

This essay was written by Brook A. Bond and posted on BrookBondTeabox.com

To what extent does genetic engineering provide a radically new dimension for science fiction's investigation into what it means to be human?

Though the first instance¹ of direct artificial genetic engineering of an animal did not occur until Rudolf Jaenisch and Beatrice Mintz's 1974 experiments into inserting viral DNA into mouse blastocysts², the knowledge that genetics are changeable across generations, and can be altered through more natural processes such as selective breeding to create both beneficial and detrimental heritable effects, is potentially as old as agriculture itself³. This can be seen through different crop cultivars⁴, livestock breeds⁵, and even companion animals like the domestic dog⁶; whose breeds such as the great dane or chihuahua have become dramatically visually distinct from each other due to human interference.

The matter of altering genetics through both natural and artificial means becomes more complicated when applied to human beings. Emerging technologies such as the use of CRISPR-CAS9 germline modification (a modification that not only effects the individual receiving it, but is also heritable by their future offspring)⁷ in proposed treatments for conditions such as cystic fibrosis and muscular dystrophy⁸ have created ethical concerns that the prohibitive cost of the treatment may in future create a privileged genetic caste made up of people affluent enough to afford it and their descendants. This would leave

¹ Christen Brownlee, "Biography of Rudolf Jaenisch," *Proceedings of the National Academy of Sciences* 101, no. 39 (September 21, 2004): 82–4, <https://doi.org/10.1073/pnas.0406416101>.

² Rudolf Jaenisch and Beatrice Mintz, "Simian Virus 40 DNA Sequences in DNA of Healthy Adult Mice Derived from Preimplantation Blastocysts Injected with Viral DNA," *Proceedings of the National Academy of Sciences* 71, no. 4 (April 1, 1974): 1250–54, <https://doi.org/10.1073/pnas.71.4.1250>.

³ Melinda Zeder, "THE DOMESTICATION of ANIMALS," *Journal of Anthropological Research* 68, no. 2 (2012): 161–90, https://www.jstor.org/stable/pdf/23264664.pdf?refreqid=excelsior%3A1b0cb8c00979ef3c46a6cda792d3724f&ab_segments=0%2F5SYC-6744_basic_search%2Ftest-1&origin=&acceptTC=1,163

⁴ Michael D. Purugganan, "Evolutionary Insights into the Nature of Plant Domestication," *Current Biology* 29, no. 14 (July 2019): R705–14, <https://doi.org/10.1016/j.cub.2019.05.053>, R707-08

⁵ BBC History, "BBC - History - Robert Bakewell," BBC.co.uk, 2014, https://www.bbc.co.uk/history/historic_figures/bakewell_robert.shtml.

⁶ Joshua M Akey et al., "Tracking Footprints of Artificial Selection in the Dog Genome," *Proceedings of the National Academy of Sciences of the United States of America* 107, no. 3 (2010): 1160–65, <https://doi.org/10.1073/pnas.0909918107>, 2

⁷ Fatma Betul Ayanoglu, Ayse Eser Elcin, and Yasar Murat Elcin, "Bioethical Issues in Genome Editing by the CRISPR/Cas9 Technology," *Turkish Journal of Biology* 44, no. 2 (April 2, 2020), <https://doi.org/10.3906/biy-1912-52>.

⁸ Mary Collins and Adrian Thrasher, "Gene Therapy: Progress and Predictions," *Proceedings: Biological Sciences* 282, no. 1821 (2015): 1–8, 6 https://www.jstor.org/stable/pdf/24762350.pdf?refreqid=excelsior%3A8440bdde04fc16515a20651552ae48ec&ab_segments=0%2F5SYC-6744_basic_search%2Ftest-1&origin=.

populations in developing countries unable to access this lifesaving technology, becoming further disadvantaged through vulnerability to diseases that their peers have made themselves immune to⁹.

Despite historical pseudoscientific attempts to biologically discriminate between groups in an attempt to justify discriminatory cultural practices¹⁰, natural human variation accounts for only 0.1% of the overall genome, rendering the phenotypical differences between real-world people functionally negligible¹¹. Science fiction not only allows for the opportunity to consider fictional scenarios where people exist with significant and tangible biological differences between them, but also considers what happens when these differences have been artificially imposed by others.

