



Lysenkoism

PERMITTING IDEOLOGY TO ECLIPSE REASON

written by Alister R. Olson, Michael P. Clough, and Benjamin C. Herman

This story highlights six tactics of science misinformation and disinformation efforts: the lack of competence among false experts, creation of false legitimacy in order to fabricate a fake scientific controversy, cherry picking, putting forth conspiracy theories, avoiding peer review, and appeals directly to the public. See our website article [Characteristics of Science Misinformation/ Disinformation Efforts](#) for more information regarding these tactics.

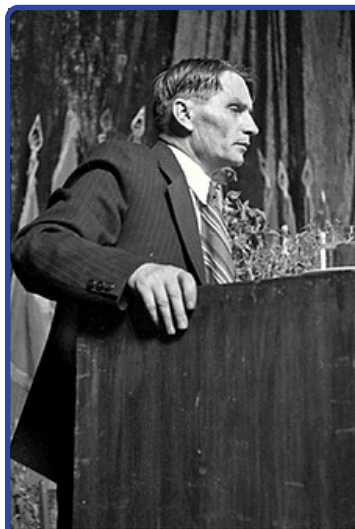
After the Russian Revolution ended in 1923, the newly formed Soviet government began to prioritize the sciences. Leading the Soviet genetics program was the esteemed geneticist Nikolai Vavilov. Vavilov was the winner of the Lenin Award, founder and head of the Lenin All-Union Academy of Agricultural Sciences (VASKhNIL) and the Institute of Plant Breeding (VIR), and member of the Collegium of the People's Commissariat of Agriculture of the U.S.S.R. (Kolchinsky, 2014). Under Vavilov, Soviet geneticists made significant advances, and the program was considered to be second only to the United States during the 1920s (Dobzhansky, 1952). However, by 1948, Vavilov had been imprisoned, the Soviet genetics program had been completely dismantled, and millions within the Soviet Union were dead from starvation. Understanding the disintegration of the once vibrant Soviet research program has lessons for combatting the extensive misinformation and disinformation present in today's world.

Trofim Lysenko

The downfall of Soviet genetics and agriculture occurred due to the alignment of numerous social, economic, scientific, meteorological, and political factors. No single person can bear complete blame for the events, but a crucial actor in the story was Trofim Lysenko. Lysenko was born to a Ukrainian peasant family in 1898, and as a result of his family's background, he did not learn to read or write until he was 13 (Roll-Hansen, 2005). He received a basic education in a war-torn region (Soyfer, 1989), and later completed a degree in agronomy from the Kiev

Agricultural Institute in 1925 (Roll-Hansen, 2005). Following graduation, Lysenko took a post at the Gandzha agricultural research station in Azerbaijan (Soyfer, 1989).

Lysenko was extremely ambitious and eager to produce immediate, tangible results. He was tasked



Trofim Lysenko at the 1948 VASKhNIL conference. *

with investigating the use of pea plants as a cover crop, but his modest beginnings and education had left him with significant deficiencies in his knowledge of scientific content and practices. Peas, a winter crop, grew well during his single season of studying the issue, but unaware that was merely due to an extremely mild winter, Lysenko considered the problem to be

solved. No further research was conducted, nothing about his work was published in professional journals, and little came of his supposed advances. Nonetheless, an account of Lysenko's work was published in Pravda, the widely-read Communist publication, lauding him for his practical research (Soyfer, 1989).

*Image from The New Scientist



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Lack of competence

Lysenko was undeniably both motivated and politically astute. However, his research was riddled with design flaws, and he vehemently opposed statistical analysis (Harper, 2017). Replication studies did not support the conclusions that he put forward (Harper, 2017). Even authors who have argued that Lysenko at least made modest contributions as a plant physiologist have admitted that his work was “uneven, burdened by poor methodology, and overrated by his supporters” (Roll-Hansen, 2005). Others, such as Cook (1949), have been less generous, stating that “Lysenko's scorn of experimental method in science, his contempt for “chance”, and his utter ignorance of the subject matter he is discussing make his teaching merely a dogma.” Lysenko's lack of expertise about genetics, despite frequently presenting himself as an authority in the area, is a classic warning sign of pseudoscience.

