

Undermining Scientific Progress: The Exclusion of Evolutionary Theory from Science Education in India

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ABSTRACT

The removal of the theory of biological evolution from school curricula in India represents a concern for the integrity of education and the country's progress. It compromises its ability to cope with climate change, undermines vital areas such as agriculture and health, and undermines its scientific and technological potential. Demonstrating the negative impacts is crucial to reversing this decision in India and setting a global example against religious influences on evidence-based education. Reconciling religious beliefs and accepting the theory of evolution is possible. Protecting the integrity of science education is essential to meet the challenges of the modern world. It is also important to consider that other countries, such as the USA and Brazil, have had their science and biological evolution education threatened by various forms of interference, therefore what is happening in India should serve as a warning and prepare reactions to this type of threat.

Key Words: teaching of evolution; religion; curriculum; Darwin; biology.

○ Introduction

It is challenging to measure how scientific development in various areas would have been without the knowledge derived from evolutionary theory. Some historical clues can be observed, such as what happened during Stalin's rule in the former Soviet Union (Stanchevici, 2017). During that period, the scientist and politically influential Figure Lysenko (Lecourt, 2017) persuaded the highest leader of the Politburo to deny the knowledge originating from the works of Mendel (Radick, 2023) and Darwin (Rindos, 2013) for Soviet agriculture. Instead, he advocated the belief that it was possible to shape the characteristics of plants through some form of environmentally directed human pressure. The result was the persecution, imprisonment, and death of prominent scientists, such as Vavilov (Vavilov, 1922), who based their plant science on well-founded evidence and theories, leading to unprecedented famine due to the loss of entire crops.

One might imagine that this kind of obscurity belonged to the past. Denying something scientifically proven, such as the

Darwinian theory? That there would be no room for such denialism or pseudoscience in the early 21st century, with so many technological advances in various fields. These technological advancements, such as increased agricultural (Denison et al., 2003; Rindos, 2013) and livestock (Wright, 1978) productivity, vaccine (Gupta, 2024) and antibiotic production (Méthot, 2015), among other achievements, are intrinsically related to the understanding of evolutionary processes. One would expect that biological evolutionary theory would be preserved, especially in the formal school context.

However, the world in the third decade of the 21st century faces new challenges in communication in general, and especially in the dissemination of scientific knowledge (Genot et al., 2021). Instead of celebrating science for developing vaccines at record speed, allowing a return to normal life after long social isolations, the COVID-19 pandemic is now the target of falsehoods about its risks and conspiracy theories (Cinelli et al., 2020). These misconceptions resonate in vaccination rates in various countries, not only related to SARS-CoV-2 (Fridman et al., 2021). Today, incredibly, in countries such as Brazil and the USA, where the anti-vaccine movement thrives, science and biology teachers often have to explain to their students how a vaccine works, the value of a vaccine, to students who read unfounded information on their social networks, media (Silva, 2023) disseminated by all kinds of professionals, including doctors, in this process of misinformation (Islam et al., 2020).

Regarding evolutionary theory, it is no different; threats to its teaching occur in various parts of the world, once again, notably in the USA and Brazil (Wiles, 2011). This threat is evident and based on an unnecessary and counterproductive conflict with religion (Silva, 2022). This conflict occurs more specifically with dogmatic religious groups that aim to exclude the teaching of evolutionary theory or insist that it be taught on equal terms with the creationist view or its supposedly scientific variant (Berkman et al., 2008), intelligent design (Silva et al., 2010; Wexler, 2010). These two countries, with their various Christian denominations, more or less resistant to Darwinian theory, have managed to thwart these attempts, especially in public education (Alters et al., 2001; Branch et al., 2010). However, countries such as Turkey and South Korea, with different religious, economic, cultural, and political patterns,

have experienced movements of partial or complete exclusion of evolutionary theory at various educational levels (Silva, 2017).