The subject of modified or artificial human beings has been explored in science fiction since before the biochemistry of genetics was fully understood¹². Though Karel Čapek's 1920 play *Rossum's Universal Robots*¹³ is the origin for the word robot within science fiction¹⁴, the character Domin's explanation of the titular creatures to the visiting Helena Glory in the first scene of the play betrays a more organic form as artificial humanoid beings, deviating from the idea of a metallic mechanical creation that the word would later come to mean in works such as Isaac Asimov's *I, Robot*¹⁵.

Domin explains the work of the scientist old Rossum, whose attempt to “. . . imitate the living matter known as protoplasm . . .¹⁶” resulted in “. . . a substance which behaved exactly like living matter although its chemical composition was different¹⁷.” Though Rossum's attempt at creating an animal using this substance resulted in “. . . some sort of stunted calf. . .¹⁸”, his humanoid robots are cosmetically

⁹ Fatma Betul Ayanoglu, Ayse Eser Elcin, and Yasar Murat Elcin, “Bioethical Issues in Genome Editing by the CRISPR/Cas9 Technology,” *Turkish Journal of Biology* 44, no. 2 (April 2, 2020), <https://doi.org/10.3906/biy-1912-52>, Section 4.71

¹⁰ Harvard Library, “Scientific Racism: Confronting Anti-Black Racism,” Harvard Library, 2022, <https://library.harvard.edu/confronting-anti-black-racism/scientific-racism>.

¹¹ US National Institute of Health, “Understanding Human Genetic Variation,” in NIH Curriculum Supplement Series (Maryland: National Institute of Health, 2007), <https://www.ncbi.nlm.nih.gov/books/NBK20363/#:~:text=Between%20any%20two%20humans%2C%20the,different%20between%20any%20two%20individuals..>

¹² The Encyclopedia of Science Fiction, “SFE: Genetic Engineering,” [sf-encyclopedia.com](https://sf-encyclopedia.com/entry/genetic_engineering), September 21, 2021, https://sf-encyclopedia.com/entry/genetic_engineering.

¹³ Karel Čapek, “Rossum's Universal Robots,” in *SF Masterworks: R.U.R & War with the Newts*, ed. Adam Roberts, trans. Paul Selver and Nigel Playfair (London: Gollancz, 2011), 5–73.

¹⁴ Howard Markel, “Science Diction: The Origin of the Word ‘Robot,’” NPR.org (NPR, April 22, 2011), <https://www.npr.org/2011/04/22/135634400/science-diction-the-origin-of-the-word-robot>.

¹⁵ Isaac Asimov, *I, Robot* (New York: Doubleday, 1950).

¹⁶ Čapek, “Rossum's Universal Robots,” 8

¹⁷ Čapek, “Rossum's Universal Robots,” 8

¹⁸ Čapek, “Rossum's Universal Robots,” 9

indistinguishable from natural human beings, as upon arriving on the island Helena Glory initially mistakes Domin's robot typist Sulla for an ordinary person¹⁹.

The robots, who have an expected lifespan of just twenty years²⁰, are not bred or grown as whole organisms, but assembled from their constituent components, which are manufactured en-masse in a factory on the island²¹. Though Domin manufactures certain models of robot with intelligence in mind (such as Sulla, who possesses the ability to speak several languages²²), the majority of the species are used as thralls for rough manual labour; the goods their toil produces creating an environment of comfortable post-scarcity to enrich the lives of natal human beings²³. The robots in turn receive none of the benefits of their labour, with their creator believing that they are incapable of feeling, thus undeserving of compensation²⁴.

This idea of artificial or altered human beings as an expendable underclass to natal humans is also a theme in more contemporary works, such as in Kazuo Ishiguro's 2005 novel *Never Let Me Go*²⁵. Ishiguro presents a world where infertile²⁶ human clones are raised in specialised facilities, destined to have their organs removed for transplantation into natal humans in a process euphemistically dubbed "donation"²⁷. Just as Čapek's robots live short lives of toil, Ishiguro's clones are destined to die at a young age, or "complete," after four rounds of organ removal²⁸.