Lysenko next investigated the effects of cold temperatures on plants—an issue that was of particular importance for agriculture within the USSR. After collecting data on wheat, rye, oats, barley, and cotton from 1926 to the spring 1927, Lysenko published the work in a book. However, most pages were merely raw data and tables with no statistical analysis of the results, and he essentially reached one basic conclusion—a certain amount of heat is needed for initial plant development (Soyfer, 1989).

In fall of 1929, Nikolai Vavilov organized the First All-Union Congress on Genetics and Plant and Animal Breeding (Figure 1.) (Kolchinsky, 2014). Lysenko



Figure 1. Nikolai Vavilov (left) with other members of the executive committee at the First All-Union Congress on Genetics and Plant and Animal Breeding held in 1929.*

was invited to speak at the conference, and in his presentation, he recommended cold-treatment, or vernalization, of winter wheat by exposing the seeds to cold temperatures. Vernalization, he argued, permitted winter wheat—which normally had to be planted in the fall and exposed to winter conditions for it to flower—to be planted in the spring. Despite his limited research or supporting empirical evidence, and criticism from researchers such as Nikolai Maximov, Lysenko even followed up his speech with a series of press conferences touting his supposed advances (Soyfer, 1989).

QUESTION 1

Avoiding peer review and instead promoting research findings directly to the public and policymakers are typically red flags for pseudoscience. Why should the public be suspicious of scientists skirting peer review and promoting proposed findings to the public and policymakers?

While Vavilov was hosting the meeting, he was facing increased political pressure. Scientists in the USSR often received considerable funding, but the country's economic situation led to expectations that researchers produce rapid, tangible results (Borinskaya et al., 2019).

By 1930, Vavilov had lost key supporters in the government and was facing criticism for being too academically focused, with too few practical achievements (Kolchinsky, 2014). Further exacerbating the situation was the USSR collectivizing its farms—a practice that contributed to decreases in farm yields and famines.

Conversely, Lysenko was a prime candidate for advancement in the U.S.S.R. due to the political environment of the era. In 1929, the Stalinist Cultural Revolution began, with the Communist Party establishing greater control over research personnel (Kolchinsky, 2014). As a result, over 72% of postgraduates recruited to the VIR that year were communists, over half of them came from peasant backgrounds, and most were academically unqualified for admittance (Kolchinsky, 2014). The practice of promoting and educating loyal workers and peasants (i.e., “red intelligentsia”) was a threat to the academic integrity of Vavilov's institutions, but it provided Lysenko with an unearned and unqualified path forward in his career.

Michurinism and genetics

Understanding Lysenko's research, and the reasons why he eventually came into conflict with so many of his more qualified colleagues, requires one to unpack some of the core ideas he held that may otherwise seem unintelligible to contemporary readers. Lysenko's plant breeding was not based on Mendelian views, and in fact, he did not believe in genes at all (Caspari & Marshak, 1965). Lysenko viewed "Mendelian-Weissmannian-Morganian" genetics as slow, passive, problematically reliant on statistics, and too metaphysical (Caspari & Marshak, 1965).



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Fabrication of a fake science controversy

A characteristic of pseudoscience is manufacturing a false scientific controversy that is then used to generate doubt among the public about issues, and lend legitimacy to pseudoscientific ideas. In the case of Michurinism, conflict and debate did occur, but mostly due to artificial political influence—particularly after 1948. Theodosius Dobzhansky (as cited in Gordin, 2012) stated as much when he wrote, "The uninformed reader may get the wrong impression that what happens is a discussion among scientists, with a [R]ussian school on one side and a "capitalist" school on the other. I think it is our duty to say without mincing words that it is not a legitimate scientific discussion of any kind but a conflict of science obscurantism, knowledge and incompetence" (p. 455). Similarly, disinformation about the issue that appeared in the United States, "was calculated to give the nonbiologist reader the false impression that "classical" genetics is somehow on the spot" (Cook, 1949, p. 195).

