EG2401: Engineering Professionalism

Final Report

Group 1

Tutorial 510

# Scientific/Academic Misconducts

# 10 Types Of Scientific Misconduct

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**EG2401 Engineering Professionalism**

**Group Projects - Honour Pledge**

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| **2015-2016** | **2** | **Scientific/Academic Misconducts** | **Dr. Chamila N Liyanage** |

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**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.**

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**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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# Aims

1. To discuss the ethical and moral issues behind the scientific and academic misconduct related to publishing scientific research results.
2. To discuss various types of scientific misconducts in research publication and the implications for the researchers involved, the institutions, the scientific community and public through 3 case studies.
3. To discuss what needs to be done to minimize scientific misconduct.
4. To assess whether NUS is doing enough to ensure that its staff and students do not commit scientific misconduct.

# Introduction

Scientific research is defined as the application of scientific method to study a natural phenomena or solve problems which ultimately leads to betterment of the society. However, scientist sometime violate their moral duty of working for the society and engage in activities which can lead to scientific misconduct. Scientific misconduct is defined as "the violation of the standard codes of scholarly conduct and ethical behavior in professional scientific research". This report deals with the scientific misconduct related to the publishing scientific research results. In determining whether scientific misconduct happened, it is essential that one look at the intent and willingness of the individual behind it. Scientific misconduct can have a negative impact on the researcher involved, on the public as well as on the scientific community. It also brings negative publicity for the institutions and the researcher associated with it as well as on the scientific community in general. There are various types of scientific misconducts and are generally categorized into the following broad categories:

1. ***Falsification of Data***

This kind of misconduct includes using completely fabricated data as well manipulating experiments to obtain data that supports the result.

1. ***Plagiarism***

This category involves utilizing results or research obtained from someone else without giving proper credit and citing the source. It also includes “self-plagiarism” where the researcher reuses or recycles results from their previous work without proper disclosure.

1. ***Impropriety of Authorship***

This category overlaps slightly with ***Plagiarism***but is also distinct in other respects. It includes things like claiming undeserved authorship, denying authorship to other contributors, granting authorship to non-contributors.

1. ***Gaming the Peer Review Process***

This involves using unethical methods to manipulate the peer review procedure and get undeserving research published. An example of this is using dummy accounts to review research.

1. ***Inappropriate Behavior in Relation to Suspected Misconduct***

This involves failure to report suspected misconduct, destruction of any evidence related to any claim of misconduct. It can also include making false accusations of misconduct.

1. ***Publishing biased results which supports their own interests***

This involves failure to engage in unbiased scientific research and the conflict of interest that may arise if one engages in research that promotes his own interest over society’s.

# Different Ways of Scientific Misconduct

As mentioned before, there are various ways of scientific misconduct. This sections elaborates on different scientific misconducts using case studies. It applies various ethical frameworks to analyze the ethical and moral issues involved and its implication on the researchers involved, the institutions, the scientific community and public.

Data Falsification - Alirio Melendez

In this case, Alirio Melendez, a researcher at NUS was found guilty of scientific misconduct and had 13 papers retracted. In March 2011, NUS received an anonymous tip that there was evidence of fabrication, falsification or plagiarism associated with Melendez. NUS states that it did not receive any direct communication from Melendez during the investigation even though he had opportunity to claim innocence and they tried to contact Melendez during NUS’s team investigation in UK. However, there was no communication from Melendez side. Melendez denies that he was contacts and maintains his innocence. After the investigation was completed, NUS did not release their investigation results. There was no evidence of scientific misconduct by his co-authors. The following actions were used to analyze the case -

1. Alirio Melendez falsifying data, self plagiarizing, failing to review and fabricating data on papers where his authorship appears.
2. NUS not making public investigation findings and methodology even after conclusion of the investigation

The result of different frameworks is as follows:

