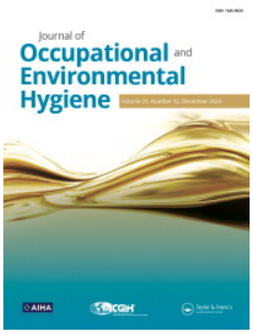

Journal of Occupational and Environmental Hygiene

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/uoeh20

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To cite this article: Edward J. Calabrese & Dima Yazji Shamoun (06 Jan 2025): The unraveling of a Nobel Prize: How Hermann Muller was awarded the Nobel Prize: A front for eugenics, Journal of Occupational and Environmental Hygiene, DOI: 10.1080/15459624.2024.2440558

To link to this article: https://doi.org/10.1080/15459624.2024.2440558

Published online: 06 Jan 2025.

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JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL HYGIENE
https://doi.org/10.1080/15459624.2024.2440558

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The unraveling of a Nobel Prize: How Hermann Muller was awarded the Nobel Prize: A front for eugenics

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ABSTRACT

This paper asserts that the Nobel Prize for Medicine/Physiology that Hermann J. Muller received in 1946 was a front to enhance the legitimacy, acceptance, and application of eugenics, a strategy to guide the direction and rate of human evolutionary change. Seven of the nine people nominating (1932–1946) Muller were proponents of eugenics with Muller being among the most visible of the scientific leaders. Muller's nominators never cited his Nobel Prize research in scientific literature, lacked expertise in radiation-induced mutations, and were not qualified to evaluate Muller's research. Muller's claim of induced "gene" mutations with extremely high radiation dose rates remained highly uncertain, undercutting legitimate Nobel Prize consideration. Despite their diverse range of educational, research, and political backgrounds, they nominated Muller based on the convergence of their respective eugenic ideologies. The Chair of the Nobel Prize committee not only was a committed eugenicist but also nominated Muller the previous year and had invited these nominators under the belief they would support his prolonged advocacy for Muller. While the underlying intent of the nominations was to associate extremely high scientific achievement with eugenics, the Prize was ironically awarded immediately after World War II, and eugenics would be profoundly stigmatized due to its association with horrific actions against humanity by the Nazis. However, Muller's Nobel Prize became a fear-based lightning rod for the environmental revolution, inspiring the book *Silent Spring* (1962), and providing the central framework for cancer risk assessment by regulatory agencies worldwide.

KEYWORDS

Cancer risk assessment; history of science; linear risk assessment; LNT; radiation; Rockefeller Foundation

Introduction

In 2003, James Jamieson of the Council for Social and Economic Studies, Washington, DC published a paper entitled "*Hermann J. Muller: Nobel Prize Winning Eugenicist.*" The author noted that: "Muller was a committed eugenicist who strove to alert the world to the urgent threat of genetic decay implicit in modern civilized societies" (page 291). While Muller's leadership in the eugenics[1] community at the national and world levels was well known, with his clearest and most dynamic expression being his 1936 book "*Out of the Night: A Biologist's View of the Future*," Jamieson (2003) makes the striking assertion that the reason why Muller received the Nobel Prize was because "his mutation inducing research opened the door to modern genetic intervention in the germline of living organisms. It was this achievement that won him the Nobel Prize." As early as 1921 Muller (1923) asserted at the International Eugenics Congress that mutation theory needed to be a major tenet of eugenics research.[2] Even though a causal relationship between mutation and human deterioration had not yet been made, Muller stated that the "same general [mutational] thesis undoubtedly applies to mankind." (Gormley 2006).

The road to Stockholm for Hermann J. Muller, the 1946 recipient of the Nobel Prize in Medicine/Physiology, started with his publication on July 22, 1927, in the journal *Science*, entitled "*The Artificial Transmutation of the Gene*," some 19 years earlier. Muller reported that he induced gene mutation in the fruit fly using ionizing radiation from X-rays. More specifically, Muller reported the occurrence of transgenerational phenotypic changes that he interpreted as being due to gene mutation. The findings were considered extraordinary and created much excitement

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since numerous efforts over the previous 15 years had failed to show convincing evidence of induced gene mutation. The findings were of further interest since Muller produced relatively large numbers of X-ray-induced gene mutations in a short period of time. Despite the great excitement generated by these findings, it also elicited considerable scientific debate over the mechanism mediating transgenerational phenotypic changes. Muller's claim that he had produced gene mutations was an inference, lacking proof, yet this assertion was at the core of the significance of his claim (Calabrese 2017). The question was immediately raised as to whether Muller had induced gene mutation or merely induced modest to large gene deletions within the chromosomes (Muller 1928).[3] This controversy led Muller to quickly assign Frederick B. Hanson, a mouse geneticist on sabbatical leave from Washington University, St. Louis MO, to assess whether X-rays could induce reverse mutations in the fruit fly (Calabrese and Giordano 2023). If this were the case, it might suggest that an X-ray-induced mutated gene is still intact and not deleted. So important was this question that Muller and his department chair, John Patterson, did extensive follow-up research in a rather desperate attempt at resolving this uncertainty (Patterson and Muller 1930). Muller would continue this focus to the middle of the 1930s until it became overwhelmingly evident that the evidence had not supported his gene mutation interpretation (Calabrese 2015, 2017, 2019b; Lefevre 1949, 1950).

The scientific debate over whether Muller had induced gene mutation in his groundbreaking research continued for several decades (Calabrese 2015, 2017, 2019b). Nonetheless, the vast majority of the genetic changes that Muller induced were due to X-ray-induced chromosome breaks and position effects (>80%) with the remaining causes being uncertain (Herskowitz 1946, 1951). Modern nucleotide analysis has indicated that the vast majority of genetic changes reported by Muller were modest to massive gene deletions and other chromosome alterations with few, if any, gene mutations (Calabrese 2017, 2019b). Despite the scientific clarification over time that challenged as well as discredited Muller's gene mutation hypothesis, his findings continued to generate considerable excitement and interest due to their enormous biological, medical, and societal implications, one of which was the assumption that the response from ionizing radiation was linear down to a single ionization for gene mutation, an assumption with considerable implications for hereditary and cancer risk assessment. Given these developments and unresolved scientific controversies, the question may be asked as to how Muller was awarded the Nobel Prize for Medicine/Physiology. This paper argues that the award was not deserved but was a front to promote the eugenics movement that sought to control the direction and rate of human evolution.

Scientists nominating Muller for the Nobel Prize

This section profiles and assesses the individuals who nominated Muller for the Nobel Prize in Medicine/Physiology. These assessments provide information on the scientific background of the individuals and their associations with Muller and the eugenics concept. Since the individuals assessed were prominent, with highly productive professional careers, much information was available on each person from scientific, professional, and personal perspectives. Autobiographies were obtained for Henschen (1957) and Hogben (Hogben and Hogben 1998), while a biography was available on the Vogts (Henschen 2008). Based on a review of the Nobel Prize nominations of Hermann Muller, seven of those providing nominations had a professional association with eugenics. Since this paper now considers Muller's nominators, it is important to emphasize that, according to Reichard (2002), a former Nobel Prize committee member: "to win the prize, strong candidates must as a rule be nominated …." Thus, the nomination process is a necessary critical step to receive the Nobel Prize.

Oskar and Cecilia Vogt: Initiation and promotion of Muller's Nobel Prize

During the five years since his report in *Science* in 1927 on the gene mutation findings, Muller had become a highly sought-after speaker in various scientific venues, some being extremely prominent, such as providing a plenary presentation at the 6th International Genetics Congress at Cornell University, Ithaca NY in 1932 (Calabrese 2015, 2019b). Also, in 1932 Muller received a Guggenheim fellowship to research at the Kaiser Wilhelm Institute in Berlin with the radiation geneticist Nikolai Timofeeff-Ressovsky. During this same relatively narrow period, Muller would receive his first nominations for the Nobel Prize in Medicine/Physiology. The nominations were offered by a famous husband and wife neuroscientist/physician team, Oskar and Cecilia Vogt,[4] who also worked at the Kaiser Wilhelm Institute under the same administrative leadership where Muller would

spend his Guggenheim fellowship. How and why this dual set of nominations for Muller by the Vogts occurred is curious since the Vogts researched the causes and treatments of human neurodegenerative diseases, not the area of radiation-induced gene mutations. That is, the nomination for the Nobel Prize came from individuals who were not in his area of research, could not have assessed the quality or strengths/limits of his research, and would not have been asked to peer review such papers, yet they offered a nomination for the highest science award. The nomination by the Vogts represented a lumping of multiple projects that Muller had researched including his dissertation research on aspects of chromosomal crossing over, as well as later work on lethal genetic factors and the effects of temperature on reproductive cell gene mutation frequency, none of which would have generated interest in a Nobel Prize (Muller Nobel Prize Nominations, Nobel Prize Organization website, https://www.nobelprize.org/prizes/medicine/1946/muller/nominations/). Their Muller nominations, which also included his radiation-induced gene mutation claim, were a potpourri of past activities with no insightful discrimination, simply take your pick, as if all were similarly deserving.

