic modifications to transition from therapeutic use to non-therapeutic enhancement raises slippery slope concerns. As for social implications, the use of genetic enhancement could worsen social inequalities since the technology would be initially accessible only to the wealthy.

As the plot unfolds, it becomes clear that Crake's intention to forge a new, uncorrupted world populated by harmless Crakers stands in opposition to Crake's deliberate interventions in the Crakers' genetic blueprint. Bernice Bovenkerk (2020) outlines four concerns regarding the genetic modification that impacts the perception of well-being and the concept of a good life in genetically modified beings. These objections include violation of the being's integrity, instrumentalization of the being, the "playing God" argument, and acting unnaturally. Bovenkerk argues that these concerns extend beyond the principles of animal welfare or rights (45), meaning they are not limited to genetically modified beings such as animals, which can be altered for purposes like organ harvesting – a theme also touched upon in *Oryx and Crake*. The concern regarding integrity, according to Henk Verhoog (2007), is not discussed in terms of physical harm but whether the being is able to thrive in an environment suited to its species. The motivation behind particular genetic modification is paramount; if one's decision to conduct genetic modification is motivated by the objective necessity of avoiding some form of harm, then such a decision can be justified. However, if the decision stems from an individual's subjective view, as in the case of Crake, then the use of genetic engineering technologies becomes a moral issue. Furthermore, the Crakers, genetically modified humanoids, disrupt the traditional notion of the human. Determining how "human" they are is complicated, but they are distinctly less human than unmodified humans. While the Crakers excel in adapting to their surroundings due to their modified abilities, their reduced cognitive capacities set them apart from intellectually advanced human beings.

The issue of instrumentalization includes concerns such as commodification, as portrayed in Crake's plan to sell the Crakers as flawless children to wealthy customers. Bovenkerk, however, points out another problem: genetically modified beings are frequently viewed as mere components within a broader system (47), which raises the question whether the beings should be modified to conform to the system or if the system should conform to them. Instead of designing the Crakers to achieve a harmonious, violence-free world, an alternative effort could have been made to eliminate the flaws of society, which in turn eliminates the need for creating the Crakers. The argument of "playing God", referenced also by Haldane (1924), states that a geneticist's inventions are viewed as humans crossing their boundaries and losing control over technology; it questions the belief that life can be carefully planned. Lastly, criticizing the use of genetic modification as unnatural portrays the given beings as artificial, again comparing them to the components within a broader system. Nevertheless, labeling the Crakers as unnatural is a subjective assessment, which complicates the argument. By lowering their cognitive functions, Crake takes away

the Crakers' ability to self-govern, which renders them non-autonomous. However, Britta C. van Beers (2020) points out that the exact opposite – absolute autonomy – should be avoided as well; she suggests biotechnological concerns should be considered from three distinct levels. From the perspective of the whole society it becomes evident that the notion of pursuing the common good is at stake, since the overemphasis on the individual choice may overshadow the need for coordinated actions that would benefit the whole community, especially in crisis situations.

It is thus apparent that the bioethical issue extends beyond the fundamental question of whether the creation of a genetically engineered being is justified. The scope of this issue extends further, encompassing the very nature of the new organism, which Elisabeth H. Ormandy, Julie Dale and Gilly Griffin (2011) associate with the Aristotelian concept of *telos*, as it is needed to define what the essence and purpose of the organism is, maintain its intrinsic value, and determine what about the organism should be left unchanged, respected.

