THE PROCESS AND ITS CHALLENGES

“The peer review system isn’t perfect. What are some of the problems it faces?”

ACTIVITY:

Students are given real news articles on major scientific stories and answer set questions on the role of peer review in those stories, and the consequences of the limitations of the peer review system.

OBJECTIVES:

By carrying out this exercise, students should understand that:

- peer review is not a fraud detection system
- there is pressure on scientists to reveal findings that are important to public health
- there is a balance between publishing novel and exciting work and making sure it meets the requirements of the peer review system.
- scientists working on similar studies may not agree and may be in competition to publish their work
## CURRICULUM CONNECTION

<table>
<thead>
<tr>
<th>Reference</th>
<th>Activity</th>
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<tr>
<td>National Curriculum (KS4)</td>
<td>Pupils should be taught:  &lt;br&gt; 1.2d to evaluate methods of collection of data and consider their validity and reliability as evidence  &lt;br&gt; 1.3c to present information, develop an argument and draw a conclusion, using scientific language  &lt;br&gt; 1.4c how uncertainties in scientific knowledge and scientific ideas change over time and about the role of the scientific community in validating these changes</td>
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<td>GCSE Science A (AQA)</td>
<td>Candidates should be able to:  &lt;br&gt; a) demonstrate knowledge and understanding of the scientific facts, concepts, techniques and terminology in the specification  &lt;br&gt; b) show understanding of how scientific evidence is collected and its relationship with scientific explanations and theories  &lt;br&gt; c) show understanding of how scientific knowledge and ideas change over time and how these changes are validated.</td>
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<td>GCSE Science B (AQA)</td>
<td>Element 2: Report on Science in the News  &lt;br&gt; A. Candidates are expected to be able to: The ability to plan an approach to the task, including the selection of suitable sources of data/information, which will address the issues.  &lt;br&gt; • Plan to answer a scientific question (PoS 3.6ia)  &lt;br&gt; • Collect data from secondary sources, including the use of ICT sources and tools (PoS 3.6iib)  &lt;br&gt; • Apply and question scientific information or ideas (PoS 3.6iia).  &lt;br&gt; B. The ability to analyse the data/information and interpret it to show trends or patterns. Candidates are expected to be able to:  &lt;br&gt; • Interpret data, using creative thought, to provide evidence for testing ideas (PoS 3.6ib)  &lt;br&gt; • Analyse scientific information or ideas (PoS 3.6iia).  &lt;br&gt; C. The ability to evaluate the data/information to reach judgments about its reliability and validity. Candidates are expected to be able to:  &lt;br&gt; • Consider the validity and reliability of data as evidence (PoS 3.6id)  &lt;br&gt; • Interpret and question scientific information or ideas (PoS 3.6iia).  &lt;br&gt; D. The ability to relate the data/information to social, economic and environmental issues and understand how science can contribute to decision making. Candidates are expected to be able to:  &lt;br&gt; • Know why decisions about science and technology are made, including those that raise ethical issues, and know about the social, economic and environmental effects of such decisions (PoS3.6ivb)  &lt;br&gt; • Know that uncertainty in scientific knowledge and ideas changes over time and know the role of the scientific community in validating these changes (PoS 3.6ivc).</td>
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<td>GCSE Science (Edexcel)</td>
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<td>GCSE Science (OCR – Gateway)</td>
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<td>REFERENCE</td>
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<td>ROLEPLAY EXERCISE</td>
<td>SCIENCE IN THE NEWS</td>
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<td><strong>GCSE Science (OCR – Twenty First Century Science)</strong></td>
<td>IaS4.2 Students can:</td>
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<td>• identify absence of replication as a reason for questioning a scientific claim;</td>
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<td>• explain why scientists regard it as important that a scientific claim can be replicated by other scientists.</td>
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| **International Baccalaureate Diploma Programme** | The International Baccalaureate Diploma Programme requires students to research and prepare a 4000 word write-up or mini-thesis on a subject topic of their choice. This is called the Extended essay. It enables the students to get introduced to the concept of independent and fruitful research work, which should involve reproducible experimental results and plausible theoretical back-up. |
| | If the student chooses to write an extended essay in a science subject, such as Chemistry, he or she would need to be made aware of the importance of peer review in evaluating new scientific ideas, how science is reported in the news, and the risks associated with plagiarism and improper representation of facts. |

More materials online at senseaboutscience.net
TEACHER’S NOTES

This is additional information which can be printed for the students to read through or discussed as additional information to the other exercises.

It deals with some of the challenges faced by the peer review system and how the publishing industry deals with them. Despite these challenges peer review remains the best system to date for ensuring science is conducted to a specific standard.

FRAUD

Peer Review is not a fraud detection system. Referees may pick it up as they have special knowledge and an interest in the subject but if someone sets out to deliberately falsify data it may not be apparent until after the paper has been published. However, it normally comes to light when other scientists try and repeat the experiment.