Despite the overall secrecy of the Nobel Prize nomination process, the committee recommendations, and the voting process,[5] Muller informed his wife in a March 30, 1933 (Muller 1933) letter that he had insider knowledge and learned that he was now in the running for the Nobel Prize, claiming that he had received six or seven out of 21 votes, an impressive number. It therefore appears that the nomination of Muller by the Vogts had indeed generated interest in Muller's research by the Nobel Prize committee via the advocacy of Henschen. This interest was then reflected in receiving the six or seven votes by the Karolinska Institute faculty, who were the final authority for the Nobel Prize. Muller suggested to his wife that he had a chance to receive the Nobel Prize the next year, perhaps sharing the award with Morgan.

It should be noted that Folke Henschen, Nobel Prize committee member at that time and later chair of this committee, invited Muller to Stockholm early in April 1933 to discuss the nomination of Morgan, leading to Morgan receiving the Nobel Prize that year (Henschen 1957). It seems likely that Muller's insider information mostly occurred as a result of the interactions with Henschen and the Vogts and perhaps others. Furthermore, it is likely that soon after the Muller March 30, 1933 letter to his wife Muller learned that Morgan would be the target for the 1933 prize, not him, with Muller now being forced to be helpful. Ironically, Muller had extreme contempt for Morgan (Carlson 1981) and most likely disguised it during this process, being helpful to endear himself to Henschen.

The Vogts became heavily involved with the study and advocacy of eugenics at least as early as 1930. Their efforts were integrated into the framework of the German political system, the leadership and direction of the Kaiser Wilhelm Institute, and their own research and clinical activities. Oskar Vogt was a human brain cortex researcher and the director of the Kaiser Wilhelm Institute for Brain Research in Berlin-Buch.[6] On December 2, 1930, he wrote to the "Emergency Association of German Science" President, Friedrich Schmidt-Ott trying to position their brain research activities as a valuable contribution to the major science programs in public health and racial hygiene and moved them into this agency's institutional framework (Stahnisch and Kurbegovic 2020). As in many other negotiations with major funding agencies, Vogt promoted his collaborations and offered research aid through the assistance of his Institute. In 1932 Oskar Vogt (1932) wrote an article in *The Eugenics Review*[7] that provided an assessment of medical eugenics and how it could be advanced by experimental research. Of particular importance is that he attempted to show how behavioral genetics research with *Drosophila* could be useful for eugenics citing the research of Nikolai Timofeeff-Ressovsky. This paper was published just before Muller arrived at the Kaiser Wilhelm Research Institute, where he would work with the *Drosophila* radiation geneticist Timofeeff-Ressvosky and develop a professional and friendly relationship with the Vogts.

Muller's intuition was not very good as far as Nobel Prize nominations were concerned. The two nomination votes that he received from the Vogts in 1932 were the last he would receive until 1939, a seven-year gap. From 1939 until his Nobel Prize year in 1946, Muller would receive a total of nine additional nominations, starting with one in 1939 by Gunnar Dahlberg[8] (Sweden), three in 1940 by Lancelot Hogben (United Kingdom), Karl Landsteiner (United States), Otto Mohr (Norway), one in 1945 by Folke Henschen (Sweden) and then four in 1946 from Gunnar Dahlberg, Otto Mohr, Arno Saxen (Finland) and Eric Essen-Moller (Sweden). Even though there were only eleven nominations from nine individuals over the 15 years, this relatively modest number of nominators had unique and prominent reputations in the biological, biomedical, and/or clinical domains. Perhaps most importantly, the 1946 year would be Henschen's

last as chair of the Nobel Prize committee as retirement was imminent, making it the last year for Henschen to personally deliver the Nobel Prize for Muller.

The Otto L. Mohr-Muller connection: A chance meeting leads to friendship

Among the nine nominating persons, Otto Louis Mohr (1886–1967) knew Muller for the longest time. It was a lucky initial acquaintance. Muller had become a faculty member at the Rice Institute (Rice Institute would become Rice University in 1960) having been invited by Jullian Huxley[9] in 1915 after finishing his PhD at Columbia. However, according to Carlson (1981), Huxley decided to leave Rice to return to the UK as a result of World War I to serve in the British Army Intelligence Corp (Deese 2011). Muller arranged to recruit his best friend, Edgar Altenberg, to Rice to replace Huxley. As the United States was also to enter the war, Muller tried to escape being drafted, claiming to be the sole support of his mother even though he also was mostly blind in his right eye since he was an infant. Muller then was made exempt from the draft due to having a vision disability. This exemption was reversed, and Muller got drafted into the military. His military service lasted one day as he was then found to have a heart murmur, freeing him from service (Carlson 1981). When Alfred Sturtevant at Columbia was drafted, Muller was asked to return as an instructor, hoping it might eventually lead to a permanent position. Thus, Muller returned from Texas (i.e., Rice Institute, Houston, Texas) to Columbia University, New York City in 1918 after the spring semester ended. As a result of these unexpected events, Muller returned during the year that Otto Mohr was taking a one-year post-doctoral position with Morgan. This series of events created an opportunity for Mohr and Muller to develop a professional and friendly relationship.

Mohr was first educated as a physician in 1912. Soon after receiving his medical degree, he then took two one-year postdoctoral appointments, one in cytology in Brussels studying with Albert Bracket, a renowned embryologist, for eight months. During that time, he studied chromosomes microscopically, receiving a doctoral degree based on studying gametes from large grasshoppers that had only one generation/year. While studying with Morgan, he was introduced to using fruit flies, which had 12 generations/year, changing the research model for the rest of Mohr's career. During this time Mohr and his wife became friendly with Morgan, establishing a prolonged letter-writing relationship. As a result of their working together at Columbia during the second half of the year, Otto Mohr and his wife were invited to Muller's home for the Thanksgiving holiday with his mother and sister in November. In effect, Otto Mohr and his wife returned this Thanksgiving favor by becoming part of the Muller itinerary on the way to start his Guggenheim Fellowship in Berlin (Mohr 1972). During his time at Columbia, Mohr would develop such close relationships with Morgan and his team that Alfred Sturtevant would later write that Mohr was considered a member of Morgan's Team (Allen 1978), leading Mohr to nominate Morgan twice for the Nobel Prize (1924, 1925) and offering the same advocacy for Muller (1940, 1946). While Mohr studied the occurrence of several possible naturally occurring mutations in the fruit fly and their modes of inheritance, this research occurred nearly a decade before Muller reported that he had induced gene mutation with X-rays.

Mohr's interest in eugenics started several years before he visited Morgan's laboratory at Columbia. He became actively engaged in a broad spectrum of public debates on the role eugenics plays within society and its scientific foundations. In general, Mohr's interest was viewed as scientifically, rather than ideologically, focused and had a significant influence on the development of eugenics in Norway, which resisted racial hygiene measures in the 1920s and 1930s (Roll-Hansen 1989, 1999).

From the beginning of the 1930s, Mohr became increasingly involved with administrative leadership at the university as well as in the Norwegian Academy of Sciences. By 1934, he had become Dean of the Faculty of Medicine and then President of the Academy of Sciences in 1940. After World War II in 1945, he became the Rector of the University of Oslo, eventually retiring from that position in 1951. During World War II, Mohr was removed from professorship by the Nazis and imprisoned for seven months. Other members of his family were imprisoned as well for varying periods (Roll-Hansen 1989, 1999).

Lancelot Hogben, the chromosome heredity-Morgan/Muller connection and a left-wing eugenics supporter[10]

Hogben first got acquainted with Thomas Hunt Morgan and Hermann J. Muller as a result of his graduate student research in 1920 and 1921. At that

time, the idea that genes had a linear arrangement along chromosomes was still novel and not broadly accepted. In addition, it had been widely believed that chromosomes displayed end-to-end pairing based on a highly regarded paper by Farmer and Moore (1905). However, Hogben challenged this view via his detection of a very short-lived stage during meiosis that Farmer and Moore (1905) had missed. Hogben was able to find the "missing" stage within a specific time window. The chromosome theory of inheritance was contingent upon the pairing side by side. The prevailing view held that the chromosomes, before the split, lined up end to end (telesynapsis) (Hogben and Hogben 1998). Lancelot Hogben caught the fleeting event of the chromosomes pairing, side by side (parasynapsis). His research therefore disputed the end-to-end claim. Morgan wrote to Hogben stating that "if the pairs fused end to end and the tetrad arose by two longitudinal divisions, the outcome would not be in harmony with the theory of segregation based on separation of maternal and paternal chromosomes, at reduction." Morgan and Muller made a special visit to Hogben in England to review his cytological work. This visit not only satisfied the scientific demands of Morgan and Muller but also resulted in strong friendships and follow-up letter communications.

Of considerable relevance is that Hogben reported that twenty years later, in 1940, the Nobel Prize Committee invited him "to represent Britain in connection with nominations for a 1940 laureate for the medical, that is, the biological, sciences. In that capacity, I prepared the brief for the choice of H. J. Muller–a friend of long-standing, foremost among the architects of the theory of the gene and the first to produce mutations by radiation. The invasion of Norway and Denmark delayed a decision until the liberation, but it was gratifying to renew my friendship with H. J. when he spent a few days in Britain on route to receive the award in 1946" (Hogben and Hogben 1998).