MAN OF SCIENCE, MAN OF FAITH

The portrayal of Crake challenges the typical “mad scientist” trope, as he embodies more than just a one-dimensional character. Luz María Hernández Nieto and Peter Weingart point out that contemporary portrayals of scientists are most often associated with fields of science, which are complex and ethically ambiguous, the exact kind of area within which Crake and pharmaceutical corporations in the novel operate (2021, 55). However, this does not imply that stereotypical portrayals of mad scientists are completely absent in contemporary fiction, only that the distinction between simplistic and sophisticated is getting increasingly blurry. Besides delving into which features of a scientist depicted in fiction can be considered stereotypical and which complex, Hernández Nieto and Weingart further provide examples that contemporary narratives can depict stereotypical scientists positively – as noble heroes –, and complex, realistically portrayed scientists negatively, reflecting their corrupted ambitions (55). Crake exemplifies the latter category; initially, he presents his creation of an artificial species which will possess no human imperfections. He claims he will profit from selling these child-like beings to wealthy parents: “They’d be able to create totally chosen babies that would incorporate any feature, physical or mental or spiritual, that the buyer might wish to select” (Atwood 2003, 304). Crake’s intention to commercialize the Crakers by selling them to the wealthy couples highlights a problem identified by Roberta M. Berry (2007) regarding the socio-economic divides in accessing genetic engineering for selecting gender or ensuring no life-threatening disabilities. Berry points out that such services, being available exclusively to the upper class, discriminate against the less privileged classes, violating the principles of equality and equal protection rights. Moreover, the creation of the Crakers is an issue of reproductive medicine as they represent an extreme form of genetic engineering and artificial reproduction: “The ethical and policy issues raised by the application of new knowledge and technique in the realm of reproductive medicine – and associated counseling – have ranged from safety issues, to issues surrounding claimed eugenic aims, assumptions about the value of human life, and subtle coercion” (17).

Atwood manages to include the diverse discourse surrounding the new reproductive technologies, as Crake's artificial beings and his reasoning behind creating them mirror the contrasting perspectives found in publications on the bioethical issues of genetic engineering. Naturally, Crake as the architect of the new species expresses viewpoints of the advocates for the new reproductive technologies. Counter to expectations, Atwood does not assign the role of a critic to Jimmy, or some other character that would directly oppose Crake; instead, it is Crake again who acknowledges potential unintended consequences and problems, although in a dismissive manner:

The present methods on offer were very hit-or-miss, said Crake: certain hereditary diseases could be screened out, true, but apart from that there was a lot of spoilage, a lot of waste. The customers never knew whether they'd get exactly what they'd paid for; in addition to which, there were too many unintended consequences. But with the Paradise method, there would be ninety-nine percent accuracy. (Atwood 2003, 304)

The repercussions of Crake's erratic behavior as the mad scientist who is not constrained by moral principles are intensified when it becomes apparent that he has much more sinister plans. Contrary to expectations of emphasizing strict adherence to rules and minimization of chance, Crake is frequently depicted as an anti-positivist; he is often not entirely certain about the results of his actions, yet this uncertainty never hinders his determination to proceed with his plans. Using language that conveys a sense of doubt, Crake says he "think[s]" (306) that introducing a hint of malice into the Crakers' genetic design might lead them to develop a sense of humor, he admits that the methods used in modifying the Crakers' desired features "were very hit-or-miss" (304) or recognizes that certain hereditary diseases in the Crakers only "could" (304) be ruled out. According to Marcy L. Galbreath, his depiction not only challenges the stereotype of the scientist as infallible and precise, but also reveals that Crake, despite his intelligence, possesses personality traits that drive him to act recklessly under the influence of his deep-rooted convictions and prejudices (2010). Although Crake's initial plan to profit from genetic engineering aligns with the narrative of a highly commercialized scientific endeavor, his character's trajectory reveals far more sinister intentions. The revelation of Crake's true plan – to eradicate all humanity and replace it with peaceful Crakers – strips him of any remaining ethical limitations. The mad scientist archetype allows Atwood to explore morally ambiguous issues. Consequently, the novel transcends a mere cautionary tale about exploitative use of technology; it also presents a speculative exploration of the consequences of neglecting the bioethical discussion in relation to advanced genetic engineering.

