

**EG2401A: Engineering Professionalism**

**Group Project Interim Report**

**Tutorial Group T205, Group 3**

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| --- | --- |
| Name | Matriculation No. |
| Benjamin Tay Hong Xiang | A0253404N |
| Boo Jia Shen | A0253256E |
| Ong Zhi Yong | A0253349Y |

**EG2401A Engineering Professionalism**

**Group Projects - Honour Pledge**

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| ***Year*** | ***Semester*** | ***Project Title*** | ***Tutor*** |
| **2023-2024** | **2** | **Project 6: Academic Research Ethics** | **Mr Tay Tong Earn** |

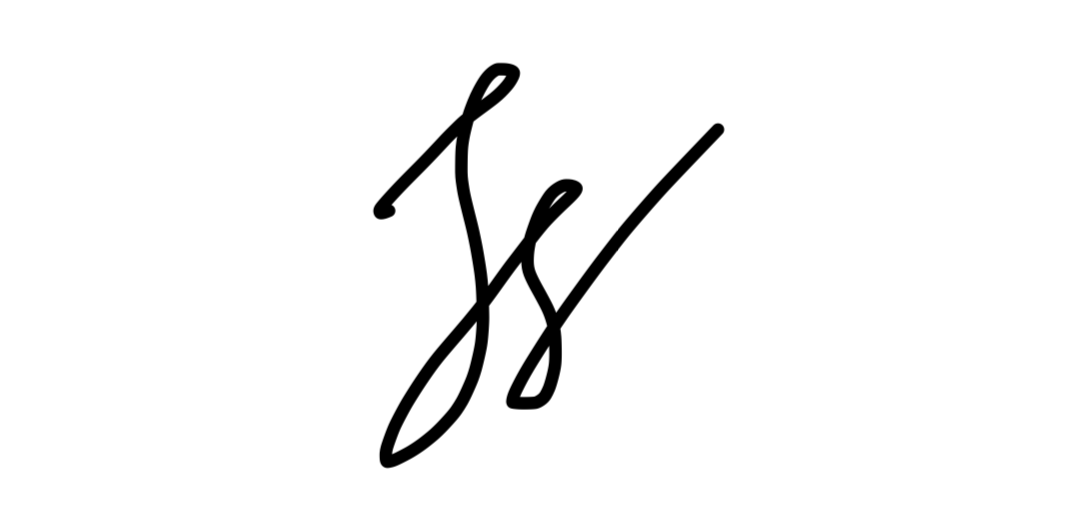
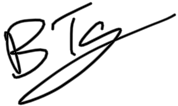
**We, the following students of NUS, upon our honour, hereby confirm that we have neither received nor given any unauthorised help on the EG2401A group project carried out by us.**

**The project report and the presentation reflect truly our own efforts. In all cases where material from other sources such as books, articles, notes and websites have been used, we have taken care to provide clear and unambiguous references to the same.**

**We confirm that we have not provided unauthorised help to other groups doing the same project. Furthermore, we also confirm that we will not pass on our research materials, report and presentation materials to other students who may take this module in later semesters.**

**In addition, this project report has been prepared and submitted by us only as a part of an academic exercise. Its contents are not meant for publication in any manner.**

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| ***Sl. No.*** | ***Matric No.*** | ***Name*** | ***Signature*** | ***Date*** |
| **1** | **A0253404N** | **Benjamin Tay Hong Xiang** |  | **27/03/24** |
| **2** | **A0253256E** | **Boo Jia Shen** |  | **27/03/24** |
| **3** | **A0253349Y** | **Ong Zhi Yong** |  | **27/03/24** |