This passage from the Hogben autobiography illustrates several facets of the Muller Nobel Prize story. First, there was the fact that Hogben's graduate research proved to be significant and relevant to Morgan and Muller. Second, Morgan and Muller showed extraordinary professionalism by tracking down the claims reported in the Hogben papers and verifying the findings. The development of a positive professional and personal relationship was the net outcome of these interactions. Such a relationship became an essential development that would provide the foundation for other activities such as inviting Hogben to sign the Eugenics Manifesto in 1939 and for the Muller Nobel nomination a year later. It was curious to note that the Committee solicited the nomination from Hogben, a comment confirmed in the autobiography of Henschen (1957). The role of nominating longtime friends for awards is quite evident in the case of Muller by Hogben and Mohr. Since Hogben was not a radiation geneticist, but an experimental zoologist (e.g., amphibian pituitary areas) who evolved a strong interest in medical statistics, it is unlikely that he could have adequately critically reviewed the radiation-induced mutational findings of Muller.

Gunnar Dahlberg, a left-wing director of the government Institute for Race Biology

In 1921, the State Institute for Race Biology (STRB) was created by the Swedish government and became operational on January 1, 1922, being located in Uppsala. While the Institute was supposed to offer medical guidance/solutions to a spectrum of social problems such as alcoholism and psychiatric diseases, its research tended to focus on projects that studied racial traits of the Swedish population. Gunnar Dahlberg (1893–1956), a long-time associate director, was appointed the director in 1935. He had a strong politically left-wing orientation (Roll-Hansen 1989). During his leadership, Dahlberg directed the Institute away from its close ties with Germany, which was nurtured by the previous director (i.e., Herman Lundborg, 1868–1943), but toward collaboration with geneticists and eugenicists in Great Britain with an emphasis on race science based on genetic analysis and statistical evaluation rather than on what might be considered nationalistic and discriminatory approaches as seen in Germany. Dahlberg would denounce the national socialist notion that there were any "superior" races among Europeans. This orientation toward Great Britain led Dahlberg to collaborate with Hogben, a similar strongly left-wing-oriented eugenicist, who visited him in Uppsala in the spring of 1940 (Ericsson 2021). Hogben would translate one of Dahlberg's books, noting in the Preface that Dahlberg was one of the six most knowledgeable persons in the field of heredity (Hogben and Hogben 1998). The timing of this collaborative activity is also important to the Muller story as Dahlberg signed both the Eugenics Manifesto in 1939[11] (Crew et al. 1939) and nominated Muller for the Nobel Prize that year while Hogben did so at about the time of his visit with Dahlberg in 1940. The autobiography of Hogben

as facilitated by his family after his death, provides important insights into the mutually supportive professional and personal relationships between Dahlberg and Hogben (Hogben and Hogben 1998). It should be noted that Dalberg tried to strengthen his letter to the Nobel Prize Committee for the Muller Nobel nomination by obtaining additional supportive statements from leading scientists, such as F.A.E. Crew, J.B.S. Haldane, Lancelot Hogben, and Julian Huxley, all strong eugenicists and signatories of the Eugenics Manifesto (Bjork 2024).

It should be noted that Dahlberg was heavily involved in the work of the commission that developed the Swedish sterilization law of 1935, acting as a consultant on human genetics. According to Roll-Hansen (1989), while Dahlberg was not a strong believer in the positive eugenic effects of sterilization, he accepted it on social grounds, as was also the case with Otto Mohr. During the development of the 1935 Swedish sterilization law, a compromised agreement was achieved that "the sterilization of severely feeble minded and others with grave defects is justifiable and desirable from society's point of view, even in cases where the sub abnormality is not caused by heredity." The Swedish Commission also concluded that for the "slightly defective, … sterilization on a large scale cannot be considered desirable," and that sterilization needed to be voluntary.

Folke Henschen: A right-wing German sympathizer, Mullerian, eugenicist, and Nobel Prize insider

Folke Henschen (1881–1977) has an extremely important role in the Muller-Nobel Prize story (Henschen 1957). He was a member of the Nobel Committee starting in 1926 and being chair of the committee from 1942 to 1946. In his last official act as chair of the Nobel Prize committee, Henschen (1957) made sure that Muller got his long-sought-after prize, the goal of scientific and academic immortality. As noted earlier, Henschen was also extremely close friends with the Vogts, who first nominated Muller for the Nobel Prize. He researched with the Vogts at their institute at the time Muller was there, knew Muller well, and soon became his strong Nobel Prize advocate. The Vogts, Henschen, and Muller, while being from very different areas of the biomedical sciences, were united in the focus and advocacy of eugenics.

As Bjorkman (2016) stated (page 165), Henschen was neither a physical anthropologist nor a geneticist but a pathologist. Thus, based on education and training, he was not equipped to render informed guidance on matters related to racial differences and the general area of eugenics. However, this is not how Henschen saw it. He strongly believed that it was precisely because he was not trained in these areas and lacked their inherent professional conflicts/biases that he could contribute in professionally meaningful and more objective ways to the debate. As a result, Henschen assessed the occurrence of geographic pathology and used it as a means to provide scientific insight into the eugenics issue of how to improve the quality of the population. Henschen therefore directed his geographic pathology research into the area of racial differences (see his History and Geography of Diseases—1962), believing this orientation would improve the health of the population, a belief he adhered to for the rest of his life (Bjorkman 2016). In striking contrast to Dahlberg, Hogben, and Mohr, Henschen maintained a close relationship with Germany before and during World War II, communicated with the notorious Hermann Goring,[12] visited Germany three times during the war (1940, 1941, 1943), lectured during the first visit in seven cities. The 1941 trip was in connection with the 400th anniversary of Paracelsus' death. The final trip in 1943 involved another lecture tour to eight universities, clearly displaying the high regard that Henschen maintained with the German government.

Of considerable relevance to the present paper is that Henschen had a lifelong relationship with Vogts. In his autobiography, Henschen (1957) recounts the numerous visits to their home and their professional and social interactions. Henschen would also spend considerable time with the Vogts in a professional context. Muller was located at the same facility, becoming integrated into their scientific and social strata. Muller's close radiation geneticist colleague Timofeeff-Ressvosky would collaborate with both the Vogts and Muller on research activities. Henschen (1957) also reported that he organized a significant appreciation party for the Vogts, which was attended by Muller. It was during this general period that Muller was nominated for the Nobel Prize by the Vogts and was invited to Stockholm by Henschen to discuss the Morgan Award deliberations. Henschen (1933) would give the Nobel Prize Ceremonial Lecture for Morgan at the December 1933 celebration. The Morgan ceremonial award presentation by Henschen appears to have been drafted, at least in part, by Muller based on the writing style and content. Morgan, who missed the formal Nobel Prize ceremony, finally visited Stockholm, giving his delayed

presentation on June 4, 1934. Henschen (1957) would write that he had strongly promoted Muller for the Nobel Prize since the Morgan Award in 1933, trying to convince other members of the Nobel Prize committee that Muller deserved his own prize even though he also contributed substantially as a team member to the Morgan award. So committed was his advocacy for Muller that he acted as both a nominator (1945) and chair of the Nobel Prize Committee, and even actively solicited nominations, in effect giving him three bites at the apple. The year 1946 may well have been Muller's last chance for the Nobel Prize as Henschen stepped down from his academic role to become an emeritus professor in 1947 and no longer serving on the committee (Henschen 1957).

Eric Essen-Moller, a leader in psychiatric genetics and eugenics with a Nazi mentor

Eric Essen-Moller (1901–1992) was a major figure in the area of psychiatric genetics. He was initially educated in the areas of genetics and statistics, later receiving a medical degree in 1931 at the University of Lunde, a prominent comprehensive university in Sweden. Key to his academic orientation was his inspiration from the geneticist Herman Nilsson-Ehre, his genetics professor, who for many years also was a key leader in Sweden in the area of science and policy promoting eugenics and an advisor to the government Institute for Racial Biology. Essen-Moller would then accept a two-year fellowship from the Rockefeller Foundation (RF) (1931–1933) to study the fertility of the mentally ill at the German Institute for Psychiatric Research in Munich under the overall direction of Ernst Rudin. Rudin (1874–1952) was the most significant leader in German psychiatry for approximately the first half of the twentieth century (Roelcke 2014, 2019; Bjorkman and Widmalm 2010). Rudin researched in the areas of genealogy and demography, which had the specific goal of assessing the epidemiology and genetics of psychiatric disorders for eugenic purposes. Rudin was the director of this research program from 1917 until the end of World War II. After the Nazis came into power in 1933 Rudin became a member of the government's Executive Committee for Health and Racial Policy. This Committee guided the development and adoption of the National Compulsory Sterilization Act starting in 1934 (Roelcke 2014, 2019). Rudin was also greatly influenced by his then-brother-in-law as well as longtime friend and colleague, Alfred Ploetz, the father of "racial hygiene" and who coined this term in 1895. In 1904, Rudin became co-editor of the new journal, *Archives of Racial Hygiene and Social Biology,* and in 1905, he helped to create the German Society for Racial Hygiene (Proctor 1988). Rudin was also invited to speak to the plenary session at the 7th International Genetics Congress in Edinburgh (August 1939) where Muller presented his *Eugenics Manifesto* article (Roelcke 2014). The research of Rudin's department, which was funded by the Nazi state, was specifically intended to contribute to the genetic foundation of the state's racial hygiene policies. It was within this setting that Essen-Moller continued his eugenics research immersive acculturation (Roelcke 2014). Essen-Moller's orientation to the Rudin racial hygiene perspective is seen in his presentation at the International Congress of Population Science in Berlin in 1935, during which he started his presentation by acknowledging eugenic policy goals and how they guided his assessment of population-based studies (Roelcke 2019).