To illustrate the risks of this kind of trend, which is not limited to these countries, not confined to a particular religion, and not restricted to an ideology, attention should be paid to what recently happened in Indian education, the world's largest democracy, with all its peculiarities (Hardgrave Jr, 1993). One must be attentive to what occurred in this country, considering all possible repercussions, so that other peoples, nations, and educational systems can guard against the consequences of this type of unwarranted interference.

India, which in the third decade of the 21st century is among the leading players in the global economy (Jain et al., 2013) and the cutting edge of technology (Jadhav et al., 2023; Upendra et al., 2020), also holds the title of the world's most populous nation (Hertog et al., 2023). With remarkable advances in the economy and digital communication (Jordan et al., 2023), India has achieved remarkable feats, such as landing a probe in a lunar region unexplored by other nations or space agencies (Goswami, 2020). However, this outstanding scenario coexists with worrying setbacks in education (Dash, 2000).

The country recently announced curriculum changes that exclude important scientific topics from school textbooks, such as the periodic table and Darwin's theory of evolution, a measure that will affect around 134 million young students aged 11 to 18, sparking outrage among scientists and teachers (Lewis, 2023). More than 4,500 scientists, teachers, and science communicators came together in an appeal for the restoration of content on evolution in Kolkata, India (Breakthrough Science Society; Samanta, 2023; Lewis, 2023). In the meantime, there is a need to understand the reasons behind this decision and its implications in the context of the country. It is worrying that this kind of setback, which is already occurring in other countries with the influence of movements such as creationism (and intelligent design) opposed to the teaching of evolutionary theory (Silva, 2017), reaches a country of great global and regional importance.

These recent educational changes in India, particularly the removal of subjects such as evolution and the periodic table, reflect a complex interplay of factors influenced by religious, cultural, and political dynamics. Driven by the Rashtriya Swayamsevak Sangh (RSS) (Sharda, 2018), an organization with ties to the ruling Bharatiya Janata Party, the alterations in the curriculum align with a broader societal shift away from perceived external threats to Hinduism. Some religious groups in India have taken anti-evolution stances, viewing it as conflicting with creation stories (Brown, 2021). This move signals a departure from rational thinking and Western ideas, with historical narratives and, notably, scientific content becoming targets. The lack of transparency in the decision-making process and the absence of engagement with educators and parents raise concerns about the potential long-term impacts on scientific literacy and intellectual curiosity among students (and teachers) in India.

Although India has vast potential for the future, the issue of science education is crucial, and it is essential to reflect on how this measure contradicts India's achievements and aspirations to be a leader in global scientific development. In this context, it is relevant to investigate whether the action against science education is predominantly related to religious issues (Khalsa et al., 2022) or whether it also reflects negligence in relation to the country's educational development (Jayapalan, 2005). The influence of religion and politics has been previously cited concerning erratic actions in the

teaching of evolution. However, India's standing in the PISA international performance test implies a further dimension of negligence in this domain (Lall et al., 2005). Despite endeavors to enhance scientific development, India appears to struggle in effectively channeling its resources toward this goal. The consequence is evident in its ranking at the bottom of this examination (Kumar et al., 2021), a situation potentially exacerbated by the removal of fundamental subjects from its school curriculum.

The difficulty of realizing the importance of evolutionary theory for science and national development can be challenging, but it is important to list the potential negative impacts in the short, medium, and long term that India will face in the face of this measure.

○ Short Term

The removal of the subject of biological evolution from the school curriculum in India, promoted by the Indian government, will have significant and immediate impacts on the educational system and the development of the country's students. The decision to exclude evolutionary theory, even in the short term, has several worrying implications:

