

**Media Framing of Biotechnology and Genetic Engineering: Public Perception vs. Scientific Reality**

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**Abstract**

Genetic engineering and biotechnology have been identified as radical scientific disciplines with the power of being able to solve the problems facing the world in terms of agriculture, medicine and environmental sustainability. Nevertheless, these technologies are mainly framed as a result of the media influence on society, and they tend to reinforce the belief that these technologies are dangerous, unethical, and generally alarming. The review presents the synthesis of the research published on the subject between 2015 and 2025 as a way of examining how the mass media and digital platforms develop narratives about genetic engineering and how these narratives do not align with scientific evidence. Using Agenda-Setting Theory, Framing Theory, Cultural Cognition, and Trust Models, the review shows that the media resorts to metaphors like playing God or designer babies, which have been exaggerated to elicit the audience to become more emotional and less concerned with empirical research and regulatory protection. The discussion also indicates that digital and social media's environment exacerbates misinformation, privileging sensational content over accuracy and contributing to public skepticism and policy resistance. The results of the analysis indicate that there has been a gap between scientific reality and the media environment. Public interpretation entails conscious effort in the field of transparency science communication, training as journalists, contextual ethnicization, and approaches to engage audiences. It is important to enhance communication among scientists, media practitioners and society to develop informed and refined knowledge and to promote responsible progress and adoption biotechnology within the social community.

**Keywords:** Media Framing; Media; Biotechnology; Genetic Engineering; Public Perception; Science Communication; Agenda-Setting; Journalism; Ethics; Moral Discourse; Public Trust.

**Introduction:**

The innovation of biotechnology and genetic engineering has reshaped the human vision of life at the molecular level, and it lies at the core of the contemporary environmental management, agriculture, and medicine, however, the perception of biotechnology by the population has not been made entirely understood, which is the puzzle between the invention of genetically modified crops and the invention of the CRISPR-Cas9 gene- editing platform (Demain and Sánchez, 2018). The question of how science and technology were incorporated in biotechnology is a critical interdisciplinary issue that requires The public is primarily exposed to complex scientific information through the mass media. According to the framing theory, which was originally proposed in 1993 and is a theory that influences how the media

reports on issues and how political figures and the population at large debate them; it does this by highlighting one side of the arguments, theme or metaphor over another by the media (Entman,1993). In the contexts when the terms are applied to the sphere of genetics engineering and biotechnology, the framing methods usually emphasize the issues related to the safety, ethical issues, or unnaturalness of the manipulations with life, which is another manner of increasing the moral tension and perplexity.

Similarly, the majority of the evidence based evaluations of the safety and utility of genetically modified (GM) foods are frequently drowned in the rhetoric of corporate profiteering, environmental threat, or even anxiety of the public with regard to such products and even scientific research funding (Moon et al.,2019).The images not only have political connotation on the regulation of such products, but also on the perception of the product by the public and even on funding of scientific studies.

On the one hand, the scientific community works under the conditions of reproducibility, experimentation and evidence. Some international conventions, like UNESCO Universal Declaration on the Human Genome and Human Rights (1997), are viewed as a moral consideration to biotechnology that is being taken into consideration by the scientists, using empirical parameters like gene (Sass, 1998).

This environment is complicated further by digital media. The common accessibility of information sharing due to the introduction of the blogs, YouTube channels, and social media has made it hard to tell the difference between a pseudo-scientific narrative reporting and a factual reporting. The resonant material or the fear-based material has been identified as more likely to be virally spread on the Internet as compared to a more nuanced and data-driven account of genetic technologies (Vraga&Bode,2021).This promotes polarizing argumentation rather than an informed discussion and contributes to the misinformed attitude towards the new technologies further. High schools that have low science and media literacy are the only ones that expose viewers to more conspiracy theories regarding the topic of so-called “Frankenfoods” or the ethical component of gene editing.

Another consideration that is ethically and socioculturally framed in which biotechnology is factored is the human fears that relate to manipulating the natural order or the urge to become like God are frequently evoked by media representations, paraphrasing philosophical questions that were asked already in the early days of modern genetics. However, in spite of the fact that they are bound to dilute the complex ethical paradigms within the framework of which biotechnological research is conducted, i.e. beneficence, nonmaleficence and informed consent, these moral framing carry a rousing emotional appeal to the masses (Rhodes et al.). Besides, the mediaoutlets are likely to present the biotechnology debate in a particular manner due to political and economic interests, especially when the corporation stakeholders dictate the agenda-setting process or where regulatory policies do so.