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# Introduction

In the world of academia, academic research plays an important role in the development of new theories, insights and discoveries across disciplines. This research can be defined as a “set of activities in which researchers use various structured methods to contribute to the development of knowledge, whether this knowledge is theoretical, fundamental, or applied” (Drolet et al., 2022). Though much of academic research is done in a bid to further the human understanding of a wide array of topics, the reality is that the environment in which this research is conducted is fiercely competitive. Competition is present and often encouraged in many aspects of life, and academic research is no different. The phrase “publish or perish” is often quoted as a representation of the pressures that academics face in order to survive in their field of study. As such, the high level of competition in the field of academic research, coupled with performance indicators that incentivise noteworthy results and breakthroughs, make for an environment where academics are forced to make decisions that call into question their ethical implications. One such ethical decision is the falsification of test data. In their 2009 book “On Being a Scientist: A Guide to Responsible Conduct in Research”, the United States Committee on Science, Engineering and Public Policy (2009) describes falsification of data as one of a group of actions that is deemed as “research misconduct” (p. 3).

This report aims to discuss some of the ethical questions surrounding the falsification of data in academic research through the analysis and discussion of real examples, as well as the theoretical case study of Dr Dunne (Appendix A).

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# Discussion

In this section, the report will discuss several topics that revolve around the reasons and implications of the falsification of data in academic research.

## Reasons and justifications for falsification of data

In our everyday decision making process, we form reasons and justifications for every action we take, whether consciously or subconsciously. Within the code of ethics in academic research put forward by the European University Institute (2022), “academic integrity” is listed as one of the first and foremost practices that any good researcher adheres to. As such, when cases of data falsification arise, the opportunity to learn and understand the reasons provided by the perpetrators is of great interest to the rest of the academic community.

### Pressure to publish

The first and most common reason that has been raised in many cases of fraudulent research has been the pressure on researchers to publish quickly and in large quantities. The frequency that one publishes papers is a metric that is increasingly being used by academic institutions to measure a scholar’s talent as compared to his or her peers. This issue is especially prevalent amongst graduate students pursuing PhDs, as the pressure to publish quickly is increased due to factors like career prospects and even their candidature eligibility being reliant on metrics and key performance indicators that revolve around publishing papers. In an interview, the authors of the research paper titled “Nothing but publishing” commented that “In each and every interview we conducted [with doctoral students], everything would be reduced to one thing, which was publications” (Sharma, 2022). This quote encapsulates the crux of this justification, that falsifying data in order to publish quickly and in large numbers is a necessity in an environment where publishing is king, and has become the only subject that PhD students can talk about lest it become detrimental to one’s career and future prospects. In the case study presented, Dr. Dunne states that he had been under “intense pressure to complete the study quickly” and also that within his first year he had already authored “nine publications within top scientific journals” (See Appendix A). In this instance, it follows that Dr Dunne had been facing the same pressures that PhD students face in publishing, and that falsifying data in his mind was the only way to keep up with the increasing pressures on him to complete his studies to present the results.

### Allure of glory and fame

The second reason for falsifying data is the allure of glory and fame. When pursuing a career path in academia, one of the measures of success is whether one’s paper gets published in a well known scientific journal or publication, and the number of citations said paper has in other research papers (Zaumanis, 2020). This has led to some researchers resorting to falsifying data to make their papers have seemingly more interesting results, in hopes that the academic community takes notice, and that their name would become prominent in their field of study. Being known within the academic community also has perks, one of which is being offered high ranking positions at academic and research institutions. It would not be a far stretch to think that a promising researcher with ambitions to hold high positions at prestigious academic institutions would cave into the allure of fame and glory by falsifying data to get ahead of their peers and stand out amongst the multitudes of great minds within the field of academic research.

Regarding the case study, Dr Dunne was undoubtedly hard working, with the amount of time he had reportedly worked as a research fellow. He also was regarded as a “potential research leader in the making”, and would have likely been on the radar of many prestigious institutions for potential employment. As such, it could be suggested that Dr Dunne falsified his data in pursuit of maintaining a stellar record of publishing in top journals in order to stay in the conversation as an exciting prospect in research. A similar link can be seen in the case of Jan Hendrik Schön, a promising physicist who seemed a shoo-in for a Nobel prize before it was found out that he had falsified data in his “revolutionary” paper that claimed he and his team were able to make non-conductive molecules behave like semiconductors (Cassuto, 2002). In both cases, the researchers were promising starlets in their fields of study, and yet the allure of recognition and achievement led them to commit research misconduct and falsification of data, ironically leading to the opposite effect of notoriety and infamy.