1. *Serious Gap in Science Education:* The removal of biological evolution from the school curriculum will leave a significant gap in the science education of Indian students. Biology, as a discipline, is intrinsically connected to the theory of evolution, which serves as a central axis for understanding all topics related to life and biological diversity (Sadava et al., 2009).
2. *Lack of Integration of Biological Topics:* The theory of evolution acts as an integrating link in biological studies, connecting diverse concepts such as genetics, ecology, anatomy, and physiology (Helfman et al., 2009). Removing this central pillar will undermine students' ability to understand biology holistically, and how it is fundamental to humanity's progress (Meagher, 1999). Theodosius Dobzhansky's phrase, "Nothing in Biology makes sense except in the light of Evolution" (Dobzhansky, 1973), sums up the critical importance of this theory. Removing Darwin from the classroom denies students the opportunity to understand the principles that underpin all modern biology.
3. *Loss of the History of Science and Scientific Method:* Darwinian theory is not only a scientific concept, but also a striking example of the scientific method in action (Ayala, 2009). The detailed observation, data collection, rigorous analysis, and reasoned conclusions that led to the formulation of Darwin's theory are essential to understanding the scientific process (Feibleman et al., 1959), as well as being considered a historical and even philosophical milestone (Dewey, 2007) in science. To deprive students of this perspective is to damage their appreciation of the construction of scientific knowledge and the unfolding of a theory in related areas.
4. *Harm to Inspiration and Religious Tolerance:* Charles Darwin's life serves as an inspiration to many students and future researchers around the world (Desmond et al., 1992). His biography highlights that religion and science are not incompatible, showing that it is possible to maintain religious beliefs while adhering to fundamental scientific

principles (Ayala, 2007). In the scientist's own words: "It seems absurd to me to doubt that a man can be a fervent theist and an evolutionist."¹ In India, where religious beliefs play a prominent role in society, this lesson is of great relevance.

The abrupt removal of biological evolution from the Indian school curriculum in the short term creates a deficiency in science education that undermines understanding of biology and undermines students' ability to develop a comprehensive view of science. Furthermore, this action represents a setback in recognizing Darwin's contribution to science and the need to teach sound scientific methods. It is therefore important to consider the negative impacts that this measure will have on the next generation of Indian scientists and citizens and to re-evaluate its implementation.

○ Medium Term

The removal of the subject of biological evolution from the school curriculum in India, in the medium term, will have profound and challenging consequences for the scientific fields and for the training of new professionals in the country. Several effects will become evident as the students who have been deprived of this knowledge progress through their academic and professional journeys:

1. *Challenges for science undergraduates:* In science degrees, especially in the biological and health fields, students will arrive without a solid knowledge of the theory of evolution (Dagher et al., 1997). This will raise serious questions about how these courses will work on fundamental subjects that have been deemed dispensable by the Indian education authorities.
2. *Lack of connection between biology and health:* Biology and health are intrinsically linked, and the theory of evolution provides an essential basis for understanding how diseases evolve and how organisms respond (and undergo selection) to them (Moalem, 2007). The absence of this knowledge can hinder the connection between these fields, which is detrimental to the training of doctors and other health professionals.
3. *Difficulties in Understanding Bacterial Resistance:* A practical example of the value of knowledge about biological evolution is understanding bacterial resistance to antibiotics (Mancuso et al., 2021). Without a basis in natural selection and evolution, students may struggle to understand how bacteria develop resistance to antibiotics over time (Dykhuizen, 1990).

These insights are essential to guide future Indian scientists (and those from any part of the world) in the development of new antibiotics, taking into account potential bacterial resistance. Likewise, upcoming medical professionals will comprehend the importance of judiciously prescribing these medications, avoiding indiscriminate use, as witnessed in various countries during the COVID-19 pandemic, notably in Brazil (Silva, 2021), which posed risks of new strains of antibiotic-resistant bacteria. Furthermore, aspiring scientists must address the issue of resistance when considering the production of novel vaccines to confront this evolutionary phenomenon of microorganism resistance. This is essential for medical practice and public health (Aslam et al., 2018).