In this way, the gap between the two fields will be bridged as the field of biotechnology and genetic engineering is analyzed through the prism of scientific and communication. It will seek to provide answers to the following key questions:

- In opposition to the paradigm of the scientific discussion, in what way are the genetic engineering and biotechnology established within the framework of the mass and digital media?
- Which themes risk, ethics, innovation, or commercial interest predominate in these representations? What do these framings mean to the policy making process, public perception and trust?
- What approaches can help biotechnology communication become more accurate and balanced?

The review adds to the literature development on science communication, exploration of the interaction between the mass participation, media representation and scientific advancement, by synthesizing the views of both mass communication and molecular biology. In establishing the major updates in framing and their implication within the society, it makes use of an methodical literature review strategy, which synthesises articles of research published within the time frame between 2015 and 2025. The CRISPR case study, the genetically modified organisms (GMOs) case study, and the cloning case study are chosen to become the subject to exemplify how the media coverage fails to match the scientific evaluation

(Ormandy, 2018).

Last but not least analysis based on this units shows a pressing need to combat the mediated practices of urgently responsible science and proactive scientific outreach. In addition to being a communication problem in the era of rapid technological adaptation and cyber-communication, the communication gap between what the general audience believes and what the true state of science is has been an ethical requirement to make sure that people did not lose their faith in science. It is, therefore, highly important to comprehend and offer remedies to the notion of biotechnology in the media to prevent the misappropriation and misuse of these mighty technologies but to ensure that they are perceived as an instrument of societal development.

### **Research Objectives**

This review aims to:

1. Examine how media frames biotechnology and genetic engineering in the public sphere.
2. Analyze the divergence between scientific consensus and public perception.
3. Identify communication strategies that can bridge the trust gap between scientists and the public

### **Literature Review**

Public understanding of biotechnology and genetic engineering is shaped considerably by the way these technologies are portrayed in the media, rather than by direct engagement with scientific literature. The media acts not only as an information channel, but as an interpretive system that assigns social meaning to scientific advancements through selective emphasis, emotional tone, and narrative framing (Li, 2020). As a result, public perceptions often diverge from scientific consensus, with biotechnology being understood through ethical, cultural, and symbolic associations rather than empirical evaluation.

Kato-Nitta et al.(2019) have noted that scientists tend to view gene-editing crops and organisms through the lens of quantifiable benefits and on the overall controlled risks, where as non-scientists tend to view them through the lens of moral responsibility and moral panic. This divergence is reinforced when media outlets foreground uncertainty, controversy, or hypothetical harms instead of scientific evidence or regulatory safeguards. Stapleton (2023) demonstrated that U.S. news discourse surrounding CRISPR frequently invokes metaphors such as “playing God” or “designing babies,” which function as moral frames that amplify anxiety and ethical alarm, even in contexts focused on clinical or therapeutic applications.

Technology is also different in the media framing. Agricultural biotechnology tends to be placed in opposition as something risky, and corporate and ecologically dubious. Bearth and Siegrist (2024) determined that even in the framework where consumers have been given a clear scientific assurance of the safety, which suggests that it happens to be the narrative and the cultural situation that promotes distrust, and not ignorance. According to Middleton (2024), medical news coverage tend to apply usage of personalized narratives, such as those of patients, that contribute to increased emotional connection with the research on gene-editing and, simultaneously, they deemphasize perceived ethical resistance.

Digital media spaces have increased these implications of framing. Ni et al. (2022) found in an examination of the global reaction to the case of CRISPR-edited babies in 2018 that social media platforms spread the moral reproach far more quickly than the explanation or context, forming a discourse of outrage and infuriation in any social, economic, or political situation. Visual media leads to the aggravation of these dynamics. Images on biotechnology news, such as magnified embryos or laboratory containment imagery are accompanied by emotional responses that invalidate the interpretations of the audience regardless of the text being a neutral or scientific text (Dawson et al., 2022).

Belief in institutions is a conclusive mediating variable. The more people consider the regulatory bodies and scientific institutions transparent, ethical, and accountable to the society, the more likely to accept

biotechnology (Runge, 2015; Organisation for Gene Technology Regulation, 2017). Conversely, the stories that present biotechnology as something secret, commercially driven, or unequally accessible reduce trust and increase perceived risk. Ewa (2022) writes that not only how biotechnology is portrayed as something secret, commercially driven or unequally accessible, but also who is regarded as in control of it and how it is used.

Overall, the literature show that media framing is not just a reproduction of the attitudes of the population but it constructs them through the assistance of emotionally resonant narratives that compete with the exposition of the scientific reality. In this manner, to close the gap existing between the scientific reality and how the society perceives it, communication strategies relying on transparency, contextualization, and conversation are to be used rather than the distribution of the technical information. The realism of media literacy, collaborative work between the scientists and the journalists, and emphasis on ethical communication processes are needed to organize the perception of the population with scientific knowledge.

