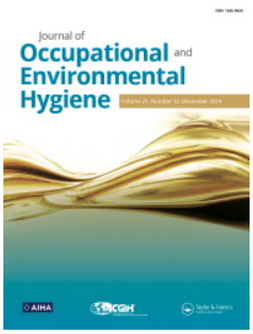

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COMMENT

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Professional improbity: How Hermann J. Muller's ethics affected his science

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ABSTRACT

The present paper provides an assessment of how the scientific and national policy achievements/goals of Hermann J. Muller were impacted by his ethics and provides several documented episodes in which Muller acted unethically to promote his personal gain—at the expense of others—within the scientific community. Muller manipulated the scientific community in self-serving ways to suppress perspectives that challenged his own views on radiation-induced gene mutation, and hereditary and cancer risk assessment in ways that influenced his significant awards (e.g., Nobel Prize in Medicine or Physiology), continued grant funding, and manifest effect on public health policy. Muller acted irresponsibly toward students and directed them to violate University of Texas policies that incurred severe student disciplinary actions (e.g., University suspension). Muller avoided responsibility by resigning from the University of Texas, avoiding a trial that could have led to his dismissal, and impacted his career achievements during the period of his nomination for the Nobel Prize. Muller was also a member of a US National Academy of Sciences Committee that committed scientific misconduct by misrepresenting the research record in ways that enhanced his continued funding support and fortified his influence on US health policy. The case of Muller is presented as a morality and object lesson worthy of consideration for current and future ethical conduct of scientific research.

KEYWORDS

Cancer risk assessment; linear dose response; LNT; misconduct; mutation; scientific integrity

Introduction

Hermann J. Muller holds a distinguished place in the scientific community. He became enormously famous by being the first to be honored for inducing gene mutations with radiation, receiving the Nobel Prize (1946) for this achievement. Muller is generally regarded as developing the concept of the linear nonthreshold (LNT) dose response, which was later adopted by the United States (US) and other countries for cancer risk assessment, and which remains the regnant model of radiation-induced cancer risk assessment (Calabrese 2009, 2013, 2015, 2017, 2018, 2019a, 2022a, 2022b, 2024). In many respects, Muller was one of the most influential scientists of the twentieth century, whose work had broad influence within the global scientific, political, and public spheres. He was described by Julian Huxley as the "world's greatest living geneticist" and is considered "one of the most prestigious scientists ever to serve on the University's faculty" (i.e., University of Texas at Austin) (Dettmer 2012).

Despite such successes, the Muller story has taken somewhat of a derogative turn, as it was revealed that he did not induce gene mutation, but rather only produced gaping holes in chromosomes, called gene deletions, which was not whatsoever a novel finding (Calabrese and Selby 2023a, 2023b, 2023c, 2024a, 2024b, 2024c). Muller conducted his Nobel Prize-winning experiments using a dose rate that exceeded background radiation by 100 million-fold, making his study of no practical environmental relevance (Calabrese 2019b). Muller also made the incorrect assumption that genetic damage repair did not occur, a position that led to the development of the LNT single-hit model of cancer risk assessment, absent a repair component; it became the default model in cancer risk assessment and continues to be employed by regulatory agencies worldwide (Calabrese et al. 2022). Muller directed the US National Academy of Sciences (NAS) Biological Effects of Atomic Radiation (BEAR) Genetics Panel not to assess a major study by the Atomic Bomb Casualty Committee that addressed the occurrence of

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mutations and birth defects of offspring of parents who were exposed to atomic bomb radiation in Hiroshima and Nagasaki, given that the findings were negative—a result that he called "delusional." Findings of no genetic effects, as reported in 75,000 offspring in 1956, remain, despite numerous improvements in methods of assessment and evaluation that yield ever-greater sensitivity, precision, and a wider range of (new) endpoints (Calabrese 2020).

While the story of Muller's scientific legacy is still evolving, it is important to consider how his endeavors reflected his (lack of) adherence to the virtue of honesty in science, without which the entire validity, veridicality, and ethical value of science—as an enterprise to inform and sustain knowledge and practices that can be leveraged with trust—are violated. In the course of investigating the Muller scientific legacy, the author's research has uncovered over a dozen instances that provide considerable insight into Muller's ethics. These episodes have been previously discussed in the peer-reviewed literature, but have been addressed as components of papers focusing upon other issues, and thus have not been presented in an integrated, unified thesis.

Toward such ends, the present paper offers newly obtained information on a critical and far-reaching episode in Muller's professional life in which he was accused of a series of ethical violations at the University of Texas at Austin (UT). This information was discovered as part of a deeper investigation into Muller's past, including information obtained from Federal Bureau of Investigation (FBI) files. The UT episode was briefly touched upon in the Muller biography by Carlson (1981). However, Carlson did not obtain information from the FBI due both to the challenges in obtaining them, as well as a recommendation/request by the Muller family that Carlson not further pursue this direction of inquiry.[1] The Muller-UT story will afford a more detailed view of Muller's professional ethical conflicts, to better understand how Muller's ethics impacted his scientific pursuits, assertions, and achievements, and how these apparent ethical improbities ultimately affected national and international policies and practices of hereditary radiation and cancer risk assessment.