Essen-Moller returned to the University of Lunde in 1935 as an assistant professor, continuing his psychiatric genetic research with a strong eugenics focus and rising up the academic ranks due to research productivity. He would be invited to speak at the 65th birthday celebration of his mentor Ernst Rudin in 1939. Eventually, Essen-Moller was invited to be chair of the Department of Psychiatry at the Karolinska Institute in 1943, which had important implications concerning awarding the Nobel Prize, especially concerning getting to know and interact with other faculty who vote on such awards. The timing of his invitation to the Karolinska Institute was nearly perfect concerning the nominating activities of Henschen to ensure Muller received the Nobel Prize. According to Roelcke (2019), Essen-Moller, who would later return to the University of Lund, would maintain his strong eugenics convictions during his entire career, retiring in 1967.

Muller: Career in genetics and eugenics: The Eugenics Manifesto and a major book on eugenics

Muller, who had a significant role in the area of eugenics as a supporter, critic, and refiner, wrote a 1936 book on the topic (Out of the Night). In addition, Muller drafted a paper that was published in *Nature* that is referred to as the Eugenics Manifesto that was coauthored by over 20 leading scientists including Gunner Dahlberg and Lancelot Hogben (Roll-Hansen 1988). This paper was shared with the

attendees of the 7th International Genetics Congress at Edinburgh where Muller had a prominent role, and it met a receptive audience. The Eugenics Manifesto (Gruenberg 1939) stated that:

> The most important genetic objectives, from a social point of view, are the improvement of those genetic characteristics that make a) for health, b) for the complex called intelligence, and c) for those temperamental qualities which favor fellow-feeling and social behavior rather than those (today most esteemed by many) which make for a personal "success," as success is usually understood at present.
>
> A more widespread understanding of biological principles will bring with it the realization that much more than the prevention of genetic deterioration is to be sought for, and that the raising of the level of the average of the population nearly to that of the highest now existing in isolated individuals, in regard to physical well-being, intelligence and temperamental qualities, is an achievement that would–so far as purely genetic considerations are concerned– be physically possible within a comparatively small number of generations. Thus, everyone might look upon genius, combined of course with stability, as his birthright. And, as the course of evolution shows, this would represent no final stage at all, but only an earnest of still further progress in the future.

According to Paul (1984), "H. J. Muller was the scientist most prominently associated, during the 1920s and 30s, with the development of socialist eugenics. His book, *Out of the Night* … was its manifestation. At the core of his argument is the assumption that intelligence, character and personality, like physical characteristics, have an irreducible and substantial genetic basis. While it does not dismiss the influence of environment; … The ideal … situation is one in which favorable environments allow the expression of superior genotypes."

At the Third International Eugenics Congress in 1932, Muller promoted sterilization of the unfit at the beginning of his presentation stating: "That imbeciles should be sterilized is of course unquestionable." He also emphasized that eugenics could contribute in important ways to a socialist society such that "the possibilities of future eugenics under these conditions (i.e., socialism) are unlimited and inspiring" (Muller 1934).

The biographer of Muller, his last graduate student, Carlson (1981), asserted that for Muller, eugenics was the recurring theme of his life, his so-called "leitmotif," starting with the first paper written at the age of nineteen in which he presents his version of a eugenics-based world to when he was in poor health near the end of his life, some 50 years later[13] when he was deeply involved with a business venture with Robert Graham to make available to women the sperm of exceptional men. In a July 4, 1965 letter to Graham, Muller wrote that he was determined to work on the sperm preservation project, despite his serious health issues "because I look on it as the most important work of my life, and certainly of the later part of my life" (Muller 1965).[14]

The three major philosophical/ideological directions of Muller involved:

1. his commitment to a socialist communist state,
2. the linear no-threshold (LNT) concept for health protection and
3. the eugenics concept.

The present analysis of these three powerful directions reveals that the socialist communist state and the cancer risk assessment/LNT focus were subservient to and supportive of the eugenics cause. Concerning the social communist perspective, Muller was attracted to it because it was designed to make the social and economic environments equalized across society. Once the so-called massive environmental variables had been, in effect, neutralized for all, the basis for differences among individuals would be seen as largely genetic and his eugenics framework could then become operational. Muller was living in the Soviet Union when he finalized and published the book *Out of the Night* and sent it to Stalin in 1936 along with a well-publicized submissive letter (Carlson 1981). However, Muller had misunderstood Stalin's view of the Soviet revolution. Stalin hated the Muller book as it identified a potentially significant genetic component in the advancement of society.[15] However, the Russian Revolution was largely involved with removing historically elite families, their leadership and control over the Russian society, that is, the belief that there was a genetically superior group that led the country. Furthermore, the rise of Lysenko within the Stalin ideological framework fit into this view.[16] While Stalin hated Muller's book, it was praised in at least a dozen reviews outside of the Soviet Union in other European countries (Paul 1984). The LNT concept was important to Muller not only to protect the genome but also to create a technological means to improve it, again serving the broader goals of his eugenics perspective. Improving the genetic health of the population was the central focus of Muller, with all other factors being integrated to support it. Muller wanted intelligent and well-meaning leaders to direct the future of human evolution, finally putting aside

the Darwinian "natural selection" principle for humans, strongly believing that human intelligence, even though often affected by politics, power issues, and biases, would be better than a ruthless and demanding evolution based on natural selection processes.

Sweden, a eugenics culture and the Nobel Prize

While numerous countries show a unique eugenics history, being led by different scientific and societal organizations, government or otherwise, there is a striking similarity concerning their origins, development, societal activities, laws, and eventual decline. These developments have been documented most notably, in Sweden, Norway, Finland, Germany, the UK, France, and the United States (Krimbas 2001). However, of particular relevance to the present paper is the evolution of the eugenics concept in Sweden since it is the home of the Nobel Prize. Bjorkman and Widmalm (2010) have detailed the historical foundations of eugenics in Sweden, its scientific foundations as well as political and cultural leadership and their dynamic interactions. These analyses provide insight into how Swedish eugenics activities were initiated and subsequently institutionalized via the use of carefully designed media strategies and governmental lobbying showing insightful strategic planning. These processes led to the creation of a vast professional network that affected critical aspects of society and the implementation of eugenic activities.

The human eugenics movement in Sweden grew out of the application of Mendelian genetics in plant breeding, especially led by Professor Herman Nilsson-Ehle (1873–1949), a right-wing conservative, who became a major advocate of eugenics (Bjorkman and Widmalm 2010). By 1910, the Mendelian Society was created with Nilsson-Ehle being the first chairman of the Society where eugenics became a prominent topic. One year earlier (1909), the Swedish Society for Racial Hygiene was created. It viewed Mendelian genetics as a sound foundation upon which to develop the eugenics concept. The goal of the Society for Racial Hygiene was to affect public policy and public opinion independent of political persuasion. This society supported strategies that enhanced the reproductive potential of the more "fit" elements of the population while minimizing reproductive production among those with "undesirable" traits, with the latter being the target of national sterilization programs. In addition, the Swedish Eugenics Association was created in 1910, again reflecting the strong interest in eugenics at the start of the twentieth century. According to Bjorkman and Widmalm (2010), the Swedish eugenics network has been historically important, with a close relationship with those individual leaders of the German eugenics movement that would share Nazi biopolitics.

Similar ideas were promoted in other countries such as the U.S. during the 1920s by academic leaders in the genetics area such as Castle at Harvard, Conklin at Princeton, Morgan at Columbia, and Jordan at Stanford (Allen 1983). Allen (1983) emphasized the advance in 1905 by Karl Landsteiner[17] who discovered that the A-B-O blood group was inherited by Mendelian principles giving considerable confidence that these biological principles were generally applicable across the full biological kingdom from plants to humans (Allen 1983).

Several professional society members were academic leaders in Sweden such as Johann Hultzkrantz, a physician and professor at Uppsala University (Bjorkman and Widmalm 2010), and Frithiol Lennmalm, physician, the chair of neurology for thirty years, President of the Karolinska Institute for six years and a member of the Nobel Committee for Medicine. In fact, under the leadership of Lennmalm, multiple efforts were made to create a eugenics Nobel Research Institute in Sweden starting in 1916, seeking out the necessary political, scientific, medical, and financial support. After several preliminary attempts in 1919, plans to create such a eugenics Nobel Institute nearly met with success, failing by one vote among the professional staff of the Institute due to financial limitations. The supporters quickly refocused their goals, replacing the eugenics Nobel Research Institute concept at the Karolinska Institute with that of a new governmental institute. The net result was the creation of an Institute for Racial Biology that began on January 1, 1922, with Herman Lundborg (1868–1943), the former student of Lennmalm being appointed as its director. The board of directors included a group of prominent supporters, including Lennmalm, Nilsson-Ehle, Hultkrantz, and Hofsten,[18] each a strong proponent of medical eugenics. The eugenics vision of Lundborg would become the official scientific eugenics vision in Sweden. He was a dynamic leader who attempted to transform the culture of Sweden to adopt a eugenics framework guiding multiple aspects of society, including government, academia, and medicine. Lundborg was the director of the state institute from 1922 to 1935. It was the only race biology establishment in the world that had been

created and funded by a national government. It would serve as a model for The Kaiser Wilhelm Institute for Anthropology, Human Genetics, and Eugenics founded in Berlin five years later in 1927, intentionally opening on the last day of the Fifth International Congress where Muller made his Nobel Prize data presentation to showcase it to the many attendees. Charles Davenport, the director of the Carnegie Institute's eugenics program was the chair of the human eugenics section of the Congress, being an Honorary President of the Congress (Black 2012). In 1935, Gunnar Dahlberg, who would nominate Muller twice for the Nobel Prize, replaced Lundborg. Dahlberg started his career as Lundberg's assistant within the Institute for Racial Biology. Four years after replacing Lundborg, Dahlberg would sign the Eugenics Manifesto drafted by Muller.