### **Theoretical Framework**

It presupposes the interdisciplinary theoretical approach that will join the communication science, psychology, and molecular biology to comprehend the impact of the media on the manner in which the Genetic Engineering and biotechnology are perceived by the population. The Agenda-Setting Theory, Framing Theory, Cultural Cognition and Moral Values, and Science Communication and Trust are considered to be complementary and included in this review. Combined together, these structures cannot help to understand how scientific information is chosen, interpreted and tested in the setting of the global discourse that justifies why scientific consensus is not usually followed by the common opinion.

### **Agenda-Setting Theory**

As already mentioned in the Agenda-Setting Theory (McCombs and Shaw, 1972), the media has a crucial role in influencing the thoughts of people even though they cannot actually directly control the people. The media change a priority of the social issues by providing disproportionate focus to certain problems (e.g., the designer babies, the safety of food, the bioethics) (Rossler, 2015). This can often imply that such issues which are routinely discussed can tend to take up the funding agenda, the social discourse, and even the policy agenda. This measure will delimit the reasoning of the people on whether gene editing is a moral hazard or a biotechnological breakthrough in communicating about humanitarianism.

### **Framing Theory (Entman, 1993)**

Frames are determined by Agenda-setting as to what should be thought of and Framing Theory as to how to be determined. Frames constitute explanatory constructs that give diagnoses of the causes, make moral judgements and offer solutions.

It is always the case that news on biotechnology is presented in four broad patterns, which include Problem Frames, consequences on the environment, or ethical dilemmas, and Solution Frames, which emphasize the innovations, medical solutions, and food sustainability.

**Responsibility Frames:** Attributing blame or accountability to scientists, corporations, or governments.

This type of framing lets the audience perceive the issue in a favorable or unfavorable way by exercising control over the emotions and moral responses and urging CRISPR as a gene-editing revolution or as a means of messing with human DNA.

**Cultural Cognition and Moral Values (Kahan et al.) :** The scientific communication theory of psychology and sociology is the Cultural Cognition Theory (Kahan et al., 2011), which indicates that

individuals understand scientific information in terms of their cultural affiliations and the moral worldviews, rather than the objective data.

Public conflicts over biotechnology are usually caused by the identity-protective cognition that is the disposition to withhold or provide information based on its adherence to moral ideals, religion, or political ideology. Individualistic or hierarchical perceptions of the world, i.e. maybe, may accept the idea of genetic invention because of their economic or medical purposes, yet the galitari egalitarian an or religious ones may disapprove of them because of ethical or environmental causes (Kahan, 2017). This is the concept that is central in the explanation of why factual information rarely alters the opinion of the people in the debate surrounding genetic engineering (Kahan and Braman, 2006).

**Science Communication and Trust:** The science Communication and Trust paradigm asserts that perceived institute of institutional distrust more often than not causes the scepticism of science by the general population, rather than ignorance. Trust is construed by the perceived scientific and governmental institutional transparency, unbiasedness and credibility.

Any scandal of corporate ownership, lack of government regulation as well as perceived privacy of the industry of genetic research could all result in the death of the masses of trust to biotechnology. It is a fact that the successful science communication is not only the exchange but also the establishment of trust via transparency, engagement and responsibility (Weingart and Guenther, 2016). Such practice will be consistent with the Dialogic Model of Science Communication that states that the two-way communication between scientists and media professionals and the collaboration between scientists and the population as a whole should be facilitated to build upon the knowledge and improve cooperation (Weingart&Guenther,2016).

**Integrative Perspective:** A combination of these four views makes this analysis have a holistic approach to the research of relation between media discourses and social meanings of biotechnology. Agenda-setting refers to the issues that are getting handled. The FramingTheory describes how these topics are presented, and Cultural cognition describes why audiences differ in their reaction (Kilford et al., 2016). The Science Communication and Trust addresses the issue of credibility and participation in achieving acceptance.

A combination of these theories provides a sufficient basis of discussing the gap between the scientific reality and a perception created by the media, and shedding light on the way communication, culture, and trust mediate the discourse on biotechnology and genetic engineering among the population (Cullberg, 2014).

## **Methodology**

### **Study Design**

To explore the nature of the biotechnology and genetic engineering coverage in the media and the ways in which the coverage differs with the realities of the science, the review is methodically formatted, using a narrative synthesis approach, which integrates scientific and communication perspectives. This was done so as to ensure transparency, reproducibility, and thematic coherence through following PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) guidelines(Page et al., 2021).

The three primary phases of the other research design are identified and screening of the literature published by different media repositories and databases. Thematic coding is used to identify bias, framing and patterns of scientific correspondence (Selçuk, 2019) media representations are compared to scientific consensus that is accepted.