Muller at the University of Texas: Underground student communist party activities

While a professor at the UT, Muller became a clandestine faculty sponsor for a highly controversial "underground" (i.e., illegal/not permitted on campus) newspaper of the National Student League (NSL), which sought to have their work distributed to several US universities. The FBI had decided that the NSL was a Communist Front Organization (Carlson 2011). Although Muller was aware that this paper would not be permitted at the UT campus, he strongly supported the students' cause, as he had been rather sympathetic to their philosophy and programs since his high school years, when his then best friend Edgar Altenberg[2] influenced him to adopt this political philosophy (Muller June 19, 1932a-letter to Barron). Muller knew (or at least should have known as a member of the UT faculty) that breaking the University rules concerning distributing this publication on campus could result in disciplinary action for students, which could include their suspension and expulsion. Nevertheless, Muller's apparent ideological commitment to the message of the paper may have been grounds for his knowingly directing the students' activities in ways that explicitly violated UT regulations.[3]

This newspaper was to be the first edition of a publication called "The Spark," a masthead title chosen to reflect that of a newspaper produced by Lenin during his time in exile in Switzerland (Carlson 1981). The UT students' version of "The Spark" was developed during the first months of 1932. It was Muller's goal to use the publication as a recruiting tool for the NSL. However, little did Muller know that he and his student group were being investigated by the FBI (Carlson 1981). According to Carlson (2011), Muller's final graduate student and biographer, Muller anonymously authored several of "The Spark" articles as well as was involved in editing the issue. He also got Altenburg involved by convincing him to distribute "The Spark" on his campus at Rice Institute (Carlson 2011).

On June 1, 1932, the first, and only issue, of "The Spark" was published. It contained a series of articles about worker exploitation, racism, poor living conditions in Austin, and other topics that might encourage college students to join their cause. Despite the attempted secrecy of Muller's participation with the NSL and the establishment, production, and distribution of "The Spark," his activities were reported to the University of Texas President, Harry Yandell Benedict (who served from 1927 to 1937) by the FBI. On June 23, 1932, Robert Lynn Batts (Batts 1932a), the chair of the UT Board of Trustees wrote to President Benedict stating that: "I do not see how we can keep from acting on this matter of 'The Spark' nor do I see how we

can escape trouble whatever form the action may take." He then informed Benedict that he created the following administrative resolution for the President's consideration:

> There has been circulated on the campus of the University a publication called "The Spark." It purports to be published by the "University of Texas Chapter, The National Student League." The publication is anonymous except as indicated. The officers and members of the league are not named in the publication. The membership of the league is secret- as are its proceedings. "The Spark" undertakes to inculcate a lack of respect for and opposition to established government and antagonism to the principles upon which American civilization is based. The inevitable effect of the dissemination of the views expressed in the manner indicated and by a secret organization will be discord and disorder and permanent injury to the University:
>
> In view of the recitals, RESOLVED
>
> 1. Members of The National Student League shall not be received into the University;
> 2. Any member of the National Student League matriculated, membership therein not having been disclosed, shall, upon discovery of the fact of membership, be excluded from the University;
> 3. Any student publishing, or aiding therein, or circulating or aiding in the circulation of anonymous publications shall have the privileges of the University withdrawn.

This resolution soon became approved policy at the University of Texas.[4] On July 12th of that year, a letter from Greene (1932) informed R.L. Batts that U.S. government immigration officials told him that they had been tracking foreign communist activities in the US and that there were definitive indications that involved student activities at UT. This letter mentioned that a high-profile communist organizer (i.e., Barron) was arrested in San Antonio, Texas, and had on him a letter addressed to him from Professor H.J. Muller dated June 19, 1932 (Muller 1932a). The letter commenced with the salutation, "Dear Comrade Barron," and provided a check (dated June 18th, 1932) from Muller's American National Bank of Austin, payable to the bearer, to support Party activities. In the same letter, Muller also mentioned a Comrade Offermann, his postdoctoral student, who at that time was on a trip to Houston to learn NSL activities, and Muller's plans to publish the next edition of "The Spark." Photographs of the letter and the bank check were provided to Batts. The Greene (1932) letter to Batts claimed "conclusively" that Muller was the "Daddy" of the movement at the university, and was, as faculty sponsor of the newspaper, encouraging students to hide their association with the publication. Thus, there was strong evidence that Muller was a central player in this activity and was directing efforts to circumvent (i.e., violate) University regulations.

On July 13, 1932, Batts (1932b) wrote to Edward Crane (who served on the UT Board of Regents from 1927 to 1933) concerning the fact that Muller had attempted suicide in early January of that year. In the letter, Batts stated that earlier that day he received a draft letter (unsent, July 13, 1932) from President Benedict to Muller, indicating that Muller would need to be tried before a faculty committee for his actions, with the final disposition to be made by the Board of Trustees. However, Batts, clearly concerned with the optics and notoriety of the Board's decision, convinced Benedict not to go through with the trial, arguing that this might place Muller under additional stress, and lead to another suicide attempt. Over the next several days, Batts's perspective gained support among other members of the Board of Trustees. In addition, since Muller had been awarded a Guggenheim fellowship to Germany for the next academic year, it seemed best to not proceed with the faculty trial, and instead allow him to pursue research in Germany. However, disciplinary action against the involved students was undertaken at UT, and this seemed to resonate strongly with Muller. Four months later, on October 6, 1932, Offermann was found guilty of participating in the publication and distribution of "The Spark" and was suspended from the University for six months (Report of Discipline Committee 1932). During that trial, Muller testified that "he knew nothing of the latter's (i.e., Offermann) connection with 'The Spark,' even though the evidence indicates Muller directed it, Offermann helped pay for it, and Muller explicitly mentioned Offermann's involvement in his letter to "Comrade Barron" regarding the first edition of "The Spark." The owner of the printing business that produced "The Spark" testified against Offermann at the trial, telling the committee that he attempted to convince Offermann "to confess." It is not known if the testimony was given under oath. Written comments by committee members questioned Offermann's honesty during the trial, as it conflicted with the objective evidence that was presented.

