

From goodness to good looks: Changing images of human germline genetic modification

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Abstract

When writing about deliberate changes to the human germline, bioethicists tend not to discuss the modification of specific genes and instead refer to broader concepts like making people smarter, taller, or longer-lived. Only a limited number of these traits are mentioned regularly in the literature. Examples like health and intelligence appear frequently at all stages of the germline modification discourse, but the third most frequently mentioned trait has shifted over time. Prior to the early 1980s, publications discussed giving humans a kinder temperament significantly more often than cosmetic modifications, while more recent works reverse the frequency of these traits. Contributing factors likely include a greater focus on individual decision-making, combined with the increasing uptake of real-world reproductive technologies like IVF and gamete donation. This shifting imagery could have a profound influence on the way scholars develop arguments about gene editing since cosmetic modifications are generally viewed more negatively and considered less relevant to the identity of future people. In comparison with earlier images of germline modification, they also suggest a more contemporary, Western, and politically liberal social context for gene editing technology. Examining how authors move between writing about different traits can also help us to be aware of the traits that are arbitrarily omitted from the discourse and to consider our preparedness for unexpected kinds of modification.

KEYWORDS

cosmetic enhancement, genome editing, history of bioethics, human germline genetic modification, moral enhancement, rhetoric of bioethics

1 | INTRODUCTION

Scientists and other stakeholders began to discuss the prospect of genetically modifying human embryos and gametes many decades before the development of CRISPR technology. However, work on the bioethical impact of these images of the future remains incomplete. The academic debate on human germline genetic modification

(hereafter HGGM) first emerged in the form of eugenics manifestos, crossing disciplinary lines in the mid-1960s as theologians began to challenge scientists' authority over ethical questions.¹ Almost imme-

¹Evans, J. H. (2002). *Playing god?: Human genetic engineering and the rationalization of public bioethical debate*. University of Chicago Press, p. 61; Walters, L., & Palmer, J. G. (1997). *The ethics of human gene therapy*. Oxford University Press, p. 143.

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diately, scholars acknowledged that metaphors like genetic “engineering,” “surgery,” “manipulation,” or “algeny” could frame the discourse in different ways.² However, no authors have examined the potential framing effects of another rhetorical device: the choice of which genetic modifications to give as examples.

Whether aimed at scholars or the general public, most bioethical publications on HGGM name at least a few traits that scientists might eventually modify. Authors writing before the establishment of molecular genetics were obviously unable to name the actual sequences they wished to change. Even after the discovery of numerous alleles hyped as “genes for” particular characteristics, most stakeholders continued to discuss not specific DNA modifications but complex traits—including ones that are deeply influenced by the environment or even socially constructed. The most common of these include beauty, creativity, dementia resistance, eye color, hair color, health, height, immune response, intelligence, longevity, memory, morality, musical talent, new abilities, personality, servility, sex, skin color, and strength.

This article examines how the set of traits discussed in the HGGM debate has changed over time. First, it shows how academic authors moved from writing more frequently about moral traits to writing more about cosmetic traits around 1980. The article examines what this shift might tell us about authors’ scholarly, cultural, political, or technological influences, and how it may have implicitly affected their ethical arguments. Finally, it argues that contemporary bioethicists have continued to overlook the ethical issues raised by modifications outside of the typical shortlist.

2 | INTELLIGENCE AND MORALITY IN THE EARLY DEBATE

The idea of making people smarter and kinder dates back to the very beginning of the eugenics movement. Francis Galton, who coined the word “eugenics” in 1883, wrote that modern man had failed to develop the “wits and goodness” needed to administer a complex civilization.³ He urged readers to improve the “mental, moral, and physical” nature of their race.⁴

Accordingly, eugenics advocates in the early 20th century described the need to make people “physically, mentally, and morally stronger and healthier”⁵ or seek partners who were “perfect physi-

cally, mentally, and morally.”⁶ Although health was a major concern for eugenicists, especially in the 1930s and onward, they generally prioritized mental traits.⁷ One of their primary motivations was the perceived increase of criminality.⁸

Charles Davenport, who ran the Eugenics Record Office at Cold Spring Harbor, argued that there was a single gene for violent outbursts.⁹ However, the majority of early geneticists came to view allegedly immoral behavior as the downstream consequence of a gene for low intelligence.¹⁰ Henry Goddard, whose views overtook Davenport’s in the 1910s, classified people between “dull normal” and “feebleminded” based on whether they could tell right from wrong.¹¹

Although “mainline” eugenics continued into the 1970s and beyond through sterilization programs,¹² this literature did not directly influence discussions of HGGM. Rather, the debate was shaped by “reform” eugenics, a breakaway movement that sought to distance genetic improvement from racist and classist pseudoscience.¹³ Reform eugenicists thought modern civilization was selecting against intelligence and altruism¹⁴ while preserving harmful mutations in the gene pool. Nobel-winning geneticist H. J. Muller, who would become the most cited figure in the early HGGM debate,¹⁵ labeled this purported health risk the “genetic load.”¹⁶

⁶Hall, W. S. (1914). The relation of education in sex to race betterment. In E. F. Robbins (Ed.), *Proceedings of the First National Conference on Race Betterment* (pp. 324–334). Race Betterment Foundation, p. 332; see also Dare, H. (1915, August 12). After we are eugenically and otherwise remodelled. *San Francisco Chronicle*, p. 135.

⁷Kline, W. (2001). *Building a better race: Gender, sexuality, and eugenics from the turn of the century to the baby boom*. University of California Press, p. 94; Paul, D. B. (1995). *Controlling human heredity: 1865 to the present*. Humanities Press, p. 122; Paul, D. B. (1998). *The politics of heredity: Essays on eugenics, biomedicine, and the nature-nurture debate*. State University of New York Press, p. 144; see also Condit, C. M. (1999). *The meanings of the gene: Public debates about human heredity*. University of Wisconsin Press, p. 40; Proctor, R. (1988). *Racial hygiene: Medicine under the Nazis*. Harvard University Press, pp. 107–108.

⁸See Kevles, D. J. (1985). *In the name of eugenics: Genetics and the uses of human heredity*. Alfred A. Knopf, p. 147; Ludmerer, K. M. (1972). *Genetics and American society: A historical appraisal*. Johns Hopkins University Press, pp. 17–18.

⁹Davenport, C. B. (1920). Heredity of constitutional mental disorders. *Psychological Bulletin*, 17(9), 300–310; Haller, M. H. (1963). *Eugenics: Hereditarian attitudes in American thought*. Rutgers University Press, p. 71.

¹⁰Condit, op. cit. note 7, p. 28; Haller, *Ibid*: 68–69, 82, 104; Kevles, op. cit. note 8, p. 79; Paul (1998), op. cit. note 7, p. 64; Rothschild, J. (2005). *The dream of the perfect child*. Indiana University Press, p. 41; Wikler, D. (1999). Can we learn from eugenics? *Journal of Medical Ethics*, 25(2), 183–194.

¹¹Goddard, H. H. (1920). *Human efficiency and levels of intelligence*. Princeton University Press, p. 87

¹²e.g., Harris, L. H., & Wolfe, T. (2014). Stratified reproduction, family planning care and the double edge of history. *Current Opinion in Obstetrics and Gynecology*, 26(6), 539–544; Roberts, D. E. (1997). *Killing the black body: Race, reproduction, and the meaning of liberty*. Pantheon Books, pp. 89–94.

¹³Gudding, G. (1996). The phenotype/genotype distinction and the disappearance of the body. *Journal of the History of Ideas*, 57(3), 525–545; Stern, A. M. (2005). *Eugenic nation: Faults and frontiers of better breeding in modern America*. University of California Press, p. 154.

¹⁴e.g., Dobzhansky, T. (1962). *Mankind evolving: The evolution of the human species*. Yale University Press, p. 342; Medawar, P. B. (1960). *The future of man: The BBC Reith lectures 1959*. Methuen, pp. 71–83.

¹⁵Evans, op. cit. note 1, p. 46.

¹⁶*Ibid*: 49; Muller, H. J. (1962). Should we weaken or strengthen our genetic heritage? In Hoagland, H., & Burhoe, R. W. (Eds.), *Evolution and man’s progress* (pp. 22–40). Columbia University Press, p. 26.

²e.g., Dobzhansky, T. (1967). Changing man. *Science*, 155(3761), 409–415; Etzioni, A. (1973). *Genetic fix*. Macmillan, pp. 52, 103; Glass, B. (1975). Ethical problems raised by genetics. In C. Birch, P. Abrecht, & World Council of Churches (Eds.), *Genetics and the quality of life* (pp. 50–58). Pergamon Press, p. 50.

³Galton, F. (1894). The part of religion in human evolution. *The National Review*, 23(138), 755–763.

⁴Galton, F. (1865). Hereditary talent and character. *Macmillan’s Magazine*, 12, 157–166, 318–327.

⁵Jordan, H. E. (1912). The place of eugenics in the medical curriculum. In *Problems in eugenics: Papers communicated to the First International Eugenics Congress* (pp. 396–399). Eugenics Education Society, p. 396.

In 1939, *Nature* published a “geneticist’s manifesto” primarily authored by Muller¹⁷ and signed by many other notable contributors to the early debate, including Julian Huxley, Theodosius Dobzhansky and J. B. S. Haldane. It stated:

The most important genetic objectives, from a social point of view, are the improvement of those genetic characteristics which make (a) for health, (b) for the complex called intelligence, and (c) for those temperamental qualities which favour fellow-feeling and social behaviour rather than those (to-day most esteemed by many) which make for personal ‘success’, as success is usually understood at present.¹⁸

After a lull following World War II and the defeat of Nazi Germany, these scientists began publishing eugenics articles again, circa 1953.¹⁹ Many repeated the same three priorities.²⁰ In 1955, Bentley Glass suggested all could agree on “freedom from gross physical or mental defects, sound health, high intelligence, general adaptability, integrity of character, and nobility of spirit.”²¹ In 1963, Francis Crick described a consensus supporting “good health, high intelligence, [and] general benevolence.”²² This common grouping may reflect a folk ontology in which people consist of “mind, heart and body.”²³ The ability to divide humans into just three broad components is both elegant and rhetorically powerful.

Nevertheless, many reform eugenicists continued to prioritize mental improvements.²⁴ Muller opined in the debut issue of the

American Journal of Human Genetics that not health or strength, but “Greater intellectual capacity, and along with it kindlier natural feelings, are surely the greatest biological needs of all humanity.”²⁵ Although intelligence was the more universally valued of the two,²⁶ reform eugenicists no longer saw it as the root cause of morality.²⁷ In fact, Muller thought enhancing intelligence alone could be catastrophic.²⁸ He ended his involvement in the Repository for Germinal Choice, a defunct sperm bank intended for Nobel Prize winners, when he realized that owner Robert K. Graham valued intelligence far more than altruism.²⁹

The intellectual environment of the early HGGM debate was especially conducive to discussing moral enhancement because of its emphasis on society as a whole.³⁰ While living in the USSR in the 1930s, Muller had presented Stalin with his manifesto *Out of the night*, which argued that reform eugenics was compatible with socialist revolution.³¹ Even after his disillusionment, Muller emphasized the need to extend cooperation beyond “race, or nation, or class” to “mankind as a whole” and thus to prevent war.³²

Some of his colleagues even thought that genetic engineering might help prevent nuclear Armageddon.³³ In conference proceedings published the year after the Cuban Missile Crisis, fellow Nobel winner Joshua Lederberg commented that genetic engineering could theoretically forestall World War Three by removing “personality problems and emotional disturbances.”³⁴ Issues like aggression and warfare may have been especially emphasized because, in Lederberg’s words, images from the sixties were “overwhelmingly male-oriented.”³⁵ Indeed, Muller often described compassion in gendered language such as a “virile ... comradeship.”³⁶

¹⁷Carlson, E. A. (1981). *Genes, radiation, and society: The life and work of H. J. Muller*. Cornell University Press, p. 266.