A famous case of fraud was Hwang Woo Suk who published two papers on stem cells in the journal Science in 2004 and 2005. He claimed to have made 11 lines of stem cells from sick patients, which was exciting work as it raised the possibility of treating sick patients with their own stem cells. Following reports about unethical egg donation information Hwang was investigated by Seoul University and on January 10th 2006 the university announced the two papers were fabricated and Hwang was discredited.

To find out more about Hwang Woo Suk click here: http://tinyurl.com/2g37wh

PUBLISHING OF CONTROVERSIAL WORK

Sometimes people worry that new ideas won’t be accepted by other scientists but if someone has been exceptionally clever, other scientists are more likely to distinguish it. Journal editors like novel ideas and scientific publishing has brought thousands of discoveries to light.

However, journal editors have to be careful about striking the balance between publishing exciting work and making sure it has met the standard of peer review.

More materials online at senseaboutscience.net
In 1998 Andrew Wakefield and a group of scientists published a paper in the Lancet suggesting a link between the combined vaccine for measles, mumps and rubella (MMR), a rare bowel disease and autism. At the news conference Wakefield suggested single vaccinations should be used instead. There was huge media campaigns and many parents refused to vaccinate the children with MMR. Consequent studies have showed no links between MMR and autism and in 2004 10 of the original 13 authors issued a retraction of the papers interpretations. This was to make it clear that the data showed no link between MMR and autism.

Alongside the original study, the Lancet published an editorial which expressed doubts about the validity of the study and detailed the problems of its methodology. However, the editor of the Lancet, Richard Horton, came under criticism for publishing it particularly when it was discovered Wakefield had serious conflicts of interest. Editors have to find the balance between publishing this type of work and making sure it fits the standards imposed by the peer review system.

To read more about this click here: http://tinyurl.com/27pk8f

**ACTIVITIES**

1) Divide the class into groups and give each group copies of one of the worksheets below.

2) Ask the students to read the articles and answer the questions attached.

3) Discuss the issues raised amongst the class. What are the shortfalls of peer review? Does it rely too much upon scientists being honest? Could the students design a better system for appraising research?
CHALLENGES FOR PEER REVIEW

WHY CAN’T THERE JUST BE A CHECKLIST OF SCIENTIFIC VALIDITY?

Assessing scientific papers cannot be done in the same way as giving a car an M.O.T. or marking a maths test. New research usually has its own unique features, which are difficult to predict with a check list and which require expert judgement about their validity, significance and originality.

DOES PEER REVIEW DETECT FRAUD AND MISCONDUCT?

Peer review is not a fraud detection system. Referees are likely to detect some wrongdoing, such as copying someone else’s research or misrepresenting data, because they care about their subject. They know what research has been conducted already and the kinds of results that are likely. However, if someone deliberately sets out to falsify data, there is sometimes no way of knowing this until the paper is published and others in the scientific community scrutinise and try to repeat the work.

IS ‘MAVERICK’ SCIENCE REJECTED THROUGH PEER REVIEW?

Sometimes people worry that new ideas won’t be understood by other scientists (although this is also an excuse given when researchers don’t want to submit to the scrutiny of their peers). It is true that referees can be cautious about unusual findings; and important insights can initially be overlooked. But if someone has been exceptionally clever, other scientists are most likely to recognise it and to distinguish it from flawed or inflated claims. Journal editors like novel ideas and scientific publishing has brought thousands of important discoveries to light.

DOES THE PEER REVIEW PROCESS SLOW DOWN ADVANCES IN SCIENTIFIC AND MEDICAL KNOWLEDGE?

In our world of instant communication and 24-hour news, a deliberative process like peer review can seem frustratingly slow. Electronic communication has improved it, but good assessment of research does take time. Sometimes people justify the promotion of unpublished findings by saying they are ‘too important to wait’. But, although some papers take months to review and improve, if there is a major breakthrough the process can be completed in weeks. Furthermore, if the findings are very important – e.g. they concern public health – then it is all the more necessary to check them through peer review.

More materials online at senseaboutscience.net
“DISGRACE”

by David Smith

The unmasking of South Korean stem cell expert Hwang Woo-suk as a fraud has staggered the scientific world.

If there is such a thing as the Korean Dream, then Hwang Woo-suk was surely its embodiment. At the height of his popularity he was regarded as a national hero.

But last week, months after he claimed to have made a breakthrough that would revolutionise the treatment of the disabled and chronically ill, Hwang's career and reputation lay in tatters after one of the most extraordinary cases of scientific deception ever perpetrated, one which could have profound implications for medical progress.

In an infamous paper published in the US journal Science in May last year, Hwang said that he had cloned human embryos and extracted stem cell lines tailored to match his patients. He had apparently come closer than anyone to turning the dream of therapeutic cloning into a reality that could benefit millions of people with debilitating illnesses.