Following the one-year Guggenheim fellowship in Germany, Muller would continue his absence from the University of Texas, being given consecutive leaves of absence for three additional years. Muller had moved to the Soviet Union and was directing genetics research there (examples of letter exchanges for leaves

of absence between Muller and Benedict (Muller 1933, 1934; Benedict 1934). But by early 1936 (January 18th), President Benedict (Benedict 1936a) demanded that Muller return to UT to undergo a formal trial. This decision may have been influenced by the death of Batts the previous year on May 19th, 1935. Indeed, now Benedict could pursue his original plan to bring Muller to trial.

On January 18th, 1936, President Benedict sent a letter to Muller indicating the need for the trial:

> In the summer of 1932, I started to write a letter to you, but did not complete the letter or mail it to you. The reasons for starting to write you at that time and the reason for not completing the letter and sending it to you promptly are set forth below.
>
> In June 1932 an alleged organizer of the Communist Party in Texas was arrested by U.S. officials in San Antonio and among his effects was found a letter from you which, if genuine as apparently, it is, shows that you were involved in the anonymous publication of The Spark, Vol. 1., No. 1, and that you were at the time of your writing conspiring to get out No. 2 in violation of the University regulations against secret publications.
>
> My first impulse was to draft a letter to you dated July 13, 1932, containing the information that evidence tending to show you guilty of a serious breach of University regulations and professorial ethics was in my hands, evidence so strong as to require your trial as provided in our University regulations. Consulting however with Judge Batts, then Chairman of the Board of Regents, and with other Regents, notably doctor Edward Randall and Edward Crane, it was unanimously decided not to send you such a letter at the time. It was felt that to notify you that you must stand trial for a serious offense might have an injurious effect on your health, at that time somewhat affected, and it was hoped that your health would greatly improve during the leave of absence for 1932–33 then already granted you. We all agreed in thinking that delay in sending the letter could not damage you in any way and that immediate sending of the letter might do you some harm.
>
> In a letter from Berlin dated February 22, 1933, you requested an extension of your leave to cover the year 1933–34. This request was granted by the Regents and again for the same reasons it was decided not to notify you that upon your return you would have to be placed on trial for a serious breach of the University regulations. On January 16, 1934, you wrote a letter asking for a leave during 1934–35, and on January 19, 1935 for a leave during 1935-1936. Each of these requests was promptly granted by the Regents and this and the letter notifying you of the charge against you was each time postponed. Each time the reasons for postponement were (a) no damage to you could arise from the postponement, (b) more time would be allowed for you to recover and (c) your research in Europe would not be interrupted.
>
> It is now the opinion of the Regents that ample time to recover your health has been allowed, that your leave of absence should not again be extended, and that your guilt or innocence should be determined carefully and justly in accordance with the procedure set forth by the "Rules and Regulations of the Board of Regents for the Government of the University." This procedure is described on the printed enclosure. The necessary hearings must be held in Austin at such times during the current fiscal year, September 1, 1935–September 1, 1936, as may be mutually agreed on.
>
> It being desirable for you to be present at these hearings. I am hereby requesting you to suggest a date at which you can appear before the official committee. An early reply from you would be appreciated.
>
> Very sincerely yours,
>
> H.Y. Benedict, President.

An earlier letter drafted to Muller by President Benedict dated July 13, 1932, but which was not sent, explicated the allegations in detail:

> Enclosed you will find a copy of a letter apparently written by you. The original is said to have been found among the effects of this person to whom it was written when he was recently arrested in San Antonio by Officers of the United States Immigration Service in whose possession it now is.
>
> The contents of this letter are so serious as to demand an investigation. I am therefore compelled to quote as applicable to you the last paragraph of Section 4 (Appointments, tenure and promotions) of Article I of the Rules and Regulations of the Board of Regents for the Government of the University of Texas:
>
> An associate professor or a professor may not be dismissed on against his will until a committee of the faculty appointed by the President for the purpose shall have heard him and made investigation. The Regents before acting will have their Grievance Committee review the findings of such faculty committee, which findings shall be submitted in writing and referred back to the Board.
>
> If you desire a trial before a committee of the faculty please let me know at the earliest possible moment.
>
> Sincerely yours,
>
> H.Y. Benedict, President

Two months later, on March 11th, 1936, Benedict (1936b) again wrote to Muller, saying:

Your letter February 23 has just reached me.