In a similar vein to how Domin discounts the idea of his robots possessing feeling, the clones at the Hailsham facility are encouraged to produce artworks for Madame Marie-Claude²⁹, who is attempting to use them to see if she can ". . . prove you [the Hailsham students] had souls at all."³⁰

¹⁹ Čapek, "Rossum's Universal Robots," 14

²⁰ Čapek, "Rossum's Universal Robots," 12

²¹ Čapek, "Rossum's Universal Robots," 16

²² Čapek, "Rossum's Universal Robots," 14

²³ Čapek, "Rossum's Universal Robots," 23-4

²⁴ Čapek, "Rossum's Universal Robots," 22

²⁵ Kazuo Ishiguro, *Never Let Me Go* (London: Faber And Faber, 2005).

²⁶ Ishiguro, *Never Let Me Go*, 53

²⁷ Ishiguro, *Never Let Me Go*, 8

²⁸ Ishiguro, *Never Let Me Go*, 187

²⁹ Ishiguro, *Never Let Me Go*, 25-6

³⁰ Ishiguro, *Never Let Me Go*, 174

In both instances, the dehumanisation could be argued to be unwarranted. Ishiguro goes to great lengths to portray the cloned characters as behaving just as normal young humans do; they play games³¹, have petty arguments³², form juvenile crushes³³, and have (unfortunately untenable) aspirations for their futures³⁴. Though the only meaningful differences they have from natal human beings are their infertility and their cloned origin, they are oppressed and slaughtered in ways that natal human beings would not be subject to.

Though Čapek's robots are perhaps less emotionally human than the clones in *Never Let Me Go*, especially initially with their seeming ambivalence to the idea of themselves or their kin being dissected by Domin at the start of the play³⁵, the characters seen in the epilogue set after the robot revolution are undeniably portrayed as sapient beings, having developed an awareness of and protection towards their lives. This is displayed through revolutionary leader Radius, whose practical desire to continue his species causes him to offer up robots for dissection, saying "You shall have all you need! A hundred of us! A thousand of us!"³⁶ However, when the surviving human Alquist suggests that Radius offers himself up for dissection, he briefly hesitates:

ALQUIST: Ah, you are afraid of death?

RADIUS: I? Why should I be chosen?

ALQUIST: So you will not.

RADIUS: I will³⁷.

Though he recognises the practical importance of survival of the robot race, his hesitation at the idea of his own dissection shows that he has an awareness of himself, and that he holds his life in value. In turn, the human Alquist has also seemingly come to value robot lives, saying "God, give me strength – God, give me strength – if only this murder is not in vain"³⁸. At the prospect of dissecting a robot. Murder is the

³¹ Ishiguro, *Never Let Me Go*, 11

³² Ishiguro, *Never Let Me Go*, 82-83

³³ Ishiguro, *Never Let Me Go*, 119

³⁴ Ishiguro, *Never Let Me Go*, 58

³⁵ Čapek, "Rossum's Universal Robots," 15

³⁶ Čapek, "Rossum's Universal Robots," 68

³⁷ Čapek, "Rossum's Universal Robots," 69

³⁸ Čapek, "Rossum's Universal Robots," 69

operative word in this line, as the word is explicitly defined as “intentionally killing a person³⁹,” implying that Alquist has come to accept that robots are in fact people.

If both clones and robots possess the mental trappings of personhood, why have the wider societies in which they exist decided that it is acceptable to use and abuse their bodies for personal gain? The start of an answer to this question can be inferred from Kathy and Tommy’s adulthood confrontation with Miss Emily and Madame Marie-Claude in *Never Let Me Go*:

“... for a long time, people preferred to believe these organs appeared from nowhere, or at most that they grew in a kind of vacuum. . . . So for a long time you [the clones] were kept in the shadows, and people did their best not to think about you. And if they did, they tried to convince themselves you weren’t really like us. That you were less than human, so it didn’t matter.⁴⁰”

According to American psychologist Leon Festinger, cognitive dissonance is the idea that “. . . if a person knows various things that are not psychologically consistent with one another, he will, in a variety of ways, try to make them more consistent.⁴¹” The noble aim of creating post scarcity so that “everybody will be free from worry and the degradation of labour.⁴²”, or using transplantation and transfusion to create “. . . a world that has come to regard cancer as curable.⁴³” are very much incompatible with the idea of an underclass of beings whose bodies are used against their will. To make these ideas compatible enough to come to fruition, a culture can otherise and minimise⁴⁴ the oppressed group so that they are considered “. . . less than human, so it didn’t [doesn’t] matter.⁴⁵” The robots and clones are not inherently biologically inferior to the natal humans; they think and feel and value their lives in much the same manner. It is cognitive dissonance that has forced them into this role.