**Duty Ethics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Action** | **Alirio Melendez** | **Scientific Community** | **NUS** | **Public** |
| Alirio Melendez falsifying data, self plagiarizing, failing to review and fabricating data on papers where his authorship appears. | Melendez violated his duty by not vigilant during his tenure at NUS. | Melendez violated his duty of being honest towards scientific community by failing to verifying and review papers. | Melendez violated his duty as per the NUS Academic Honesty Policy. | Melendez violated his duty to work towards betterment of society. |
| NUS not making public investigation findings and methodology even after conclusion of the investigation | Nus violated their duty towards the accused by not revealing the details behind the investigation. | NUS violated their duty towards scientific community by not providing transparent investigation into accusations in which they are stakeholders. | Not applicable | NUS violated duty towards public, as investigation was not transparent, and grounds on which Melendez was maligned not revealed. |

**Rights Ethics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Action** | **Alirio Melendez** | **Scientific Community** | **NUS** | **Public** |
| Alirio Melendez falsifying data, self plagiarizing, failing to review and fabricating data on papers where his authorship appears. | Melendez can claim that he has the right to act in self-interest as an increase in papers published will increase his career prospects. However, it is a weak argument that he cannot exercise his right at the cost of other parties’ rights. | Melendez violated the rights of scientific community to receive honest results for further research. | Melendez violated the right of NUS to have an honest research conducted under their name | Melendez violated the right of public to receive honest results which can form the basis for further research |
| NUS not making public investigation findings and methodology even after conclusion of the investigation | NUS violated the right of Melendez to have a fair investigation. | NUS violated the right of scientific community to know which papers were falsified | **Not Applicable** | NUS violated the right of public to know the full truth behind the incident. |

**Action 1:**

**Act Utilitarianism:**

* Melendez: It is satisfied as if Melendez is uncaught it will boost his career standing.
* NUS: It is satisfied as if Melendez is uncaught it boosts reputation of NUS.
* Public: It is not satisfied as incorrect knowledge can be potentially harmful for further research and applications.
* Scientific community: It is not satisfied as misleading research is a potentially a waste of time, funds and efforts.

**Rule Utilitarianism:**

* Melendez: It is not satisfied as there is violation of university rules and scientific code of ethics

**Virtue Ethics:**

* Melendez: It is a violation of honesty, integrity, trustworthiness, and a practise of deception for personal gain.

**Action 2:**

**Act Utilitarianism:**

* Melendez: Unable to defend himself against public accusations without knowledge of the evidence (Negative)
* NUS: Taints image of transparency and leads to aspersions being cast on the veracity of findings on one hand, but likely to lead to fewer challenges, and keeps control of investigative scope within the organization. Less scrutiny attracted if, as Melendez claims, he was being made a scapegoat for a larger fraud. (Positive)
* Public: Kept in the dark about the investigative process and evidence that led to the circumstances of the fraud (Negative)
* Scientific community: Unable to ascertain fraud claims and source independently (Negative)

**Rule Utilitarianism:**

* No rule was broken by NUS or any other party, when NUS chose to keep the investigation private and only disclose selected findings.

**Ethical Line Diagram**

Action 1

NP

PP

P3

P2

P1

SC1

|  |  |  |
| --- | --- | --- |
| **Point** | **Ethics Line Drawing, point of view of Alirio Melendez** | **Location from Left** |
| **NP** | Melendez deliberately submitting papers with plagiarism and fabricated data. | Left Point |
| **PP** | Melendez carefully reviewing the papers that bear his authorship thoroughly and reporting any suspected misconduct diligently. | Right Point |
| **SC1** | Melendez being responsible and cooperating with the NUS investigation. | Approx 7/10 |
| **P1** | Melendez trusting his co-authors and juniors and relying on their judgment instead of verifying papers with his name, himself. | Approx 5/10 |
| **P2** | Melendez refusing to cooperate with NUS over the investigation / failing to respond to NUS on time. | Approx 3/10 |
| **P3** | Melendez being ignorant and failing to verify or review papers being authored by him. | Approx 1/10 |