¹⁸Crew, F. A. E., Darlington, C. D., Haldane, J. B., Harland, C., Hogben, L. T., Huxley, J. S., Muller, H. J., Needham, J., Child, G. P., David, P. R., Dahlberg, G., Dobzhansky, T., Emerson, R. A., Gordon, C., Hammond, J., Huskins, C. L., Koller, P. C., Landauer, W., Plough, H. H., ... Waddington, C. H. (1939). Social biology and population improvement. *Nature*, 144(3646), 521–522. See also Paul, D. B. (1987). “Our load of mutations” revisited. *Journal of the History of Biology*, 20(3), 321–335; Muller, H. J. (1935). *Out of the night: A biologist’s view of the future*. Vanguard Press, pp. 117–118; Muller, H. J. (1959). The guidance of human evolution. *Perspectives in Biology and Medicine*, 3(1), 1–43.

¹⁹Paul (1998), op. cit. note 7, p. 135; Paul, D. B. (2005). Genetic engineering and eugenics: The uses of history. In H. W. Baillie, & T. Casey (Eds.), *Is human nature obsolete?: Genetics, bioengineering, and the future of the human condition* (pp. 123–151). MIT Press, p. 135; Turney, J. (1998). *Frankenstein’s footsteps: Science, genetics and popular culture*. Yale University Press, p. 165.

²⁰Compare Condit, op. cit. note 7, pp. 82, 89, 107.

²¹Glass, B. (1959). *Science and liberal education*. Louisiana State University Press, p. 51.

²²Wolstenholme, G. E. W. (Ed.) (1963). *Man and his future: A Ciba Foundation volume*. Little, Brown, p. 294.

²³Muller, H. J. (1963). Genetic progress by voluntarily conducted germinal choice. In *Ibid* (pp. 247–262); compare Rothschild, op. cit. note 10, p. 16; Savulescu, J., & Kahane, G. (2009). The moral obligation to create children with the best chance of the best life. *Bioethics*, 23(5), 274–290.

²⁴Paul, op. cit. note 18; see also Paul (1995), op. cit. note 7, p. 127.

²⁵Muller, H. J. (1949). Progress and prospects in human genetics. *American Journal of Human Genetics*, 1(1), 1–18; see also Allen, G. E. (1970). Biology and culture: Science and society in the eugenic thought of HJ Muller. *Bioscience*, 20(6), 346–353; Carlson, op. cit. note 17, p. 402; Muller (1959), op. cit. note 18; Muller, H. J. (1961). Human evolution by voluntary choice of germ plasm. *Science*, 134(3480), 643–649; Muller, op. cit. note 16; Muller, op. cit. note 23; Muller, H. J. (1965). Means and aims in human genetic betterment. In T. M. Sonneborn (Ed.), *The control of human heredity and evolution* (pp. 100–121). MacMillan; Muller, H. J. (1968). What genetic course will man steer? *Bulletin of the Atomic Scientists*, 24(3), 6–12.

²⁶Muller (1968), *Ibid*; Sinsheimer, R. L. (1970). Genetic engineering: the modification of man. *Impact of Science on Society*, 20(4), 279–291.

²⁷Haller, op. cit. note 9, p. 69; but see Wolstenholme, op. cit. note 22, p. 298.

²⁸Carlson, op. cit. note 17, p. 402; Paul (2005), op. cit. note 19, p. 133; see also Glass, op. cit. note 2, p. 53.

²⁹Kevles, op. cit. note 8, p. 262.

³⁰Evans, op. cit. note 1, pp. 20, 68.

³¹Paul (1998), op. cit. note 7, p. 24.

³²Allen, op. cit. note 25; Muller (1968), op. cit. note 25.

³³Danielli, J. F. (1972). Industry, society and genetic engineering. *Hastings Center Report*, 2(6), 5–7; Davis, B. D. (1973). Threat and promise in genetic engineering. In P. N. Williams (Ed.), *Ethical issues in biology and medicine: Proceedings of a symposium on the identity and dignity of man* (pp. 17–32). Schenkman, p. 30; see also Davis, K. (1966). Sociological aspects of genetic control. In J. D. Roslansky (Ed.), *Genetics and the future of man* (pp. 171–204). North-Holland, p. 174.

³⁴Wolstenholme, op. cit. note 22, p. 289; but see Lederberg, J. (1966). Experimental genetics and human evolution. *Bulletin of the Atomic Scientists*, 22(8), 4–11; Lederberg, J. (1970). Orthobiosis: The perfection of man. In A. Tiselius & S. Nilsson (Eds.), *The place of value in a world of facts: Nobel Symposium XIV* (pp. 29–58); Lederberg, J. (1971). Genetic engineering or the amelioration of genetic defect. *Pharos*, 34(1), 9–12.

³⁵Lederberg (1966), *Ibid*.

³⁶Muller (1959), op. cit. note 18.



The emphasis on wide-scale HGGM for the public good also extended to the other traits these scientists discussed. Preserving the gene pool from deterioration was not just a way to alleviate individual suffering, but a strategy for rescuing civilization. Even when writing about enhancements, authors often framed traits like intelligence as ways to provide society with better leaders.³⁷ For instance, Julian Huxley, the brother of Aldous and first director of UNESCO, suggested creating statesmen with a long-term view of politics.³⁸ Scientists also imagined genetic changes on an extended time frame, agreeing that issues like genetic load would take centuries or longer to correct.³⁹ Haldane's last major article on the topic, published in 1963, examined "possibilities for the human species in the next ten thousand years."⁴⁰

Around the same time, biochemical geneticists began to enter the debate, bringing with them the idea that direct genetic modification might be imminent.⁴¹ Rather than slowly combining promising gametes for statistical benefits to the gene pool, they foresaw technologies that would let eugenics be applied to individual humans.⁴² However, the scope of the debate remained wide in the mid-60s because theologians were beginning to challenge scientists' jurisdiction over the ethics of HGGM.⁴³ While they disagreed about concepts like genetic load, both groups were primarily concerned about society on a broad scale and—with notable exceptions like Methodist ethicist Paul Ramsey—the distant future.⁴⁴

As the debate continued into the 1970s, scientists and theologians considered genetic intervention in the context of an increasing range of issues, like chimeras, cloning, sperm banks, abortion, and global pollution.⁴⁵ They also contended with the emergence of so-

ciobiology which renewed public interest in the heritability of traits like intelligence, altruism, criminal behavior, and alcoholism.⁴⁶

Eric Juengst called the 1970s the "Romantic stage of inquiry"⁴⁷ marked by "awe,"⁴⁸ while Alexander Capron coined the term "genicity" to describe the strong emotions and vivid rhetoric stirred by these speculations.⁴⁹ Sociologist John H. Evans has described it as the last decade dominated by Weberian "substantive rationality," as participants in the HGGM discourse considered incommensurable ends like "species perfectionism, beneficence, obeying God, creating meaning for human society, the pursuit of knowledge as an end in itself, and many others."⁵⁰ Within this intellectual culture, it seemed natural to mention modifications like moral enhancement.

3 | THE MOVE AWAY FROM MORAL ENHANCEMENT

Some categories of modification discussed in the HGGM debate are constants, such as therapeutic applications. The most commonly mentioned enhancement over the past hundred years has clearly been intelligence,⁵¹ and many authors have expressed concern about the special attention paid to it by scientists and bioethicists alike.⁵² Intelligence manipulation through chemical methods is also featured in *Brave new world*, by far the most cited work of science fiction in the debate.⁵³

Although it can be difficult to quantify precisely, interest in other traits has fluctuated more dramatically over the past hundred years. Compared to early writings on HGGM, references to creativity, servility, and animal genes have noticeably fallen, while references to cosmetic appearance, athletic ability, resistance to infectious diseases, and lowered risk of Alzheimer's disease have increased.

³⁷Crow, J. F. (1961). Mechanisms and trends in human evolution. In Hoagland & Burhoe, op. cit. note 16, p. 19; Huxley, J. (1963). The future of man – evolutionary aspects. In Wolstenholme, op. cit. note 22 (pp. 1–22), p. 17; Sinsheimer, op. cit. note 26; see also Bostrom, N., & Roache, R. (2008). Ethical issues in human enhancement. In J. Ryberg, T. S. Petersen, & C. Wolf (Eds.), *New waves in applied ethics* (pp. 120–152). Palgrave Macmillan; Scott, R. (2006). Choosing between possible lives: Legal and ethical issues in preimplantation genetic diagnosis. *Oxford Journal of Legal Studies*, 26(1), 153–178.

³⁸Huxley, J. (1962). Eugenics in evolutionary perspective. *The Eugenics Review*, 54(3), 123–141.

³⁹Evans, op. cit. note 1, pp. 20, 56, 69; Muller, op. cit. note 23.

⁴⁰Haldane, J. B. S. (1963). Possibilities for the human species in the next ten thousand years. In Wolstenholme, op. cit. note 22 (pp. 337–361).

⁴¹Evans, op. cit. note 1, p. 55; Paul (2005), op. cit. note 19, p. 137; Turney, op. cit. note 19, pp. 146, 150.

⁴²Evans, J. H. (2020). *The human gene editing debate*. Oxford University Press, pp. 20, 48–50; Taylor, G. R. (1968). *The biological time bomb*. World Publishing Company, p. 175.

⁴³Evans, op. cit. note 1, pp. 61, 68.

⁴⁴Evans, op. cit. note 1, pp. 20, 68–69; Ramsey, P. (1972). Genetic therapy: A theologian's response. In M. P. Hamilton (Ed.), *The new genetics and the future of man* (pp. 161–175). Eerdman, p. 169.

⁴⁵Evans, op. cit. note 1, p. 20; Fletcher, J. C. (1983). Moral problems and ethical issues in prospective human gene therapy. *Virginia Law Review*, 69, 515–546; Callahan, D. (1973). The meaning and significance of genetic disease: Philosophical perspectives. In B. Hilton, D. Callahan, M. Harris, P. Condliffe, & B. Berkley (Eds.), *Ethical issues in human genetics: Genetic counseling and the use of genetic knowledge* (pp. 83–101). Plenum, p. 94; U.S. Congress House Committee on Science and Technology. (1982). *Human genetic engineering: Hearings before the Subcommittee on Investigations and Oversight of the Committee on Science and Technology, U.S. House of Representatives, Ninety-seventh Congress, second session, November 16, 17, 18, 1982*. US Government Printing Office, p. 350.