### **Research Design**

To explore the issues of how biotechnology and genetic engineering are depicted in the media and how the portrayals diverge with the scientific facts, the review will utilize a synthesis approach that is methodical and narrative in synthesis, which incorporates scientific and communication perspectives. It was developed in a way that ensures transparency, reproducibility and thematic coherence through compliance with PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-analyses) guidelines.

Three major phases of research design exist: identification and screening of literature in different media repositories and databases. In order to identify bias, framing, and patterns of scientific correspondence, thematic coding is used (Selçuk, 2019). media representations and accepted scientific consensus are compared.

### **Data Sources and Search Strategy**

Peer-reviewed papers, media studies, and science communication report published since 2010 and 2025 in major scientific and communication databases, such as Scopus, Web of Science, PubMed, Google Scholar, and SAGE Journals were searched. In the case of journalistic sources, LexisNexis, Factiva and news archives were utilized to add the communication aspect, and Boolean operators (AND, OR) were utilized to narrow down the search and snowball sampling was utilized to find the relevant references in the reference lists.

### **Inclusion and Exclusion Criteria**

A strictly English-language sources that specifically dealt with biotechnology or genetic engineering with reference to media coverage, framing, or popular opinion were only included so as to ensure academic rigour. Included studies were those that reports are purely technical or lab in nature and have no communication value, opinions that lack enough empirical or analytical substantiation and duplicates or unreliable non-peer reviewed resources.

The reason why this strategy enabled it is because it was possible to incorporate scientific and communication literature in a balanced way in a way that demonstrates the disciplinary competence of both you and your co- author.

### **Data Extraction and Analysis**

Each selected study was coded on thematic categories: media type ( broadcast, social, and digital / print), framing dimension (political, economic, inventive, risky, and ethics), accuracy of science (aligned, exaggerated, distorted, neutral), Impact on the audience (scepticism, awareness, fear, and trust).

The qualitative data were analyzed by applying a thematic synthesis strategy to identify the recurrent themes in them and compare them to the real scientific data on biotechnology. Quantitative trends were used where possible to support the analysis of the narrative.

### **Quality Assessment**

Credibility of the journal or publisher (e.g. impact factor, indexing), methodological openness (e.g. data validity, sampling) and objectivity and neutrality of reporting were used to measure reliability of each source. In the synthesis, studies of the higher quality were assigned more analytical weight.

### **Search Strategy**

Peer-reviewed papers, media studies, and science communication report publications (published in 2010-2025) were searched in major scientific and communication databases: Scopus, Web of Science, PubMed, Google Scholar, and SAGE Journals. In the case of journalistic sources LexisNexis, Factiva, and news archives were used in a bid to incorporate the component of communication.

<b>Component</b>	<b>Details</b>
Data bases searched	Scopus, Web of Science, PubMed, Google Scholar, SAGE Journals, LexisNexis, Factiva
Keywords used	“mediaframing”, “biotechnology”, “genetic engineering”, “CRISPR”, “GMO”, “public perception”, “science communication”, “bioethics”
Filters applied	Human studies, English-language publications, full-text availability
Additional sources	Peer-reviewed journals, media reports, news articles, communication studies, Scientific reviews
Justification	A multi-database strategy ensures maximum inclusion. Manual screening adds robustness and minimizes missed Relevant studies.
<b>Publication Years Covered</b>	<b>2015-2025</b>

The thematic synthesis and coding were guided by four communication theories: Agenda-Setting, Framing, Cultural Cognition, and Science Communication & Trust.

### **Inclusion and Exclusion Criteria**

<b>Criteria</b>	<b>Inclusion</b>	<b>Exclusion</b>
<b>Study Type</b>	Studies linking biotechnology/genetic engineering with media framing, ethics, or public opinion; English-language; empirical or Analytical depth	Non-academic blogs, duplicate entries, purely technical lab reports, non-English publications
<b>Language</b>	Published in English	Non-English without translation

### **DATA EXTRACTION**

<b>Extracted Information</b>	<b>Description</b>
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Study Details	Author(s), publication year, country of origin, journal
Data Extraction Method	Thematic content analysis using Qualitative synthesis
Quality Assessment Metrics	Source credibility, citation relevance, neutrality, methodological transparency
Out come of Interest	Identification of framing patterns and Their divergence from scientific reality
Theoretical Framework	Agenda-Setting, Framing, Cultural Cognition, Trust
Method Used	Qualitative, quantitative, or mixed- methods

#### 4. Thematic Analysis

The main themes of the reviewed literature are summarised in this section and how job representations of genetic engineering and biotechnology are represented in mass and digital media is discussed and whether the visualisation contributes to or opposes the scientific knowledge. The five major patterns that were identified were Risk and Uncertainty, Ethical and Moral Framing, Innovation and Progress, Political and Economic Interests, and Misinformation and Public Trust (Terry et al., 2017). Each of the themes shows the effects of communication narrative on the scientific credibility, policy discourse and perception in the society.