It is possible to recognize the capability of fiction to bring attention to challenges and limitations posed by potential technological advancements of the future. As opposed to non-fiction, academic literature which deals with bioethical issues, but is bound by the constraints of the current state of science, culture, and politics, speculative fiction, on the other hand, is granted a broader canvas. It allows for setting up such a societal, cultural, and political environment that, while not completely copying the situation in the real world, has to maintain a sense of plausibility – the key element Atwood identifies as crucial to speculative fiction (Vint 2021b, 6). *Oryx and Crake* focuses on both technological and societal plausibility; it invites the reader

to engage critically with the portrayed socio-technological developments which are not mere tropes of the genre. The capability of speculative fiction to bend an element of the narrative to the author's liking, while at the same time keeping its foundation realistic, extends to technological advancements too. By the same logic, a new horizon is opened for bioethical questions which suddenly arise from these potential technological advancements. It is therefore the fictional narratives that encourage the development of bioethical arguments, and based on the direction current technological progress in genetic engineering is heading, it cannot be ruled out that the given bioethical questions may become relevant in reality.

AT THE INTERSECTION OF FICTION AND GENETIC ENGINEERING

On 15 November 2019, Margaret Atwood was invited to North Carolina State University to participate in an academic discussion entitled "An Evening with Margaret Atwood: Literature to Explore Our Genetic Engineering Futures". This event was organized by the Genetic Engineering and Society Center (GES) in collaboration with various faculty organizations (Beal 2019). While introducing the event, Jennifer Kuzma, the co-director of the GES Center stated that their institute "has the mission to guide biotechnologies in responsible and sustainable ways" and emphasized that they "ask not only what is possible with genetic engineering, but what is desirable" (2019). Numerous times during the debate, both Atwood and Kuzma underscored the importance of integrating social sciences and humanities with natural sciences. Such an interdisciplinary approach – to address the challenges posed by rapid technological advancement in genetic engineering –, as advocated by the GES Center, is considered essential for ensuring the responsible and ethical use of genetic engineering innovations.

Scholars have already accepted that it will be challenging to ensure that genetic engineering technologies are applied while adhering not only to the fundamental principles of bioethics, but also to socio-political considerations (Almeida and Ranisch 2022, 7) and epistemic humility (Schwab 2012). Epistemic humility, a cornerstone for ethical decision-making and responsible innovation, requires acknowledging the inherent uncertainties and limitations of human knowledge and thus calls for a careful approach. It also emphasizes the need of recognizing the potential negative consequences in the case of overstepping the bounds of current scientific understanding. As a theoretical virtue, epistemic humility is essential for developing and applying genetic engineering technologies with a conscious knowledge of their ethical and social implications. Atwood's critical questioning whether human desires and cognitive abilities are appropriate ethical drivers that shape the advancing biotechnology correlates with bioethicists' call for integrating epistemic humility into scientific practice. As Abraham Schwab states, the inherent uncertainty in scientific practice regarding the application of new biotechnologies stems from the imbalance of the amount of evidence for different medical decisions. While one decision may be supported by substantial evidence such as clinical trials and observational studies, other decisions may only rely on intuition and estimation, and although "[b]oth kinds of evidence are limited, [...] intuitions and received knowledge are more dangerous

guides” (2012, 32). Addressing epistemic humility in bioethical discourse is pivotal, as it reveals both the overconfidence and the undue modesty in ethical decision-making. In her speech, Kuzma gives examples of virtuous applications of biotechnology, including “clean water, low carbon energy, disease eradication, and environmental restoration” (2019), and although she regards these applications as “good” (2019), there has to be a warrant to approach each of these matters carefully. To rely solely on intuitive affirmation of these applications simply because of their apparent benefit is insufficient and may later prove to be dangerous.