⁴⁶Duster, T. (2003). *Backdoor to eugenics*. Routledge, p. 95; Paul (1998), op. cit. note 7, p. 29; Shannon, T. A. (2005). Human nature in a post-human genome project world. In Baillie & Casey (Eds.), op. cit. note 19, p. 273; U.S. Congress House Committee on Science and Technology, *Ibid*.

⁴⁷Juengst, E. T. (1991). Germ-line gene therapy: Back to basics. *The Journal of Medicine and Philosophy*, 16(6), 587–592.

⁴⁸Juengst, E. T. (1990). The NIH "Points to Consider" and the limits of human gene therapy. *Human Gene Therapy*, 1(4), 425–433.

⁴⁹Boone, C. K. (1988). Bad axioms in genetic engineering. *Hastings Center Report*, 18(4), 9–13; Capron, A. (1985). Unsplicing the Gordian knot: Legal and ethical issues in the new genetics. In A. Milunsky & G. J. Annas (Eds.), *Genetics and the law III* (pp. 23–35). Springer, p. 24; Fletcher, J. C. (1990). Evolution of ethical debate about human gene therapy. *Human Gene Therapy*, 1, 55–68; Fletcher, J. C., & Anderson, W. F. (1992). Germ-line gene therapy: A new stage of debate. *Law, Medicine and Health Care*, 20(1–2), 26–39.

⁵⁰Evans, op. cit. note 1, pp. 16, 49–52, 59; President's Council on Bioethics. (2003). *Beyond therapy: Biotechnology and the pursuit of happiness*. President's Council on Bioethics, p. 31.

⁵¹Agar, N. (2005). *Liberal eugenics: In defence of human enhancement*. Blackwell, p. 23; Buchanan, A. E., Brock, D. W., Daniels, N., & Wikler, D. (2000). *From chance to choice: Genetics and justice*. Cambridge University Press, p. 179; Glover, J. (1984). *What sort of people should there be?* Penguin, p. 46; Smith, J. M. (1965). Eugenics and utopia. *Daedalus*, 117(3), 487–505.

⁵²Buchanan et al., *Ibid*: 179; Glover, *Ibid*: 134; McGee, G. (2000). *The perfect baby: Parenthood in the new world of cloning and genetics*. Rowman & Littlefield, p. 41; Walters & Palmer, op. cit. note 1, p. 141; see also Rothschild, op. cit. note 10, p. 142.

⁵³So, D. (2019). The use and misuse of *Brave New World* in the CRISPR debate. *The CRISPR Journal*, 2(5), 316–323.

However, the most significant shift in the discourse is that references to moral enhancement dropped precipitously in the 1980s.

Perhaps the most obvious interpretation is that scientists like Muller, Huxley, and Haldane had been unable to attract younger scholars to their ideologies.⁵⁴ Eugenics first became “a term of opprobrium” among scientists during the 1960s.⁵⁵ In 1966, as the debate was first becoming interdisciplinary, sociologist Kingsley Davis suggested that only stakeholders who had already cemented their reputations still felt safe advocating ambitious eugenic programs; meanwhile, lesser-known authors stuck to moderate proposals like voluntary genetic counseling.⁵⁶ This meant that the early HGGM debate was disproportionately influenced by older scientists, with a background in population and statistical genetics, most of whom passed away by the mid-1970s.

Even during the broadly substantive period of the debate, participants occasionally pointed to aggression and cooperation as the scientific weak points in eugenic proposals.⁵⁷ Purported crime-prone “supermales” with XYY chromosomes were mentioned only a handful of times in the debate and mostly dismissed as spurious;⁵⁸ Bentley Glass noted that it was not clear that “sympathy, empathy, or cooperativeness” were objectively measurable or even hereditary.⁵⁹

Over the second half of the 1970s, scientists interested in genetic modification began to turn their attention from the far future toward the immediate risks and benefits of somatic gene therapy.⁶⁰ The year 1980 saw the first somatic therapy trials,⁶¹ as well as the first transgenic mice⁶² and the first patent on a genetically modified organism.⁶³ As a result, genetic engineering quickly regained the center of attention over less realistic technologies like cloning.⁶⁴

The next step in the debate was largely sparked by the 1982 President’s Commission report *Splicing life*, which has been described as the most significant publication in the history of the HGGM debate.⁶⁵ Rather than drawing on reform eugenics literature,⁶⁶ its authors took inspiration from the newer field of research ethics and

the recombinant DNA debate.⁶⁷ *Splicing life* explicitly repudiated substantive theological approaches to HGGM, categorizing religious concerns as variants of the “playing God” argument.⁶⁸

The 1982 Congressional hearings on Human Genetic Engineering, chaired by Al Gore and featuring testimony from many of the major contributors to the debate, included only one reference to “emotional, moral sensitivity,” from Catholic theologian Richard McCormick,⁶⁹ and one to “aggression,” by then-Episcopal priest John C. Fletcher.⁷⁰ Even though theological statements on HGGM became frequent in the 1980s,⁷¹ scientists were ceasing to engage with religious authors on deeper questions about society.⁷²

By the middle of the decade, the most influential opponents of HGGM were not theologians⁷³ but activists like Jeremy Rifkin, who mobilized clergy as supporters but couched his substantive criticism in non-religious language for the general public.⁷⁴ Efforts to improve the compassion of future people would be mentioned in only one notable secular publication on HGGM during the 1980s, Peter Singer and Deane Wells’ *The reproduction revolution*.⁷⁵

New analyses by scientists and by the rapidly growing discipline of bioethics⁷⁶ moved from society to individual minds and bodies,⁷⁷ viewing procreative liberty as a safeguard against state eugenics⁷⁸ and casting doubt on our ability to decide for distant generations.⁷⁹ Instead of debating the meaning of existence or projects for world betterment, these authors used a “formal rationality” that targeted their work to the calculations and compromises sought by new government commissions.⁸⁰ The adoption of bioethical principlism, outside its original context in human subjects research, had produced an intellectual environment that made it difficult to argue philosophically against HGGM.⁸¹

⁵⁴Paul (1998), op. cit. note 7, p. 29.

⁵⁵Paul (1995), op. cit. note 7, p. 124; Stern, op. cit. note 13, p. 10.

⁵⁶Davis, K., op. cit. note 33, p. 199.

⁵⁷e.g., Carlson, E. A. (1973). Eugenics revisited: The case for germinal choice. *Stadler Symposium*, 5, 13–34; Taylor, op. cit. note 42, p. 203.

⁵⁸Etzioni, op. cit. note 2, pp. 9, 24, 125; Restak, R. (1975). *Premeditated man: Bioethics and the control of future human life*. Viking Press, p. 91.

⁵⁹Glass, op. cit. note 2, p. 53; see also Golding, M. P. (1967). Ethical issues in biological engineering. *UCLA Law Review*, 15, 443–479; Taylor, op. cit. note 42, pp. 203, 207.

⁶⁰Evans, op. cit. note 1, pp. 74–76, 80; Juengst, op. cit. note 48; Rothschild, op. cit. note 10, p. 158; see also Condit, op. cit. note 7, p. 165.

⁶¹Juengst, op. cit. note 47; U.S. Congress, Office of Technology Assessment. (1987). *New developments in biotechnology – background paper: Public perceptions of biotechnology*. U.S. Government Printing Office.

⁶²Cook-Deegan, R. M. (1994). Germ-line gene therapy: Keep the window open a crack. *Politics and the Life Sciences*, 13(2), 217–220.

⁶³*Diamond v. Chakrabarty*, 447 US 303 (1980).

⁶⁴Evans, op. cit. note 1, p. 174; Juengst, op. cit. note 48; Rothschild, op. cit. note 10, p. 158.

⁶⁵Cook-Deegan, op. cit. note 62; Evans, op. cit. note 1, p. 101.

⁶⁶Evans, op. cit. note 1, p. 149.

⁶⁷Juengst, op. cit. note 47.

⁶⁸Evans, op. cit. note 1, pp. 101, 106, 129.

⁶⁹U.S. Congress House Committee on Science and Technology, op. cit. note 45, p. 338

⁷⁰Ibid: 344.

⁷¹So, D. (2019, October 12–18). *What are you begetting? Using theological anthropology to understand how stakeholders imagine germline gene editing* [conference presentation]. ASBH 22nd Annual Conference, online.

⁷²Rothschild, op. cit. note 10, p. 162.

⁷³Evans, op. cit. note 1, p. 136.

⁷⁴Ibid: 166; Fletcher & Anderson, op. cit. note 49.

⁷⁵Singer, P., & Wells, D. (1984). *The reproduction revolution: New ways of making babies*. Oxford University Press, p. 189.

⁷⁶Evans, op. cit. note 1, p. 38.

⁷⁷Duster, T. (2003). The hidden eugenic potential of germ-line intervention. In A. R. Chapman & M. S. Frankel (Eds.), *Designing our descendants* (pp. 156–178). Johns Hopkins University Press, pp. 157, 164; Evans, op. cit. note 1, pp. 68, 174; Rothschild, op. cit. note 10, p. 158.

⁷⁸Rothschild, op. cit. note 10, p. 165.

⁷⁹Evans, op. cit. note 1, p. 20.

⁸⁰Ibid: 68; Rothschild, op. cit. note 10, pp. 158, 165.

⁸¹Evans, Ibid: 89, 136.

Starting with W. French Anderson's 1985 paper "Human gene therapy: Scientific and ethical considerations," a consensus began to emerge that HGGM might be permissible if the risk/benefit balance was appropriate and the technology was used only for therapy.⁸² It also reconnected the debate to the ethics of reproduction,⁸³ where the principle of autonomy was especially strong. Genetic counselors had begun placing a high value on nondirectiveness as early as the 1950s,⁸⁴ resulting in decades of tension between their original eugenic goal of reducing disease alleles and the goal of following clients' subjective interests.⁸⁵

With the exception of the remaining theologians in the debate,⁸⁶ the focus on individual couples' decisions over global effects or substantive ends would intensify in the 1990s.⁸⁷ Many authors adopted a position open to parental choice called "liberal eugenics," which was piloted by Jonathan Glover's 1984 book *What sort of people should there be* and joined in the subsequent decade by authors like John Harris, John Robertson, Philip Kitcher, Lee Silver, and Nicholas Agar.⁸⁸

Perhaps the largest new influence was from analytic philosophy,⁸⁹ examining questions like numerical identity⁹⁰ and distributive justice. Many authors drew on the rival political theories of John Rawls and Robert Nozick, both of whom originally addressed genetic engineering only in footnotes.⁹¹ Rawlsian principles allow inequality in "primary goods" like health and intelligence only when they make everyone better off,⁹² while Nozick's "genetic supermarket" would

allow parents to choose their offspring's traits without state interference.⁹³ However, both theories remain open to HGGM based on individual preference, including enhancement.⁹⁴

Indeed, enhancements to physical traits like strength and height were being analyzed within the framework of formal rationality by the mid-90s.⁹⁵ The first associations between specific genes and personality were published in 1996,⁹⁶ making it easier for authors to discuss behavioral HGGM. But since genetic modifications were now being framed as medical procedures,⁹⁷ measurable physical enhancements were epistemically favored over traits like altruism that seemed closer to the social sphere of teachers or religious leaders.⁹⁸ This trend extended beyond academic discourse to popular media: Celeste Condit found that 43% of articles from the "classical" eugenics era mentioned moral enhancement, whereas only 14% did so by 1995.⁹⁹

The early 2000s would see an upswing in publications with more substantive objections to HGGM based in human nature, including highly cited works by members of George W. Bush's President's Council on Bioethics.¹⁰⁰ However, these did not mention morality as frequently as did authors open to enhancement.