4. *Impact on the training of scientists:* The lack of teaching on the theory of evolution and fundamental concepts such as the periodic table will compromise the training of a new generation of scientists (Sheldrake, 2005). The development of solid scientific skills and a comprehensive understanding of the natural world are essential for scientific and technological advancement, and this depends on India having scientists with a solid knowledge base.
5. *Damage to Research Capacity:* Scientific research depends on understanding the fundamental principles that govern the natural world (Lenski, 2015). The removal of evolutionary theory from the Indian education system poses a profound threat to the future scientific endeavors of the country. First, a solid understanding of evolution serves as the cornerstone for various scientific disciplines, providing a framework for comprehending the interconnectedness of life forms, biological processes, and ecological systems (Pásztor et al., 2016; Stauffer, 1957). Without this foundational knowledge, aspiring Indian scientists may find themselves inadequately equipped to explore the intricacies of genetics, ecology, and other pivotal domains that rely on evolutionary principles. Second, innovation in scientific research often thrives on the ability to draw connections across diverse fields of study. The exclusion of evolutionary theory disrupts this interdisciplinary harmony, hindering the capacity of future scientists to synthesize insights from biology, medicine, and environmental science (Kartman, 1967; Watts et al., 2019). In an era where groundbreaking discoveries emerge at the crossroads of different scientific realms, the absence of evolutionary knowledge could impede the holistic perspective necessary for pioneering research. Therefore, the limitation of knowledge about evolution not only jeopardizes the individual scientific pursuits of aspiring researchers but also undermines the collective potential of the scientific community in India to contribute meaningfully to the global advancement of knowledge.

The removal of the theory of evolution from the Indian school curriculum in the medium term will have substantial negative impacts on the training of professionals in the scientific and health fields. It will be crucial for educational institutions and the Indian government to consider the damage this measure could cause and seek ways to reintroduce and strengthen the teaching of biological evolution to ensure a more solid future for science and education in the country.

○ Long Term

The government of India's long-term withdrawal from the subject of biological evolution has profound and lasting implications for the country, affecting crucial areas such as agriculture, livestock, health, and its claim to be a global reference in these areas.

1. *Impact on Agriculture and Livestock:* Agriculture and livestock are the backbone of the Indian economy (Cagliarini et al., 2011; Pandey, 1995), and understanding evolution plays a key role in these areas. Natural selection and genetic adaptation are essential concepts for improving productivity, pest resistance, and the development of crop varieties resistant to adverse conditions (Mehrotra, 1989).

The absence of this knowledge could jeopardize India's ability to feed its growing and enormous population.

2. *Historical damage to agriculture:* History shows us examples of how the denial of evolutionary theory and ideological interference in science can seriously damage a country (Joravsky, 2010). The case of the Lysenko doctrine in the Soviet Union resulted in significant delays in agricultural research and widespread famine in the 20th century, which cost the lives of millions through the denial of genetics and Darwinian evolution (Lecourt, 2017). India must learn from this kind of historical mistake and recognize that sound, evidence-based science is fundamental to progress.
3. *Failure in Public Health Development:* Understanding evolution is also vital for public health. Without it, future health professionals may struggle to understand the rapid evolution of pathogens (Elena et al., 2003), such as viruses and bacteria, and drug resistance. The handling of the COVID-19 pandemic, the mutations of SARS-CoV-2, the difficulty of treatment and the need for vaccination, have shown how important it is to understand the evolution of a virus (Silva, 2021) and be prepared to deal with this type of event. This could compromise the country's ability to deal with disease outbreaks and develop effective public health strategies.
4. *Compromising the Scientific Vanguard:* The lack of a solid foundation in science and evolution could compromise India's ability to lead technological and biotechnological advances in the future. Biotechnology, in particular, is an area that relies heavily on an understanding of evolutionary principles for the development of new therapies, drugs, and technologies (V. Gupta et al., 2017).
5. *Damage to tackling climate change:* India, as the world's most populous nation, faces serious challenges related to climate change, which may be compounded in their coping by the removal of critical scientific topics from its education, such as the subject of evolution. The nation is vulnerable to extreme weather events such as intense monsoon rains and prolonged droughts, often exacerbated by global warming (Aadhar et al., 2018; Guhathakurta et al., 2011). Understanding climate and environmental sciences is fundamental to facing these threats, and understanding how evolution occurs in the face of these conditions is fundamental to reducing the effects of these changes, including the extinction of species and the abundance of pests.