> If you want to return to the University to continue as a Professor of Zoology after September 1, 1936, you will have to stand trial in Austin some time before that date. If you do not wish to continue as a member of the University Staff, a trial will be entirely unnecessary and the evidence in your case will merely be filed in the archives of the University without any publicity.
>
> What your wish is I should like to know definitely by May 1, and earlier if possible.
>
> Sincerely yours,
>
> H.Y. Benedict, President

On April 3rd, 1936, Muller (1936c) wrote to President Benedict, stating:

> My dear President Benedict:
>
> Replying to your letter of March 11, this letter is to inform you of my definite decision to resign from my position at the University of Texas, the resignation to take effect at the close of the present academic year (1935–'36). This decision, arrived at several months ago and indicated in a letter to Professor Painter written at that time, is occasioned by the superior opportunity of directing research afforded by my position here, and by my greater degree of freedom here in expressing what I consider to be the cardinal truth which must require recognition by the world today. At the same time, I regret the severance of my connections with those former coworkers in the Department of Zoology with whom I had collaborated in a comradely way in my scientific and academic work.
>
> Your very truly,
>
> H.J. Muller

On the same day Benedict acknowledged the letter from Muller, indicating that the Board of Regents held a meeting on April 27th, at which Muller's resignation was accepted.

Muller's version of the Texas story

On February 23, 1936, Muller (1936a) responded to President Benedict's letter of January 18th of that year informing him that the University of Texas would subject him to trial for activities associated with his role in the publication and distribution of "The Spark" four years earlier. Muller was surprised by this, replying to Benedict that "I most emphatically deny having at any time attempted to promote or aid in the anonymous publication of the journal named or any journal or tract whatever." This denial offered despite Benedict having informed Muller of his knowledge of a letter from Muller to the communist organizer "show[ing] that you were involved" (it is unlikely that Muller retained a copy of that letter). In that letter, dated June 19, 1932, Muller wrote: "We are going to try to do another issue of 'The Spark' this summer for the students, but have to work underground to do it; they [to whom he is referring is unclear, though Muller referred to 'the boys'] are being quizzed about it and refuse to tell." This statement would have created a serious problem for his defense at trial, leaving him either to challenge the authenticity of the letter or to defend a less obvious interpretation of the sentence.[5] As noted earlier, Carlson (2011) indicated that Muller was heavily involved in the publication of the first issue and appeared to expect active involvement in the publication of a second. He was confident that his student accomplices would "refuse to tell" of his involvement in the first. The most literal interpretation of his words refutes his claim of innocence, instead demonstrating his willingness to violate University rules. The comments of Carlson (2011) clearly indicate not only Muller's involvement but his dishonesty in communication with Benedict.

The February 23, 1936 (Muller 1936a) letter can be read as a bluff by Muller to intimidate Benedict (as he had done many times to others). For, while Muller does "deny the official charge" of involvement with the premier edition of the anonymous publication "The Spark," he puts the most emphasis on what he perceives to be ideologically motivated disparate (and hence unfair) treatment of communists by the University, finding it "impossible […] to believe that it is the anonymity of the publication which furnishes the real occasion for the charge" by referencing "instances of various other unsigned leaflets, printed announcements, etc., which have occasionally appeared on the campus" and supposing that the President's problem is with the "undesirable character of the publication," not its anonymity. By implication, Muller let it be known that it was he who would put the University on trial, both for violating its own rules protecting academic freedom and for its content-based discrimination against the speech of his students—that he was "prepared to argue for and defend the aims and methods of this great movement" in the court of public opinion.

In Muller's words (Muller 1936a):

> It is impossible for me to believe that it is the anonymity of the publication which furnishes the real occasion for the charge which is at this late date brought against me. Certainly the instances of various other unsigned leaflets, printed announcements, etc., which have occasionally appeared on the campus show that if the publication in question had been of an other [sic] character the matter of its anonymity

> would not have been pressed in so active and prolonged a fashion. The question of the desirable or undesirable character of the publication, and the reasons therefor [sic], must hence form an integral part of the matter to be discussed, at least in relation to the cases of those to whom the official charge may apply. And in this connection the further question also will unavoidably arise, of the alternative with which these persons would have been faced if they had revealed their names, as evidenced by facts of current Texas history.
>
> […] I do not wish to make a secret of my sympathy for and support of the movement aiming at the establishment of a higher, more cooperative form of society, based on ownership of the means of production by the workers. Your letter speaks of a breach of professorial ethics. Without qualms of conscience or misgivings concerning my professional or any other ethics, but with quite the opposite feelings—those of moral confidence and even pride,—I am prepared to argue for and defend the aims and methods of this great movement.

Benedict, however, would have none of it. It is interesting that in his response to Benedict's letter (Muller April 3, 1936c, letter to Benedict), Muller tried to make it appear that he was pleased with the arrangements he had in the Soviet Union, and that his resignation from UT was insignificant. Yet, within a year, Muller would attempt to flee the Soviet Union, as he had annoyed Lysenko and Stalin, and was seeking a safe exit and return to the United States (Carlson 1981). Thus, the question was whether Muller would actually confront Benedict over a situation that clearly put Muller's return—and career—in jeopardy.

A letter Muller sent to Altenburg March 30, 1936 (Muller 1936b) also addressed President Benedict's plan to subject him to a trial that could terminate his employment at the University of Texas. Muller wrote:

> Pres. Benedict of U of Texas wrote me accusing me of taking part in publishing "The Spark" on the basis of a letter found on an alleged Com. Organizer arrested in San Antonio in '32. He says that the Univ. must try me for breach of professional ethics breaking univ rules for taking part in an anonymous publication. I replied that I had never attempted to take part in an annon-public but that in fact the real point was a social and political one, in regard to which I didn't want to hide my attitude, & was ready to come down & make an issue of it—although [sic], as I'd indicted in previous letter to a colleague I hadn't intended resuming my job in Austin. I haven't received his reply to this yet. Please do not mention this to anyone. It is only known to Carlos & Ada & Gorg. It probably helps explain Duke, Cold Spring Harbor, & Harvard.