Lysenko instead asserted that heredity was distributed throughout an organism, and then became concentrated in reproductive cells (Caspari & Marshak, 1965). Grafting a branch onto a tree, or injecting blood from one type of animal into another could therefore supposedly induce hybridization because the heritability of the new organism would move from the foreign cells to the germ cells of the original organism (Caspari & Marshak, 1965). Lysenko also thought that environmental factors could lead to acquired changes that would make the organism more fit, which would then be passed on to its offspring (Caspari & Marshak, 1965). For example, the vernalization of winter wheat would supposedly not only prepare the plants to flower, but would actually fundamentally change the plants in

ways that made the next generation more amenable to spring planting (Amasino, 2004). Lysenko claimed that he had converted spring wheat into winter wheat, simply by using the reverse process: spring wheat was planted in the fall, exposing it to conditions normally encountered by winter wheat. After several years, the spring wheat had supposedly changed species into winter wheat due to the effects of the environmental conditions, which Lysenko claimed to have confirmed by an observed change in the number of chromosomes in the plants from 28 to 42 (Cook, 1949). Critics argued that the seeds he planted were likely an accidental mix of winter and spring wheat, and natural selection simply led to only the winter wheat surviving (Cook, 1949).

Despite the fact that Lamarckian ideas had largely been abandoned by most non-Soviet scientists by 1925 due to overwhelming evidence against them, Lysenko favored such views because he felt that they were more consistent with the writings of Marx and Engels (Caspari & Marshak, 1965). From the Lamarckian perspective, the U.S.S.R. just needed to improve the environment of its citizens, and the heritable changes that would result would allow each generation thereafter to improve (Amasino, 2004). Later, Lysenko would even deny the existence of intraspecific selection, which is of course a key Darwinian mechanism for evolution (Dobzhansky, 1952). In 1935, Lysenko began calling his ideas Michurinism, in honor of a famous Russian plant breeder named Ivan Michurin (Borinskaya et al., 2019). The term "Lysenkoism" was not coined until 1945, when the botanist Leo Kartman first used it (Dejong-Lambert & Krementsov, 2012). Lysenkoism eventually came to be used outside the U.S.S.R. to refer to the intertwined nature of Michurinism, Marxism, and Soviet political influences.

QUESTION 2

Individual scientists can be quite biased in their work. How does the peer-review process involving the global scientific community mitigate bias, including that associated with political ideology?

Many scientists outside of the U.S.S.R. were highly critical of Michurinism and accused it of anachronistic ideas that lacked empirical evidence. Dobzhansky (1952) stated that:

Thus far, neither Lysenko nor any one of his numerous followers have produced a single new or original idea, either a right or a wrong one. It can be stated without hesitation that michurinist biology is nothing more than a relapse towards views that were current in biology in the nineteenth century, and which were discarded early in the present century mainly owing to the discoveries of genetics. (p. 41)

Eventually, Lysenko's career would become defined by his frequent denial of classical genetics, his conflicts with Soviet geneticists, and the manner in which he responded to their criticisms.

The Fall of Nikolai Vavilov

By 1931, attacks on Vavilov were increasing. Heat was cut-off to significant portions of VASKhNIL's buildings at one point during the winter, and party appointments who were critical of Vavilov were ascending in the VIR (Kolchinsky, 2014). Impatient with the pace of agricultural improvements, party officials demanded that scientists produce new, improved varieties of plants within four to five years, despite the fact that the minimum time actually required for such a task during that era was 10-12 years (Joravsky, 1962). Vavilov managed to push back against his opponents, but crop failures led to a famine in 1932-1933 that killed approximately six million Soviets (Borinskaya et al., 2019), leading to renewed pressure on the renowned scientist. In late 1932, twenty top scientists in the VIR were arrested and exiled while Vavilov was out of the country.