Like their forerunners, contemporary authors who write about moral enhancement discuss the need to avert large-scale catastrophes.¹⁰¹ For instance, Persson and Savulescu's controversial book *Unfit for the future* suggests using HGGM to contain weapons of mass destruction and environmental degradation.¹⁰² However, these

⁸²Ibid: 80, 137, 142; Anderson, W. F. (1985). Human gene therapy: Scientific and ethical considerations. *Journal of Medicine and Philosophy*, 10(3), 275–292; Fletcher & Anderson, op. cit. note 49; Juengst, op. cit. note 47; Juengst, E. T. (1995). "Prevention" and the goals of genetic medicine. *Human Gene Therapy*, 6, 1595–1605; Walters, L. (1991). Human gene therapy: Ethics and public policy. *Human Gene Therapy*, 2, 115–122.

⁸³Rothschild, op. cit. note 10, p. 158.

⁸⁴Evans, op. cit. note 1, p. 155; Fowler, G., Juengst, E. T., & Zimmerman, B. K. (1989). Germ-line gene therapy and the clinical ethos of medical genetics. *Theoretical Medicine*, 10, 151–165; Juengst (1995), op. cit. note 82; Novas, C., & Rose, N. (2000). Genetic risk and the birth of the somatic individual. *Economy and Society*, 29(4), 485–513.

⁸⁵Evans, Ibid: 93; Juengst, Ibid; Novas & Rose, Ibid; Paul (1995), op. cit. note 7, p. 127; Rothschild, op. cit. note 10, p. 65.

⁸⁶Evans, Ibid: 28.

⁸⁷Walters & Palmer, op. cit. note 1, p. 77; Juengst, op. cit. note 47; Walters, op. cit. note 82; Fletcher & Anderson, op. cit. note 49; Evans, Ibid.

⁸⁸Agar, N. (1998). Liberal eugenics. *Public Affairs Quarterly*, 12(2), 137–155; Fox, D. (2007). The illiberality of liberal eugenics. *Ratio*, 20(1), 1–25; Sparrow, R. (2010). Liberalism and eugenics. *Australasian Journal of Philosophy*, 89(3), 499–517; Sparrow, R. (2011). A not-so-new eugenics: Harris and Savulescu on human enhancement. *Hastings Center Report*, 41(1), 32–42.

⁸⁹Evans, op. cit. note 1, pp. 159–160.

⁹⁰Elliot, R. (1993). Identity and the ethics of gene therapy. *Bioethics*, 7(1), 27–40; Zohar, N. J. (1991). Prospects for "genetic therapy" – Can a person benefit from being altered? *Bioethics*, 5(4), 275–288; Heyd, D. (1992). *Genethics: Moral issues in the creation of people*. University of California Press.

⁹¹Rawls, J. (1971). *A theory of justice*. Harvard University Press, pp. 107–108; Nozick, R. (1974). *Anarchy, state, and utopia*. Basic Books, p. 315.

⁹²Resnik, D. B. (1997). Genetic engineering and social justice: A Rawlsian approach. *Social Theory and Practice*, 23(3), 427–448.

⁹³Agar, op. cit. note 88; Walters & Palmer, op. cit. note 1, pp. 128–129.

⁹⁴See Sparrow (2010), op. cit. note 88.

⁹⁵Evans, op. cit. note 1, p. 39.

⁹⁶Silver, L. M. (1997). *Remaking Eden: Cloning and beyond in a brave new world*. Avon, p. 202.

⁹⁷Evans, op. cit. note 1, p. 28.

⁹⁸Juengst, E. T., & Walters, L. (1998). Ethical issues in human gene transfer research. In T. Friedmann (Ed.), *The development of human gene therapy* (pp. 691–712). Cold Spring Harbor Laboratory Press, p. 708.

⁹⁹Condit, op. cit. note 7, p. 40.

¹⁰⁰President's Council on Bioethics, op. cit. note 50; Kass, L. (2002). *Life, liberty and the defense of dignity: The challenge for bioethics*. Encounter Books; Sandel, M. J. (2007). *The case against perfection*. Harvard University Press; see also Habermas, J. (2003). *The future of human nature*. Polity; McKibben, B. (2004). *Enough: Staying human in an engineered age*. Times Books.

¹⁰¹Baylis, F. (2019). *Altered inheritance: CRISPR and the ethics of human genome editing*. Harvard University Press, p. 215; Buchanan, A. E. (2008). Enhancement and the ethics of development. *Kennedy Institute of Ethics Journal*, 18(1), 1–34; Engelhardt, T. H. (1990). Human nature technologically revisited. *Social Philosophy and Policy*, 8(1), 180–191; Persson, I., & Savulescu, J. (2008). The perils of cognitive enhancement and the urgent imperative to enhance the moral character of humanity. *Journal of Applied Philosophy*, 25(3), 162–177; Shinn, R. L. (1996). *The new genetics: Challenges for science, faith, and politics*. Moyer Bell, p. 128.

¹⁰²Persson, I., & Savulescu, J. (2012). *Unfit for the future: The need for moral enhancement*. Oxford University Press.

authors now tend to view morality less as a form of reasoning, the way “mainline” eugenicists or Kantians imagined, and more as a separate faculty.¹⁰³ They often promote reducing xenophobia and racism,¹⁰⁴ modifications which were never considered even by reform eugenicists. Finally, modern authors tend to focus more on pharmaceutical or neurological methods of moral enhancement than on HGGM. Many give the example of oxytocin, which, starting in the mid-2000s, was claimed to make people more generous, more trusting, and better at reading others’ emotional states.¹⁰⁵

Gene-based moral enhancement remains a common topic of discussion,¹⁰⁶ but between changing disciplinary involvement and an increasing focus on the preferences of individual parents, it no longer occupies a central position in the HGGM debate. Among major statements published since the development of CRISPR, only the 2017 U.S. National Academies report mentions using the technology to improve morality.¹⁰⁷

In order to examine the kinds of images being used in public engagement, I also performed a study that examined every survey of public opinion on HGGM over the same time period. Not one included a question about moral enhancement, but eight asked about appearance.¹⁰⁸ Indeed, the third most frequently mentioned type of HGGM in the debate, after therapeutic uses and intelligence enhancement, currently seems to be modifications to cosmetic traits. References to beauty, eye color, and hair color, as well as related

traits like stature and musculature,¹⁰⁹ have risen steadily in works by academic authors while references to moral enhancement declined.

4 | THE MOVE TOWARD COSMETIC MODIFICATION

Although physical attractiveness was not a primary concern in American eugenics,¹¹⁰ many eugenicists did take an interest in cosmetic traits. Galton himself travelled around England using a hidden

¹⁰³Douglas, T. (2008). Moral enhancement. *Journal of Applied Philosophy*, 25(3), 228–245; Eberl, J. T. (2017). Philosophical anthropology, ethics, and human enhancement. In J. T. Eberl (Ed.), *Contemporary controversies in Catholic bioethics* (pp. 313–330); Harris, J. (2010). Moral enhancement and freedom. *Bioethics*, 25(2), 102–111; Jotterand, F. (2011). Virtue engineering and moral agency: Will post-humans still need the virtues? *AJOB Neuroscience*, 2(4): 3–9; Persson & Savulescu, op. cit. note 101; Walker, M. (2009). Enhancing genetic virtue. *Politics and the Life Sciences*, 28(2), 27–47.

¹⁰⁴Buchanan, A. E. (2011). *Better than human: The promise and perils of enhancing ourselves*. Oxford University Press, pp. 52, 103; Douglas, Ibid; Persson & Savulescu, Ibid; Sparrow, R. (2014). Egalitarianism and moral bioenhancement. *American Journal of Bioethics*, 14(4), 20–28.

¹⁰⁵Liao, S. M., Sandberg, A., & Roache, R. (2012). Human engineering and climate change. *Ethics, Policy & Environment*, 15(2), 206–221; Persson & Savulescu, op. cit. note 102, p. 119; see Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature*, 435(7042), 673–676.

¹⁰⁶Glover, J. (2006). *Choosing children: Genes, disability, and design*. Clarendon Press, pp. 86–87; Savulescu, J. (2009). Genetic interventions and the ethics of enhancement of human beings. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 417–430). Rowman & Littlefield; Walker, op. cit. note 103; Walters & Palmer, op. cit. note 1, p. 106.

¹⁰⁷National Academies of Sciences, Engineering, and Medicine. (2017). *Human genome editing: Science, ethics, and governance*. National Academies Press, p. 123.

¹⁰⁸So, D., Sladek, R., & Joly, Y. (2021). Assessing public opinions on the likelihood and permissibility of gene editing through construal level theory. *New Genetics and Society*. Advance online publication. <https://doi.org/10.1080/14636778.2020.1868985>