### Potential for financial gain

The third reason that is associated with the falsification of data is the potential for financial gain. This reason is multifaceted as the term financial gain refers to monetary profit- both directly and indirectly- for the researcher and institutions in question. Due to the importance of academic research in pursuit of human development, there is a large amount of money that is invested into this industry by both private and government organisations alike. In 2022, the research and development expenditure for American colleges alone topped USD 97 million (Nietzel, 2023). The most common form of financial gain stemming from false data is the provision of research grants. If a study has positive results and is perceived to have potential for further development, investors are more likely to provide financial support to fund that particular study. For example, a common practice for private and public hospitals is to provide funding to scientific studies in medicine with the hopes of discovering and developing new tools to help save more lives and increase the quality of life for their patients. However, since resources are limited, these institutions are forced to choose where to invest, and that decision is commonly based on results that have been produced by the researchers themselves. With many new studies and research groups vying for the same grants, having results that are positive or groundbreaking could be the make or break between receiving funding that could go up to the millions in value. In the case of Dr Dunne, his research likely led to some if not all of the investment by the National Institutes of Health to the Mines-affiliated Brompton Children’s Hospital. It could be said that both Dr Dunne and the hospital likely benefited financially from the grants and funding given to them as a direct result of his falsification of data in his research findings.

## Victims of falsification of data

Falsification of data violates the ethical principles of integrity and honesty in research. Stakeholders across different domains will be directly affected by the consequences of this misconduct, which extends far beyond the immediate perpetrators. This section will explore the diverse range of individuals and entities impacted by data falsification, shedding light on the multifaceted consequences.

### Perpetrators of research data falsification

Being the main culprits of the misconduct, as well as those who collaborated in the research, perpetrators of data falsification bear the most consequences from the decision. Their career would be ruined as most of them would be immediately revoked from their position, with their credibility crumbling to none. Their reputations would also be tarnished, making future career prospects in the field tenuous at best. The emotional toll after being caught can be at times too much to bear. Those involved in the study- directly or indirectly- will constantly be scrutinised and criticised, with their actions always following close behind them within the academic world. There have been cases of research fraud leading directly to deaths by suicide from researchers, as evidenced in the case of Professor Yoshiki Sasai- a Japanese stem cell biologist who was involved in a scandal over discredited stem cell research. He supervised two studies on "STAP" cells (stimulus-triggered acquisition of pluripotency) in 2014. However, suspicions arose when other scientists failed to replicate the results, leading to an investigation. Haruko Obokata, the lead author of the papers, was subsequently found guilty of scientific misconduct, resulting in the retraction of the papers. Although Professor Sasai was cleared of direct involvement in the misconduct, he faced criticism for not detecting inconsistencies in the publications under his supervision. Despite not being directly implicated, he expressed guilt and remorse over his role in the scandal. Tragically, he took his own life, which was seen as a devastating consequence of the controversy surrounding the research (Eisen, 2014).

In Mr Dunne's case, he ruined his career as his research position was lost and the offer of a faculty position was withdrawn. He was also barred from NIH for funding and committees. Those who were involved in the research were also greatly affected, with his mentor needing to take his time to investigate Dunne’s research instead of focusing on his own work. Dunne's credibility was significantly tarnished, leading to scrutiny of all his previous work. This suspicion extended to his research collaborators, who were also viewed with suspicion by others in the academic community.