**Action 2**

NP

PP

P2

P1

SC1

SC2

|  |  |  |
| --- | --- | --- |
| **Point** | **Ethics Line Drawing, point of view of NUS** | **Location from Left** |
| **NP** | NUS colluding with Melendez in scientific misconduct and encouraging its researchers to publish as many papers as possible, without regard for ethics. | Left Point |
| **PP** | NUS having a comprehensive code of research integrity. Additionally, NUS thoroughly investigating suspected misconduct by its researchers and imposing strict penalties on offenders to deter future misconduct. | Right Point |
| **SC1** | NUS having a comprehensive and strict code of research integrity without proper investigations into alleged misconduct or strict penalties for offenders. | Approx 2/10 |
| **SC2** | NUS having a comprehensive and strict code of research with thorough investigations into suspected cases of misconduct without having strict penalties for offenders. | Approx 4/10 |
| **P1** | NUS making every effort to contact Melendez and giving him ample opportunity to defend himself. | Approx 9/10 |
| **P2** | NUS not releasing the results of the investigation publicly and withholding its findings. | Approx 5/10 |

Both NUS and Melendez could have been more ethical about certain aspects of this case. Melendez could have been more thorough by reviewing all the research bearing his authorship before publishing it. Additionally, he could have been more cooperative and responsive with the NUS investigation. NUS, on the other hand, did almost everything right. However, they could have been more transparent about their investigation by publishing their findings publicly (or at least part of their findings).

Gaming the Peer Review Process - Chinese Peer Review Scandal

In 2015, China began to crack down on scientists and researchers who were faking peer reviews to publish their papers. The lead investigating agency CAST (China Association for Science and Technology) demanded that these scientists return their funding. The agency began to investigate companies which were promoting themselves as English Language Editing services but in actual were ‘paper brokers’ which engaged in ghost or fraudulent papers. The investigations revealed that the scientists had reviewed their own papers and used multiple email addresses to falsify credibility. These incident revealed the publish-or-perish mentality behind the China’s research industry. Many of the papers involved in the scandal were in medical science and so health agencies like China’s National Health and Family Planning Commission have been severely impacted. The following actions were used to analyze the case -

1. Researchers manipulating peer review process. (Fake emails for reviewers, submitter and reviewer on same IP Address).
2. Researchers signing off on papers they didn’t help write

**Duty ethics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Action** | **Researchers** | **Scientific Community** | **Health Agencies** | **Public** | **CAST** |
| **Researchers manipulating peer review process. (Fake emails for reviewers, submitter and reviewer on same IP).** | Researchers violated their duty of indulging in honest research. | Researchers violated their duty of being honest towards the scientific community by falsifying data and taking the help of ‘paper brokers’ | Researchers Violated their duty towards health agencies by failing to contribute to development of medical science. | Researchers violated their duty to work towards betterment of society. | CAST fulfilled their duty of investigating fraudulent researchers. |
| **Researchers signing off on papers they didn’t help write** | Researchers violated their duty to genuinely evaluate their peers’ work. | Researchers violated their duty to thoroughly review their peers’ work which forms the basis for further scientific research. | Researchers violated their duty of contributing to development of medical science. | Researchers violated their duty to work towards betterment of society. | CAST fulfilled their duty towards investigation. |

**Rights Ethics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Action** | **Researchers** | **Scientific Community** | **Health Agencies** | **Public** | **CAST** |
| **Researchers manipulating peer review process. (Fake emails for reviewers, submitter and reviewer on same IP).** | They have the right to act in self-interest as the chinese research industry is described as a publish-or-perish industry. Hence, researchers could lose their livelihood if they did not publish. | ResearchersViolated the rights of scientific community to receive honest results for further research. | ResearchersViolated the right of health agencies to have an honest research conducted under their name | Researchers Violated the right of public to receive honest results which can form the basis for further research | Not Applicable |
| **Researchers signing off on papers they didn’t help write** | Not applicable | ResearchersViolated the right of scientific community to maintain the integrity of the papers that were published | ResearchersViolated the right of health agencies to have an honest research conducted under their name | Researchers Violated the right of public to know which papers were falsified | Not Applicable |

**Action 1/ Action 2:**

**Act Utilitarianism:**

* Researchers: If the researcher is uncaught, he has benefits through higher career prospects.
* Scientific Community: It is a net loss to the scientific community as research is incorrect or misleading. It is a cost to verification and investigation.
* Health Agencies: There is overall loss as products / practices stemming from research endanger treatment efforts.
* Public: The public loses out as incorrect information / knowledge is harmful.
* CAST: There is a loss of reputation and failure to monitor.

