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Intellectual Honesty and Research Integrity Addressing scientific misconduct through fabrication, falsification and Plagiarism

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***Abstract*—The principles of integrity and honesty in research provide the basis for the credibility, reliability and development of scientific research. Scientific misconduct such as fabrication, falsification and plagiarism (FFP) is a real threat to science damaging public trust, compromising evidence, and misleading people from within the scientific community. The paper reviews the concepts of intellectual honesty, research integrity, and scientific misconduct and highlights the three major types of misconduct, their ethical, academic and societal significance. It also explores the consequences of fabrication, falsification and plagiarism on the credibility of science, institutional legitimacy and people welfare and discusses about the regulatory regime under the University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018. Finally, the paper points to preventive measures and recommendations in order to encourage ethical research practices, reinforce responsible science and ethical scholarship in general, and cultivate a culture of integrity, transparency and accountability in scientific research.**

***Index Terms*—fabrication, falsification, plagiarism, research integrity, scientific misconduct, intellectual honesty, research.**

I. INTRODUCTION AND BACKGROUND

The scientific community has long been considered to be one of the more trustworthy sources of knowledge, innovation and solutions to complex societal problems. Whether it's medical advances, technological progress, or legal changes, environmental efforts, or other policy decisions, research is the foundation of evidence-based decision-making and public policy. However, the validity of research is not only contingent on the quality of its methodology, but also the ethical behaviour of researchers. Researchers have a responsibility to pursue the truth by following the highest standards of intellectual honesty and research integrity, which involve obtaining accurate,

transparent, reproducible, and unbiased results from research (National Academies of Sciences, Engineering, and Medicine (NASEM, 2017).

In recent decades, research integrity has become an increasingly important global issue with the dramatic growth of scientific publications, interdisciplinary research, competitive grant funding, and the digital dissemination of research products. New technology has given rise to new opportunities for innovation, but also new challenges for ethics, such as pressure to publish, more competition for academic recognition, and more opportunities for wrongdoing. The changes have raised concerns about the reliability and credibility of the scientific literature, leading to an increased focus on promoting responsible conduct in research (Steneck, 2006, World Conference on Research Integrity, 2022).

Intellectual Honesty is not just a matter of following institutional guidelines but also a moral obligation to be truthful, fair, objective and accountable in the process of research. Researchers must be intellectually honest by collecting, analysing, interpreting and reporting data without manipulation or misrepresentation. It also requires proper citation and attribution of the work of other scholars. The responsibility for maintaining research integrity is therefore a shared responsibility among researchers, research institutions, peer reviewers, journal editors, research funders and policymakers, who collectively help to ensure the credibility of research (Resnik, 2020).

Even with the presence of ethical guidelines and regulatory bodies, cases of scientific misconduct are still undermining trust in research. A number of well-known instances of falsified clinical trial data, misreported experimental results, and plagiarism have shown that unethical research activities have real world implications that can be devastating. Scientific misconduct can result in dissemination of false knowledge, waste of valuable public resources, compromise of patient safety, misguide of public policies based upon inaccurate evidence, and loss of trust in scientific institutions. The relevance of upholding high standards of research integrity was further accentuated by the COVID-19 pandemic, and the need to ensure that inaccurate and/or manipulated results could impact global health decisions with significant consequences (Horbach, 2020).

There are numerous unethical research practices, which are commonly agreed to be the most serious are fabrication, falsification and plagiarism, commonly known as FFP. Fabrication is the invention of data or research results; falsification is the manipulation of research materials, equipment, procedures, or data to alter or distort the findings of research; and plagiarism is the representation of the work of others as one's own. These practices are a fundamental violation of principles of honesty, transparency, accountability, and respect for intellectual property, and reduce the integrity of the scientific record (Office of Research Integrity [ORI], 2000). There has been growing attention in international organisations to the need for a harmonised approach to principles of responsible research conduct. Honesty, accountability, professional courtesy, transparency and stewardship are principles supporting ethical research that are highlighted in documents including the Singapore Statement on Research Integrity (2010), the European Code of Conduct for Research Integrity (2023) and the Montreal Statement on Research Integrity in

Cross-Boundary Research Collaborations (2013). Likewise, national regulations and funding bodies have established detailed policies covering ethical approval, data management, disclosure of conflicts of interest and investigation of complaints of research misconduct (ALLEA, 2023). The increasing importance of academic excellence, interdisciplinary research and university rankings in India have led to greater awareness of research ethics and academic integrity.