While Vavilov was battling with his political opponents, Lysenko was gaining considerable attention, and powerful allies. Based on Lysenko's previous flawed conclusions, he asserted that implementation of vernalization could dramatically increase yields, despite significant contrary evidence from several other researchers (Borinskaya et al., 2019). Regardless, widespread implementation of vernalization was ordered in 1931, with Lysenko promising not only increased yields but also the creation of new varieties of wheat within the incredibly short time frame of only 2-3 years (Borinskaya et al., 2019). Similarly limited testing of potato planting techniques that were devoid of statistical analyses and rooted in factually inaccurate ideas (e.g., Lysenko ignored empirical evidence that potato viruses that were ravaging the plants and instead asserted that degenerative aging due to excessive heat was to blame), were used to make unrealistic promises about potato production that were enthusiastically received by Stalin (Joravsky, 1962).



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Cherry-picking

Scientists often select the best representative data in presenting their case, but the key is that the selection is representative of the larger body of evidence. Cherry-picking, on the other hand, is a highly selective selection of data against a backdrop of unsupporting evidence. At times, the distinction is not clear and requires further scrutiny by experts in the field. Cherry-picking in the manner that Lysenko did is a clear indicator of bad or fraudulent science, and it is also a tactic that is frequently employed in pseudoscience to give the appearance of greater support than what actually exists.

Under fire politically and in need of rapid scientific achievements, Vavilov publicly lauded Lysenko's rapidly ascending work, nominated him for the Lenin Prize, and put him forward for membership in professional organizations (Soyfer, 1989). The extent to which Vavilov was truly aware of the magnitude of Lysenko's scientific deficiencies or his over-inflated accomplishments is unclear. Likewise, the extent to which Vavilov's support of Lysenko was an attempt to appease his critics, an effort to be a good supporter of the Communist Party, or a misguided move to further his own research agenda using Lysenko's supposed expertise and advances, is also not known with certainty. Regardless, Vavilov's support of Lysenko would not be rewarded.

By 1935, empirical studies of Lysenko's vernalization technique that had been carried out since 1930 concluded that wheat yields were actually decreasing (Soyfer, 1989). His potato planting protocols, which simply ignored the transmission of potato viruses that were ravaging the plants, were also largely not succeeding on the 500-600 farms that had been selected to utilize them (Joravsky, 1962). However, Lysenko published the results of only the 50 top-performing farms, thereby creating the illusion that his work was succeeding (Joravsky, 1962). During this time, Lysenko was openly criticizing Vavilov in front of Stalin, and he was blaming his failures on incompetence and enemies supposedly working against him. The underperforming potato farms were supposedly not worth focusing on, because the low numbers were simply the result of factors such as lazy workers and poor administration (Joravsky, 1962). Lysenko had managed to turn what should have been damaging empirical results into political victories that continued

to bolster his support with Stalin and other party leaders. Conversely, Vavilov was struggling with his efforts and he was removed as the leader of VASKhNIL in 1935.

In 1936, Stalin's "Great Purge" began—a period that would eventually result in the deaths of up to 1.2 million perceived enemies of the state (Ellman, 2002). Many geneticists who spoke out against Lysenko at the Fourth Annual All-Union Congress on Genetics and Plant and Animal Breeding were arrested (Kolchinsky, 2014). Following criticism by Lysenko regarding a perceived lack of support, the president of VASKhNIL was shot in 1937 (Borinskaya et al., 2019). By the time the Great Purge ended in 1938, many of the geneticists and agronomists who had opposed Lysenko had been killed (Borinskaya et al., 2019). Vavilov had come to understand the true gravity of the situation, and that the very discipline of genetics was being threatened when he stated, "We will go to a stake, we will be burned but we will not surrender our convictions" (as cited in Kolchinsky, 2014). However, Lysenko was appointed president of VASKhNIL in 1938, by which point he was openly blaming geneticists for supposedly undermining his work (Borinskaya et al., 2019). Two years later, Vavilov was arrested (Figure 2.) and many of his supporters were dismissed from their positions (Borinskaya et al., 2019). Vavilov was sent to a labor camp and died in 1943, possibly of starvation in the isolated city of Magadan (Cook, 1949).