This section returns to Lundborg who coauthored a book with the well-known Swedish scientist, John Runnstrom (1888–1971). The book is entitled: *The Swedish Nation in Word and Picture: Together with Short Summaries of the Contributions Mades by Swedes Within the Fields of Anthropology, Race-biology, Genetics and Eugenics*. The book was said to have been given out with the Cooperation of Experts Commissioned by the Swedish Society for Race-hygiene (Lundborg and Runnstrom 1921).[19] Runnstrom served on the Nobel Prize Committee in 1932 and evaluated the recommendations from the Vogts that Muller receive the Nobel Prize. According to Rannar Bjork (July 2024 letter to E.J. Calabrese), Runnstrom recommended that Morgan and Muller share the prize. In contrast, Folke Henschen, another reviewer, favored Morgan. Morgan, of course, received the award the next year. Of particular relevance to the present paper is that Runnstrom had a strong eugenics focus and had coauthored the above book with the right-wing eugenics ideologue, Lundborg. This vignette into the 1932 Nobel Prize deliberations shows that the Committee had at least two strongly committed right-wing eugenics researchers.

In 1940, Arne Muntzing along with Henschen served on the Nobel Prize Committee (Bjork 2024, letter to EJ Calabrese). Muntzing had a strongly directed eugenics focus, being recruited to become part of the research team of Nilsson-Ehle, relatively early in his career. Nilsson-Ehle, who had built a powerful and large academic research program, retired in 1937, only after ensuring that Muntzing would succeed him as the chair of the genetics department (Höglund and Bengtsson 2014). An influential genetics textbook by Muntzing that went through ten editions in multiple languages, had a strong eugenics emphasis, especially in earlier editions (Saura 2020). Again, one finds that the Nobel Prize Committees that evaluated Muller had members who were very strongly and positively eugenics-oriented.

Discussion

How Muller got the Nobel Prize: Henschen reveals the story

This paper shows that it was the interaction with Henschen that would be the deciding factor that led to Muller receiving the Nobel Prize. After working with Muller in the context of the Morgan nomination and evaluation for the Nobel Prize while at the Vogts in Berlin and in Stockholm in 1933, Henschen (1957) wrote in his autobiography:

> Then I made-up my mind that Muller would also receive a Nobel Prize for his induced mutations, but things went slowly. Year after year I contacted Scandinavian and foreign researchers to submit nominations for Muller's prize, but to no avail. How often I stood alone in the committee. The members disagreed with the stubborn soldier they thought I was. Haggqvist[20] had his misgivings. But persistence prevailed. It finally worked.[21] It was the last year that I was on the committee and the vote was unanimous. When I was offered to speak for Muller at the ceremony in the Concert Hall, I stated that I would end my long association with the Nobel Prize awards with such a speech. I refer now to the fact that we had a professor of cell research and genetics Caspersson, and that I was delighted for him to appear in the award ceremony. I have now left being part of the medical Nobel prizes, pleased that my long-standing efforts advanced Muller to a well-deserved Nobel Prize which was also closely connected with Morgan's award.

Muller's Nobel Prize: A front for the promotion of eugenics

The comments of Henschen show that getting Muller the Nobel Prize was his mission, a goal to be achieved. Being a long time Nobel Prize insider and now Chair, he knew it was necessary to promote his candidate.[22] Thus, Henschen took it upon himself to contact people who were prominent and who could strongly support Muller. Henschen targeted those with a strong eugenics focus, all of whom lacked the relevant scientific experience to critically evaluate the Muller findings. The nomination of Muller for the Nobel Prize was not because of the legitimacy of his research for the award. The key interpretation of

Muller's (1927) paper that he had induced gene mutation had been significantly weakened by numerous investigators during the 1930s and 1940s and Muller's inability during this time to provide support for his reverse mutation hypothesis was a significant issue (Lefevre 1949, 1950; Herskowitz 1946, 1951). Muller had come to doubt his gene mutation interpretation by the mid-1930s based on the series of non-supportive studies published by others who were challenging his perspective (Carlson 1981).

There was also the striking failure of George Snell to find radiation-induced mutation in a mouse model using the same study design and dosing scheme as Muller while working as a postdoc in Muller's laboratory (see below) (Calabrese and Selby 2024). Muller would eventually admit that his transgenerational phenotypic changes were overwhelmingly due to gene deletion. This admission was made in writing, but only after receiving the Nobel Prize (Muller 1956). Thus, despite the international acclaim following the publication of his *Science* 1927 paper that contained no data, and no proof of gene mutation, no nominations for the Nobel Prize for Muller were made by those who knew his research best, that is, the members of the radiation genetics community. After years of failure to secure spontaneous Muller nominations (1933–1938), Henschen became an activist Chair on Muller's behalf, soliciting nominations from a diverse range of scientists who had one major feature in common with each other, as well as with Muller and the Nobel Prize Committee, that is, they were actively involved in promoting eugenics. Given this set of circumstances, it is proposed that the nomination of Muller for the Nobel Prize acted as a front for the promotion of eugenics. The actions of Henschen were similar to a journal editor who intentionally selects reviewers who are extremely likely to be supportive of a paper for publication. It was a stacked jury. The comments of Henschen indicate that this was most likely Muller's last chance, especially with his pending retirement. None of the nine nominators of Muller (1932–1946) cited his key 1927 *Science* paper on radiation-induced gene mutation during the previous 19 years, nor were any of the nominators technically knowledgeable about radiation genetics and how to induce mutations.

The Muller-Snell negative mutation data suppression: Nobel Prize implications

Despite the support that Muller received from Henschen, the RF, and his loyal fellow nominator eugenicists, the path that led to the eventual Nobel Prize had an important, and, perhaps a crucial twist, that may have ended Muller's quest for the Nobel Prize (Calabrese and Selby 2024). It is a story of how Muller acted to suppress negative X-ray data on germ cell mutations, manipulating and misleading the field to enhance his chances for the big prize. George Snell, a post doc in Muller's lab (1931 to 1933), failed to induce gene mutation in mice following the same protocol as Muller, showing only massive chromosomal damage.

Of significance is that these major findings of Snell (1935) were strikingly suppressed in his (i.e., Snell's) paper. Of considerable further importance is that Muller never cited the findings of Snell during his entire career. Likewise, Snell also never cited the famous 1927 paper of Muller (Calabrese and Selby 2024). Yet, the Snell research was entirely motivated by it and based upon it. It was the reason that Snell left his faculty position at Brown University as he wanted to determine whether the exciting findings of Muller could be extended to a more human-relevant model. He was excited to learn that Muller was thinking along the same lines, as Muller was indeed planning for such a critical test (Calabrese and Selby 2024). Muller had already set up a mouse facility, with many hundreds of cages and mice. Muller excitedly welcomed Snell, a Harvard-trained mouse geneticist, to take the lead on this big test, under his direction. Yet what happened to the findings and the excitement?

This act of scientific "suppression" involving both Muller and Snell effectively resulted in these major negative findings having almost no penetration within the scientific community. If such negative findings with a mammalian model had been known by Folke Henschen, the other members of the Nobel Prize committee, and the nominators of Muller, how would it have affected his path to the Nobel Prize? Henschen (1957) acknowledged that Muller failed to get nominations until he found it necessary to solicit them. This situation suggests that Muller had a significant incentive and role in keeping these important negative findings from Henschen, the RF, and the entire field. Failure to replicate the original findings of Muller in a mammalian model by a well-trained researcher working under his direction and in his laboratory was an issue that needed to be known, acknowledged, and assessed (Calabrese and Selby 2024). Yet, the suppression strategy of Muller was successful, essentially resulting in the findings of Snell having no impact on the field. Snell would leave the field of radiation genetics and redirect his research to immunogenetics

where he won the Nobel Prize in 1980, keeping silent on this episode, yet still showing his enormous talents (Calabrese and Selby 2024).

Muller was aware of the Snell findings when he first met the Vogts, Timofeef-Ressovsky, and Henschen at the Vogt Research Institute in Berlin in late 1932. One may wonder how excited Henschen would have been about the worthiness of a Muller nomination for a Nobel Prize had he known what Muller knew about the Snell findings. One may also wonder what Henschen would have done if he learned that Muller had not been open with him about these findings.