The technique would enable scientists to grow genetically specific tissue that could be used to repair disease-damaged tissue. Because the stem cells would be genetically tailored to suit each individual, there is no risk of rejection by the patient's immune system. His work, scientists said, would one day enable them to develop a new generation of regenerative therapies for people with illnesses such as Alzheimer's and Parkinson's disease. Diabetics would no longer require insulin to stay alive; the paralysed might walk again.

But on Thursday Hwang was exposed as a fraud. A nine-member investigation panel at Seoul National University said his claims were little more than an elaborate work of fiction. There was no evidence, they said, to corroborate his claims that he had cloned 30 human embryos and extracted 11 stem cell lines that were identical genetic matches to his patients.

'So far we could not find any stem cells regarding Dr Hwang's 2005 paper that genetically match the DNA of patients,' said Roe Jung-hye, the university's dean of research affairs. 'It is the panel's judgment that Dr Hwang's team does not have the scientific data to prove they made [patient-specific stem cells].'

With his single-minded devotion to work and his apparent love of the simple life, Hwang embraced a near-Calvinistic ethic that guides many Koreans from childhood. For his harshest critics, Hwang didn't simply disgrace himself; he did untold harm to his country's prestige.

His demise began a month ago when he admitted that he had breached the code of ethics by using eggs donated by women working in his lab. Hwang insisted the lapse was due to nothing more than a desire for results. 'The world gasped in awe when I first showed the results of my research,' he said. 'I felt a national pride and tasted the confidence that we Koreans could achieve things too. I was blinded by work and my drive for achievement.' Later he admitted that some of the eggs had been bought, despite spending the previous 12 months insisting they had been donated. His colleagues began to rebel.

The scandal is far from over. Hwang faces criminal charges of fraud, and no one is certain how many of his colleagues will eventually become implicated in his web of deceit.

http://tinyurl.com/2g37wh

http://tinyurl.com/2g37wh
QUESTIONS ON “DISGRACE”

1. What had Hwang Woo-suk supposedly achieved for him to be considered the embodiment of the ‘Korean Dream’?

2. What medical benefits were there from Hwang’s supposed discoveries?

3. List the reasons why the Seoul National University considered Hwang’s work to be fraudulent?

4. What is the impact of this act of fraud on:
   a) Hwang?  b) Korea?     c) the general public?   d) stem cell research?
EDITOR IN THE EYE OF A STORM

by Joanna Lyall

Is the editor of a medical journal responsible for the way its contents are reported, and the quality of the ensuing debate, as well as the accuracy of the material itself? It is a question that Dr Richard Horton, editor of the Lancet, and one of the figures in the eye of this week's media storm over the MMR (measles, mumps, and rubella) vaccine, has answered in the past. He says: "Although I knew this paper would be controversial, I did not expect the level of attack and personal rebuke that followed. I was terribly naive. I should have at least tried to persuade Andrew Wakefield not to recommend splitting the vaccine.

"I failed to do enough to manage the media reaction to this work. Until the Wakefield paper, I had not seen this media management role as one for a scientific medical journal editor. I now see it as one of my main responsibilities."

Last Friday BBC Online quoted Dr Horton saying that with hindsight the Lancet would not have published the paper. "If we had known the conflict of interest Dr Wakefield had in this work I think that would have strongly affected the peer reviewers about the credibility of this work and in my judgment it would have been rejected." He also said: "As the father of a three year old who has had the MMR, I regret hugely the adverse impact this paper has had." But he added: "Professionally, I don't regret it. The Lancet must raise new ideas."

The allegations published in last weekend's Sunday Times concerned the ethics of Wakefield's research study and claimed a failure to disclose a conflict of interest. It revealed that Wakefield was paid £55 000 by the Legal Aid Board to investigate children who were allegedly vaccine-damaged for a possible legal action by their parents. A press statement from the Lancet expressed "regret" that this funding was not disclosed.

The controversy over MMR has been one that has played out in the media all along; in the past week it has almost come to a head. Instead of Andrew Wakefield himself in the media firing line, it is the Lancet that has found itself under scrutiny.

On Tuesday Dr Horton told the BMJ that the UK needed an independent body to investigate the conduct of research. He added that authors had a duty to reveal the context of their work and potential conflicts of interest. "The whole system depends on trust and honour," he said. And the duty of medical editors? "To report new thinking and make sure that the context is responsible."

http://tinyurl.com/27pk8f
QUESTIONS ON “EDITOR IN THE EYE OF A STORM”

1. **Who is Dr. Richard Horton?**

2. **Why Did Dr. Horton say that with hindsight he would not have published the paper?**

3. **Why did the Legal Aid Board pay Dr. Wakefield £55 000? What implications did this have for his research?**

4. **What did Dr. Wakefield suggest to parents?**

5. **What impact did Dr. Wakefield’s suggestions have?**

6. **Dr. Horton says that he sees media management as one his main responsibilities. Why do you think he says this?**

7. **Do you think The Lancet were right in publishing Dr. Wakefield’s article?**

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