¹⁰⁹e.g., Baylis, op. cit. note 101, pp. 41, 54, 90; Bosley, K. S., Botchan, M., Bredenoord, A. L., Carroll, D., Charo, R. A., Charpentier, E., Cohen, R., Corn, J., Doudna, J., Feng, G., Greely, H. T., Isasi, R., Ji, W., Kim, J.-S., Knoppers, B., Lanphier, E., Li, J., Lovell-Badge, R., Martin, G. S., ... Zhou, Q. (2015). CRISPR germline engineering—the community speaks. *Nature Biotechnology*, 33(5), 478–486; Brokowski, C., Pollack, M., & Pollack, R. (2015). Cutting eugenics out of CRISPR-Cas9. *Ethics in Biology, Engineering and Medicine*, 6(3–4); Center for Genetics and Society & Friends of the Earth. (2015). *Extreme genetic engineering and the human future: Reclaiming emerging biotechnologies for the common good*. <https://foe.org/resources/extreme-genetic-engineering-and-the-human-future-e-reclaiming-emerging-biotechnologies-for-the-common-good/>, pp. 28, 40; Church, G. M., & Regis, E. (2014). *Regenesis: How synthetic biology will reinvent nature and ourselves*. Basic Books, p. 159; Commission de l'éthique en science et en technologie. (2018). *Genetically modified babies: Ethical issues raised by the genetic modification of germ cells and embryos: summary and recommendations*. Commission de l'éthique en science et en technologie, p. 16; Doudna, J. A., & Sternberg, S. H. (2017). *A crack in creation: Gene editing and the unthinkable power to control evolution*. Houghton Mifflin Harcourt, p. 230; Evans, op. cit. note 42, pp. 13, 63, 90, 100; Gyngell, C., & Douglas, T. (2015). Stocking the genetic supermarket: Reproductive genetic technologies and collective action problems. *Bioethics*, 29(4), 241–250; Juengst, E. T. (2017). Crowdsourcing the moral limits of human gene editing? *Hastings Center Report*, 47(3), 15–23; Knoepfler, P. (2015). *GMO Sapiens: The life-changing science of designer babies*. World Scientific, pp. 1–2, 10, 16, 147–148, 197; Kozubek, J. (2016). *Modern Prometheus: Editing the human genome with CRISPR-Cas9*. Cambridge University Press, pp. 58, 224, 326, 350–352; Lander, E. S. (2015). Brave new genome. *New England Journal of Medicine*, 373(1), 5–8; Lander, E. S., Baylis, F., Zhang, F., Charpentier, E., Berg, P., Bourgain, C., Friedrich, B., Joung, J. K., Li, J., Liu, D., Naldini, L., Nie, J.-B., Qiu, R., Schoene-Seifert, B., Shao, F., Terry, S., Wei, W., & Winnacker, E. L. (2019). Adopt a moratorium on heritable genome editing. *Nature*, 567, 165–168; Liao et al., op. cit. note 105; Macintosh, K. L. (2018). *Enhanced beings: Human germline modification and the law*. Cambridge University Press, pp. 16, 68, 130; Mathews, D. J., Chan, S., Donovan, P. J., Douglas, T., Gyngell, C., Harris, J., Regenber, A., & Lovell-Badge, R. (2015). CRISPR: A path through the thicket. *Nature News*, 527(7577), 159–161; Mehlman, M. J. (2012). *Transhumanist dreams and dystopian nightmares: The promise and peril of genetic engineering*. Johns Hopkins University Press, pp. 13–15, 17, 27, 30–31, 61, 73–75, 79, 81, 89, 91, 101–102, 199; Musunuru, K. (2019). *The CRISPR generation*. BookBaby, p. 224; National Academies of Sciences, Engineering, and Medicine, op. cit. note 107, pp. 141–143; National Academies of Sciences, Engineering, and Medicine & Royal Society. (2020). *Heritable human genome editing*. National Academies Press, pp. 87–88, 107; Parens, E., & Johnston, J. (Eds.) (2019). *Human flourishing in an age of gene editing*. Oxford University Press, pp. 53, 67, 99, 105, 114, 157, 153; Porteus, M. H., & Dann, C. T. (2015). Genome editing of the germline: Broadening the discussion. *Molecular Therapy*, 23(6), 980–982; Powell, R. (2012). The evolutionary biological implications of human genetic engineering. *Journal of Medicine and Philosophy*, 37(3), 204–225; Rowe, G. (2019). *Genome editing public engagement synergy (GEPES): A draft framework for the evaluation of public engagement with genome editing*. National Co-Ordinating Centre for Public Engagement, p. 16; Savulescu, J., Pugh, J., Douglas, T., & Gyngell, C. (2015). The moral imperative to continue gene editing research on human embryos. *Protein & Cell*, 6(7), 476–479; Sparrow, R. (2014). Ethics, eugenics, and politics. In A. Akayabashi (Ed.), *The future of bioethics: International dialogues* (pp. 139–153). Oxford University Press, p. 143; Sparrow, R. (2019). Yesterday's child: How gene editing for enhancement will produce obsolescence—and why it matters. *American Journal of Bioethics*, 19(7), 6–15; Van Dijke, I., Bosch, L., Bredenoord, A. L., Cornel, M., Repping, S., & Hendriks, S. (2018). The ethics of clinical applications of germline genome modification: A systematic review of reasons. *Human Reproduction*, 33(9), 1777–1796; Vassena, R., Heindryckx, B., Peco, R., Pennings, G., Raya, A., Sermon, K., & Veiga, A. (2016). Genome engineering through CRISPR/Cas9 technology in the human germline and pluripotent stem cells. *Human Reproduction Update*, 22(4), 411–419.

¹¹⁰Condit, op. cit. note 7, p. 40; compare Meloni, M. (2016). *Political biology: Science and social values in human heredity from eugenics to epigenetics*. Palgrave Macmillan, pp. 72–73.

score card to tally the attractiveness of women in different cities,¹¹¹ and Charles Davenport published pioneering papers on the inheritance of eye and hair color.¹¹² Most infamously, Nazi eugenics elevated “Aryan” features into an aesthetic ideal that continues to resonate in popular culture.¹¹³ Perhaps, as a result, these kinds of traits were mentioned less frequently by scientists during the early HGGM debate.¹¹⁴

It is fairly easy to see why some traits were increasingly discussed over the following decades: references to athletic enhancement presumably take partial inspiration from doping scandals, height from the use of human growth hormone, dementia from the discovery of the risk-raising *APOE4* allele, and resistance to infectious diseases from variants like *CCR5Δ32*.¹¹⁵ While it is possible that bioethicists were responding to the normalization of plastic surgery,¹¹⁶ there was no specific gene or medication to discover for aesthetic appeal. Moreover, purely cosmetic traits like eye color have been used as textbook examples of genetic traits for decades despite remaining imperfectly understood on the molecular level.¹¹⁷ The turn toward these kinds of modifications in the HGGM debate may have come not in response to new scientific developments, but indirectly through the world of business.

During the 1980s, as the burgeoning biotechnology industry became increasingly responsible for research funding,¹¹⁸ scientists and other stakeholders developed a more commercial and capitalistic understanding of how HGGM might be used. Rather than a collective responsibility, DNA itself was conceptualized as a material resource.¹¹⁹

At the same time, scholars were presented with a readymade model of commoditized reproduction. The first commercial sperm bank opened in Minneapolis in 1970.¹²⁰ Although sperm freezing had

been possible for decades, this was the first time that it had been distributed through a company rather than within the doctor-patient relationship. By the end of the decade, the three most important sperm banks had all opened in California, and frozen sperm would supplant “fresh” stocks entirely with the advent of the AIDS crisis.¹²¹ As a result, authors in the HGGM debate may have found it more relevant to allude to the kind of aesthetic choices that parents were making in the real world, such as selecting sperm donors with a particular skin tone, hair color, eye color, and height.¹²² Most physicians also expressed willingness to select sperm based on IQ and education.¹²³

Ironically, the aesthetic focus of the fertility industry developed indirectly from Muller’s plans for the betterment of society. Robert K. Graham, his one-time partner in the Repository for Germinal Choice, was an old-school eugenicist, but he noticed a pattern in his clients’ questions. As journalist David Plotz observed, “Sure, sometimes his applicants asked how smart a donor was. But they usually asked how good-looking he was. And they *always* asked how tall he was. Nobody, Graham saw, ever chose the ‘short sperm.’”¹²⁴ By sending recruiters to gather donations from physically attractive men, and listing them in an ad-like catalog, Graham turned the Repository into a model for the rest of the industry.¹²⁵ These preferences were likely carried over into the HGGM debate as it looked increasingly to the wishes of individual couples.

Other new reproductive technologies were also gaining attention in the early 1980s. IVF was becoming widely accepted,¹²⁶ surrogacy was making headlines,¹²⁷ and physicians had become increasingly open to sex selection.¹²⁸ Indeed, the number of American geneticists willing to diagnose or refer patients for sex-selective abortions rose from 1% as of *Roe v. Wade* to 62% by 1989.¹²⁹ Like eye and hair color, sex selection was often considered a psychological slippery slope to other discretionary uses of genetics.¹³⁰ In contrast with the emphasis on genetically modified men in the early debate, sex selection also foregrounds the possibility of female designer babies, and the idea of using reproductive technologies for beauty, complexion, and coloring plays into

¹¹¹Kevles, op. cit. note 8, p. 12.

¹¹²Haller, op. cit. note 9, p. 64; but see Condit, op. cit. note 7, p. 40.

¹¹³Kirby, D. A. (2000). The new eugenics in cinema: Genetic determinism and gene therapy in “GATTACA”. *Science Fiction Studies*, 27(2), 193–215.

¹¹⁴Etzioni, op. cit. note 2, pp. 9, 118; Feinberg, G. (1968). *The Prometheus project: Mankind’s search for long-range goals*. Doubleday, p. 63; Hotchkiss, R. D. (1965). Portents for a genetic engineering. *Journal of Heredity*, 56(5), 197–202; Leach, G. (1970). *The biocrats*. McGraw-Hill, p. 118; Lederberg (1970), op. cit. note 34, p. 53; Ramsey, op. cit. note 44, p. 163; Rosenfeld, A. (1969). *The second genesis: The coming control of life*. Prentice-Hall, p. 119; Rostand, J. (1959). *Can man be modified?* Basic Books, p. 32; Taylor, op. cit. note 42, p. 159.

¹¹⁵Belloy, M. E., Napolioni, V., & Greicius, M. D. (2019). A quarter century of *APOE* and Alzheimer’s disease: Progress to date and the path forward. *Neuron*, 101(5), 820–838; Samson, M., Libert, F., Doranz, B. J., Rucker, J., Liesnard, C., Farber, C. M., Saragosti, S., Lapoumeroulie, C., Cogniaux, J., Forceille, C., Muyltermans, G., Verhofstede, C., Burtonboy, G., Georges, M., Imai, T., Rana, S., Yi, Y., Smyth, R. J., Collman, R. G. ... Parmentier, M. (1996). Resistance to HIV-1 infection in Caucasian individuals bearing mutant alleles of the *CCR-5* chemokine receptor gene. *Nature*, 382(6593), 722–725.

¹¹⁶Evans, op. cit. note 42, p. 38.

¹¹⁷Green, R. M. (2007). *Babies by design*. Yale University Press; Porteus & Dann, op. cit. note 109; Shannon, T. A. (2000). *Made in whose image?: Genetic engineering and Christian ethics*. Humanity Books, p. 3.

¹¹⁸Rabinow, P. (2002). Life sciences: Discontents and consolations. *Journal of Molecular Biology*, 319(4), 947–955.

¹¹⁹Andrews, L., & Nelkin, D. (2001). Molecular metaphors: The gene in popular discourse. *Nature Reviews Genetics*, 2(7), 555–559; Ibid; Van Dijk, J. (1998). *Imagenation: Popular images of genetics*. New York University Press, pp. 95, 99, 100.

¹²⁰Maranto, G. (1996). *Quest for perfection: The drive to breed better human beings*. Scribner, p. 178.

¹²¹Plotz, D. (2005). *The genius factory: The curious history of the Nobel prize sperm bank*. Random House, pp. 34, 169.

¹²²Curie-Cohen, M., Luttrell, L., & Shapiro, S. (1979). Current practice of artificial insemination by donor in the United States. *New England Journal of Medicine*, 300(11), 585–590; U.S. Congress, Office of Technology Assessment. (1988). *Artificial insemination: Practice in the United States: Summary of a 1987 survey – background paper*. U.S. Government Printing Office.

¹²³Rothschild, op. cit. note 10, p. 128.

¹²⁴Plotz, op. cit. note 121, p. 102.

¹²⁵Plotz, op. cit. note 121, pp. 159, 172, 173; Silver, op. cit. note 96, p. 16.

¹²⁶Silver, Ibid: 70; Simpson, J. L., & Edwards, R. G. (2003). Public objections to designer babies and cloning in USA: Not quite what was expected. *Reproductive Biomedicine Online*, 6(2), 147–148.

¹²⁷Silver, Ibid: 140.