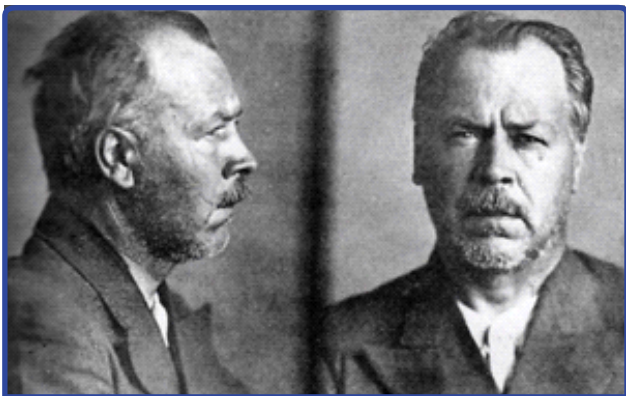


Figure 2. Nikolai Vavilov after his arrest.



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Promoting conspiracy theories

Note how Lysenko utilized conspiracy theories to account for his failures. Such a tactic is a major warning sign that the arguments being made are pseudoscientific in nature.

QUESTION 3

Why is the scrutiny of scientific findings by the community of experts needed rather than permitting citizens and policymakers to decide which ideas about nature are most worthy?

The 1940s and the Establishment of Official Party Doctrine

With Vavilov gone, Lysenko dominated Soviet agriculture through the end of World War II. However, he soon faced his own problems. When Lysenko was elected in 1945 to the ruling committee of the USSR Academy of Sciences—the top scientific institution in the country—numerous scientists spoke out against him, citing his poor scientific reputation (Borinskaya, 2019). Over the next several years, Lysenko was criticized numerous times, and there were even steps taken to open an institute of genetics (Soyfer, 1989). From 1946-1947, up to 1.5 million people died within the Soviet Union due to famine (Ellman, 2000). Lysenko's nadir during this period was reached in April of 1947, when he was harshly criticized by Yuri Zhdanov, who highlighted Lysenko's failures, pointed out the destructive manner in which he had demonized geneticists, and argued that monopolies in science inhibit advancement (Soyfer, 1989). Zhdanov's words were particularly dangerous for Lysenko, given that the chemist was from a family with close ties to Stalin (e.g., Zhdanov went on to eventually marry Stalin's only daughter) and he was a member of the powerful Central Committee of the Communist Party (Boterbloem, 2002).

The politically savvy Lysenko reacted by sending two letters to Stalin. In the letters, Lysenko portrayed himself as the defender of Michurinism who was being unfairly attacked and undermined by geneticists, which was obstructing his work. Lysenko appealed to Stalin for help in dealing with the geneticists, and in July of 1948, Stalin met with him. Lysenko made the outlandish claim during the meeting that he had made so much progress on branching wheat—plants of personal importance to Stalin, but which the scientific community had long deemed intractably problematic for agricultural purposes—that yields would increase fivefold in the coming year (Soyfer, 1989). Stalin agreed to help Lysenko.

The annual VASKhNIL conference commenced several weeks later, and ran from July 31st to August 7th. Lysenko made the closing speech (Figure 3.),

during which he made the infamous statement, “the Central Committee of the Party has examined my report and approved it” (as cited in Dobzhansky, 1958). Those in attendance immediately recognized the significance of what had been stated: Lysenkoism was now Communist Party doctrine. Of the eight geneticists who had spoken during the conference, three immediately repented for what they had said, four did so a short time later, and the only scientist who refused to do so was barred from conducting future research (Borinskaya et al., 2019). Yuri Zhdanov, whose critical comments had pushed Lysenko to seek Stalin's assistance, also quickly issued an apology for his remarks (Soyfer, 1989). Within weeks, 3,000 scientists were dismissed (Soyfer, 1989), including several renowned scientists from the Soviet Academy of Sciences (Cook, 1949), and everyone within the department of genetics at Moscow State University (Borinskaya et al., 2019).



Figure 3. Trofim Lysenko speaking at the 1948 VASKhNIL conference.