### Academic and scientific community

There is a profound impact of research data falsification on the academic and scientific community. They bear the brunt of the misconduct with the foundation of trust upon which scientific progress relies being destroyed while wasting time, money and valuable human effort. The prevalence of falsified data also threatens the validity of scientific literature, making it increasingly challenging for scholars to discern genuine findings from fabricated ones.

### General public

The general public might not seem significantly impacted by the misconduct at the outset. However, the effects of data falsification are instead felt only much later, and usually observed to be more akin to a “butterfly effect”. The growing ease in which information can be accessed through the internet has exacerbated the problem of inaccurate data being dispersed, of which research data falsification will only serve to contribute to this ever growing issue. As a result, addressing the consequences of data falsification would become increasingly challenging and would demand significant effort and resources to rectify or mitigate. Additionally, falsification in data may potentially lead the general public to be sceptical towards scientific claims and reluctant to accept evidence-based practices or policies.

A good example of this could be seen in the Lancet MMR autism fraud case involving Andrew Wakefield and his collaborator in 1998. In his paper, Wakefield claimed that the combined measles, mumps and rubella (MMR) vaccine could cause autism spectrum disorders. His research paper was then retracted in 2010 after an investigation which showed that the data were fabricated and there were no causal links established between the vaccine and autism due to insufficient data (Rao & Andrade, 2011). Despite that, most parents would still not vaccinate their child due to the fear of the possible “side effects” and parents would still claim that the cause of the autism disorder of their children is from the vaccination (GI Society, 2016).

### Intended recipients of studies

Fraudulent clinical research undermines the accuracy and reliability of medical data, potentially resulting in the approval and introduction of pharmaceuticals that are either ineffective or harmful to patients. The revelation that the treatment that one is going through might be based on fraudulent data might be emotionally devastating, especially given the fact that most of these treatments are usually experimental in nature and already leave much room for fear of the unknown. Additionally, patients of such studies might lose trust in the medical system or the doctors, dissuading them from continuing potentially life saving procedures in the future, causing more harm in the long run.

### Research institutions

Research institutions confront grave challenges when misconduct is uncovered within their studies. External funding for research projects is often awarded based on the quality of the proposal, and the data presented within them is given the benefit of doubt to be true. As such, fabricated data not only diminishes the integrity of the research but also destroys trust in the institution's ability to conduct rigorous and reliable studies. It would result in research funding being withdrawn, with the compromised research viewed as a reflection of decreased quality and ethical standards. Moreover, misconduct leads to a waste of valuable resources. Countless hours, financial investments, and intellectual efforts dedicated to the research endeavour are lost in an instant. The misallocation of resources not only disrupts the progress of legitimate research but also hampers the institution's capacity to pursue future endeavours effectively. In essence, the fabrication of research data not only jeopardises the reputation and credibility of research institutions but also inflicts tangible financial and resource-related losses. Such misconduct undermines the integrity of scientific inquiry and poses significant obstacles to the advancement of knowledge and innovation.

In the case study presented, the hospital where Dunne’s research was conducted suffered severe consequences when it became the first institution that the National Institute of Health (NIH) ever required to return funds due to research involving fraudulent data. The incident inflicted considerable damage to the hospital's reputation, tarnishing its standing within the scientific community and among stakeholders. Internally, the effects were equally damaging. The revelation of research misconduct had a detrimental effect on staff morale and productivity. Employees may have felt disillusioned or betrayed by the unethical actions of their colleagues or superiors. Moreover, the negative publicity surrounding the incident may hinder recruitment efforts, making it challenging for the hospital to attract top talent and retain existing staff.

## Implications for future researchers

The falsification of research data not only undermines the integrity of the scientific process but also significantly impacts the perspective of research for aspiring researchers. By manipulating research data, the process of getting accurate information is hindered and hence, weakens the foundation on which future generations are getting educated.