The University Grants Commission (UGC) has laid down comprehensive guidelines for ensuring academic honesty through the University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018, which specify the institutional procedures for detecting plagiarism, awareness programmes and disciplinary action. The regulations have been framed as per the policy of India, which aims to maintain the academic standards of India according to the internationally accepted principles of responsible research conduct and promote ethical research culture among the HEIs (University Grants Commission [UGC] 2018). The values of research integrity are not only about preventing the occurrence of research misconduct, but they are also underlying values of maintaining public trust in science, safeguarding the welfare of research participants, efficient use of research funding and enabling meaningful scientific progress. While misconduct harms the goals of reproducibility, transparency, and collaborative innovation, ethical research practices foster these goals and build trust in academic institutions. Ethics education, institutional accountability, mentorship, and the creation and maintenance of an academic culture that encourages, and is committed to, quality, transparency, and integrity, are needed as well as effective regulatory mechanisms, to encourage and promote intellectual honesty (NASEM, 2017; Resnik, 2020).

In this context, the present paper discusses the issue of scientific integrity and its linkage with intellectual integrity which is explored by discussing the concept of scientific misconduct with emphasis on fabrication, falsification and plagiarism. It also discusses the ethical, legal, academic and societal implications of such misconduct, examines current national and international approaches to regulation and outlines strategies to support the development of good practice in research. In this analysis, the paper aims to join the ongoing debate of fostering ethical scholarship and ensuring the integrity of scientific research in the current competitive and interconnected academic landscape.

II. DEFINING INTELLECTUAL HONESTY, RESEARCH INTEGRITY AND SCIENTIFIC MISCONDUCT

Intellectual integrity is an important ethical tenet, which demands that researchers seek to and communicate knowledge honestly, objectively, and transparently. It reflects a dedication to accuracy in collecting, analysing, interpreting and reporting research results and an appreciation of the work of others by giving proper credit and citing their work. Intellectual honesty is not just about following rules or regulations instated by institutions but about an individual's moral obligation to avoid bias, manipulation, selective reporting and misrepresentation at various stages of the research process. It requires that researchers present evidence without being selective in

what they present, even if the evidence doesn't support their hypothesis, expectations, or personal interests (Resnik, 2020).

It is not just about not plagiarizing or falsifying information, it is about being open to criticism, open to error and ready to change one's conclusions based on new evidence. Promoting an academic culture based on fairness, accountability and respect for the cumulative nature of scientific knowledge, therefore, is promoted by intellectual honesty. Because research depends on the power to verify, replicate and extend existing research, honesty in reporting is essential to the credibility and reliability of research results (National Academies of Sciences, Engineering, and Medicine [NASEM], 2017). Ethically, intellectual honesty helps to protect public trust in scientific institutions. Governments, judiciary, healthcare practices, technology and social welfare programmes are all affected by research. Misrepresentation of facts is not only a violation of scholarly integrity but can also have negative repercussions for society. Therefore, in all academic fields, intellectual integrity is considered an ethical duty and a professional ethical principle (Steneck, 2006).

Research Integrity: Research integrity is the application of ethical principles and professional standards for research that are considered necessary for perpetuation of research as a process conducted with responsibility, transparency and objectivity throughout its life cycle. It involves planning and conducting research, recording it, reviewing it, publishing it, disseminating it, and analysing it, in an honest, accountable, fair and respectful manner, taking care to research participants, colleagues and society. It is a positive approach to research that enhances the quality, reproducibility and trustworthiness of scientific knowledge (ALLEA, 2023). Research integrity is generally recognized internationally as the four principles elaborated in the Singapore Statement on Research Integrity and those are, “honesty in all aspects of research, accountability in conducting research, professional courtesy and fairness in collaboration, Good stewardship of research for others.” The principles highlighted the need for research integrity, which includes keeping good records, declaring conflicts of interest, providing full and objective reporting of research and giving credit to the work of others and previous researchers (World Conference on Research Integrity, 2010).

The European Code of Conduct for Research Integrity also builds on these principles, and outlines the following principles of responsible research: reliability, honesty, respect and accountability. The Code states that researchers are supposed to be methodologically sound, transparent in data management, ethical in the treatment of humans and animals, responsible as authors, and open in communicating research results. All these standards help to maintain the credibility of scientific publications and to build trust in academic institutions in scientific research (ALLEA, 2023).