Muller was quite coy with Altenburg, writing about an "alleged communist organizer." However, Muller's letter of June 19, 1932 to Barron (Muller 1932a) acknowledges that Barron was a key figure in the party activities. Muller was pleased with Barron for "opening up headquarters of the Party in Waco" enough to give him money to support his work toward their common ideological pursuits, and shared plans for the next issue of "The Spark" and activities of other "comrades." Further, Muller and Altenburg shared the same ideological affinities. In his letter to "Comrade Barron," Muller indicated that Altenburg's commitment to the party should be reinvigorated even though it was Altenburg who converted him to communism. The authors find Muller's language with Altenburg to represent a sophisticated type of dishonesty and believe that it is important to consider why Muller may have been unable to communicate honestly with his best friend.

Benedict's letter to Muller (January 18, 1936a) revealed to him that correspondence, which he believed to be private (e.g., his letter to Comrade Barron), may have been under scrutiny by the US government for over four years without his knowledge. Muller could no longer be candid in his communication even with his closest friends in the US regarding his communist ties or theirs for that matter, as he recognizes that he could get terminated from the University for cause, ending his academic career, tarnishing his reputation in the US, as well as jeopardizing the career of his best friend (Altenburg), and all of that without having a promising outlet for his research in Europe or back in America. Muller, by this time, was aware that he had been nominated for the Nobel Prize, and so losing his academic affiliation in such a fashion could mean the end of his ambitious career.

In his March 30, 1936 letter to Altenburg (Muller 1936b), Muller revealed his suspicions that while he had applied for faculty positions at Duke University, Cold Springs Harbor, and Harvard University, all had shown no interest, despite his prominence in the field. He implied that he was being "blackballed" by UT, and although he wanted to be back in the US, this bias prevented him from being hired by another major research university. Understandably, Muller wanted to keep an academic option open in America, even if that is not at UT, and so he attempted to manipulate a future outside reader of his correspondences, thus sharing with Altenburg partial truths regarding the magnitude of his commitment to the communist movement.

Evaluation of the Muller-University of Texas case

Muller's actions were complex and had long-term implications. Presuming the authenticity of the letters and documentation obtained from the UT Archives, a reasonable reading of the correspondences reveals that Muller violated the terms of his contract with UT by participating in an activity that was explicitly not permitted by the institution, whether that activity is supporting an anonymous student publication or being a communist party member while being employed at UT. Yet, Muller would not only undertake this activity, but explicitly encouraged others, especially vulnerable, and easily influenced students, to follow his directions. Muller exercised the power dynamic of his position and reputation to deliberately place the careers—if not personal lives—of these students at risk, and in so doing, additionally affected both these students and their families' investment(s) in their education, professional development, and personal security. To wit, Carlos Offermann, Muller's postdoctoral fellow, along with several other students, was suspended from the university for six months following a trial. Once the suspension decision was rendered, Muller requested that Offermann be allowed to complete an important experiment for the forthcoming Sixth International Genetics Congress that was being held that summer at Cornell University, a request (Muller letter to Moore, July 13, 1932) (Muller 1932b) that was denied by the Committee (Moore letter to Muller, July 15, 1932) (Moore 1932). Therefore, Muller's involving Offermann in an illegal activity represents an ethical misconduct and a breach of fiduciary duty as a faculty to his students.

In all, this episode provides evidence that Muller acted unethically, in multiple situations and ways, and did so with full knowledge, and apparent disregard for the well-being of students. While it is clear that Muller knew that students were at risk, it is not clear to what extent he recognized his own risk—until he was so informed by the University. He facilely put vulnerable others in harm's way and did so by exploiting the power of his professional position. But what of his perceived risk to self?

Thus, "The Spark" episode confronted Muller with a challenge. Did he have the courage of his convictions to go through the ordeal of a "trial" at UT, defend his actions, promote and explain his beliefs, set an example to student followers, and learn of the consequences? It seems that Muller carefully assessed the impact of a possible firing at the University of Texas on his future career prospects. By 1935 Muller was a major figure in his field and knew that he was being nominated for the Nobel Prize (Calabrese 2024). Giving up a tenured full professorship at a major US university must have been a very difficult decision, but it was a necessary strategic move if he was to minimize the damage and keep his options open. Moreover, the UT Board of Regents was pleased with his resignation and sought to quietly close the Muller debacle. Muller had to be well aware that his unethical deeds would be buried within university archives (letter of Benedict to Muller, March 11, 1936b) and that he would be safe from exposure.