³⁹ Cambridge Dictionary, “MURDER | Meaning in the Cambridge English Dictionary,” Cambridge.org, November 27, 2019, <https://dictionary.cambridge.org/dictionary/english/murder> .

⁴⁰ Ishiguro, *Never Let Me Go*, 176

⁴¹ Leon Festinger, “Cognitive Dissonance,” *Scientific American* 207, no. 4 (1962): 93–106, https://www.jstor.org/stable/pdf/24936719.pdf?refreqid=excelsior%3A075ca62765c5de1c76ec2fca20a84e79&ab_segments=0%2F5YC-6744_basic_search%2Ftest-1&origin=&acceptTC=1,93

⁴² Čapek, “Rossum’s Universal Robots,” 24

⁴³ Ishiguro, *Never Let Me Go*, 176

⁴⁴ Joy DeGruy, “Cognitive Dissonance: Easing the Conscience,” in *Post Traumatic Slave Syndrome: America’s Legacy of Enduring Injury and Healing* (Oregon: Uptone Press, 2005), 222–32, <https://melaninandhoneydotcom.files.wordpress.com/2016/07/degruy-joy-post-traumatic-slave-syndrome.pdf>, 222

⁴⁵ Ishiguro, *Never Let Me Go*, 176

Using genetically engineered life forms as a metaphor for an oppressed class, science fiction can provide a conceptual space divergent from the historical and cultural trappings of reality within which real-world inequalities and biases can be explored. By giving a reader an awareness of these biases, using a sense of unfairness to foster empathy for beings unlike themselves, science fiction can prepare in advance for a potential future where biological differences between peoples are more than just cosmetic, and germline modification has imposed more significant differences⁴⁶.

Unlike the human-to-human transplantations of *Never Let Me Go*, Margaret Atwood's 2003 novel *Oryx and Crake*⁴⁷ presents a world where science has moved beyond the practice of “. . . keeping a for-harvest child or two stashed away in some illegal baby orchard⁴⁸”, and has graduated to growing viable organs within the bodies of pigs⁴⁹. The pigs, dubbed pigoons, are modified with donor human DNA to create organs that will not be biologically rejected, and this addition is considered significant enough that their meat is unsuitable for consumption⁵⁰.

Combined with the idea of constructing a person from manufactured organs featured in *Rossum's Universal Robots*⁵¹, these proposed new technologies rewrite the boundaries of the human body as a unit; a situation where man is not an immutable whole, but a series of modular systems working in tandem that can be assembled, discarded, and replaced while still maintaining the identity of the collective.

An example of this rewriting of boundaries taken to its extremes can be found in C.M. Kösemen's 2006 novella *All Tomorrows*.⁵² While Čapek's robots and Atwood's proposed transplantation subjects retain a human appearance despite the modular nature of their internal organs, Kösemen's Modular People⁵³ have been transformed by genetic engineering and natural evolution to totally erode the boundaries of their once human form in favour of vast zooidal masses of interchangeable parts. Anatomically resembling

⁴⁶ Ayanoglu et al., “Bioethical Issues in Genome Editing by the CRISPR/Cas9 Technology,” Section 4.71

⁴⁷ Margaret Atwood, *Oryx and Crake* (2003; repr., London: Virago Press, 2013).

⁴⁸ Atwood, *Oryx and Crake*, 27

⁴⁹ Atwood, *Oryx and Crake*, 25-6

⁵⁰ Atwood, *Oryx and Crake*, 27

⁵¹ Čapek, “Rossum's Universal Robots,” 16

⁵² C.M Kösemen, *All Tomorrows: A Billion Year Chronicle of the Myriad Species and Varying Fortunes of Man*, 2006, <https://drive.google.com/file/d/0ByV5-S712cg8Tk1vQWVFZVM5S28/view?resourcekey=0-f0n8tTyFknuKmWvLl6gYFQ>.