In the Indian context, research integrity has gained significance in the field as now it is getting more institutional attention through several legislations and regulations like the University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018. The regulations urge higher learning institutions to implement tools and systems to tackle plagiarism, awareness campaigns, and disciplinary actions

and encourage ethical research among students, researchers, and teachers. The regulations are in line with the aim and vision of India to build a culture of responsible scholarship, which is in tune with the universally accepted research ethical norms (University Grants Commission (UGC, 2018).

Scientific Misconduct: Scientific misconduct is defined as knowingly or inadvertently committing acts of or allowing acts of scientific misconduct, which is defined as actions that are intentionally or recklessly undertaken that are contrary to scientific integrity or best practices. It includes any act of altering, concealing, misrepresenting or jeopardizing the validity of the research process and the reliability of scientific information. Scientific misconduct differs from honest mistakes or methodological limitations, or even differing interpretations of the scientific facts, in that it is deliberate deception or a substantial deviation from accepted scientific practices that ultimately leads to misleading or fraudulent results (ORI, 2000).

The definition of scientific misconduct used by the United States Office of Research Integrity (ORI) was one of the most widely accepted definitions of FFP and that is the fabrication, falsification or plagiarism in proposing, performing, reviewing, or reporting research.

- Fabrication: To make up data or results and record or report them;
- Falsification: To manipulate research materials, equipment, processes, or data such that the research record no longer accurately reflects the actual findings;
- Plagiarism: To record or report another person's ideas, processes, results, or words without giving appropriate credit (ORI, 2000).

Scientific misconduct is very much distinct from research error or negligence. A genuine error caused by an error of some equipment, computational error or some unexpected limit in methodology is not considered misconduct, as long as it is admitted and corrected with good faith. Likewise, when there is a genuine difference of opinion or interpretation of data, or methodological approach, it is not deemed to be misconduct. The hallmark of scientific misconduct is the intentional deception, recklessness with regard to research integrity, or conscious misrepresentation of evidence (NASEM, 2017).

The repercussions of scientific misconduct are far-reaching beyond the individual scientist. These are all potential consequences of fraudulent research which can lead to misguiding future research, the loss of public money, compromising safety for patients, manipulating governmental policy, tarnishing reputations and destroying public faith in science. As a result, a number of legal measures and institutional frameworks have been put in place to investigate and punish scientific misconduct and to encourage responsible conduct of research, by governments, funding agencies, universities, publishers, and international organisations. These are steps to upholding scientific integrity, knowing that in today's knowledge-driven society, the social value and credibility of scientific research is critical (Resnik, 2020; Steneck, 2006).

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III. FORMS OF SCIENTIFIC MISCONDUCT DEFINED

While there are many forms of misconduct in research, there is international agreement that the three main forms are fabrication, falsification and plagiarism (also known as "FFP"). FFP is more than academic ethics. Research results are often used to guide decisions by the courts, to inform changes in laws, to direct medical and health care interventions, to shape educational programs, innovative approaches in industry, and environmental management. This can lead to wrong public policy, unsafe medical care, monetary losses, harm to institutions' reputations and loss of trust in science. Multiple examples have been reported in the public press such as fabricated stem-cell studies, faked trials on vaccines, and diverse plagiarism scandals, which have shown that even a single case of misconduct can have international consequences and erode trust in scientific institutions (Resnik, 2020; Steneck, 2006).

Given these threats, the international bodies World Conference on Research Integrity, Committee on Publication Ethics (COPE), European Federation of Academies of Sciences and Humanities (ALLEA) and International Committee of Medical Journal Editors (ICMJE) have established guidelines on ethical conduct in research, which demand that researchers be honest, transparent, accountable and responsible in their research. All of these frameworks share a focus on ethical behaviour in all stages of scientific research, from formulating a hypothesis to research results being published and disseminated, as well as the importance of technical competence (ALLEA, 2023; COPE, 2019).

The three major types of scientific misconduct that are fabricated, falsified and plagiarized are described in the following sections, along with their distinguishing features, their apparent forms, their consequences, and the ethical considerations.

1.Fabrication of Data

Fabrication is considered one of the most egregious practices of scientific misconduct since it involves the creation of research data, observations, experiments, participants, or results that did not actually occur. The researcher makes up information instead of collecting evidence through scientific investigation and presents the made-up information as scientifically collected evidence. This behaviour undermines intellectual honesty and compromises the trustworthiness of scientific research since data that has been invented cannot be confirmed or reproduced independently (Office of Research Integrity [ORI] 2000).