During the debate at the GES Center, Atwood (2019b) mentioned that *Oryx and Crake* is often referred to as prophetic, but she also repeatedly expressed her desire that it not become so. Concerned about the future, Atwood stresses the cautionary – or, rather, the informative aspect of the novel: to depict potential threats of unchecked technological advancements, especially in genetic engineering. By writing and engaging in scholarly debates, Atwood raises awareness to prevent the dystopian outcome depicted in her work. Fred Gould, co-chair of the GES Center, views Atwood’s visit to North Carolina State University as a part of the center’s agenda to integrate diverse disciplinary perspectives on genetic engineering (Beal 2019). Utilizing fiction is a recent method that allows the exploration of the sociopolitical impact of human gene editing which, as Mara Almeida and Robert Ranisch (2022) note, is largely unknown. The debate further revealed that the natural sciences, in the same manner as the humanities, are filled with narratives that contain moral implications. For instance, biology is both a scientific discipline and a storytelling art form which incorporates ethical themes within the study of life and biological processes. The plot of *Oryx and Crake* consists of real-life issues integrated within the speculative landscape. It provides a commentary on the vulnerabilities of human society, the risks of uncontrolled scientific ambition, and the ethical issues arising from the use of biotechnological knowledge for malicious intents.

CONCLUSION

Speculative fiction, through its exploration of humanity’s fears as well as hopes for scientific progress, plays a crucial role in depicting the transformations of society that could arise from technological advancements. *Oryx and Crake* not only depicts the impact of genetic engineering technologies but also emphasizes the significance of speculative bioethics in parallel with current ethical debates, which illustrates the continuity between contemporary and future concerns. Such fictional narratives extend ethical considerations beyond personal experiences by employing theoretical scenarios that push the boundaries of one’s moral imagination. Engaging with these narratives encourages an interdisciplinary dialogue on emerging issues and potentially enhances an understanding of the technological impact.

As genetic engineering technologies continuously evolve, there is a strengthening call from bioethicists to address the ethical dimensions emerging from their use. These dimensions – encompassing safety, sociopolitical, and deontological aspects (Almeida and Ranisch 2022) – require a platform for bioethical analysis. In this context, *Oryx and Crake* exemplifies how speculative fiction can provide such a platform.

Due to its adherence to the concept of plausibility, the novel maintains a balance between real-world technological possibilities and its imaginative applications, thus developing distinct bioethical issues. Analyzing such speculative fiction works not only addresses current challenges, but also lays the groundwork for future bioethical debates, especially as cultural and political circumstances in contemporary society increasingly reflect the circumstances depicted in speculative narratives.

NOTES

- ¹ In the context of healthcare and bioethics, sustainable medicine represents such an approach to medical practice that aims to reduce environmental impact while promoting health and well-being. The idea of sustainable medicine includes a variety of practices, such as decreasing waste and energy consumption in healthcare institutions or the use of renewable resources and eco-friendly materials. Sustainable medicine also requires pharmaceutical practices to be reevaluated, especially the development or disposal of medications – to ensure they do not harm the environment.
- ² The concept of “commodification of life” refers to the profound effects of genetic engineering technologies on personhood, dehumanization, and social inequality. This theme, commonly explored in speculative fiction, reveals scenarios in which organs are traded, genetically modified beings are purchased and sold, or valuable substances are capitalized on. Such narratives emphasize that these benefits are mainly available to the wealthy, which then deepens socio-economic disparities and creates a landscape for the exploitation of living beings; the concept of commodification of life also demonstrates the manner in which life, under the domination of capital, maintains historical forms of oppression and gives rise to new ones.
- ³ As a groundbreaking genome editing technology, CRISPR/Cas9 enables scientists to make specific changes to DNA by removing, adding, or altering parts of the DNA sequence. It is based on a natural system used by bacteria to protect themselves against viruses. The system works by using the Cas9 enzyme which acts like a precise editor that can target and modify specific areas of DNA. The CRISPR/Cas9 technology has revolutionized genetic research, as it has created a potential for treating various genetic disorders by correcting mutations at their genetic roots.

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