⁵³ Kösemen, *All Tomorrows*, 72

primitive aquatic organisms like tunicates and siphonophores⁵⁴, each segment of a Modular Person's body is not merely an organ, but a dramatically atrophied human being using its specialised singular function to sustain the whole⁵⁵.

While in the other two instances the introduction of this technology plays a hand in the fall of their respective civilisations, Kösemen's Modular People manage to not only survive in spite of their modifications, but thrive because of them: "Due to their biological structure, these people had managed the impossible. They were actually living in a world of peace and utopian equality, where everybody was happy to be parts of greater, united wholes⁵⁶."

Instead of being ascribed to some positive or negative quality of the technology itself, this could perhaps be due to the attitude in which it has been implemented. While the robots and pigeons definitely provided worthwhile services to their respective societies, they did not exist in the spirit of altruism, but profit; with the OrganInc corporation creating "glossy and discreetly worded⁵⁷" advertisements to sell their pigeon organs, and Alquist admitting in *Rossum's Universal Robots* that for all of their high-minded talk about ending scarcity and enriching humanity, their robot company primarily existed ". . . For our [their] own selfish ends.⁵⁸" This factor is reflected in the real world, with the prohibitive cost of the potential CRISPR-CAS9 treatment being one of the ethical concerns in its implementation⁵⁹.

Meanwhile, the development of the Modular People was in response to the suffering of their Colonial ancestors at the hands of defeat by alien invaders⁶⁰, with the coming together into their modular forms reflecting the repair of their society⁶¹. These examples present genetic engineering in science fiction not as a uniquely corruptive evil, but a tool like any other that follows the motivations of its wielders to bring about benefits and detriments.

⁵⁴ G.O Mackie, "From Aggregates to Integrates: Physiological Aspects of Modularity in Colonial Animals," *Philosophical Transactions of the Royal Society of London. B, Biological Sciences* 313, no. 1159 (August 14, 1986): 175–96, <https://doi.org/10.1098/rstb.1986.0032>, 182-3

⁵⁵ Kösemen, *All Tomorrows*, 72

⁵⁶ Kösemen, *All Tomorrows*, 72

⁵⁷ Atwood, *Oryx and Crake*, 27

⁵⁸ Čapek, "Rossum's Universal Robots," 53

⁵⁹ Ayanoglu et al., "Bioethical Issues in Genome Editing by the CRISPR/Cas9 Technology," Section 4.71

⁶⁰ Kösemen, *All Tomorrows*, 36

⁶¹ Kösemen, *All Tomorrows*, 72

Another genetic engineering novus presented by Atwood in *Oryx and Crake* are the Crakers; modified posthuman beings created by the titular Crake according to his view of an ideal new humanity fit to inherit the Earth upon the plague death⁶² of the previous paradigm. Crake utilised a utilitarian and animalistic perspective in their creation, stripping away all factors he felt were unnecessary: They have a ruminant digestive system similar to that of a rabbit that allows them to eat usually indigestible plant matter instead of cooked food⁶³, a polyandrous three-year heat cycle taken from baboons intended to eliminate sexuality and romantic feeling⁶⁴, and a supposed lack of artistic and religious sensibilities, which Crake views reductively as “A stab at getting laid.”⁶⁵

Though these attempts to reduce humanity to its primal bare essentials appear to have been partially successful, with the protagonist Jimmy regarding the Crakers with the uncanny observation of being “. . . placid, like animated statues.”⁶⁶, the ways in which Crake’s modifications have failed reveal the ways in which the Crakers are posthuman and not inhuman. Despite all of his strange and numerous modifications, Crake’s reductive view of art and spirituality could not prevent the Crakers from developing their own form of folk mythology⁶⁷. No longer human in the strictest biological sense, it is this residual connection to the human tendency to create stories that, much like Čapek’s robots and Ishiguro’s clones, signifies they have remained human in the ways that matter. Author Ursula K. Heise explains this concept thusly: “Atwood’s affirmation that authentic humanness can be identified through culture, therefore, plays itself out in a context that is thoroughly posthuman in biological terms.”⁶⁸