The Office of Research Integrity (ORI) defines fabrication as "making up data or results and recording or reporting them" (ORI, 2000). Fabrication is defined as deliberate deception, as opposed to methodological errors or statistical error. It is an intentional change of fictional evidence for real evidence, leading to the misleading of readers, reviewers, funding agencies, policy makers, and other researchers. As science progresses, invented results taint the scientific record and can potentially mislead future research for a long time (National Academies of Sciences, Engineering, and Medicine [NASEM] 2017).

Fabrication can happen at any and all points in the research process. Researchers can make up observations, manipulate answers to surveys, develop clinical trial subjects that never existed, conduct lab experiments for which there are no data, or present statistical calculations from non-existent data sets. In qualitative research, fabrication can include making up interview protocols, focus group discussions, field observations, or documents. In legal and social science research, for example, false case studies or surveys can lead to false conclusions that can drive policy recommendations and legal debates (Shamoo & Resnik, 2022). There are a number of reasons for fabrication. Today's academic landscape is clearly marked by a high level of competition for grants, academic advancement, institutional prestige, and publication in prestigious journals. The much-decried 'publish or perish' culture can lead to a lot of pressure for researchers to generate positive and statistically significant results in a short time. Sometimes researchers may be pressured, by supervision, poor institutional control, monetary rewards or fear of failure to publish work that falls short to publish false or negative results. While pressures might be the cause for misconduct, they are not morally legitimate to intentionally deceive (Fanelli, 2009).

The most famous example of fabrication is the case of South Korean stem-cell researcher Hwang Woo-suk who claimed he had successfully cloned human embryonic stem cells. Published in Science in 2004 and 2005, his research attracted worldwide acclaim and was hailed as a revolutionary breakthrough in regenerative medicine. Further inquiries, however, were to show that much of the information reported had been fabricated and manipulated. The scandal led to the retracted papers being published, the dismissal of the researcher, criminal charges and severe loss of public trust in stem-cell research. The case is a classic illustration of how 'research can be invented to shape a fact' and how a lot of money can be squandered on the process (Cyranoski, 2006). The principle of reproducibility is also violated by fabrication, a key aspect of scientific research. Any real scientific findings should be replicable by other scientists. No one ever observed the facts underlying fabricated findings, so they cannot be replicated. This means that other scientists can invest significant time, money, and effort trying to replicate the fictional findings. (NASEM, 2017).

2. Falsification of Data

Falsification starts with real research, but the researchers manipulate the research process or results, in a deliberate way, to obtain a desired outcome, whereas fabrication involves making up data entirely. These actions undermine the validity, credibility and replicability of scientific information and deceive others, thus undermining the principles of scientific research integrity and intellectual honesty (Office of Research Integrity [ORI], 2000).

According to the United States Office of Research Integrity, "falsification" is defined as "manipulating research materials, equipment or processes; or changing or omitting data or results such that the research is not accurately represented in the research record" (ORI, 2000). This definition reinforces the idea that falsification can involve any kind of manipulation of the research record, not just numbers. This can happen during any phase of the research process, from design, to data collection, statistics, image processing, finding interpretation, or even publication. A

falsification is not an honest error in science or due to flaws in the methodology. Research is always subject to uncertainties and investigators may occasionally find that equipment breaks, calculations are wrong, samples are mis collected or misinterpreted. The shortcomings are not considered as misconduct if they are recognized and rectified good faith. (NASEM, 2017).

Depending on the field and approach, falsification can take many different forms. In quantitative research, this can include changing numerical data to maximize the significance of the data, selectively omitting outliers that do not have scientific basis, tampering with the size of the samples, omitting data that is not convenient, adjusting variables to get desirable results or omitting outlier data that does not fit with the other data. Researchers can also use the statistical methods inappropriately by implementing p-hacking, which involves performing several statistical analyses with no a priori hypothesis in mind until results that are statistically significant come back. Likewise, the HARKing phenomenon (Hypothesizing After the Results are Known) is when researchers propose a hypothesis after analyzing the results as if it had been formulated beforehand, leading readers to believe that the results were valid or not (John, Loewenstein & Prelec, 2012).

In qualitative research, falsification can include selectively characterizing responses given during interviews, deleting information that contradicts the conclusions of the study, changing information that exists in the field notes, or changing information that appears in documents. For instance, in socio-legal studies, a researcher may want to deliberately overlook judicial rulings or legislative documents which are contrary to the main thesis of the study. While qualitative research is always interpretive, the researcher should always be faithful to the evidence and avoid manipulating it to make it more consistent with a preferred story (Shamoo & Resnik, 2022).