**Rule Utilitarianism:**

* Researchers: There is clear violation of rules as manipulating peer review process strictly prohibited by all scientific standards.
* CAST: CAST followed their rules and eventually caught fraudsters but they were accused of being overtly lax initially.

**Virtue:**

* Researchers: Virtues of dishonest, Incompetent, and manipulative were violated. Knowingly manipulated peer reviews, hired “paper brokers”, etc.
* CAST: CAST eventually did the right thing. They maintained the virtues of competency and vigilant.

**Ethical Line Diagram**

NP

PP

P1

SC2

SC1

|  |  |  |
| --- | --- | --- |
| **Point** | **Ethics Line Drawing, point of view of researchers** | **Location from Left** |
| **NP** | Researchers giving in to the “publish or perish” mentality and manipulating the peer review process by using fraudulent accounts etc. and signing off on papers they didn’t write. | Left Point |
| **PP** | Researchers working with universities and research organizations to change the mentality of “publish or perish” and focus on quality instead of quantity, along with increased emphasis on honesty and credibility of research. | Right Point |
| **SC1** | Researchers being honest about papers they did or didn’t write but still manipulating the peer review process to get their research published. | Approx 2/10 |
| **SC2** | Researchers letting their research be reviewed fairly, without any manipulation and being honest about claiming ownership of their research | Approx 9/10 |
| **P1** | Researchers employing “paper brokers” to write papers for them. | Approx 0.5/10 |

As can be observed from above, the Chinese researchers in question were being very unethical by taking ownership of research not conducted by them. Moreover, they committed fraud by manipulating the peer review process and getting their research published through unfair mean. However, an argument could be made that their actions were dictated by the “publish-or-perish” mentality prevalent in the Asian research community. On the other hand, CAST, eventually did the right thing and took the necessary action. However, the fact that they were lax initially and failed to detect and monitor such fraud was quite unethical.

**Conflict of Interest - Andrew Wakefield Case**

In 1998, physician Andrew Wakefield published a study in which he claimed that there was a connection between autism and MMR (measles, mumps and rubella). MMR is single vaccine used to all three diseases together instead of using three separate vaccines. This research had as significant impact and public confidence in vaccine decreased. This led to many parents refusing to get their children vaccinated. As a result of this, there was an increase in number of cases of measles and mumps in U.S. and Europe with some areas experiencing severe outbreaks. The most recent one was at Disneyland in 2014. When Wakefield was faced with an investigation in 2010, it was revealed that he and his colleagues modified the facts about the children during their study. It was also revealed that Wakefield was paid by a lawyer who was planning to sue the manufacturer of MMR. The British medical authorities found Wakefield guilty of fraud and misconduct. The case is analyzed using the following actions:

1. Andrew Wakefield didn’t declare financial conflict of interest that motivated research. (Moreover, financial gain was not declared in the published paper.)
2. Children involved in research subjected to tests not required or justified by study, and which constituted abuse, as later proven.
3. Andrew Wakefield fabricating link between isolated 12 cases and eventual ‘findings’, which were found to be incorrectly linked to actual medical records.