This assertion that some form of human identification can persist within forms that are no longer biologically human is explored further in Köseman’s *All Tomorrows*. Though humanity’s multi-million year journey through interplanetary civilisation sees people assume increasingly divergent genetically

⁶² Atwood, *Oryx and Crake*, 381

⁶³ Atwood, *Oryx and Crake*, 187-8

⁶⁴ Atwood, *Oryx and Crake*, 194

⁶⁵ Atwood, *Oryx and Crake*, 198

⁶⁶ Atwood, *Oryx and Crake*, 115

⁶⁷ Atwood, *Oryx and Crake*, 117-9

⁶⁸ Ursula K. Heise, “The Android and the Animal,” *PMLA* 124, no. 2 (2009): 503–10, <https://www.jstor.org/stable/25614291>, 508

modified forms⁶⁹, Köseman uses his narrator character, a sympathetic alien scientist⁷⁰, to ground the bizarre creatures in a sense of emotional familiarity. On a planet where humanity has assumed a serpent form with a single “pelvic hand⁷¹”, people still read books and listen to music⁷². On a world where humans have grown fins and taken to the sea like dolphins⁷³, the people watch television on cephalopod skin screens and form close bonds with their domesticated pets⁷⁴. In a future an uncountable number of eons from the present, where a cataclysmic war has permanently melded man and machine⁷⁵, artisans still develop fashionable accessories⁷⁶. “. . . never forget that these beings are human intelligences, only in different bodies,” The narrator says⁷⁷. “A creature could feed on putrefying meat, stink like a grave and express its affection by defecating on others, but it might as well be your own grandchild *and* the last hope of mankind.⁷⁸”

By abandoning a definition of humanity drawn on strict biological lines, and exploring a more open and empathic view that accounts for shared traits between natal and modified human beings, science fiction can present a vision of humanity in celebration of the persistence of the human spirit. By presenting certain positive human qualities as unalienable in the face of genetic modification, science fiction can instil these values in a reader in preparation for the effects that emerging technologies may create⁷⁹.

In conclusion, the use of genetic engineering in science fiction can be used to explore hypothetical scenarios where the biological differences between sapient humanoid beings are significant and tangible, such as being constructed or grown instead of born. Through this, human biases can be explored, including the cognitive dissonance required to significantly otherise an out-group in order to use them for in-group gain.

⁶⁹ Kösemen, *All Tomorrows*, 2

⁷⁰ Kösemen, *All Tomorrows*, 111-2

⁷¹ Kösemen, *All Tomorrows*, 64

⁷² Kösemen, *All Tomorrows*, 65

⁷³ Kösemen, *All Tomorrows*, 68

⁷⁴ Kösemen, *All Tomorrows*, 68-9

⁷⁵ Kösemen, *All Tomorrows*, 91

⁷⁶ Kösemen, *All Tomorrows*, 103-4

⁷⁷ Kösemen, *All Tomorrows*, 104

⁷⁸ Kösemen, *All Tomorrows*, 34

⁷⁹ Peter Singer, “What Inspires Them: Science Fiction’s Impact on Science Reality,” in *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (London: Penguin, 2009), 32–42, http://papers.cumincad.org/data/works/att/acadia09_32.content.pdf, 33

The use of transplantation in science fiction can be used to evaluate the boundaries of the individual human being as a unit, and examine the concept of the transplant subject as a colonial organism akin to a siphonophore or tunicate; with internal workings not as an unchangeable system, but as a collection of zooid-like pieces that can be discarded and replaced while still maintaining the overall identity of the whole.

The role of this technology in maintaining a successful civilisation can be interrogated, examining how the motives behind their implementation are more significant than ascribing a moral value to the technology itself.

Finally, science fiction can be used to investigate if genetic engineering can suppress the development of culture, and how human ingenuity can still potentially thrive despite every attempt to remove it. By portraying living beings who have otherwise been dramatically modified as individuals with culture and feeling, science fiction can highlight the strength of the human will, and help foster understanding of disparate beings.

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