Pressure is a major contributor to falsification, one of the main factors being the pressure on academic performance indicators in today's society. The number of publications, the citation indexes, research grants and the positions of the institution in the rankings are increasingly used to assess scholars at universities and research institutions. The "publish or perish" ethic could encourage researchers to come up with new, significant or positive results even if they are not supported by the evidence. Other factors in competitive funding, career advancement, tenure, and professional recognition also might create the "Pressure to Bias Research Results" (Fanelli, 2009; Steneck, 2006).

There are a number of well-known examples of the effects of falsification. In one of the biggest identified cases, Yoshitaka Fujii, the Japanese anaesthesiologist whose studies were discovered to contain copious amounts of data manipulation and falsification. Investigations found statistical irregularities in a large number of publications, and led to the retraction of over 180 scientific articles, one of the highest numbers of retractions ever attributed to a single researcher. The case demonstrated the need to examine research data statistically, to monitor them institutionally, and to hold the journal accountable for their accurate representation before they become part of the medical literature (Carlisle, 2012).

Another interesting case is the German anaesthesiologist Joachim Boldt, whose work on intravenous fluid and electrolyte therapy had to be retracted due to research falsification, data

irregularities and ethical violations. The misconduct involved evidence used in anaesthesiology and intensive care medicine, and reshaping of treatment recommendations, which were based on falsified studies, which makes the clinicians and researchers reconsider their treatment recommendations. The Boldt case is a good example of how a study with serious research misconduct can lead to the rejection of evidence-based medicine and the loss of confidence in published scientific literature (Kranke, Apfel, & Roewer, 2011).

3. Plagiarism

Plagiarism might be the most prevalent and serious type of scientific cheating, since it is the theft of another individual's intellectual property without proper citation. Plagiarism differs from fabrication or falsification, which involve altering data about the research, by involving an unethical presentation of another person's idea, words, data or creative expression(s) as one's own. This is a breach of the standards for responsible research that uphold intellectual honesty, fairness and accountability. Researchers have a moral responsibility to give credit to other people's work, to cite and reference works that lead to their own, and to cite and reference other people's work that they build on (National Academies of Sciences, Engineering, and Medicine (NASEM, 2017). Plagiarism is defined by the United States Office of Research Integrity (ORI) as "The appropriation of another person's ideas, processes, results, or words without giving credit to the originator" (ORI 2000). Plagiarism too, according to the Committee on Publication Ethics (COPE) is any presentation of another party's work as if it were one's own, whether deliberate or inadvertent (Committee on Publication Ethics [COPE], 2019).

How someone uses another person's work can be different types of plagiarism. Copying from a published or unpublished source of text without quotation marks or proper citations is called direct plagiarism. It's the simplest kind of plagiarism and is likely to be considered a conscious attempt to cheat. This form of plagiarism is evident and can have severe academic and professional ramifications (Roig, 2015).

Another type is called mosaic or patchwork plagiarism, where a researcher quotes from more than one source, but changes the wording of the quotation and does not cite the original sources. There may be some word changes but the substance of the ideas is largely lifted. Mosaic plagiarism is more difficult to detect than exact plagiarism, and can mislead readers of the plagiarized work as to its originality (Pecorari, 2015).

Plagiarizing by paraphrasing takes place when an author restates the ideas of another person in his or her own words without giving credit to the other writer. A paraphrase must not only be a substantial restatement of the original text but it must also be properly referenced to the original text. If the ideas are borrowed, it's not original work, just a few words and sentence structure changed. As a result, even when a quote does not occur in the text, it is still necessary to cite the source (Shamoo & Resnik, 2022).

Self-plagiarism is another form of plagiarism that has become very serious; it is when researchers copy large sections of their previously published work without proper attribution or citation. The material originally written by the same author may be presented as if it were entirely new research,

which may lead the editors, reviewers, funding agencies and readers to question the originality of the publication. Duplication of publications, duplication of publications of any sections, and plagiarism of text, tables and figures without citations are common self-plagiarism practices (Roig, 2015).

Idea plagiarism occurs when you take another researcher's ideas, hypotheses, methodology, interpretations or research designs without giving proper credit. Unlike with textual plagiarism, idea plagiarism can take place even if the words were not copied. Ethical research involves giving credit to the original source of ideas, especially if the ideas have in some way driven the research being done, since intellectual contributions do not stand alone, but are also represented in other ways such as in written form (Fishman, 2009).