Muller's other ethical transgressions

This picture of Muller as a self-serving, unethical opportunist comports well with his actions in several other (previous and subsequent) cases. For example, in 1926, Curt Stern reported a novel discovery related to the linear arrangement of the genes in *Drosophila*, which was a major advance. However, several years later, Muller used his own subsequently obtained data to claim the primacy of this discovery and failed to mention that Stern was the first to (previously) report such findings. Stern summoned the courage to challenge Muller, and Muller was forced to correct the record. Muller was fortunate that Stern was merely happy to simply move forward, dropping the matter, rather than pursuing some recognition of (and perhaps retribution for) Muller's unethicality (Calabrese 2015). During this same period, Muller (1927) espoused his major claim for inducing gene mutation. However, a similar, legitimate claim had been made some six months earlier by Gager and Blakeslee (1927), as reported in the *Proceedings of the National Academy of Sciences*. Once again, Muller failed to cite such findings, claiming instead that the discovery was uniquely his own. In addition to failing to cite Gager and Blakeslee (1927), Muller also arranged a deal with the owner and Editor-In-Chief of the journal *Science* (i.e., Cattell) to publish his manuscript—without any data, and before the final of three experiments were even started (Calabrese and Giordano 2022a). He arranged this to establish his primacy in this area, and the field at large, knowing all too well that several other research groups were also vigorously involved in such studies, and were poised to make competing claims. This publishing arrangement also enabled Muller to avoid peer review of his work, something that all of his competitors had to undergo. As a matter of fact, Muller did not subject the final data of the three experiments to peer review, instead publishing

his findings in a non-peer reviewed conference proceedings (Calabrese 2015, 2019a). In each and all of these instances, Muller intentionally sought to engage in unethical practices to evoke positive career developments, and he did so knowingly at the expense of others, and with intent to deceive the scientific community and the public. To be sure, his publication in *Science*, "recognized" as being the first to induce mutation, empowered him to gain substantive credibility and clout toward being awarded the Nobel Prize and thereafter would afford him the prestige to aggressively promote his science policy directives, and, in so doing, realize his professional goals.

Adding to this pattern of unethical behavior, Muller never cited or acknowledged the research performed in his laboratory from 1931 to 1933 by his postdoc (and future Nobel Prize recipient) George Snell, who was not able to demonstrate X-ray-induced gene mutations in mice. Snell (1935) used the same study design that Muller employed in his research with *Drosophila*; a study design and method on which Snell and Muller worked closely together. It was curious that neither Snell nor Muller cited the work of the other on this topic. Snell's (1935) negative findings were published in a strikingly suppressed manner (Calabrese and Selby 2024b). Muller knew (at least by early 1933) that he had been nominated for the Nobel Prize (Calabrese and Selby 2024c), and if it had become widely known that his findings in *Drosophila* could not be replicated in mice, it very likely would have challenged the significance of his earlier work on mutational induction, and its generality and application to humans. It seems that Muller's solution was to suppress—at least to a considerable extent—Snell's results in the only way possible, by simply ignoring them. Muller surely recognized that his prominence in the field would overshadow Snell, and he was correct. Snell's findings were poorly recognized and rarely cited at the time. As a result, Snell redirected his work from studies of radiation-induced genetic damage to immunogenetics and went on to be awarded the Nobel Prize in this field, thereby distancing himself from Muller.

Further evidence of Muller's ethical improbity is provided by his Nobel Prize speech, wherein he told the world audience that there was no scientific support for a threshold dose response model of radiation risk assessment, and it was therefore necessary to adopt the LNT model (Calabrese 2015, 2019a). In this way, Muller failed to veritably share major threshold findings of Ernst Caspari that were acquired during the Manhattan Project at the University of Rochester, a project for which Muller consulted, and the results of which he had been provided, about a month before the acceptance ceremony for his Nobel Prize. Muller knew that these results were the strongest study to date, and he blatantly ignored the request of Curt Stern, the project leader, to share Caspari's data with the Nobel Prize audience (Calabrese 2023a). Having thus deceived the Nobel Prize audience, Muller would then publish multiple papers claiming that Caspari's control group was aberrantly high, a statement that was readily refuted by Caspari, and interestingly was contrasted by Muller's data, written statements, and assertions by Stern (Calabrese 2023b). Muller's deceit was overt, and curiously (and most likely due to Muller's notoriety and the gravitas of being awarded the Nobel Prize), Stern, Caspari, and others on the research team remained silent on the matter (Calabrese 2015, 2019a). Muller's actions in this regard may be seen as both strategically protecting himself from being accused of not telling the truth at the Nobel Prize Lecture and fortifying his promotion of the LNT model for risk assessment.

On August 27, 1948, Muller wrote a private letter to Everett R. Dempster, a notable genetics professor at the University of California at Berkeley, claiming that the research findings of Florence Keys and Fred Hanson (Washington University, St. Missouri, USA) that strikingly supported the LNT model were likely fabricated from the late 1920s onward. Muller discovered this situation himself since it started in his lab when Hanson was working there while on sabbatical leave (Calabrese and Giordano 2023). However, Muller never made this public, even though he claimed to Dempster that he confronted the authors in 1933. This prompts questions about Muller's motives. It is noteworthy that by the mid-1930s, Hanson had become Muller's principal grants manager at the Rockefeller Foundation (RF). Challenging Hanson and Keys's earlier results—and reputations—would have created a major controversy, with considerable social, and scientific implications, which could have threatened both Hanson's position at RF and the continuity of Muller's funding support. So, Muller did nothing further; possibly concluding that disrupting and possibly destroying Hanson's career might bode poorly for the economics of Muller's research endeavors. This decision also continued to support his LNT proposal, without him revealing his criticism. Why Muller, in fact, wrote to Dempster on this matter at this time, some five years later and after the death of Hanson in 1945, remains to be clarified.