Snell (1935) reported that the effects of such high doses of radiation were seen at the level of chromosomal damage but not at the level of point mutation as Muller had asserted. The Snell findings therefore were likely to have been critical in any deliberation concerning the biomedical significance of the Muller research. This insight into the Muller/Snell episode shows the dynamic interaction that occurred between Henschen and Muller and how the circumstance was manipulated to Muller's advantage. Muller was so successful in his suppression strategy that the findings of Snell were missed by the entire field, with Snell also distancing himself from these findings, possibly to avoid conflict with Muller, who was well known for his capacity to inflict professional retribution (e.g., the case of James Neel; Calabrese 2020).

The demise of eugenics

The demise of the eugenics movement was one of the consequences of the defeat of Nazi Germany in World War II. Even though the concept was still alive, with leaders such as Hermann Muller aggressively advocating a more scientific, and non-racial view, the concept had become politically and socially fatally damaged, with the academic offspring of the "Mullerian" generation, turning a progressively deafer ear to the message of their prestigious University mentors. These academic offspring were quickly, yet quietly, trying to get some distance from their accomplished and often famous mentors and their views since they did not want their careers to be affected by this 'racist'-driven scientific dogma, a career killer, that was central to the beliefs and actions of their academic heroes (Ramdsen 2009). For example, the memory of some beloved geneticists of the Muller era and culture, such as James Crow, University of Wisconsin, a true Mullerian devotee, received significant criticism related to his many publications in the *Eugenics Quarterly* in the 1950s and 1960s when the University proposed an institute on evolution in his honor (Felsenstein 2012). Similar attacks were directed at the extraordinary biostatistician R.A. Fisher, stripping his once-honored name from several awards and dedications (Tarran 2020; Bodmer et al. 2021). Recently, Cal Tech removed the name of Robert Millikan, a former Cal Tech President and Nobel Prize recipient from their library, a professorship, and other notable academic accolades over his association with the eugenics movement about 90 years ago. This was also the case at nearby Pomona College which stripped the beleaguered memory of Millikan from their library as well (Hales 2024).

The fact that the visibility of the eugenics concept has dramatically fallen over the past ~80 years, now being only the serious purview of historians of science, has led to the impression within the scientific community that this concept was never of critical importance, but an aberration, even for those of the Muller era, who gave society its fundamental hereditary and cancer risk assessment framework. Yet, eugenics was a dominant perspective within the genetics community and many applied aspects of medicine (e.g., genetic psychiatry, a range of neurodegenerative diseases, such as schizophrenia) for the first half of the twentieth century, shaping and directing scientific and social policies (Allen 1983, 1986).

The central theme of the present paper is that the Nobel Prize for Muller was not about his so-called "discovery" of producing gene mutations. It was used as a vehicle to promote eugenics, associating it with Muller, a world-renowned researcher. The Nobel Prize was used as a manipulative advertising gimmick which was cleverly linked to Muller's story of having been a radicalized scientist who had been duped by the ideology and vision of Joseph Stalin, but now this brilliant scientist was on a mission to save humanity via the intelligent guidance of human evolution that would lead to a humanistically motivated earthly "promised land." However, the irony of having received the Nobel Prize in 1946 was that it was only a year after the demise of the Nazis in World War II. Awarding Muller the Nobel Prize at that time, in retrospect, was an act that combined both poor timing and desperation, as the eugenics concept would soon go into a freefall, but a fall with the potential to cause career-altering peripheral damage as seen with some of the major luminaries.

While eugenics was taking its deep and prolonged dive, the concept of environmental health, including hereditary and cancer risk assessment, was on the

ascendancy but still in need of a simple, but scientifically viable platform. The answer was found in awarding Muller the Nobel Prize, which soon became the central feature of the environmental/public health/regulatory science movement, providing the necessary strategic vision and one with numerous applications.

Thus, Muller's long reach was far more complex than previously believed. In the case of his main goal and those of his nominators, his reach as seen with the demise of eugenics, became rapidly truncated and abortive, in fact, a major failure (Paul 1987). But his research, despite its limitations, soon became "visionary," molded and applied to the environmental movement, being a major inspiration for the Rachel Carson (1962) book, *Silent Spring*, with Muller, and his mutation "claims" and his Proportionality Rule/LNT concept becoming the foundation for cancer risk assessment, starting with the US Environmental Protection Agency (EPA) and then, ironically, spreading like a metastasizing cancer to the rest of the world (Albert 1994).

The failure to recognize the historical foundations that drove the awarding of the Noble Prize to Muller prevented the scientific community and society from recognizing that the award to Muller was a tactic to manipulate the world community to adopt a transformative social engineering eugenics concept, by powerful governmental and wealthy grant funding social engineers at the RF, Carnegie Foundation, and other such organizations. Further enhancing this ideological "take over" of the Nobel Prize for a social engineering concept is that it also compelled its followers to exaggerate the scientific quality of Muller's research, while failing to acknowledge its limitations as have now been documented and as seen in the ceremonial speech of Caspersson (1946) for the Muller award.

This ideological takeover philosophy was quickly, yet quietly, adopted by the leadership of the modern environmental movement and their political and governmental enablers, such as the US EPA, to use the same flawed science of Muller that was intended to bolster the eugenics movement to become the central principle of the environmental precautionary principle (Calabrese 2024). In an odd but striking parallel fashion, the eugenics concept, like the environmental movement, was based on a "precautionary principle."[23] The eugenics goal was predominantly driven by a desire to quickly prevent targeted groups from reproducing even without a well-founded understanding of the genetic foundations of the diseases in question and their environmental influences. In pursuit of rapid policy change, the environmental movement has followed a similar ideological path and applied the fear-based precautionary principle, leading often to crippling and irrational societal decisions that have a history of failing to protect, enhancing harm, and being enormously costly (Calabrese 2024).

Eugenics, the Rockefeller Foundation, and Muller: Seeing the big picture

The support of Muller for the Nobel Prize is seen here as a tactic in a much larger scheme to advance a massive geopolitical narrative/initiative of social engineering to guide no less than the future course of human evolution. Huxley's (1936) Galton Lecture, as presented to the Eugenics Education Society (February 1936) which displayed the "enlightened" (i.e., reformed), not racial eugenics framework, stated that the goal of eugenics is "to control the evolution of the human species and guide it in a desirable direction." The plan is a breathtaking one, far bigger than campaigns against cancer, Alzheimer's Disease, hunger, human rights, and other profoundly important goals. These goals were subservient to the control of human evolution. Within this broad context, it can be seen why Muller received support from strange bedfellows, that is, far left- and far right-wing eugenicists who were asked to nominate Muller for the Nobel Prize.

The theme of the present paper suggests an answer to the question of why the RF offered major financial support for Muller through the many ups and downs of his professional career as well as their efforts to secure for him an appropriate professorship over many years. Their efforts were finally successful with his appointment at the University of Indiana, where their "silent" influence was substantial, being helped by Frederick B. Hanson, his long-term RF grants manager (Carlson 1981).

According to Paul (1987, 1988, 1991), by 1933 the RF established an integrated plan to understand, control, and direct human behavior, with a focus on the eugenic target of "mentality and temperament," which would morph into the term behavior genetics. Within this context, the RF provided grants to Oskar and Cecile Vogt's Institute for Brain Research in Berlin (Paul 1991). As shown in this paper, the Vogts directed and integrated their research within an ostensible eugenics framework. Likewise, at the start of the 1930s, the RF funded eugenics projects at the Pathological Institute of Copenhagen which was under the leadership of Oluf Thomsen (Saura 2020), who had a strong eugenics focus. Thomsen's student, Tage

Kemp, was the recipient of two RF fellowships, with one enabling him to study with the U.S. leading eugenicist, Charles Davenport, at Cold Spring Harbor. Kemp also received a grant from the RF to research the genetics of psychopathology. In 1936 the RF donated $90,000 toward the creation of an Institute of Human Genetics as directed by Kemp at the University of Copenhagen. The institute was intended to assess the heritability of mental traits and to provide genetic counseling explicitly within a eugenics framework. Since 1933, Kemp established a strong publication record in diverse eugenic topics. He likewise defended the Danish Sterilization Act of 1929. In October 1938 the RF created the Institute of Human Genetics at the University of Copenhagen with Kemp as the director (Roll-Hansen 2005). Following World War II, Kemp was a professor of Human Genetics and Eugenics at the University of Copenhagen. With the support of the RF, he chaired the first International Congress on Human Genetics in Copenhagen. In 1957 he continued to support strategies to prevent hereditary diseases such as mental disabilities and feeble-mindedness (Roll-Hansen 2005). The RF also funded the eugenic activities of Eugen Fischer (1874–1967) from 1930 to 1935 to "provide a means of finding a scientific basis to study the racial or biological composition of the German people and of the interaction of biological and social factors in determining the characters of the present people" (Paul 1991). In 1927 he became the director of the Kaiser Wilhelm Institute of Anthropology, Human Heredity, and Eugenics. Later he was appointed by Hitler to be the Rector of Humboldt University. Likewise, the RF provided funding for eugenic projects under the direction the Ernst Rudin, an author of the German sterilization law even after Hitler came into power (Paul 1991).