The long-term removal of the theory of biological evolution from the Indian school curriculum jeopardizes not only science education, but also economic progress, food security, public health, and India's position as a leader in technological and biotechnological advances.

○ Possible Reasons

The contemporary rejection of the evolutionary theory in India is a complex phenomenon rooted in the nation's rich tapestry of religious diversity, where Hinduism, Islam, Sikhism, and various other faiths coexist (Lopez Jr, 1995). The multifaceted nature of this rejection may find its origins in the intersection of religious beliefs with the scientific narrative proposed by evolutionary theory. India, with

its pluralistic society, is home to a spectrum of religious interpretations, ranging from conservative to more liberal perspectives (Singh, 2004). The rejection of evolution might be linked to a conservative strain within certain religious communities that perceive evolutionary principles as conflicting with their traditional religious tenets.

The diverse religious landscape in India introduces a challenge of navigating through contrasting theological viewpoints (Patrick, 2020), where interpretations of creation and human origins may vary significantly. The rejection of evolutionary theory might, in part, be a response to the perceived threat it poses to established religious narratives, particularly those rooted in literal interpretations of religious texts (Bowler, 2003). This rejection may be exacerbated by the presence of religious fundamentalism within certain segments of the population, where adherence to strict and dogmatic interpretations prevails (Nieminen et al., 2014). Consequently, the rejection of evolution may not be a singularly religious stance but rather a manifestation of broader socioreligious dynamics that shape attitudes toward scientific paradigms. Understanding the nuanced interplay between religious diversity and scientific acceptance is crucial for devising effective strategies to reconcile these seemingly conflicting domains within the educational landscape of India.

In the intricate tapestry of Indian society, religion plays a significant and multifaceted role. Despite the rich diversity of religious practices, Hinduism stands out as the predominant faith, influencing the cultural, social, and political fabric of the nation (Bloch et al., 2009). The heterogeneity within Hinduism itself, with its myriad shades of belief systems, further adds to the complexity of the religious landscape (Sharma, 2011). Amid this intricate scenario, the recent removal of evolutionary theory from the Indian education system introduces a unique challenge. While the decision is ostensibly linked to appeasing various religious sentiments, it is noteworthy that many scientists within the Hindu community do not view the intersection of their religious identity with scientific principles as a point of contention. In fact, a considerable number of Hindu scientists exhibit a harmonious coexistence of their faith with evolutionary theory (Breakthrough Science Society; Samanta, 2023). This nuanced perspective is exemplified by the acceptance of the Dashavatara, the ten avatars of Lord Vishnu in Hinduism, as a conceptual framework aligning with the tenets of Darwinian evolution (Palai & Mishra, 2022). Despite the prevailing religious landscape, the attitudes of Hindu scientists underscore the potential compatibility between religious beliefs and acceptance of evolutionary science, emphasizing the need for a more inclusive and informed approach to education in India.

The current decision by the Indian government to withdraw the teaching of evolutionary theory from regular education reflects a complex interplay of political considerations, religious sentiments, and societal dynamics (Laborde, 2021). In an effort to cater to and align with various religious groups within the country, the government appears to be responding to demands that perceive the teachings associated with Darwinian theory as challenging or conflicting with traditional religious beliefs (Aiyar, 2020). By removing evolution from the curriculum, the government may be attempting to appease conservative religious factions, particularly those who view the theory as a threat to their doctrinal narratives. This strategic move, while ostensibly aimed at garnering support from religious communities, raises concerns about the potential compromise of scientific integrity in the educational system. The government's decision underscores the delicate balance that political leaders often navigate between secular education and accommodating diverse religious beliefs, highlighting the need for a nuanced approach that

preserves the integrity of scientific teachings while respecting the religious fabric of the nation.