Plagiarism has been an issue in India which has been addressed by the University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018. Institutions of higher learning and universities should implement measures to detect plagiarism, establish Academic Integrity Panels, awareness programmes and provide a ranking of penalties based on the percentage of plagiarized content. To prevent plagiarism, a combination of individual moral responsibility and institutional efforts is needed. On a practical level, researchers need to safeguard their research by keeping careful research notes, learning how to paraphrase, citing all the sources, using quotation marks correctly, and following the reference styles (UGC, 2018). Consequences of Scientific Misconduct

If the integrity is lost, by fabrication, falsification or plagiarism, the impact extends beyond the person involved. The consequences on society as a whole are significant both socially, economically and legally when research is flawed, as it can have an impact on medical treatments, court decisions, public policies and innovations. This has led to an even stricter approach by international organizations and regulatory bodies to discourage scientific misconduct and to promote research integrity (NASEM, 2017; Resnik, 2020).

Fabrication and falsification directly distort the authenticity of the scientific record by providing false or manipulated evidence in the scientific record. These false discoveries can lead to failure in future research, by forcing repetition of flawed experiments and waste of funding. The falsification or fabrication of data can result in wrong clinical guidelines, unsafe treatment options, slow scientific advances, and endanger patient safety in fields like medicine and public health. (Steneck, 2006; Shamoo & Resnik, 2022).

While plagiarism differs from fabrication and falsification, the implications are serious nonetheless, as plagiarism is an offence against intellectual integrity and an unfair claim on the credit of the original author(s). A researcher who has been caught plagiarizing can have their manuscript rejected, article removed, lose credibility, be suspended from academic programmes, fired from their jobs, research grants rescinded, and be marred for years. Plagiarism detection software and strict policies are increasingly being used by academic institutions and publishers to detect and deal with plagiarism pre-publication (Committee on Publication Ethics [COPE], 2019; Pecorari, 2015).

Plagiarism is mentioned and regulated specifically under the University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018 in India. Academic dishonesty is penalized according to Regulation 12 which uses a percentage of similarity to determine the extent of the dishonesty. If the similarity is up to 10% (Level 0) it is considered minor similarity and no penalty is given. If the thesis is above 10% to 40% (Level 1), it needs to be revised or withdrawn. In Level 2 (40-60%) the student faces more severe penalties, which may include debarment from submitting revised work for a defined period, and in Level 3 (more than 60%) may result in cancellation of registration for the student or other harsh disciplinary measures for faculty and researchers.

The Regulations also stipulate penalties shall be imposed only following due inquiry, application of principles of natural justice and exhaustion of appellate remedies. The provisions are in keeping with the spirit of upholding academic integrity and a high standard of research ethics in higher educational institutions in India. (ALLEA, 2023; NASEM, 2017).

IV. CONCLUSION

One of most pertinent elements of prevention is to inculcate a culture of honesty, transparency, accountability and moral responsibility (NASEM, 2017). Establishing clear and regular policies for reporting and the investigation of misconduct is also essential, including those that provide for fairness, confidentiality and due process in all cases. Plagiarism software (e.g., Turnitin and iThenticate), a required data management plan, strict peer review, research audits, and open science all put the screws into fabrication, falsification and plagiarism.

Moreover, the mentors and supervisors have a large contribution in guiding and supervising the new and yound researchers to executing their research in an ethical (ALLEA, 2023; Shamoo & Resnik, 2022). National policies such as the Regulations, 2018 of the University Grants Commission (UGC) of India, contribute to academic integrity by encouraging awareness campaigns, ensuring compliance, and implementing fair disciplinary measures, thereby preserving the trust of the public and facilitating the trusted and reliable conduct of research and responsible work practices that benefit society (UGC, 2018). The integrity, trustworthiness and advancement of science depend on intellectual honesty. Fabrication, falsification and falsification or theft of data by researchers not only infringe upon ethical codes but also violate public trust, consume precious resources and actively impede human progress. It's a shared responsibility among researchers, research institutions, publishers, funders and regulators. Institutions should introduce regular ethics training to ensure its protection, promote transparent data policies, and take a firm stance against misconduct by enforcing rigorous action against it. This means for researchers, that they retain perfect records and they are able to cite others perfectly according to international standards of ethics. A combination of continuous awareness programs, severe peer review and compliance to requirements such as the UGC Regulations will help foster an environment of accountability for research. Only in this way will public trust be gained, real breakthroughs will be achieved in science and research will continue to be useful to the world.

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