The RF also became interested in non-human-oriented eugenics research which was driven by academics in universities conducting experimental research. For example, Alfred H. Sturtevant, in his 1954 presidential address to the Pacific division of the American Association for the Advancement of Science (AAAS) stated that "man is one of the most unsatisfactory of all organisms for genetic study." He stated that there are sufficient examples that show that the same principles occur in humans and higher animals. Most of the evidence concerning practical features of human genetics is best based on experimental research via organisms rather than from human studies. He went on to state that human research is especially unsatisfactory for the most important of all human differences, namely mental capabilities. Once this perspective was recognized by the RF efforts were made to work with Clarence C. Little at the Jackson Laboratory to put this eugenics framework into experimental practice resulting in a 13-year study starting in the mid-1940s using five dog breeds to evaluate the role of genetics in the development of intelligence and temperament, ending in 1956 (Paul 1991), just as the National Academy of Sciences (NAS) Biological Effects of Atomic Radiation (BEAR) 1 Genetics Panel, on which Little was a member, was getting started.

The vast support of various eugenic efforts among the American elite or otherwise is consistent with this view. The RF was not alone in its efforts to promote eugenics, as the Carnegie Foundation had established a major eugenics research center at the Cold Spring Harbor in the US starting in 1910 under the direction of Charles B. Davenport, the most prominent eugenicist in the US before the emergence of Muller (Allen 1986). The RF simply internationalized their eugenic efforts, targeting multiple leading countries and various scientific leaders, with Muller being far from unique, again, simply one of a range of "investments" in their vision to influence the future evolution of humanity. The RF would also even go so far as to fund eugenics at a medical department in Germany in the area of psychiatric genetics, under the leadership of the Nazi government (Weintraub 2012). Thus, it is also not surprising that John D. Rockefeller Jr., who led the RF since 1897, had a major interest in eugenics, in general, especially in the area of population control. He would become a member of the American Eugenics Society and a trustee of the Bureau of Social Hygiene (Weintraub 2012). He would write to Charles Davenport, the director of the Carnegie-funded Eugenics Records Office, stating that prison sentences for weak-minded women would have eugenic value if these women "would … .be kept from perpetuating their kind … … until after the period of childbearing had passed" (Weintraub 2012).[24] According to Sachse (2009), since eugenics had been considered a viable science during that time, it was easy for the RF to support organizations and individuals that fit into this scheme, enter Muller.

It is argued here that the RF identified Muller as a unique, if troubled and hard to control,[25] talent. Over time, the RF and Muller would become more interdependent. The self-destructive actions of Muller at the University of Texas, which led to his giving up a tenured full professorship (Calabrese 2024; Calabrese et al. Forthcoming), and his support

for Stalin and the Soviet Union came very close to destroying his career. However, the RF intervened to protect the self-destructive Muller as best it could. The RF tried to convince various universities to hire Muller by pledging to pay his salary and research costs. Muller was also hand-picked by the RF to serve on the US NAS Genetics Panel which led to the acceptance of the LNT for cancer assessment (Calabrese 2019b). The Chairman of the NAS Genetics Panel was Warren Weaver, the long-time research director of the RF. In retrospect, the placement of Weaver, a non-geneticist to manage/direct this Panel, may well have been done, at least in part, to protect their investment in Muller, who was doing his best to challenge and alienate the US Atomic Energy Commission (AEC), so much so that they prevented him from speaking at the first Atoms for Peace Conference in Geneva, a decision that they would eventually regret (Calabrese 2019b, 2024).

In retrospect, this was simply just another manifestation of the RF using Muller to promote its eugenic goals within a major geopolitical scheme to direct evolution. Muller seems to have understood the big picture within which he was being simultaneously manipulated, protected, and promoted by the RF. These actions were also part of the process that eventually would both control and promote Muller and his ideas including the framework of cultural and scientific support for his Nobel Prize nomination and then to promote his ideas after the award. The receipt of the Nobel Prize by Muller was also a major achievement for the RF that supported him for two decades and in rather desperate times and circumstances. Hermann Muller had now achieved worldwide status and could be managed as long as the RF provided him and his university with adequate funding. Of further significance is that the RF, via the leadership of Warren Weaver, was also funding the Karolinska Institute, including the research of Einar Hammarsten and Torbjorn Caspersson, members of the Nobel Prize Committee, who would make positive judgments on Muller. Thus, Muller, Hammarsten, and Caspersson had substantial funding from the RF with the same grant manager at the time of his receipt of the Nobel Prize (Rockefeller Foundation 1945).

Muller realized his dependence on the RF. The authors previously reported that Muller had discovered serious scientific misconduct in a series of papers coauthored by Frederick Hanson, who had been serving as his RF grants manager from about 1935 onward until his death a decade later, and who intervened at the University of Indiana for his professor position (Calabrese and Giordano 2023). Despite the seriousness of the possible charges involving Hanson, Muller would not proceed to publicly challenge/correct the scientific record and expose the misconduct to ensure that his funding would not be affected (Calabrese and Giordano 2023).

Conclusion

The present paper places Muller and his Nobel Prize in a new historical light. This paper argues that the Nobel Prize that Muller received was principally a front to promote the legitimacy, acceptance, and applications of eugenics. This perspective is supported by an analysis of the Nobel Prize nomination process that targeted eugenicists to nominate Muller, all within the framework of a powerful eugenics-supporting Nobel Prize Committee chair whose principal goal was to find a way to get Muller the prize. These actions were independently complemented and supported by a several-decade effort of the RF to promote the career of Muller and many others whose goals were in close agreement with their intention to guide the direction and rate of human evolution within a scientifically guided and "enlightened" eugenics framework. These efforts were part of a major ideologically driven scheme to associate prominent scientists, such as Nobel Prize winners, with their key policy objective, the control of human evolution. The RF investment in Muller lasted until the end of his life with his last paper promoting eugenics, being published nearly one year following his death (Muller 1968).

Acknowledgments

The first author acknowledges longtime support from the US Air Force (AFOSR FA9550-19-1-0413) and ExxonMobil Foundation (S18200000000256). The U.S. Government is authorized to reproduce and distribute for governmental purposes notwithstanding any copyright notation thereon. The views and conclusions contained herein are those of the author and should not be interpreted as necessarily representing policies or endorsement, either expressed or implied. Sponsors had no involvement in study design, collection, analysis, interpretation, writing, and deciding to and where to submit for publication consideration.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes

1. Roll-Hansen (1999) defined eugenics as a "social policy aimed to improve the genetic makeup of a human population." The types of eugenics were identified as both positive and negative strategies. Positive eugenics focused on enhancing the genetic quality by selection/introduction of genes thought advantageous. Negative eugenics tries to prevent the transmission of genes thought to be undesirable. For those interested in an in-depth historical assessment of eugenics see Edwin Black's War Against the Weak, Dialog Press.
2. Note that the highly regarded geneticist, Sewall Wright, who would later serve as a member of the NAS BEAR I Genetics Panel with Muller, also spoke at this same conference (Gormley 2006).
3. Muller exposed the fruit flies in his Nobel Prize research to a dose rate of radiation that was 100 million-fold greater than background exposures. At such exposure levels, the X-rays would have induced a plethora of biological effects, damaging various cellular organelles, causing massive cellular inflammation and other damage beyond the genetic effects he was focused on (Calabrese 2019a).
4. Oskar Vogt invited Nikolai Timofeeff-Ressovsky, a 25-year-old without an undergraduate degree, to work with him at the Kaiser Wilhelm Institute in 1925 (Paul and Krimbas 1992). He would later become the director of a new department dealing with radiation genetics. Vogt became interested in Timofeeff-Ressovsky on a trip to the Soviet Union (1924) to study the brain of Lenin. Vogt learned that he had found a mutation in fruit flies that resulted in highly variable deformations in the wings of the fruit fly. During that time period Vogt was attempting to figure out why certain hereditary neurological disorders vary greatly in frequency and severity. Thus, the findings that a single type of mutation could produce many different wing morphologies captured Vogt's interest and led to the hiring of Timofeeff-Ressovsky.

   This would prove to be a major breakthrough for Muller for the eventual Nobel Prize. The Vogts had a long standing and close relationship with Folke Henschen, who was a member of the Nobel Prize committee. In 1932/1933 Muller would study with Timofeeff-Ressovsky and get to know quite well professionally and socially the Vogts and Henschen who were there at the same time. This was the connection that Muller so desperately needed to get linked with the Nobel Prize, as it led to his first nominations for the Nobel Prize in 1932 by the Vogts. It also resulted in developing a close relationship with Henschen, who adopted Muller's cause as his own for the Nobel Prize, becoming his strong and continuous advocate (Henschen 1957).
5. The book entitled Nobel Prizes and Life Sciences by Erling Norrby (2010) provides information of how the Nobel Prize nomination, evaluation and voting process operates and how it has evolved over time.
6. There were three Kaiser Wilhelm Institutes in Germany devoted to eugenics. These include those addressing psychiatry (directed by Rudin), Anthropology, Human Genetics and Eugenics (directed by Fischer) and Brain Research (directed by Vogt). Each became integrated with the Kasiser Wilhelm Institute during the late 1920s, with each receiving substantial funding from the Rockefeller Foundation (RF) from the late 1920 until the mid to late 1930s when the Nazi activities forced the RF to develop alternative funding strategies (Black 2012). The funding served multiple purposes, including research facility construction, research project support, and fellowships/travel.
7. *The Eugenics Review* was started in 1909 and continued through 1968 and was the official organ of the Eugenics Society of England. The journal was then renamed as the *Journal of Biosocial Sciences* and it continues as such to the present. The new journal website curiously states: "the Society encapsulated the rise and fall of the eugenics movement by stating that 'the initial drive behind it, as behind the Society, came from those concerned with social evils, rather than with human biology. This orientation was understandable in the context of 1909 when social evils were obvious to all, but knowledge of human genetics was rudimentary and human cytogenetics was unknown. The overall result was that in those early days the eugenic ideals of the few vastly outran knowledge and both outran the motivation of the many.' [emphasis in original]".