Muller was also a member of the BEAR Genetic Panel that deliberately misrepresented the research record in their *Science* journal publication as has been well documented (Calabrese 2015, 2019a) to enhance the acceptance of their policy recommendations to support the adoption of the LNT model for risk assessment. Furthermore, this same committee was involved with permitting the fabrication of the Public Report of the Panel, in which it was claimed by the President of the NAS that the Panel wrote it; however, the Panel never wrote, read, or approved of the report. Likewise, the BEAR Panel members failed to correct multiple important errors. This Panel simply was silent on the distortions of truth offered by the NAS president, Dr. Detlev Bronk (Calabrese and Giordano 2022b).

Discussion

Muller's ethics: Effects and implications for science and policy

Muller was a scientific dynamo of his era; exceptionally bright, insightful, hard-working, and certainly motivated. He was also quite fortunate, having been raised in New York City, the location of Columbia University, the home institution of geneticist Thomas Hunt Morgan, who led one of the most important university research teams in a series of major scientific advances in the field. The Columbia/Morgan connection is important to Muller's history, as that formative period forged his own focus and strong desire to be successful, if not the best, often at others' expense. Historical vignettes reveal Muller to be very angered at not being given due credit for those ideas that helped to shape important discoveries of Morgan's research group (Carlson 1981; Schwartz 2008). It is interesting that in his subsequent career, Muller often appropriated the ideas of others and took credit for their work. It is tempting to speculate that his suspicions of the Morgan lab era were a matter of projection. For example, Muller took credit from Stern, and failed to cite the prior work of Gager and Blakeslee (1927); as regarding Stern, the Editor-In-Chief of the journal *American Naturalist,* to which Muller sent his "retraction" (i.e., Muller had to inform the journal that Stern, rather than he, deserved primacy for Stern's aforementioned 1926 discovery of the linear arrangement of the genes in *Drosophila*) was Thomas McKeen Cattell, a close and longtime friend of Morgan, whose daughter was a graduate student of Morgan at the same time as Muller. Thus, Muller was afforded grace for his unethical actions by an indulgent editor, with what may only be viewed as conflicting interest.

Muller's evident intellect, talent, and capacity to professionally intimidate others obviously made it very difficult—out of fear for what was sure to be Muller's abusive reprisal—to criticize his methods, data, and interpretations. This enabled Muller's frequently fungible ideas (e.g., lack of genetic damage repair (Calabrese et al. 2022); linearity at low doses, etc.), and research interpretations to gain traction and achieve what may be regarded as his long reach, which extended to the present in its influence and effect upon cancer risk assessment. Two of Muller's best friends and colleagues, Crow and Abrahamson (1997), longtime professors of genetics at the University of Wisconsin, have noted that his personality was often exasperating, in that he was rarely able to acknowledge the legitimate scientific perspectives and findings of others, instead needing to be dominant and perceived as "best," which adversely affected his professional relationships. For those who admired Muller, this was indeed frustrating. But for those who were subjected to his vitriol and retributive actions, for example as James Neel has noted, he was regarded as narcissistic, unfair, often cruel, and publicly humiliating. Neel directed the Atomic Bomb Casualty Commission study on genetics for 50 years at the University of Michigan. Muller's toxic leadership style and often abusive behavior prevented Neel's 10-year-long study (i.e., 1946–1956) from being discussed at the BEAR Genetics Panel in 1956. The recommendation by the BEAR Genetics Panel to adopt an LNT model of radiation risk assessment was, as a matter of fact, based on Muller's flawed fruit fly data, absent even cursory consideration given to Neel's work in humans. Muller further extended his domination by attempting to prevent Neel from presenting and publishing his findings in the literature (Calabrese 2020).

Instances such as these provide veridical evidence of Muller's unethical behavior, and it is without doubt that his dishonesty negatively impacted the posture and conduct of science, and, by extension, government health policies adopted in the US and elsewhere. A long reach, indeed. While it is incontrovertible that Muller's knowledge and talents contributed to his professional acumen and a regnant dominance in his field, it must be emphasized that he also made a series of significant scientific mistakes, which have been well documented (Calabrese 2024). Immanuel Kant famously said: "From such crooked timber as humankind is made of nothing entirely straight can be made." It is not novel in the history of science that one scientist

can be so driven by his individual pursuit to fame as to undermine the discovery process, but that is precisely why the integrity of the process must be maintained and protected. The pursuit of truth requires courage, but the scientific community here failed to effectively question, critique, or rebut Muller's erroneous work based on an appeal to his authority as well as for fear of incurring his rebuke and wrath. This allowed Muller's personal traits to purloin his professional integrity, which ultimately empowered him to transform and dominate scientific discourse, in effect serving his personal interests, without meaningful restraint.

Conclusion: Muller in perspective

While this paper assumes a historical view to address Muller's personal traits and the negative effect these have had upon the trustworthiness of science and the validity and value of national policies based and built thereupon, it is important to study the Muller story as an object lesson for the current and future ethical probity and conduct in science. It is naïve to think that scientific and professional policy bullying—using a wide range of tactics across federal agencies and within the scientific community—are things of the past; for sure, they are not. Such scientific and regulatory agency administrative bullying to enhance professional success and policy dominance has recently been revealed in the field of radiation health effects, in essence continuing to promulgate Muller's dogmatism (Cardarelli 2024). Of course, there are additional examples of such dogmatism and bullying in other politicized domains of science (e.g., climate change; COVID), and it is the authors' hope that this assessment sheds light upon the importance of ethical responsibility in all domains of the scientific enterprise—inclusive of obligations to place in check those personalities that seek to exercise undue influence for personal, performative gains that impugn the validity, trustworthiness, and public good of science as a practice. Let Muller be regarded both as a brilliant intellect and talent corrupted and serve as an exemplar for a present and forthcoming cadre of researchers of what not to do or be. The Muller example provides actions necessary for researchers to take if they are to protect the integrity of the scientific process from the few who decide to abuse it for personal gains. While the few may be small in number, as the Muller story reveals, they can be great in reach. It is the moral duty of scientists to limit that reach in the face of obvious lapses in professional ethics.