**Duty Ethics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Action** | **Wakefield** | **Co-Authors** | **Media** | **Public** | **Scientific Community** |
| **Andrew Wakefield didn’t declare financial conflict of interest that motivated research. (Moreover, financial gain was not declared in the published paper.)** | Wakefield violated his duty to conduct scientific research independently away from any bias. | Co-Authors violated their duty to be vigilant while conducting research. However, their fulfilled their duty once they came to know about Wakefield’s conflict of interest. | Media violated their duty of responsible journalism. Instead of presenting unbiased facts to the public which contradicted Wakefield’s claims, most journalists focused supported Wakefield based on feeble evidence. | Wakefield violated his duty by dishonest in his work towards betterment of society. | Wakefield violated his duty towards scientific community to conduct research independently away from any bias. |
| **Children involved in research subjected to tests not required or justified by study, and which constituted abuse, as later proven.** | Wakefield violated his duty as scientist to follow the ethical protocol. | Co-authors violated their duty to be vigilant while conducting research. | Media violated their duty of responsible journalism by failing to report this action. | Wakefield violated their duty towards public by indulging in irresponsible research. | Wakefield violated their duty towards scientific research by indulging in irresponsible research. |
| **Andrew Wakefield fabricating link between isolated 12 cases and eventual ‘findings’, which were found to be incorrectly linked to actual medical records.** | Wakefield violated his duty as a scientist to follow appropriate research methodology and not make wild accusations. | Co-Authors violated their duty to be vigilant while conducting research. However, their fulfilled their duty once they came to know about Wakefield’s conflict of interest. | Media violated their duty towards responsible journalism by not thoroughly investigating on how Wakefield made his conclusions. | Wakefield violated his duty towards public by claiming results without proper procedure. | Wakefield violated his duty towards public by claiming results without proper procedure. |

**Rights Ethics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Action** | **Wakefield** | **Co-Authors** | **Media** | **Public** | **Scientific Community** |
| **Andrew Wakefield didn’t declare financial conflict of interest that motivated research. (Moreover, financial gain was not declared in the published paper.)** | Wakefield can argue that he has the right to engage in activities that promote his self-interest. However, this is not a strong argument if it violates other people’s rights. | The co-authors’ rights were violated as they were not aware of the financial conflict. | The media violated the rights of public by publishing feeble facts and not investigating Wakefield thoroughly which could have revealed Wakefield’s scientific research. | Wakefield violated the right of public to receive honest results which can form the basis for further research | Wakefield violated the rights of scientific community to receive honest and unbiased results for further research. |
| **Children involved in research subjected to tests not required or justified by study, and which constituted abuse, as later proven.** | The researchers violated the rights of children by engaging in test not required for the study. | Wakefield violated the right of children along with Wakefield | Wakefield violated the rights of public by failing to publish all the facts. | Not Applicable | Not Applicable |
| **Andrew Wakefield fabricating link between isolated 12 cases and eventual ‘findings’, which were found to be incorrectly linked to actual medical records.** | Not Applicable | Not Applicable | Not Applicable | Wakefield violated the right of public by claiming results without due testing. | Wakefield violated the right of scientific community by not following due procedure**.** |

**Act Utilitarianism:**

* Wakefield: Wakefield made financial profit and it improved its research standing (if gone unnoticed).
* Co-Authors: It increased their research standing if gone unnoticed.
* Media: Media gained by having more subscribers for sensationalist claims.
* Public: Public suffered MMR outbreaks and death. There was ignorance on an incredible scale.
* Scientific Community: They suffered because of incorrect facts and resources were spent on denying and verifying claims.

**Rule Utilitarianism:**

* Wakefield clearly violated rules regarding conduct of research with financial conflicts of interest, failed to mention said conflict, conducted unnecessary tests amounting to abuse of children, and fabricated data to support predetermined conclusions.