   The *Eugenics Quarterly* was the journal of the American Eugenics Society and existed from 1954 to 1968; It was preceded by *Eugenical News* which was published from 1916 through 1954, when it was replaced by the *Quarterly*. The *Quarterly* was then replaced by the journal *Social Biology* (1969–2007) and this was superseded by *Biodemography and Social Biology* (2008–present). It is quite clear that the researchers in the historical area of human eugenics wanted to distance themselves from this academic and cultural stigma of the eugenics concept and term.

   In 1920 the Eugenics Research Association planned a *Journal of Eugenics*, about 400 pages/year. In August of that year the publication *Eugenical News* was acquired from the Eugenics Records Office with the idea of using it as a temporary bulletin until the *Journal of Eugenics* was ready for publication. However, the journal was never published. The *Eugenical News* was the official organ of the Eugenics Research Association until that organization was discontinued in 1938. *Eugenical News* was first published in January 1916 by the Eugenics Record Office at Cold Spring Harbor and edited by Charles B. Davenport and H. H. Laughlin. It was first announced as a bimonthly periodical which would be the medium of intercommunication between eugenicists and a

general eugenics newspaper. The reception of that new magazine by interested readers encouraged Davenport and Laughlin to change to a monthly in 1916. It was changed to a quarterly when the American Eugenics Society became owner in 1939. The name of the publication was changed to *Eugenics Quarterly*. The *Eugenics Quarterly* was a popular publication vehicle for the radiation geneticist members of the NAS BEAR I Genetics Panel, including Beadle, Crow, Muller, Neel and others in the 1950s and 1960s.

8. Gunnar Dalberg and Otto Mohr nominated Muller twice for the Nobel Prize.
9. In 1912 Huxley was hired to lead the Department of Biology at the newly created Rice Institute (i.e., later to be named Rice University) in Houston, Texas. As preparation for this position Huxley visited the US in September 1912, visiting a number of leading universities, including Morgan at Columbia. During this visit Huxley recruited Muller to be his deputy. Muller would move to Texas for the 1915–1916 academic year. At Rice, Muller taught biology and continued *Drosophila* lab work. Huxley was a strong supporter of eugenics and would eventually become the Vice President of the British Eugenics Society from 1937 to 1944 and its President from 1959 to 1962. Huxley was a strong supporter of both positive and negative eugenic strategies and their respective tactics (e.g., sperm banks, voluntary sterilization, birth control, counseling to affect reproduction choices) depending upon the country and culture (Deese 2011).
10. The characterization of the political ideology of some of the nominators and evaluators of Muller is based on consistent views offered by multiple historians of science (e.g., Roll-Hansen 1999; Bjorkman 2016; Paul 1984).
11. Muller drafted the Eugenics Manifesto but it was authored in alphabetical order with Crew being listed as the first author.
12. Hermann Goring (1893–1946) was a famous German politician and a powerful Nazis, who was convicted as a war criminal. A childhood friend of Henschen married Goring leading to his association with Goring (Bjorkman 2016).
13. As Muller was reaching the end of his active academic leadership, he became strikingly active in the area of eugenics leadership. In the late 1950s and early 1960s he made numerous presentations on eugenics at conferences including as a partial listing: Future of Man Symposium (September 1959, New York City), the Darwin Centennial Conference (November 1959, Chicago), the Minnesota Human Genetics League (September 1960, Minneapolis), the Academy of Art and Science conferences (September to December 1960, Boston) (Crowe 2006).
14. The genius sperm bank dream of Muller would become a reality in 1980, being initially named after Muller. (Hermann J. Muller Repository for Germinal Choice). The activity was shut down in 1999, two years after the death of Graham.
15. Stalin would condemn the eugenics vision of Muller, at least in part, seeing it as an insult to soviet womanhood (Ardagh 1962).
16. Rudling (2014) provides a detailed assessment of the development of the eugenics movement in the Soviet Union. By the late 1920s, leading academic eugenicists were denounced by Soviet authorities, linked to fascist activities and relieved of faculty positions. Likewise, in 1930 the Russian Eugenics Society was terminated and its publications. Likewise, the eugenics efforts of Lundborg with Soviet scientists were also terminated by 1931. Thus, the fact that Stalin rejected the eugenics efforts of Muller was not unexpected.
17. Landsteiner was one of the nine scientists that nominated Muller for the Nobel Prize. While there is no evidence that has linked him with the eugenics movement his research was prominently displayed as providing strong support for it (Allen 1983). In fact, Henschen (1962) placed a picture of Landsteiner in his book on racial health and geography, showing how genetics can affect health and disease in humans. The Landsteiner discovery led to the creation of the Society for Blood Grouping Research in 1926. This organization had close ties with the Viennese Society for Racial Hygiene, that had a strong focus on the importance of blood groups to represent racial characteristics. Their activities then led to the creation of the Journal of Racial Physiology (Bernier 2010).
18. Nils von Hofsten was a central figure in the Swedish eugenics movement from 1910 to 1950. He was the principal government advisor and helped introduce sterilization laws of 1935 and 1941 (Roll-Hansen 1999, 2005).
19. This book contained separate chapters on eugenics by Lundborg, Hultkrantz, Nilsson-Ehle, Hofsten and others. This publication closely associated Runnstrom with a network of eugenics scholars and advocates.
20. Gosta Haggqvist, member of the Nobel Prize Committee, was also a board member of the Institute for Racial Biology, a strongly eugenics-oriented entity. In addition, he belonged to the Manhem Society and was a member of its scientific council. This organization framed their community on "hereditary identity (race) and ancient Swedish cultural foundations. While they claimed to desire greater understanding of non-Nordic people, the lectures from Gosta Haggqvist reflected a strong, racially-based eugenics framework.
21. Bjork (2024) has supported the autobiographical statements of Henschen (1957) showing that Muller had his support for the Nobel Prize on multiple years but fell just short of the Prize until 1946.
22. Henschen was a key figure in the awarding of Johannes Fibiger the 1926 Nobel Prize in Medicine/Physiology for being the first to reproducibly induce cancer in a rodent model in controlled experiments using nematodes. In 1923, Henschen nominated Fibiger, emphasizing the uniqueness of the findings. By 1926 Henschen had become a member of the Nobel Prize Committee. In a report to the Committee

he once again strongly supported the Fibiger research claiming that the discovery initiated a novel and significant area of research, being the most prominent supporter while effectively disputing opposing views. However, it was later shown that the findings of Fibiger were not reproducible (Hitchcock and Bell 1952), lacked a concurrent control and most likely fed the rats a vitamin A deficit diet which predisposed the rats to cellular changes that were misinterpreted by Fibinger as being cancerous (Stolt et al. 2004). The Fibinger example is instructive as it suggests that Henschen had a predisposition to draw hasty and non-supportive conclusions in areas outside his expertise. In 1933 Henschen would meet Muller and make a similar quick and incorrect conclusion that Muller had induced gene mutation with X-rays, leading him to become Muller's major advocate for the Nobel Prize.

23. In 2010, the EPA made a significant decision to abandon the threshold dose-response model in favor of a LNT model in assessing the risk of fine particulate matter ($PM_{2.5}$) (US EPA 2010). Given that $PM_{2.5}$ is not a carcinogen, this change was controversial and it contributed to enormous regulatory costs; the switch was justified by the need to protect highly sensitive individuals.

24. Rockefeller's scientific director, William Welch, a professor at Johns Hopkins University, also served on the Board of Scientific Directors of the Eugenics Research Office, facilitating the funding and direction of eugenics research. Welch would also be the President of the AAAS (1907) and the US National Academy of Sciences (1913–1916) (Black 2012). Thus, support for eugenics in the US reached the highest and most influential levels, creating a synergy between many philanthropic organizations, federal and state government entities, and elite academic scientific leadership. This was reflected in numerous leading US academic institutions (e.g., Harvard, Yale, U of Chicago, UCal/Berkeley) having formal courses on eugenics from about 1915–1940 and active research programs. Eugenics in the US during the first half of the 20th century was therefore very pervasive and internationally influential, long before the rise to power of the Nazis in the early 1930s (Black 2012).

25. Mililsav Demerec informed Frank Blair Hanson, Muller's grant manager at the RF, that "it would be impossible to place M. in a state institution in this country and that most privately endowed institutions would also reject him. His long residence in Russia and his widely known book on communism would militate against his acceptance here (Hanson, Dairy Excerpt, Sept. 25., 1939, 1.1 405. 4.45). An attempt was made by the RF to get Muller placed at Cold Spring Harbor where he would have considerable independence. However, this possibility ended when negotiations failed, mostly because the Carnegie trustees had great concerns with Muller's long standing political background and controversies (Paul 1988).

Funding

This work was supported by the Air Force Office of Scientific Research.

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