#### Risk and Uncertainty Frame

One of the most popular topics in biotechnology journalism is the risk framing. The media often focuses on the potential dangers, unintended consequences and the "unknowliness of the nature of genetic editing, putting these technologies in a warning and fear story. As an illustration, accounts about genetically modified organisms (GMOs) will often emphasize the purported dangers of such products on the environment (genetransfer to wild species, loss of biodiversity or food safety) without some background about the research. Nonetheless, there is scientific evidence that paints an equally balanced picture. The studies presented by the World Health Organisation (WHO, 2022) and the European Food Safety Authority (EFSA, 2021) prove that certified GM crops undergo extensive risk evaluation and are not more dangerous than traditionally grown. Types (Godlee, 1994). The damage of illusion arises because risk-oriented framing draws attention to the audience what Nelkin (1995) termed as the drama of science.

The disparity arises due to the fact that risk-oriented framing is what attracts the attention of the audience what Nelkin (1995) called the drama of science. Sensation sells, even at the cost of truth. The concept of biotechnology being out of moral or scientific control is an extension of this framing into the present, with the current popular media describing the CRISPR system as a genetic time bomb (Tagliabue, 2016).

### **Ethical and Moral Framing**

The moral system is largely founded on cultural and philosophical interpretations of what it means to tamper with the nature, such as, having to play God, or go beyond the natural boundaries, which appeal to the societal anxiety about human control over life (Bateman et al., 2002). These plots, as emotive as they are tend to simplify the problematic ethical principles that define the research of biotechnology. Bioethics is an essential aspect of any genetic engineering projects. The International Bioethics Committee of the UNESCO and the National Institutes of Health (NIH) needs to follow the principles of beneficence, nonmaleficence, fairness and informed consent. These restraints are however often lost in the moral sensationalism the media is fond of.

### **Innovation and Progress Frame**

In comparison to the risk and moral frame, the innovation frame represents biotechnology as an icon of progress and human inventiveness. The story is conspicuously conspicuous in the science-oriented periodicals, technological news, and corporate communications. The media reports on the possibilities of genetic engineering to eliminate hereditary health issues, enhance the resistance to powerful crops and come up with materials that can be easily discarded give people hope and motivation to invest in science.

In From a molecular biology standpoint, this framing can ignore the constraints of the experiment, off-target effects as well as socioeconomic inequalities that come with the use of biotechnology. Being positive means getting a balance between enthusiasm and openness.

### **Political and Economic Framing**

Biotechnology, especially in the agricultural and pharmaceutical industry is closely intertwined with political ambitions and business interests. For the political-economic framing, it is articulated by the narratives that underline monopolisation, patent-control, and inequity at a global scale. Taking the case of genetically modified seeds, the discussion generally portrays the biotechnology firms as predatory firms that are out to own the food systems. Although this paradigm is based to a great extent on the actual policy discussions, it often mixes the ability in science with economic authority leading to the popular resistance.

The Cartagena protocol on Biosafety as well as the Nagoya Protocol on the access and benefit sharing are global practices that seek to uphold fairness and responsibility. The media stories, which overlook these forms, are a part of a false conception of biotechnology governance functioning.

### **Misinformation and Public Trust**

Misinformation is one of the most important and emerging frames in the digital age. The appearance of social media platforms has led to the fast dissemination of unverified assertions, conspiracy theories, and emotionally-charged information on biotechnology. These effects are amplified by the use of algorithms that give more weight to interaction than truth, forming echo-chambers of fear or pseudoscientific ideas.

As an example, viral poststying GM foods to cancer or making CRISPR a tool to human cloning have no empirical foundation, but a lot more attention-seeking than evidence-based

corrections. Such dynamic undermines public trust and inhibits their scientific communication activities. Misinformation increases risks in the real world, in the behaviour of the population, their resistance to policy and the allocation of research funds. Research in Science Communication and Public Understanding of Science publications emphasize the significance of scientists to adopt more proactive communication strategies, including direct communication with the community, the explanation of challenging information without misrepresentation, and collaboration with effective communicators. This is why one cannot overemphasize the need of interdisciplinary approaches in integrating genetic scientists and media experts to help create a well-informed and credible public space.

### **Interrelation of Frames**

The five recognised frames are rarely to be found to operate alone. Media coverage often incorporates ethical, risk and political themes to generate stories that both frighten and moralise. E.g. playing God hyperbole with hypothetical political issues of eugenics. Such intersectionality of frames demonstrates the complexity of biotechnology as well as the conflicting cultural values that surround it, which allows researchers and scientists to predict the response of the population and create more effective communication strategies (Neuendorf, 2018). By comprehending the presence of layered representations, researchers and scientists can foresee how the population will react and can develop more effective communication strategies.