### Building up the next generation of researchers

It is imperative that researchers hold a high quality and standard of work, thereby setting the right example for future generations of researchers who are deeply committed to not just producing papers but contributing meaningfully within their field. According to the European University Institute (2022), researchers must uphold the 7 values of academic and research integrity: Honesty, Trust, Fairness, Respect, Responsibility, Legality and Communication. These principles give meaning to ethical frameworks that guide researchers in their pursuit of answers and knowledge. Without these values instilled in them, their work will lose value and credibility. Thus, when past researchers set the right example by upholding the highest standards of research integrity in their work, they provide the blueprint for aspiring researchers to follow.

However, in the case of Mr Dunne, it did not leave a good image for researchers, as he was caught engaging in research misconduct. At the same time, it gives the impression to aspiring researchers that one can partake in such misconduct and perhaps evade detection, which is evidenced by Mr Dunne’s falsification of data just a few months after his fabrication incident. This is concerning as it suggests that despite deterrence, some are still tempted and willing to compromise their ethical standards for personal benefit. Nonetheless, it is impossible to stop them from engaging in unethical behaviours but it boils down to the responsibility of each researcher to uphold the principles of integrity and honesty in their work.

While there are many incidents of research misconduct, it remains crucial for aspiring researchers to be exposed to a range of exemplary and flawed research case studies. Through learning from them, it will help future researchers gain valuable insights into the challenges of the research process and better prepare them to navigate the ethical dilemmas that they might face in their own research venture while understanding the consequences of engaging in such misconduct.

### False research data used as educational material

The utilisation of research data for educational materials provides students with the evidence to support and foster an effective process of learning in any given field of study. However, the integrity of this learning process largely depends on the research data's accuracy and authenticity. When falsified data makes its way into academic resources, it could potentially jeopardize the learning outcomes for students, as well as undermine the trust and confidence within the education sector. For instance, in the case study of Mr Dunne (refer to Appendix A) who deliberately falsified data to make it “look better”. If this fraud went undetected, Mr Dunne could continue disseminating inaccurate research findings through publications that could eventually be used by students or researchers. These misleading articles could ultimately impede their ability to precisely grasp the subject matter and lead them into a state of confusion when data from sources of a similar nature are being compared. Such a scenario compromises the quality of education and perpetuates a cycle of misinformation within the academic community.

### Artificial Intelligence (AI) use in scientific research

The exponential growth in AI technologies has increased efficiency in multiple areas, including scientific research, and it can be used as a tool to generate research work that can avoid detection by human evaluation or any plagiarism detection software. In a study conducted by Elbadawi *et al.* (2024), an AI chatbot was able to generate the results of a study and prepare a manuscript for publication in less than an hour. This efficiency raises alarm as it also opens doors to the unethical practice of “ghostwriting” in which individuals can pass off an idea as their own without giving due credit to the author (Gotham Ghostwriters, 2021), and this can be done much more easily and undetectable to the naked eye.

However, it largely depends on how the user employs AI as the utilisation of it for research does yield both positive and negative outcomes. On the beneficial side, AI can streamline the process of data collection and perform statistical analysis that can aid in easing the burden on researchers, thus enhancing their efficiency in publishing their work. Conversely, when AI is being used unethically, it can lead to dire consequences. When AI is being used to fabricate results, researchers can utilise these non-existent results to draw a conclusion that is biased and negatively impacts the accuracy of legitimate works. While AI has the potential for research advancement, it is still imperative to ensure ethical considerations and uphold research integrity when using it.

Combating the misuse of AI in scientific research is, therefore, necessary to ensure factual data does not get polluted amidst the fabricated results. One of the methods would be to strengthen AI detection tools to improve swift detection and mitigate unethical practices. Additionally, it is also important to enhance AI literacy among aspiring researchers through training programs to cultivate a deeper understanding of the capabilities and limitations of AI, thus empowering them to use this technology more responsibly.

While AI can assist researchers in understanding large amounts of data, it cannot replace creativity, intuition, and critical thinking skills that are essential in scientific research. Therefore, AI cannot replace human researchers even though people think that AI knows everything. Relying too much on AI can lead to a lack of diversity in research perspectives and limit our own scientific discoveries.