Facing dismissal and fabricated charges, some of the scientists committed suicide (Borinskaya et al., 2019). By September, the Academy of Sciences had met, and officially adopted Lysenko's ideas (Ashby, 1948). Research and teaching related to genetics were completely halted within the Soviet Union. The imposition of ideas on scientists via a political body sent shockwaves throughout the scientific community both within the U.S.S.R. and abroad. Theodosius Dobzhansky reflected on the events at the 1948 VASKhNIL conference by stating that (as cited in Gordin, 2012):

...a contemptible cheat has not only obtained backing for his prescientific and at best 19th century ideas, but has also succeeded in murdering some and bouncing other scientists who were doing first class work and who dared to oppose his charlatanism. (p. 455)



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Appeals made directly to the public

Note that the political and media efforts to promote Michurinism abroad were at odds with the worldwide consensus among the community of experts in genetics.

By the end of the year, the Soviets were actively pursuing efforts to spread their ideas beyond the boundaries of the U.S.S.R. For example, a propaganda film called Michurin was released globally, with the soundtrack recorded in nine different languages (DeJong-Lambert & Kremontsov, 2012). The 1948 VASKhNIL conference proceedings were also transcribed, printed, and sent to numerous countries, including the United States (DeJong-Lambert & Kremontsov, 2012). Editorials and media sources sympathetic to the Soviets were published in the United States and Britain with the intent of legitimizing Michurinism and portraying genetics as facing an immediate scientific crisis (Cook, 1949). Oregon State University chemistry professor Ralph Spitzer even published a letter in Chemical

and Engineering News in 1949 that defended Lysenko's work as legitimate and empirically-supported, and that accusations against him were overblown (Cook, 1949).

QUESTION 4

Spitzer was a legitimate scientist, but not an expert in the area of genetics on which he commented. What problems exist when a sole scientist or group of scientists, particularly when they are out of field, are given credibility for stances outside the consensus of the community of experts in the field?

Erosion of Power

By 1951, Lysenko's failures to achieve his lofty promises had not gone unnoticed, but he now lacked the ability to blame prominent enemies. Isai Present, who had long been an instrumental ally for Lysenko, was removed from his powerful university positions, and expelled from the Communist Party (Borinskaya et al., 2019). Stalin also began to approve published criticism of Lysenko during this time. In 1953, Stalin died, and Nikita Khrushchev took over. Khrushchev allowed Lysenko to retain power, but the new leader adopted a policy of “letting all flowers bloom”, meaning that the scientific monopoly was to end

(Caspari & Marshak, 1965). Watson and Crick's publication about the double-helix structure of DNA in 1953 was ill-timed for Lysenko, as it severely undercut his denial of genes (Borinskaya et al., 2019). Previously expelled scientists began to return, and by 1955, genetics was once again taught in the USSR (Borinskaya et al., 2019). In response to overwhelming support from hundreds of scientists from all disciplines, genetics laboratories returned in 1956 (Borinskaya et al., 2019). With the removal of Khrushchev in 1964, Lysenko lost one of his last major pillars of political support. Lysenko retained allies within numerous Soviet academic institutions into the 1980s, but advances in genetics coupled with Lysenko's inability to politically impose his will marked the downfall of Lysenkoism.

Revisionist Accounts in the Modern Era

In recent years, revisionist accounts of history, Russian nationalism, and questionable connections to modern scientific advances have led to a resurgence in interest in Lysenko. In particular, some authors have attempted to use advances in epigenetics as a means of validating Lysenko's work.

However, the argument is erroneous, in that Lysenko made few, if any, meaningful scientific contributions, he never postulated anything remotely similar to the mechanisms that are actually involved with epigenetics, and he even denied the existence of genes. As Reznik and Fet (2019) argue:

Lysenko's "predictions" were akin to those of the Middle Age alchemists. Looking for a Philosopher's Stone to turn the trivial metals into gold, they believed in transformation of chemical elements. They naturally failed, but today some might claim that the alchemists "predicted" the discoveries of modern nuclear physics. "The advanced teachings of Marxism-Leninism" was Lysenko's Philosopher's Stone. It was helpless in increasing agricultural crop yields—but very productive in crushing the heads of the "reactionary bourgeois" scientists. (pp. 1324-1325)

Moving forward, knowledge of the history of science and the ability to identify pseudoscientific positions will be critical to guard against the rise of the next Trofim Lysenko.

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