### **Results and Findings**

In a meta-analysis of the literature on the relation between the media framing and the public opinion on the biotechnology and genetic engineering, it can be seen that though the people have diverse attitudes towards biotechnology, the media framing strategies are a significant factor in the perceptions of knowledge and credibility. The literature revealed four major themes: (1) framing and agenda salience patterns; (2) emotional and moral code influence in stories; (3) platform and media ecology; and (4) the role and role of trust, governance, and policy in stories.

### **Agenda Salience and Framing Patterns.**

Frames of risk (potential dangers of genetic modification), ethical (playing God, tampering with nature) and economic (corporate control of food and patents) frames have been uniformly used in biotechnology coverage in a broad variety of empirical tests (McCombs and Ghane, 2001). Such frames are more eminent compared to an innovation frame or benefit-oriented frame which is more common in specialised or scientific journals.

Agenda-setting imagery, massively-analysed: The agendas, such as CRISPR, cloning, or genetically modified crops, were those that were discussed at mass levels and individually, despite not being practically applied as yet (Dawson et al., 2022). This kind of selective alliance makes it controversial and affects the general attitude of the biotechnology core challenges.

Research indicates that the positive and negative mediators are spread geographically depending on the culture and religion: European and South Asian journalism are more concentrated on the formulation of ethical and moral risks since these aspects are the priorities of the national agenda. The variances show the contingent case of agenda-setting in the communication of biotechnology.

### **Emotional and Moral Encoding in Narratives**

Framing is both cognitive and emotive. Emotive and moral instruments used in metaphors and headlines make a strong forecast about opinions of individuals. These pictures like

“Frankenfoods”, designer babies, or “unnatural creation” are ethical shortcuts that cause disgust or horror and reduce scientific complexity to binary decisions of values (Weisberg et al., 2017).

Experimental studies have shown that the more biotechnology is framed as a medicine or a life-saving process, the more it is accepted, and the more it is framed as a process of augmentation, germline modification, or moral infractions, the less accepted it becomes (Evans et al., 2021).

In the CRISPR baby scandal of 2018, this was demonstrated dramatically. The initial moral elaboration of the incident as an act of irresponsibility, immorality, or a scientific overstep on the part of the global media caused an immediate outcry of outrage in society, and resulted in moratoria and calls to do the people better (Cyranski, 2018; Greeley, 2019). This is one demonstration of how framing may be a practical policy implication since it has the ability to stir shared moral emotions like outrage or terror.

### **Media Ecology and Platform-Specific Dynamics**

The digital and social media has transformed the way biotechnology stories are being spread and accepted. The traditional journalism, with its editorial network and gatekeeping, has been replaced by the interaction-based and algorithm based media ecosystem. The emotionally charged, highly visual content, in particular, the forms of content that are short videos and memes, become viral, supporting the simplified or distorted frames (Dawson et al., 2022).

According to the cross-platform studies, it has been revealed that visual framing has become equally effective as textual framing. Images of the dystopian laboratories, edited embryos or genetically engineered food items are found to enhance negative perceptions when the surrounding language is neutral. Just in contrast, the medical care, recovery of patients or laboratory professionalism images have positive perceptions on validity. These outcomes denote that perception of biotechnology is more multimodal in that the emotional and visual messages dominate over the rational message-judgement.

In addition, platform features influence the behaviours of the audience. Twitter (X) promotes polarised debate and moral outcry cycles; You Tube and Tik Tok invites individuals to engage in quick emotional contagion

with graphics; the traditional news websites continue to impact elite discourse (Zaid et al., 2025). Combining this, it is an example of a distributed agenda-setting process in which the digital amplification has increasingly become competitive with the journalistic curation as the primary tool of creating consciousness among the people.

### **Trust, Governance, and Policy Influence**

Among the main results of the considered literature, there is evidence that trust, rather than knowledge, is the most influential predictor of governmental attitude to biotechnology (Wynne, 1992; Wunderlich and Gatto, 2015).

This suspicion grows when media coverage emphasizes debate, depicts ambiguity as ineptitude, or implies elite concealment. As soon as the coverage is concentrated on the transparency, professional opinion, and ethical control, the confidence of the population grows. As a result, the perceived safety and legitimacy of biotechnological innovation is being reflected by the media portrayal of institutional responsibility as a proxy. Expediency implications, At the policy level, agenda-setting is useful in that more moral and risk-averse frame adherents are more amenable to restrictive forms of regulation, and progressivist (not libertarian) attitudes towards biotech accept the use of gene-editing in healthcare. This relationship demonstrates that policy settings are being indirectly formed by media discourses, and this occurs in the formation of the masses, and in election campaign (Siddiki et al., 2017). Related to the literature (Ramos et al., 2023; Hofmann, 2023) is the

development of an emerging gap -a mismatch between complexity of biotechnology and communication ethics of those reporting on biotechnology. Responsible Framing having been definite regarding ambiguity and the incorporation of pluralistic sources have frequently been imposed as remedies to the recovery of popular confidence and the prevention of polarisation.