¹²⁸Robertson, J. A. (1996). Genetic selection of offspring characteristics. *Boston University Law Review*, 76, 421–482.

¹²⁹Wertz, D. C., & Fletcher, J. C. (1989). Fatal knowledge? Prenatal diagnosis and sex selection. *Hastings Center Report*, 19(3), 21–27.

¹³⁰Ibid; Silver, L. M. (1998). A quandary that isn’t. *Time*, 152(12), 82–83.

common stereotypes of femininity.¹³¹ Finally, the phrase “designer baby,” which entered popular culture in the 1980s,¹³² may have reinforced the idea of parents choosing aesthetically fashionable traits for their children.¹³³

5 | CONSEQUENCES FOR THE DEVELOPMENT OF BIOETHICAL ARGUMENTS

The decrease in references to moral enhancement and increase in references to cosmetic modification do not mean that authors came to value the latter more, or even that they found it more ethically intriguing. No papers or books have been devoted specifically to the ethics of genetically modifying babies’ eye or hair color, as there have been for other increasingly mentioned traits like athletic enhancement.¹³⁴ Authors who discuss potential uses of HGGM have simply begun to include cosmetic modifications more frequently in their work, even if they are simply reciting them in a list.

One way to explain this is a shared schema: an “abstract knowledge structure” of the relationships between different concepts that helps us store, retrieve, and fill gaps in our information.¹³⁵ Schemas can include stereotypes like nerd, jock, or untrustworthy politician.¹³⁶ They guide our expectations of which categories should be associated with which traits and vice versa.

Since schemas are based on experience, and there were no genetically modified people until very recently, expectations about their traits had to come from other exposures,¹³⁷ such as the work of previous authors, genetics research, associations with other reproductive technologies, or even science fiction tropes. The literature on HGGM suggests that stakeholders prior to the 1980s associated the category of genetically modified people most strongly with the traits of health, intelligence, and morality—and often with maleness—whereas recent scholars have a slightly different schema that includes more physical modifications.

This is not to suggest that other components of the schema remained identical; while intelligence has remained the paradigmatic

example of genetic enhancement, specific images associated with it have changed over time. Participants in the early debate often agreed that humans would need to be intellectually upgraded to meet the increasing complexity of modern civilization¹³⁸ or to perform research into greater and greater enhancements.¹³⁹ As the debate narrowed, most authors began to focus on more conventional desires like success in education and career.

However, the shift of cosmetic modification into the central schema and moral enhancement out of it has likely had deeper effects on the bioethical conversation. This process has encouraged the development of different kinds of arguments about HGGM, and it also suggests different images of the technology’s future social context.

In several important ways, moral enhancement and cosmetic modification are similar: from a Rawlsian perspective, neither are usually viewed as primary goods that parents might be expected to guarantee for their children in a neutral state.¹⁴⁰ While viewed as enhancements by some authors and not by others, both are also agreed not to be therapeutic.¹⁴¹

Yet moral and cosmetic modifications are associated with mostly different ethical issues. Setting aside general objections like unequal access, the former raises fears of easy exploitation, restricted freedom, circumventing character development, political stagnation, loss of behavioral diversity, prejudice against the unenhanced, and the enforcement of a single view of morality.¹⁴² Fewer authors have specifically discussed attractiveness, but they point out issues such as cultural, racial, and gendered beauty standards, loss of physical diversity, envy, and simply being a waste of money.¹⁴³

As a result of these concerns, stakeholders tend to view cosmetic modifications much more negatively than moral enhancements. Proponents of moral enhancement have generally considered it a contribution to human flourishing, despite occasionally praising the role of aggression in political change or resistance to dictatorships.¹⁴⁴ But while making someone more compassionate or less ag-

¹³¹Stock, G. (2002). *Redesigning humans: Our inevitable genetic future*. Houghton Mifflin, p. 118; see Mills, C. (2015). The case of the missing hand: Gender, disability, and bodily norms in selective termination. *Hypatia*, 30(1), 82–96.

¹³²Baylis, op. cit. note 101, p. 36.

¹³³Davis, D. S. (2010). *Genetic dilemmas: Reproductive technology, parental choices, and children’s futures*. Oxford University Press, p. 35; Genetic Alliance UK & Progress Educational Trust. (2017). *Basic understanding of genome editing: The report*. https://pet.ultimatedb.net/res/org10/Reports/genomeediting_report.pdf

¹³⁴e.g., Miah, A. (2005). *Genetically modified athletes: Biomedical ethics, gene doping and sport*. Routledge.

¹³⁵Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension*. Lawrence Erlbaum; Fiske, S. T., & Linville, P. W. (1980). What does the schema concept buy us? *Personality and Social Psychology Bulletin*, 6(4), 543–557; Anderson, R. C., & Pearson, P. D. (1984). A schema-theoretic view of basic processes in reading comprehension. In P. D. Pearson (Ed.), *Handbook of reading research* (Vol. 1, pp. 255–291). Lawrence Erlbaum Associates.

¹³⁶Fiske & Linville, *Ibid*.

¹³⁷Anderson & Pearson, op. cit. note 135; *Ibid*.

¹³⁸e.g., Danielli, op. cit. note 33; Davis, B. D., op. cit. note 33, pp. 27, 30; Dobzhansky, op. cit. note 2; Hilton et al. (Eds.), op. cit. note 45, p. 217; Sinsheimer, op. cit. note 26; Williams (Ed.), op. cit. note 33, p. 12.

¹³⁹e.g., Davis, K., op. cit. note 33, p. 201; Rosenfeld, op. cit. note 114, p. 287; Rostand, op. cit. note 114, p. 60.

¹⁴⁰Buchanan et al., op. cit. note 51, pp. 80, 174; Fox, op. cit. note 88; Resnik, D. (1994). Debunking the slippery slope argument against human germ-line gene therapy. *Journal of Medicine and Philosophy*, 19(1), 23–40.

¹⁴¹Bostrom & Roache, op. cit. note 37; Buchanan, A. E. (2011). *Beyond humanity?: The ethics of biomedical enhancement*. Oxford University Press, p. 25; Degrazia, D. (2005). *Human identity and bioethics*. Cambridge University Press, p. 265; Douglas, op. cit. note 103; Frankel, M. S. (2003). Inheritable genetic modification and a brave new world: Did Huxley have it wrong? *Hastings Center Report*, 33(2), 31–36; Harris, J. (2010). *Enhancing evolution: The ethical case for making better people*. Princeton University Press, p. 124.

¹⁴²Douglas, op. cit. note 103; Persson & Savulescu, op. cit. note 102, pp. 113, 119; Sparrow, op. cit. note 104; Walker, op. cit. note 103; Walters & Palmer, op. cit. note 1, pp. 123–128.

¹⁴³Buchanan et al., op. cit. note 51, p. 185; Krinsky, S. (2000). The psychosocial limits on human germline modification. In G. Stock & J. H. Campbell (Eds.), *Engineering the human germline*. Oxford University Press, p. 105; McGee, G. (2012). Parenting in an era of genetics. *Hastings Center Report*, 27(2), 16–22; Stock, op. cit. note 131, p. 118.

¹⁴⁴Muller, op. cit. note 23; Rosenfeld, op. cit. note 114, p. 3; Williams, P. N. (Ed.) (1973). *Ethical issues in biology and medicine*. Schenkman, pp. 12, 105, 108, 263, 269, 273; see also McGee, op. cit. note 52, p. 38, Walters & Palmer, op. cit. note 1, p. 125.



gressive is typically presented as a benefit to those around them, modifications to appearance and other physical traits are usually seen as benefits to nobody or as “positional goods” that make the modified person’s peers worse off.¹⁴⁵ Moreover, since aesthetic changes are more likely to reflect parents’ individual tastes, they may not even be considered attractive in other cultures. Cosmetic applications have routinely been the least popular use of HGGM in polls of the general public,¹⁴⁶ who criticize them as superficial.¹⁴⁷

Although some authors remain open to cosmetic modifications, most of these have merely tolerated them on the basis of reproductive liberty.¹⁴⁸ Only a handful directly endorse aesthetic enhancement through HGGM: Francesca Minerva has suggested that it might reduce social discrimination against people with unattractive face shapes,¹⁴⁹ while James Watson more vulgarly remarked that making “all girls pretty” would be “great.”¹⁵⁰ Thus, it seems that cosmetic references joined the central schema while being actively encouraged by only a small minority of stakeholders.

The strongly negative valence of cosmetic modification could create a starker contrast between different categories of HGGM, giving authors a stronger example of misuse against which to define therapeutic applications.¹⁵¹ Perhaps the 1980s’ ethical realignment from the germline/somatic distinction to the therapy/enhancement one was successful partly because enhancements were seen negatively as personal preferences rather than positively as helpful improvements to morality.

Another ethical corollary of the move toward bodily changes like cosmetic appearance, athletic ability and disease resistance involves the commonly discussed “nonidentity problem.” First posed by Derek Parfit, it asks whether it could be wrong to have a child with

some impairment if avoiding that impairment would mean creating a different child altogether.¹⁵²

Emotional characteristics tend to be more closely associated with human nature,¹⁵³ and psychology studies find that people usually see changes to morality as the most likely to affect personal identity.¹⁵⁴ In contrast, the most common example of cosmetic HGGM in recent writings is eye color, which has been cited in numerous philosophy papers as precisely the kind of shallow change that would make no difference to a future person’s identity.¹⁵⁵ As LeRoy Walters and Julie Palmer wrote, physical enhancements “may seem to be less threatening to the essence or central core of a human being.”¹⁵⁶ Besides their direct implications for the identity of genetically modified people, these intuitions could influence some stakeholders’ perceptions about the physical and social risks of different types of HGGM.

The third major way in which this shift may have affected the bioethical debate is through its implications for the imagined context of HGGM. Moral enhancement is generally agreed to be a more distant prospect¹⁵⁷ than better-characterized physical changes. As such, the move away from more “science fictional” plans toward choices similar to those made in the existing fertility industry suggests that HGGM should be considered as part of contemporary society. On the one hand, this draws necessary attention toward the existing social structures and parental motivations associated with assisted reproductive technologies. On the other, this tendency could make authors less willing to consider HGGM in the context of broader social, cultural, or technological changes, or to anticipate issues as distant as species divergence.

For instance, cosmetic modification may reinforce the idea of HGGM as a market good within liberal democracy. Authors advocating moral enhancement have often imagined that the government would facilitate it, but cosmetic modifications are likely to be excluded from

¹⁴⁵Bostrom & Roache, op. cit. note 37; Douglas, op. cit. note 103; Sparrow, R. (2019). Unraveling the human tapestry: diversity, flourishing, and genetic modification. In E. Parens & J. Johnston (Eds.), *Human flourishing in an age of gene editing* (pp. 157–171). Oxford University Press, p. 163; compare Buchanan, op. cit. note 141, p. 25; Harris, op. cit. note 141, pp. 122–124; see also Engelhardt, op. cit. note 101.