**Virtue Ethics:**

* Wakefield: Virtues of dishonest, greedy and competency were violated

**Ethical Line Diagram**

|  |  |  |
| --- | --- | --- |
| **Point**  NP  PP  P2  P1  SC1  SC2  P3 | **Ethics Line Drawing, point of view of Andrew Wakefield** | **Location from Left** |
| **NP** | Wakefield deliberately fabricating data and symptoms to support his research that showed a link between the MMR vaccine and autism as well as unethically and immorally subjecting the children taking part in his study to unreasonable amount of tests. Additionally, Wakefield having a conflict of interest with the study’s goal and financially profiting from the research. | Left Point |
| **PP** | Wakefield refusing to take part in the research as he would have a conflict of interest and would stand to gain financially from the results. | Right Point |
| **SC1** | Wakefield being honest about his research and presenting his findings without any manipulation or tampering. | Approx 9/10 |
| **SC2** | Wakefield taking the approval of the appropriate ethics committees before subjecting the children participating in his trial to invasive and potentially dangerous tests. | Approx 7/10 |
| **P1** | Wakefield profiting from the results of his research through the promotion of his own vaccine (as a competitor to MMR) and through grants awarded to him. | Approx 2/10 |
| **P2** | Wakefield fabricating data and the symptoms and histories from his trial subjects to support his research goal. | Approx 1.5/10 |
| **P3** | Wakefield subjecting the children participating in his trials to unapproved tests. | Approx 1/10 |

As can be observed from the diagram above, Wakefield had committed a highly unethical act by taking on research that presented a financial conflict of interest for him. He should have declined to conduct the research under the circumstances. Moreover, he falsified and manipulated data to support his research, as well as, subjected the children participating in his research to unjustified and unapproved tests. Both these acts were very unethical and have no basis for a defense.

# Minimizing Scientific Misconduct

It is absolutely essential that scientific misconduct be minimized and actions enforced in aiming that. Universities and Research institutes already apply various ways to minimize scientific misconduct like strong ethical policy and regular ethics workshops. However, there is always scope for improvement which can be achieved in the following ways -

1. The institutions can employ third party companies to perform audits and review the processes and scientist’s data. This ensures that the gaps which may have to due to researcher’s institutes bias can be notices as a third party won’t be influenced by anything external factor.
2. The journals in a bid to compete with each other slackened their review process and let the buzz drive it. The journals need to give more importance to data behind the research and focus less on media buzz created by a publication.
3. The journals need to ensure that peer reviews are not falsified by thoroughly reviewing the scientist conducting the peer reviews. Similar to the previous point, journals need to avoid following articles that can create buzz and focus on proper procedure on evaluating peer reviews.
4. The scientists need to be encouraged to be more forthcoming with retractions if they realized they have made error in their research.

# Scientific Misconduct at NUS

Currently, NUS employs following points to monitor and educate about scientific misconduct at NUS. They are:

1. Introduce ethics and various ethical issues that arise in workplaces as part of undergraduate education.
2. Maintain a document on research integrity and process for investigation and action (included in references) and educated employees on it.

In addition, NUS can adopt the following practices to Reduce Scientific Misconduct at NUS.

1. NUS should reconsider and make transparent, its review and promotion rubrics for Professorship and research. Michael B. Eisen, a biologist at the University of California, Berkeley, noted that in many countries including Taiwan, academic institutions have an “almost explicit” formula for promotions based on quantity rather than quality of published papers, which should not be the case.
2. NUS investigations into scientific misconduct should be made public and the process transparent, once completed, to build faith in its veracity and scope, and avoid situations like the those that arose in the Melendez case, where there are 2 different versions of the events still in a state of dispute.
3. Retractions for submissions should be less stigmatized, so as to ensure honest errors don’t blow up into fraud.

# Conclusion

In conclusion, we have seen the results of different frameworks, when applied to 3 different cases regarding scientific / academic misconduct. The results from Melendez case suggest that both parties (Melendez and NUS) could have done some things differently to be more ethical. The second case shows that the Chinese researchers should have respected the peer review process and should have refrained from publishing papers not written by them. Additionally, this case showed the negative effects of the “publish or perish” mentality prevalent in the Asian research community. Finally, the third case showed that Wakefield was clearly unethical when taking on research that presented a conflict of interest for him. Overall, scientific misconduct is an important problem that exists by ensuring that the lure indulging in it does not exits. The society as a whole needs to ensure that there is proper awareness regarding ethical misconducts in scientific research.

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