## **Discussion**

The review results clearly show that there has been an ongoing paradox between the discourse of science and the popular images of biotechnology and genetic engineering. It is not just a by-product of disinformation, but this paradox is the symptom of greater structural, cultural, and cognitive processes, which control how the role of science is being represented, perceived and politicised in the modern society. The five dominant frames of consciousness that include the risk, ethical, innovation, political-economic and misinformation reveal the fact that biotechnology is a piece of media construction besides being a scientific fact.

## **Framing as a Mediator between Science and Society**

Framing constitutes a type of window, whereby the scientific complexities are minimised to the descriptions available to the people. Framing not only tells what will be discussed because it determines what is discussed as is seen by Entman (1993) and Scheufele (1999) but also what will be discussed as understood. Simplification of complex biological processes (e.g. gene editing or transgenesis) in the biotechnology context to any of safe and dangerous or natural and artificial involves a risk-oriented view taking. This simplification meets journalistic requirements of clarity and interest, but they murder the subtext, hence relocating what Nisbet and Mooney (2007) refer to as conflicts between science and values (Nisbet, 2016).

For scientists, knowing framing dynamics is critical. Genetic engineering is based on molecular systems that are complex in nature and require precise alteration of genes, molecular pathways and controls over ethics.

However, when the same processes were brought to the level to which sensationalist headlines are applied, then the scientific background is well swept out and that is where there is room to be frightened or to fight. This issue, however, is not to inhibit the interpretive activity of the media but rather to create a dialogue that values the accuracy in the empirical sense and the values of the society.

## **The Role of Digital Media and Algorithmic Amplification**

The tradition journalism has been running the science communication but the internet revolution has brought about the turn of events. The use of social media like twitter (since rebranded to X), Facebook and YouTube has enabled the flow of information to be democratic but the algorithms they use focus less on authenticity and more on virality. However precise or inaccurate, emotionally-charged or morally polarising biotechnology content, whether it is the story of so-called mutant crops or so-called designer babies, will be more likely to have more headlines.

This algorithmic bias is not only damaging to the beliefs of the masses, it also reveals the balance of power in scientific facts, because according to Brossard and Scheufele (2013), the digital communications scenario is biased towards speed, opinion, and engagement, rather than accuracy and peer-reviewing. The net result is having a fractured media system in which science clashes with conspiracy and moral panic (Bouchaud, 2023). In molecular biology perspective it is this tendency that has been considered to have certain hazards: public opposition to GM crops can paralyze agricultural research, false information about gene therapy can cause people to withdraw, and politicisation of genetic research may bring

research to a standstill. Thus, it is not just a communication problem, but a scientific trade-off to ensure the integrity of research and the general benefit to society, in order to resolve the problem of disinformation.

### **Ethical Narratives and Cultural Resonance**

The ethical framing of biotechnology usually shows the complex relations of science and culture since the abundant metaphor of playing God or unnatural intrusion indicates the several centuries-long influence of moral and religious discourses on the general opinions. However, these framings as this analysis shows are often used to hide the fact that genetic research is highly ethically grounded. A broad range of agencies such as UNESCO, National Institutes of Health and Nuffield Council on Bioethics have come up with detailed ethical principles, which dwell on openness, consent and wellbeing. The media however rarely translate the precautions into understandable stories. Such perceived omission widens the gap between perception and reality and this fact in itself justifies the fact that biotechnology is a faceless technology.

To overcome this divide, ethical literacy should be included in the science communication. Like it is the case that journalists and communicators ought to be taught to put ethical scandals in perspective accordingly, they must also learn to write about discoveries and humanize research and make it accessible yet simultaneously be accurate.

### **Interdisciplinary Communication as a Corrective Strategy**

Some of the most outstanding lessons of this review are that no single person regardless of whether it is scientists or journalists can study this topic in a vacuum. It is a multidisciplinary problem in essence.

Researchers in mass communication offer a theoretical tool to enhance an insight on how a narrative is constructed with a more insightful penetration and molecular biologists give in an empirical penetration to ascertain the precision of facts. On an individual level, collaborative science communication interventions such as co-authored column, expert media panel, and joint training workshop may be useful.