¹⁴⁶See Angus Reid Institute. (2019). *Designer babies? Canadians say modifying genes in embryos acceptable only in certain circumstances*. Angus Reid Institute; Associated Press-NORC Center for Public Affairs Research. (2018). *The December 2018 AP-NORC Center poll*. AP-NORC Center; Chen, L., & Zhang, Z. (2018). *Chinese public attitudes on gene editing*. <https://www.globaltimes.cn/pdf/ChinesePublicAttitudesOnGeneEditing2018.11.12.pdf>; Cook-Deegan, R. M. (1990). Human gene therapy and congress. *Human Gene Therapy*, 1(2), 163–170; Silver, op. cit. note 96, p. 235; Singer, E., Corning, A., & Lamias, M. (1998). Trends: Genetic testing, engineering, and therapy: Awareness and attitudes. *Public Opinion Quarterly*, 62(4), 633–664.

¹⁴⁷Funk, C., & Hefferon, M. (2018). *Most Americans accept genetic engineering of animals that benefits human health, but many oppose other uses*. <https://www.pewresearch.org/science/2018/08/16/most-americans-accept-genetic-engineering-of-animals-that-benefits-human-health-but-many-oppose-other-uses/>; van Mil, A., Hopkins, H., & Kinsella, S. (2017). *Potential uses for genetic technologies: Dialogue and engagement research conducted on behalf of the Royal Society findings report*. Hopkins Van Mil.

¹⁴⁸See Buchanan et al., op. cit. note 51, p. 318; Robertson, op. cit. note 128; Walters & Palmer, op. cit. note 1, p. 108.

¹⁴⁹Minerva, F. (2017). The invisible discrimination before our eyes: A bioethical analysis. *Bioethics*, 31(3), 180–189.

¹⁵⁰Baruch, S., Pritchard, D., Javitt, G., Scott, J., Borchelt, R., Kalfoglou, A., & Hudson, K. (2005). *Human germline genetic modification: Issues and options for policymakers*. Genetics and Public Policy Center, p. 29.

¹⁵¹e.g., Musunuru, op. cit. note 109, p. 154.

¹⁵²Parfit, D. (1987). *Reasons and persons*. Clarendon Press, pp. 351–363.

¹⁵³Frankel, M. S., & Chapman, A. R. (2000). *Human inheritable genetic modifications: Assessing scientific, ethical, religious, and policy issues*. American Association for the Advancement of Science, p. 4; Glover, op. cit. note 106, pp. 84, 87; Wilson, S., & Haslam, N. (2009). Is the future more or less human? Differing views of humanness in the posthumanism debate. *Journal for the Theory of Social Behaviour*, 39(2), 247–266.

¹⁵⁴Molouki, S., & Bartels, D. M. (2017). Personal change and the continuity of the self. *Cognitive Psychology*, 93, 1–17; Riis, J., Simmons, J. P., & Goodwin, G. P. (2008). Preferences for enhancement pharmaceuticals: The reluctance to enhance fundamental traits. *Journal of Consumer Research*, 35(3), 495–508.

¹⁵⁵Elliot, op. cit., note 90; McMahan, J. (1998). Wrongful life: Paradoxes in the morality of causing people to exist. In J. L. Coleman & C. W. Morris (Eds.), *Rational commitment and social justice: Essays for Gregory Kavka* (pp. 208–247). Cambridge University Press; Heyd, op. cit. note 90, p. 175; Juth, N. (2016). Germline genetic modification, CRISPR, and human identity: Can genetics turn you into someone else? *Ethics, Medicine and Public Health*, 2(3), 416–425; Williams, N. J. (2013). Possible persons and the problem of prenatal harm. *Journal of Ethics*, 17(4), 355–385; see also Buchanan et al., op. cit. note 51, p. 159; Munson, R., & Davis, L. H. (1992). Germ-line gene therapy and the medical imperative. *Kennedy Institute of Ethics Journal*, 2(2), 137–158.

¹⁵⁶Walters & Palmer, op. cit. note 1, p. 109; see also Rahner, K. (1967). The problem of genetic manipulation. *Theological Investigations*, 9, 225–252.

¹⁵⁷e.g., Persson & Savulescu, op. cit. note 101; Sparrow, R. (2015). Enhancement and obsolescence: Avoiding an “enhanced rat race”. *Kennedy Institute of Ethics*, 25(3), 231–260.

healthcare funding.¹⁵⁸ Most recent writings assume they would be permitted by a laissez-faire government or that the state would only intervene to protect citizens against unethical uses of HGGM.¹⁵⁹ Authors writing after the switch from moral to cosmetic modification also focus less on civilization as a whole and more on jurisdictional conflicts between existing nation-states, such as reproductive tourism.¹⁶⁰

Finally, cosmetic images of HGGM suggest that its purchasers might be white. Except for the cover of a 2015 report by the Center for Genetics and Society,¹⁶¹ illustrations of genetically modified babies are almost universally light-skinned. While reform eugenics implicitly took the white middle class as its audience,¹⁶² this racial imagery for HGGM may have continued through the influence of the fertility industry. From the outset, assisted reproductive technology was accessed most frequently by middle-class white couples, with more white specialists to consult and more white gametes available.¹⁶³ Graham's influential Repository never successfully recruited any Black or Asian donors, nor did any Black women ever apply for sperm.¹⁶⁴ These trends may have inadvertently reinforced the image of the designer baby as a Caucasian, for whom the choice between many different hair and eye colors would not be out of place. The common example of parents choosing blond hair and blue eyes¹⁶⁵ even evokes white supremacist uses of HGGM.

Beyond restricting the imagined time frame of the debate, the move towards cosmetic images of HGGM may also suggest that it will take place for well-off white couples in Western democracies, although it has yet to be seen whether the 2018 He Jiankui affair in China will affect future representations of the technology.

6 | CONTINGENCY AND THE PROBLEM OF UNDEREXPLORED TRAITS

Acknowledging our shifting mental images of genetically modified people in previous decades leaves us with the question of how those images might continue to change in the future. The idea that people at different points in history might value different genetic traits is a long-running ethical concern in HGGM. At a practical level, genetic

modifications that seem beneficial today could hinder our descendants in a changing environment.¹⁶⁶ HGGM might also obstruct societal change by cementing the arbitrary preferences of a particular generation.¹⁶⁷ John Mackie commented that Victorians might have chosen to design "patriotic and pious" children,¹⁶⁸ while Paul Root Wolpe facetiously asked, "Women in the early twentieth century were supposed to be delicate and to faint at the sight of blood; why not select for those desirable traits?"¹⁶⁹

But if these schemas can change over time, then we may not simply value traits differently from other generations; in fact, we may not even bring the same traits to mind in the first place.¹⁷⁰ Opponents of HGGM often quote C. S. Lewis' 1943 essay "The abolition of man," which argues that the power to "condition" future generations would mean putting them in thrall to whichever random confluence of "heredity, digestion, the weather, and the association of ideas" influenced the original conditioners' plans.¹⁷¹ Given the shifting pattern of influences discussed in this article, it is easy to see how some plausible uses of HGGM might have been excluded from the debate simply based on historical chance.

One indication of this arbitrariness is that the range of characteristics seen as genetic has changed dramatically over time. Although mainline eugenicists focused on a shortlist of important traits,¹⁷² they also attempted to establish Mendelian inheritance patterns for a vast catalog of characteristics. Many of these were obviously rooted in social norms: a frequently mocked example is thalassaemia, the inclination to sail around the world.¹⁷³ Charles Davenport's Individual Analysis Cards also covered traits like daydreaming, patriotism, and ability to take a joke.¹⁷⁴

Scientific advances around the time of World War II, such as Beadle and Tatum's discovery of the link between genes and enzymes, temporarily shifted geneticists' focus to medical conditions whose etiology could be clearly demonstrated.¹⁷⁵ Yet, starting in the 1990s, many of the behavioral traits first investigated during the eugenics era began to receive renewed media coverage due to the

¹⁵⁸Mehlman, M. J. (1999). How will we regulate genetic enhancement? *Wake Forest Law Review*, 34, 671-714.

¹⁵⁹Paul (1998), op. cit. note 7, pp. 97-98; Wachbroit, R. (1987). What is wrong with eugenics? *QQ: Report from the Institute for Philosophy and Public Policy*, 7(2-3), 6-8; Sparrow (2010), op. cit. note 88; see Buchanan, op. cit. note 104, p. 71; compare Fox, op. cit. note 88.

¹⁶⁰e.g., Adashi, E. Y., & Cohen, I. G. (2019). Germline editing: Could ban encourage medical tourism? *Nature*, 569(7754), 40-41; Charo, R. A. (2016). On the road (to a cure?) — stem-cell tourism and lessons for gene editing. *New England Journal of Medicine*, 374(10), 901-903; Charo, R. A. (2019). Rogues and regulation of germline editing. *New England Journal of Medicine*, 380(10), 976-980.

¹⁶¹Center for Genetics and Society & Friends of the Earth, op. cit. note 109, p. 1.

¹⁶²Stern, op. cit. note 13, p. 154.

¹⁶³Maranto, op. cit. note 120, pp. 113, 152; Roberts, op. cit. note 12, pp. 253, 259-260.

¹⁶⁴Plotz, op. cit. note 121, p. 105.

¹⁶⁵e.g., Buchanan, op. cit. note 104, p. 32; Etzioni, op. cit. note 2, pp. 22, 117; Powell, op. cit. note 109; Singer & Wells, op. cit. note 75, p. 228; Sparrow (2010), op. cit. note 88; U.S. Congress House Committee on Science and Technology, op. cit. note 45, p. 188.

¹⁶⁶e.g., Glass, B. (1971). Science: Endless horizons or golden age. *Science*, 171(3966), 23-29; Lederberg (1970), op. cit. note 34; McGee, op. cit. note 52.

¹⁶⁷Lerner, I. M. (1973). Ethics and the new biology. In Birch et al. (Eds.), op. cit. note 2 (pp. 20-35), p. 30; Andorno, R. (2005). Human dignity and the UNESCO Declaration on the Human Genome. In J. Gunning & S. Holm (Eds.) *Ethics, law and society* (Vol. 1, pp. 73-81). Routledge, p. 79.

¹⁶⁸Glover, op. cit. note 106, p. 97.

¹⁶⁹Wolpe, P. R. (1997). If I am only my genes, what am I. *Kennedy Institute of Ethics Journal*, 7(3), 213-230.

¹⁷⁰Baylis, F., & Robert, J. (2006). Radical rupture: Exploring biological sequelae of volitional inheritable genetic modification. In J. E. J. Rasko, G. O'Sullivan, & R. A. Ankeny (Eds.), *The ethics of inheritable genetic modification* (pp. 131-148). Cambridge University Press, p. 135; Juengst (1995), op. cit. note 82.

¹⁷¹Lewis, C. S. (1988). The abolition of man. In L. W. Dorsett (Ed.), *The essential C.S. Lewis* (pp. 428-470). Macmillan, p. 453.

¹⁷²Wikler, op. cit. note 10.

¹⁷³Duster, op. cit. note 46, p. 10; Gould, S. J. (1993). *The mismeasure of man*. Norton, p. 132; Kitcher, P. (1997). *The lives to come*. Touchstone, pp. 188, 240; Ludmerer, op. cit. note 8, p. 60; Paul (1995), op. cit. note 7, p. 58; Wachbroit, op. cit. note 159.

¹⁷⁴Paul, *Ibid*: 57.