## Importance of honesty in scientific research

The importance of honesty in scientific research cannot be overstated. Scientific research is an important aspect of human development and is one of many things that require a high level of public confidence in order to be effective in application. The honesty maintained in research not only preserves the integrity of current scientific endeavours but also sustains a fertile ground for future generations of researchers to cultivate new studies with potential positive impacts on society.

### Protecting the foundations of science

A common understanding of science is that it is based on facts, not opinions or preferences (Bradford, 2022). The current level of human understanding is a culmination of centuries of research conducted by academics around the world, of which that research has been validated over and over to then be established as a common understanding. To be able to continue the work of the previous generations before them, researchers must be able to trust in the integrity of their peers, and only then is effective collaboration possible. In being honest in their work, researchers are then also able to trust in the work that their colleagues have done, which gives them the ability to work on developing their ideas and theories at a deeper level without having to question the validity of results from prior studies. A world where honesty is absent in scientific research is a world where no one can ever spend time developing new ideas, as the next generation will spend a lifetime trying to discern if the work their predecessors have done is real or just a fabrication. As such, honesty is a key pillar in scientific research, as it serves to support the foundations of science and gives a platform for future generations of researchers to perform valuable work in their own fields of study.

### Financial implications

The continued existence of scientific research as a profession is heavily reliant on public investment and taxpayer money. Due to the significant impact that scientific research has on humankind, money is continually invested in research institutions and studies by the public in good faith that they might yield results that could benefit society in the long term. Most public research is funded by governments that represent the public, and investing in scientific development is one of many choices that the government makes with the goal of benefitting their communities. This then means that if the integrity of scientific research as a whole is ever called into question, the government might rightly cut funding for scientific study, resulting in the loss of the ability to pursue new research and the development of technology. This point holds even at the institutional level, where a single case of research misconduct could lead to a specific department of study’s funding being cut, which hampers the ability of other researchers within that department to effectively carry out their work.

### Career implications

There are obvious negative personal consequences of dishonesty in scientific study, where the main perpetrators are removed from their career positions, funding stripped from them, and receive bans from practising scientific research for years or life. However, there are also career implications for the people who work with the dishonest researcher in question. “A cloud was thrown over published research bearing the names of authors whose work was linked with Dunne's” (See Appendix A). This statement from the case study represents the wide spanning career implications that dishonesty in scientific research could have on both the perpetrator and their peers.

Collaboration and reliance on prior work are integral in making research possible in the first place, and the collaborative nature of scientific research means that researchers and their careers are also commonly intertwined with one another. It is common to see multiple authors contributing to a single research paper, with a study finding there are on average seven people who are cited as researchers in any published paper (Choueiry, 2022). The implication of this is that if a single researcher within a team is found to be dishonest in reporting their research findings, at best all of their work will be scrutinised more heavily, and at worst their entire collection of published papers will be regarded as false. This has major effects on the careers of the other researchers within the team, as all the work they had put into the studies would be wasted because of the actions of one or a few of their colleagues.

### Societal implications (in medicine)

Aside from monetary investment, there are other aspects of scientific research that affect the general public and society as a whole. One such aspect is in the medical field. Scientific studies into new forms of medicine are often aimed at curing or improving the treatment options for people who suffer from disease or illness and have led to the development of new tools and medicines that doctors are able to use to treat their patients more effectively. However, when cases of false data reporting are made known to the public, the reliability of these tools or medicines is called into question, and can lead to the rejection of life saving medicines by patients who were made sceptical because of these cases of research misconduct. Another aspect of this is that doctors who deliver treatments based on research that they believe to be true might be causing harm unknowingly to their patients. These examples highlight just one pillar of society that can be seriously harmed by dishonesty in scientific research.