Government officials, particularly those engaged in public education, must recognize that science and religion are not antagonistic, even on the matter of evolutionary theory. The religions pertinent to India hold significance beyond its borders. It is crucial to identify researchers, religious figures, and thinkers who have successfully navigated the path toward harmony among Hindus (Raman, 2012), Muslims (Kojonen, 2023), Sikhs (Jhutti-Johal, 2011), Buddhists (Jackson, 2020), and others Asian religious prevalence (Brown, 2020). By doing so, not only can the current situation in India be averted, but also the emergence and endorsement of similar detrimental interferences can be preempted.

Again, based on this type of threat to the Indian education system, and the reasons for it, one has to wonder what might happen in countries such as Brazil and the USA, which are also experiencing this type of risk. As an example, Brazil recently experienced this in the Bolsonaro government, in which there were several high-ranking members in education (Silva, 2023) and science (Burity, 2021) who openly declared themselves aligned with creationism and intelligent design (Silva, 2023b), as well as refractory to evolutionary theory. This probably resulted in a framework that supported denialism in the pandemic period, in education and in scientific research in the country at that time. As in India, the Brazilian government sought to please and align itself with the growing number of more dogmatic religious denominations (Almeida, 2019), especially in relation to customs (Kibuuka, 2020).

○ Conclusions

The removal of the subject of biological evolution from school curricula by the government of India represents an act of concern not only for the scientific community, but also for the integrity of education and the future of the country. This act, which allows dogmatic religious issues to interfere in the education system, raises a number of critical questions and demands a considered analysis of the resulting effects. India, a nation that seeks to excel globally in economics, technology, and scientific research, risks undermining its own scientific knowledge base by removing a topic as fundamental as biological evolution from the curriculum. Science is a search for truth based on empirical evidence, and evolution is a well-established scientific theory that is accepted by the global scientific community. To deny its inclusion in education is to deny a fundamental understanding of biology and science as a whole.

India's approach to education, allowing religious dogma to influence the curriculum, undermines the principle of the secular state and threatens the integrity of science education. This creates an environment conducive to the proliferation of misinformation and the polarization of society on fundamental scientific issues. India will only be able to face the challenges posed by climate change if it places science education as one of the country's priorities. Only with all the knowledge relating to ecology and evolution, and biology as a whole, will it be possible to mitigate this situation imposed on humanity and its population in particular. Furthermore, it is imperative that in-depth research, analysis, and discussions take place to assess the true extent of the damage caused by this inadequate intervention in Indian education.

Clearly demonstrating the negative impacts of this measure could be an important step in promoting the reversal of this decision in India and possibly serve as an example for other countries

considering similar curriculum changes. However, it should be recognized that reconciliation between religious beliefs and acceptance of the theory of evolution is possible. Finally, the removal of biological evolution from the school curriculum in India represents a global challenge to the integrity of science education in a world where religious and political influences can affect evidence-based teaching. It is crucial that society, educators, and political leaders are vigilant to ensure that science education is preserved and that future generations have access to reliable, evidence-based knowledge to face the complex challenges of the modern world.

This addressed issue is relevant to educators in the United States, as well as worldwide, as it highlights a global concern regarding the teaching of evolutionary theory and its relationship with religious influences in educational systems, along with the risks associated with its exclusion from curricula. Similar issues arise in various countries, including the United States and Brazil, where creationist and intelligent design movements challenge the teaching of evolutionary theory in school curricula. By addressing the situation in India, an additional perspective is sought to be provided on the challenges faced by nations in different parts of the world. The removal of the theory of evolution from education in India serves as a striking example of the negative consequences that may arise when religious influences interfere with evidence-based teaching. Understanding these challenges is crucial to promoting global awareness of the importance of preserving the integrity of science and biology education, as well as its implications in other fields of knowledge, irrespective of religious pressures. It aims to encourage a broader dialogue on the reconciliation between religious beliefs and acceptance of evolutionary theory.

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○ Note

1 <https://www.darwinproject.ac.uk/letter/DCP-LETT-12041.xml>

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