¹⁷⁵Gudding, op. cit. note 13; see also Shannon, op. cit. note 46, p. 273.

discovery of purported candidate genes.¹⁷⁶ Examples like perfect pitch began to appear regularly in the HGGM debate, but most of these traits did not.¹⁷⁷ The content of contemporary discussions has clearly been influenced by scientific discoveries, but the modifications we think of do not correspond directly to what we know about the human genome.

There is no clear philosophical reason for why authors frequently write about creating mathematical or musical prodigies¹⁷⁸ while avoiding traits like anorexia, income level, political affiliation, promiscuity, PTSD, risk taking, and smoking, all of which have been examined in genome-wide association studies or marketed to the public in direct-to-consumer tests.¹⁷⁹

Scholars who do mention modifications outside of the typical shortlist often do so while imagining the consequences of overlooking those traits in future people. Jonathan Glover, who helped to rehabilitate some of Muller's work in the 1990s,¹⁸⁰ thought "one of the worst imaginable" outcomes of HGGM would be leaving out "warmth" or a sense of humor.¹⁸¹ Anderson questioned whether we

might inadvertently destroy our capacity for spirituality,¹⁸² a topic which once interested eugenicists¹⁸³ and was central to the breeding experiment in John Humphrey Noyes' Oneida Community.¹⁸⁴

Many other examples that appear only rarely in the discourse are physical, including blood type¹⁸⁵ and low odor production.¹⁸⁶ Some involve provocative new powers, like built-in biosensors,¹⁸⁷ ability to eat cellulose¹⁸⁸ or glowing in the dark.¹⁸⁹ Some are gendered, like menopause,¹⁹⁰ breast size,¹⁹¹ or ability to achieve orgasm.¹⁹² A few are associated with race, like epicanthal folds,¹⁹³ hair texture (common in advertisements for donor gametes)¹⁹⁴ and removal of the allele for "Asian flush," which has appeared in journalistic coverage of preimplantation genetic diagnosis¹⁹⁵ but not in the HGGM debate. Finally, it is striking how often scholars discuss height compared to weight, given the latter's prominent role in social perceptions and the fact that weight maintenance is the second-most investigated trait in twin studies.¹⁹⁶

In comparison to the move from moral to cosmetic modification, it is not clear why most of these traits have been comparatively neglected. Many raise unique and interesting bioethical issues that could represent an important opportunity for future research.

7 | CONCLUSION

When speculating about the ethics of HGGM, scholars have discussed only a limited set of potential modifications. This list is not intrinsic to human psychology or Western culture but reflects several interlinked historical influences. Prior to the 1980s, the HGGM debate was largely shaped by reform eugenicists and theologians,

¹⁷⁶McGee, op. cit. note 52; Rabinow, op. cit. note 118, p. 952; Rothschild, op. cit. note 10, p. 183.

¹⁷⁷Evans, op. cit. note 1, p. 39; Robertson, op. cit. note 128.

¹⁷⁸Baylis, op. cit. note 101, p. 82; Center for Genetics and Society & Friends of the Earth, op. cit. note 109, p. 40; Danish Council on Ethics. (2016). *Statement from the Danish Council on Ethics on genetic modification of future humans*. Danish Council on Ethics, p. 6; Doudna & Sternberg, op. cit. note 109, p. 230; Evans, op. cit. note 42, p. 129; Greely, H. T., (2016). *The end of sex and the future of human reproduction*. Harvard University Press, p. 183; Kozubek, op. cit. note 109, pp. 350, 352; Parens, E., & Johnston, J. (2019). Introduction to *Human flourishing in an age of gene editing*. In Parens & Johnston, op. cit. note 109 (pp. 1–11), p. 3; Vassena et al., op. cit. note 109.

¹⁷⁹See MapmyGene. *Inborn talent gene test*. <https://mapmygene.com/services-2/talent-gene-test/>; Blum, K., Gondre-Lewis, M. C., Modestino, E. J., Lott, L., Baron, D., Siwicki, D., McLaughlin, T., Howeedy, A., Kregel, M. H., Oscar-Berman, M., Thanos, P. K., Elman, I., Hauser, M., Fried, L., Bowirrat, A., & Badgaiyan, R. D. (2019). Understanding the scientific basis of post-traumatic stress disorder (PTSD): Precision behavioural management overrides stigmatization. *Molecular Neurobiology*, 56(11), 7836–7850; Demontis, D., Walters, R. K., Martin, J., Matheisen, M., Als, T. D., Agerbo, E., Baldursson, G., Belliveau, R., Bybjerg-Grauholm, J., Bækvad-Hansen, M., Cerrato, F., Chambert, K., Churchhouse, C., Dumont, A., Eriksson, N., Gandalf, M., Goldstein, J. I., Grasby, K. L., Grove, J., ... Neale, B. M. (2019). Discovery of the first genome-wide significant risk loci for attention deficit/hyperactivity disorder. *Nature Genetics*, 51(1), 63–75; Hatemi, P. K., Medland, S. E., Klemmensen, R., Oskarsson, S., Littvay, L., Dawes, C. T., Verhulst, B., McDermott, R., Nørgaard, A. S., Klofstad, C. A., Christensen, K., Johannesson, M., Magnusson, P. K. E., Eaves, L. J., & Martin, N. G. (2014). Genetic influences on political ideologies: Twin analyses of 19 measures of political ideologies from five democracies and genome-wide findings from three populations. *Behavior Genetics*, 44(3), 282–294; Hill, W. D., Davies, N. M., Ritchie, S. J., Skene, N. G., Bryois, J., Bell, S., Di Angelantonio, E., Roberts, D. J., Xueyi, S., Davies, G., Liewald, D. C. M., Porteous, D. J., Hayward, C., Butterworth, A. S., McIntosh, A. M., Gale, C. R., & Deary, I. J. (2019). Genome wide analysis identifies molecular systems and 149 genetics loci associated with income. *Nature Communications*, 10(1), 1–16; Watson, H. J., Yilmaz, Z., Thornton, L. M., Hubel, C., Coleman, J. R., Gaspar, H. A., Bryois, J., Hinney, A., Leppä, V. M., Matheisen, M., Medland, S. E., Ripke, S., Yao, S., Giusti-Rodríguez, P., Anorexia Nervosa Genetics Initiative, Hanscombe, K. B., & Purves, K. L., Eating Disorders Working Group of the Psychiatric Genomics Consortium, Adan, R. A. H., ... Bulik, C.M. (2019). Genome-wide association study identifies eight risk loci and implicates metabo-psychiatric origins for anorexia nervosa. *Nature Genetics*, 51(8), 1207–1214.

¹⁸⁰Evans, op. cit. note 1, p. 165.

¹⁸¹Glover, op. cit. note 51, p. 52; see also Bostrom, N. (2003). Human genetic enhancements: A transhumanist perspective. *Journal of Value Inquiry*, 37, 493–506; Kaebnick, G. E. (2019). Can we care about nature? In Parens & Johnston (Eds.), op. cit. note 109 (pp. 86–96), p. 94; Savulescu, J. (2005). New breeds of humans: The moral obligation to enhance. *Reproductive BioMedicine Online*, 10(1), 36–39; Savulescu, J. (2006). Justice, fairness, and enhancement. *Annals of the New York Academy of Sciences*, 1091, 321–338; Savulescu, J. (2007). In defence of procreative beneficence. *Journal of Medical Ethics*, 33(5), 284–288; Savulescu, op. cit. note 106.

¹⁸²Anderson, op. cit. note 82; Anderson, W. F. (1990). Genetics and human malleability. *Hastings Center Report*, 20(1), 21–24.

¹⁸³Paul (1995), op. cit. note 7, p. 1.

¹⁸⁴Noyes, H. H., & Noyes, G. W. (1967). The Oneida community experiment in stiriculture. *Eugenics Quarterly*, 14(4), 282–290.

¹⁸⁵Knoepfler, op. cit. note 109, p. 10.

¹⁸⁶Ibid: 187.

¹⁸⁷Harris, J. (1998). *Clones, genes, and immortality: Ethics and the genetic revolution*. Oxford University Press, p. 20.

¹⁸⁸McGee, op. cit. note 52, p. 41; Lyon, J., & Gorner, P. (1995). *Altered fates: Gene therapy and the retooling of human life*. Norton, p. 566; Stableford, B. (1984). *Future man*. Crown, p. 111; see also Buchanan, op. cit. note 101; Nuffield Council on Bioethics. (2018). *Genome editing and human reproduction: Social and ethical issues*. Nuffield Council on Bioethics, p. 47.

¹⁸⁹Knoepfler, op. cit. note 109, p. 148; Stock, op. cit. note 131, p. 97.

¹⁹⁰Rosenfeld, op. cit. note 114, p. 137; Walters & Palmer, op. cit. note 1, p. 116.

¹⁹¹Knoepfler, op. cit. note 109, p. 148.

¹⁹²Savulescu, op. cit. note 106.

¹⁹³Green, op. cit. note 117, p. 225.

¹⁹⁴Ibid; Maranto, op. cit. note 120, p. 183; Parens, E. (1995). The goodness of fragility: On the prospect of genetic technologies aimed at the enhancement of human capacities. *Kennedy Institute of Ethics Journal*, 5(2), 141–153.

¹⁹⁵Cyranoski, D. (2017). China's embrace of embryo selection raises thorny questions. *Nature News*, 548(7667), 272–274.

¹⁹⁶See Rothschild, op. cit. note 10, p. 141; Polderman, T. J., Benyamin, B., De Leeuw, C. A., Sullivan, P. F., Van Bochoven, A., Visscher, P. M., & Posthuma, D. (2015). Meta-analysis of the heritability of human traits based on fifty years of twin studies. *Nature Genetics*, 47(7), 702–709.

many of whom used a long-term, societal perspective that favored enhancements to social behavior. As they lost their jurisdiction to molecular geneticists and bioethicists, the discussion became increasingly restricted to the preferences of individual families. Stakeholders who considered HGGM from the context of reproductive autonomy found it easy to discuss traits from the burgeoning commercial fertility industry, like height or coloring, without considering deeper changes to identity or long-term developments in society.

Knowing that the kinds of modifications we discuss can change over time could help us to put old and new arguments into better context, by understanding how stakeholders with different knowledge bases imagined abstract categories like enhancement or how they pictured potential users of HGGM. It also presents new opportunities for bioethical analysis. Considering past influences on the set of traits that authors imagined changing with HGGM may enable us to anticipate future developments in the debate through greater attention to jurisdictional conflicts between disciplines, preferences in donor gamete use, and large-scale societal transformations. For instance, Françoise Baylis concluded her recent book by speculating that climate change might result in increasing attention to collective benefit in the HGGM debate.¹⁹⁷

We also need to decide which traits to prioritize in continuing discussions of HGGM. Should we start by considering precedent in the bioethics literature, perceived feasibility, potential impact on human life, level of public demand, or perceived ethical complexity? As CRISPR and related technologies continue to develop, a broad and proactive conversation about which modifications we discuss could help us respond to a more diverse range of bioethical issues than we are currently equipped to face.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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¹⁹⁷Baylis, op. cit. note 101, p. 218; see also Buchanan, op. cit. note 101.