Overall, Muller's actions as described herein can be viewed as a general failure to uphold and/or respect the fiduciary duties of science, scientists to the public, and any who trust in, and rely upon the probity of their methods and veracity of their findings. More specific examples of ethical transgressions by Hermann J. Muller that the scientific community and the public would hope to limit include:

1. Failure to credit Stern's findings on linear arrangement of genes.
   Ethical transgression(s): Intentional non-veracity/deception; lack of intellectual honesty; data manipulation.
2. Failure to cite prior research by Gager and Blakeslee on gene mutation
   Ethical transgression(s): Intentional non-veracity/deception; lack of intellectual honesty; data manipulation.
3. Failure to present evidentiary data in 1927 *Science* paper
   Muller arranges a quid-pro-quo agreement with *Science* editor that ensures early publication absent substantiating data.
   Ethical transgression(s): Fabrication/fraudulent representation; professional dishonesty; malfeasance.
4. Muller published data in a non-peer-reviewed Conference Proceedings.
   Ethical transgression(s): Failure to undergo peer-review; subsequent misrepresentation of findings; non-veracity/deception; failure of intellectual honesty.
5. Knowing and intentional violation of University of Texas regulations.
   Ethical transgression: Malfeasance
6. Engaging students to engage in behaviors explicitly prohibited by their university.
   Ethical issue(s): Malfeasance; intentional exploitation of the vulnerable.
7. Repeated intentional deception (to UT President Benedict) concerning his involvement in the publication and distribution of prohibited material (i.e., -The *Spark*).
   Ethical transgression(s): Malfeasance; non-veracity.
8. Failure to cite Snell's (contradictory) findings using murine model.
   Ethical transgression(s): Intentional non-veracity/deception; lack of intellectual honesty; data manipulation.
9. Failure to acknowledge and/or rectify compromised research of Ray-Choudhari.

Ethical transgression(s): Intentional non-veracity/deception; lack of intellectual honesty; data manipulation.

10. Failure to acknowledge the (threshold model) findings of Caspari in Nobel Lecture
    Ethical transgression(s): Intentional non-veracity; lack of intellectual honesty; data manipulation.
11. Publication of (three) papers that explicitly contradict his data, and letters to Stern on background mutation.
    Ethical transgression(s): Intentional non-veracity/deception; lack of intellectual honesty; data manipulation.
12. Interference with review of significant human mutational data during the BEAR Genetics Panel Hearings.
    Ethical transgression(s): Intentional non-veracity/deception; data manipulation; malfeasance.
13. Intentional dissemination of (recognized) inaccurate/false data (in *Science* publication).
    Ethical transgression(s): Intentional non-veracity/deception; data manipulation; lack of intellectual honesty; malfeasance.
14. Failure to acknowledge and/or correct misinformation in the Report to the Public of the BEAR Panel.
    Ethical transgression(s): Intentional non-veracity/deception; data manipulation; lack of intellectual honesty; malfeasance.

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Notes

1. The ethical implications surrounding that request and decision by Carlson (1981) to accept the Muller family request is not the subject of the present paper. It is not known whether the Muller family request affected Carlson's access to the full range of Muller preserved papers at the University of Indiana. However, it appears that the Muller family restricts/prevents researchers from assessing selected sections of the Muller files at the University of Indiana now almost 60 years after his death, especially if there is concern that the assessment may be unfavorable/critical of Hermann J. Muller.

2. Altenberg was a professor of genetics with approximately a 45-year career at Rice University and Muller's closest and trusted friend throughout his life.

3. UT policy governing anonymous student publications appear to have been in place as early as 1918. In the Austin Daily Texan issue of May 15th, 1918, an article appeared covering a new Act issued by the Student Assembly prohibiting anonymous publications in which articles of a "malicious, libelous, or indecent character are printed." Violators of this Act were deemed subject to penalties assessed by the Assembly and the University President.

4. This history of this policy is difficult to trace but as indicated, an earlier version appeared as early as 1918 and a close wording remained in place at least through 1967. As indicated on page 69 of the 1967 Rules and Regulations of the Board of Regents of the University of Texas System for the Government of the University of Texas System: "Anonymous publications are prohibited. Any student publishing or aiding in publishing, or circulating or aiding in circulating, any anonymous publication will be subject to discipline."

5. It does appear, however, that, at that time, Muller could have been tried for two separate charges in violation of University rules: (1) promoting the anonymous publication of "The Spark" and (2) being a member of the Communist Party of the USA. As Carleton points out: "University policy prohibited the employment of party members, and it was cause for dismissal" (Dettmer 2012). The history of this rule is also difficult to trace, but it was explicitly mentioned as late as 1967. As indicated on page 26 of the 1967 Rules and Regulations of the Board of Regents of the University of Texas System for the Government of the University of Texas (1967) System: "As provided by statute (Article 6252–7, Vernon's Civil Statutes), every employee is required to execute an oath or affirmation that he is not connected or associated with the Communist party or Communist activities."

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Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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