# Conclusion

Ultimately, this report has discussed the reasons cited for the falsification of data, the victims of research misconduct, and the wide spanning implications as a result. Falsification of data is inherently unethical, irrespective of whether harm is immediately evident. Ethical frameworks extend beyond consequentialism, recognizing that actions are evaluated based on more than just their outcomes. Research misconduct involves a deliberate breach of integrity; the perpetrator knowingly engages in dishonest behaviour, disregarding ethical principles. From a virtue ethics perspective, ethical judgement considers not only the consequences but also the alignment of actions with virtuous character traits such as honesty, integrity, compassion, and fairness. Therefore, falsification of data represents a profound ethical transgression, undermining trust, integrity, and the fundamental principles essential for the pursuit of knowledge and the integrity of scientific inquiry.

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# Appendix

## Appendix A: Project 6: Academic Research Ethics

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| Dr. Dunne was an intelligent student and medical researcher at the University of Limerick, Wolton University, East Anglia University, and Mines University. He was regarded by faculty at all four institutions as a potential research leader in the making with a great research future ahead of him. At Mines he reportedly often worked more than 100 hours a week as a Research Fellow 3 in the Cardiac Laboratory headed by Dr. Hugo Peterson. In less than a year at Mines he was first author of nine publications in top scientific journals. His area of research was in the testing of heart drugs on cats.  This achievement came to a halt, when three staff in the Cardiac Research Laboratory observed Dunne labelling data recordings 24 seconds, 72 hours, one week, and two weeks. In reality, only minutes had transpired. Confronted by his mentor Peterson, Dunne admitted the fabrication; but he insisted that this was the only time he had done this, and that he had been under intense pressure to complete the study quickly. Shocked, Peterson and Dunne's immediate supervisor, Dr. Stark Klingon, spent the next several months checking other research conducted by Dunne in their lab. Dunne's research fellowships were terminated, and an offer of a faculty position was cancelled. However, he was allowed to continue his research projects at Mines for the next several months (during which time Peterson and Klingon observed his work very closely).  Hopeful that this was an isolated incident, Peterson and Klingon were shocked again in December. A comparison of results from four different laboratories in a National Health Institute (NHI) Models Study showed an implausibly low degree of invariability in data provided by Dunne. In short, his data looked "too good." Since these data had been submitted in April, there was strong suspicion that Dunne had been fabricating or falsifying data for some time. Subsequent investigations seemed to indicate questionable research practices dating back as far as his undergraduate days.  What were the consequences of Dunne's misconduct? Dunne, we have seen, lost his research position at Mines, and his offer of a faculty position was withdrawn. The National Institutes of Health (NIH) barred him from NIH funding or serving on NIH committees for ten years. He left research and went into training as a critical care specialist. However, the cost to others was equally, if not more, severe. Mines-affiliated Brompton Children’s Hospital became the first institution NIH ever required to return funds ($426,341) because of research involving fraudulent data. Peterson and his co-workers had to spend many weeks investigating Dunne's research, rather than simply continuing the work of the Cardiac Research Laboratory. Furthermore, they were severely reprimanded for carrying on their own investigation without informing NIH of their concerns until several months later. The morale and productivity of the laboratory was damaged. A cloud of suspicion hung over all the work with which Dunne was associated. Not only was Dunne's own research discredited, but insofar as it formed an integral part of collaborative research, a cloud was thrown over published research bearing the names of authors whose work was linked with Dunne's.  Discussion Questions  1. What reasons are offered for fabricating data?  2. Which, of those reasons, if any, are ‘good’ reasons i.e., reasons that might justify fabricating data?  3. Who is most likely harmed by the fabrication of data? It is said that “if there is no harm done it can’t be ethically wrong” Do you agree?  4. What implications does the above case highlight in the teaching of science (or other subjects) at the primary or secondary school levels? Should academic honesty be taught as early as possible?  5. Why is honesty in scientific research important to the scientific community and the public? |