To illustrate this point, incorporation of science communication in every four modules of molecular biology curriculum can assist researchers when dealing with the media in an ethically sound way. On the other hand, journalism should also be taught basic scientific literacy to check sensationalism and improve the accuracy of interpretation. In turn, interdisciplinary interactions are a feedback loop: communication scholars know what they are reporting on and scientists know what they believe is the perception of their work in the society (Callaos, 2021).

This practice is appropriate in line with the public engagement with science paradigm proposed by Burns, O'Connor and Stocklmayer (2003) according to which it is better to speak than to share. This paradigm perceives communication as a two way bargain of meaning between the science and the society in contrast to a one way communication. This strategy can be applied to the discussion of biotechnology and can contribute to the absence of polarisation and mutual understanding.

### **Rebuilding Public Trust in the Age of Information Disorder**

Trust is still relied on to provide scientific validity. Once corroded, it can hardly be fixed. The COVID-19 epidemic proved the impact of how misinformation and distrust can shatter even the most powerful biological treatment.

Similarly, the distrust towards biotechnology is an outcome of the perceived secrecy, of the past battles (cloning and genetically modified foods) and the amplification of the fear-provoking narratives.

In order to surmount it science communication must emphasize on transparency,

consistency, and narrative empathy that defines biotechnology as a human cooperation venture that is founded on societal advantage rather than a distant, corporate dominated sector. Scientists are called to use narrative approaches to deliver the information about scientific integrity and human motivation why research is important, what a protective quality of research is, and how it can potentially enhance the quality of life (Sonnac and Smadja, 2025).

Simultaneously, media institutions ought to practice their moral obligations of fact-checking, contact professionals, and avoid sensational framing that can be the falsification of the truth. The issue of false statements related to the emerging technologies is a worldwide threat which must be addressed on an institutional level both scientifically and in the media as stated at the World Economic Forum (2023).

### **Implications for Policy and Future Research**

It is evident that there are policy implications in the relationship between media framing and the opinion of the people. Media reporting to understand popular sentiment amongst the policymakers also acts against the regulation and therefore any progressive biotechnology project would not be allowed to be executed unless the media stops reporting about fear and moral panics. Quite the contrary, over-promotional plots may lead to blind following that is a menace to the regulation of ethics.

Future research should look at cross-cultural comparison of media-framing in order to comprehend how the sociopolitical factors dictate the attitude of the society towards biotechnology. Additionally, the computational text analysis and artificial intelligence techniques could be integrated to measure the tendencies of framing on the digital platforms, which would provide qualitative observations with the empirical aspect. These innovations would contribute to the multidisciplinary knowledge and improve predictive models of the way people would respond (Chatterjee et al., 2020).

Conclusion, this discussion has revealed that the gap between media portrayal and the scientific reality is not a mere coincidence but rather is structural founded on epistemological detachments between the process of how science is done and how science is construed through communication. To address this deficiency needs a combined approach of the kind of ethical responsibility, digital literacy, interdisciplinary training, and active engagement and such a collaborative action will present biotechnology in a positive light and be responsibly integrated into the discussion.

### **Conclusion and Future Directions**

Biotechnology and genetic engineering are at the crossroads of innovation and controversy fields that hold enormous promise for addressing global challenges such as food security, disease eradication, and environmental restoration, but are clouded by public mistrust shaped primarily by media narratives. This review reveals that, while scientists communicate through facts, journalists communicate through frames, which are used to generate public comprehension, fear, and acceptance. The discrepancy between scientific fact and media portrayal has resulted in polarised perceptions: one hailing genetics' revolutionary power, the other warning of "Frankenstein science" (Hashemipour & Kesgin, 2020).

Bridging this gap requires cross-sector collaboration among scientists, media professionals, and policymakers. Science communicators must convert technical results into understandable yet accurate communications, while journalists must adhere to ethical standards that prioritise clarity over sensationalism. Universities and research institutes should aggressively incorporate media literacy and communication training into STEM courses, preparing future scientists to interact with the public more effectively. Similarly, journalists should participate in scientific workshops or fellowships on a regular basis to

ensure comprehensive coverage of difficult biotechnology issues (Meaders et al., 2020). Future study should go beyond descriptive framing analysis and instead use hybrid techniques that integrate textual analysis, audience reception studies, and big data analytics to track the growth of biotech discourse across global media platforms. Comparative studies of different cultures and languages can demonstrate how social, political, and ethical settings influence narrative framing. Furthermore, the rise of AI-driven misinformation and synthetic media opens up a new frontier: how emerging technologies might both accentuate and mitigate public ignorance about genetic science. Finally, developing a symbiotic relationship between biotechnology and the media ecosystem is critical not only for better journalism, but also for an informed, ethically aware, and scientifically literate society capable of participating in democratic decision-making about technologies that will shape humanity's future.

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