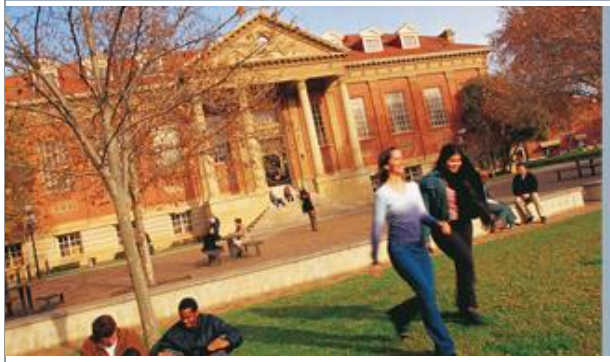
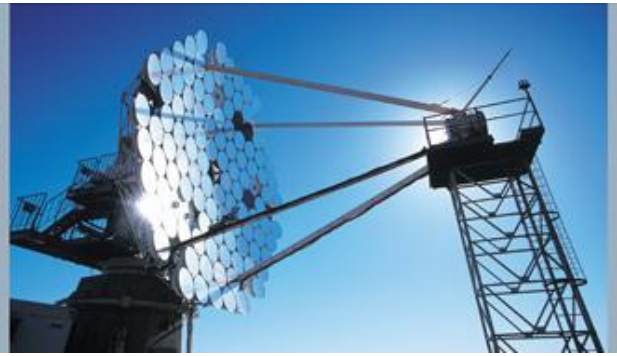
Inquiry & iPads:
Introducing first-years to science & scientists


Associate Professor Simon Pyke

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Faculty of Sciences

Life Impact | The University of Adelaide

Science LTAS Threshold Learning Outcomes

	Upon completion of a bachelor degree in science, graduates will:
Understanding science	1. Demonstrate a coherent understanding of science by: 1.1 articulating the methods of science and explaining why current scientific knowledge is both contestable and testable by further inquiry 1.2 explaining the role and relevance of science in society.
Scientific knowledge	2. Exhibit depth and breadth of scientific knowledge by: 2.1 demonstrating well-developed knowledge in at least one disciplinary area 2.2 demonstrating knowledge in at least one other disciplinary area.
Inquiry and problem solving	3. Critically analyse and solve scientific problems by: 3.1 gathering, synthesising and critically evaluating information from a range of source 3.2 designing and planning an investigation 3.3 selecting and applying practical and/or theoretical techniques or tools in order to conduct an investigation 3.4 collecting, accurately recording, interpreting and drawing conclusions from scientific data.
Communication	4. Be effective communicators of science by: 4.1 communicating scientific results, information, or arguments, to a range of audiences, for a range of purposes, and using a variety of modes.
Personal and professional responsibility	5. Be accountable for their own learning and scientific work by: 5.1 being independent and self-directed learners 5.2 working effectively, responsibly and safely in an individual or team context 5.3 demonstrating knowledge of the regulatory frameworks relevant to their disciplinary area and personally practising ethical conduct.

Background – SCIENCE 1100

- Key drivers:
  - What is 'science'? What are its boundaries? What are the methods & processes of science? How does science progress?
  - What it means to 'be a scientist' – the practices and attitudes of the practitioner.
  - How & why is science communicated? To whom? For what purpose(s)?

- Every student in the class has an iPad (~150 in 2011; ~250 in 2012)

Why did we commit to the iPad?

- **PORTABILITY** - students will carry it with them
- **CONNECTIVITY** - great for internet access (we bought 3G enabled iPads)
- **CREATIVITY** - lots of relevant apps for education
- **ACCESSIBILITY** - allows for e-books to be purchased
- **DESIRABILITY** - staff were easy to persuade to be involved (it was the shiny new device at the time...)

Line of Inquiry #1

What is science?
How does science work?

↓

Boundaries of science?

↓

Process of science?

↓

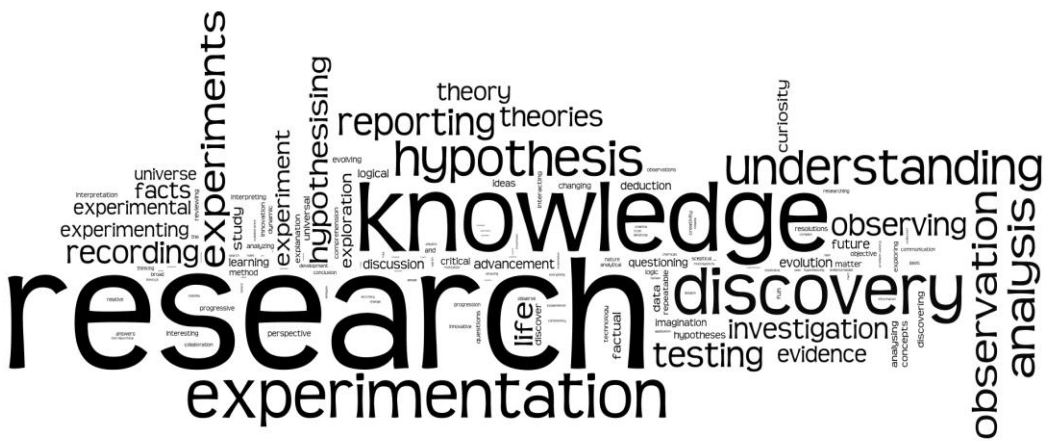
Researcher Profile:
Interviewing a researcher

SCIENCE 1100 – 'Principles & Practice of Science'

Name		Student No.	a							

What do you think 'science' is and how do you think 'science' works'? What makes science 'science'?
Record your responses to these questions in the space below (aim for 400-500 words).

This task is 'not for credit' but will form the basis of a reflective assessment task later in the semester.



Line of Inquiry #1

What is science?
How does science work?

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Boundaries of science?

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Researcher Profile:
Interviewing a researcher

http://www.badscience.net/2011/03/why-dont-journalists-link-to-primary-sources/

Line of Inquiry #1

What is science?
How does science work?

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Boundaries of science?

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Process of science?

↓

Researcher Profile:
Interviewing a researcher

#3 - Controversy: Right hand turns

Task - Controversy: Right hand turns - Set #1

GROUPS: Ampere, Archimedes, Aristotle, Bacon, Black, Bohr, Boyle, Bragg, Buckland, Cavendish, Copernicus, Cornforth, Crick, Curie, Dalrymple, Dalton, Darwin.
In this task you will examine one historical scientific controversy. Post your answers to the question to the wiki below.
HISTORICAL Find out what you can about Antoine-Laurent de Lavoisier and Joseph Priestley. What was the nature of the scientific controversy between these two individuals (and others)? What consequences did this controversy have on the scientific community?

Task - Controversy: Right hand turns - Set #2

GROUPS: Eddington, Ehrlich, Euler, Faraday, Fermi, Fischer, Fleming, Florey, Franklin, Fresnel, Galen, Galileo, Gauss, Grimaldi, Heisenburg.
In this task you will examine one historical scientific controversy. Post your answers to the questions to the wiki below.
HISTORICAL Find out what you can about J. J. Thompson, Ernest Rutherford, Niels Bohr and Erwin Schrodinger. What was the nature of the scientific controversy between these individuals (and others)? What consequences did this controversy have on the scientific community?

#3 - Controversy: Right hand turns

Post your answers to the historical controversy questions here.

Line of Inquiry #1

What is science?
How does science work?

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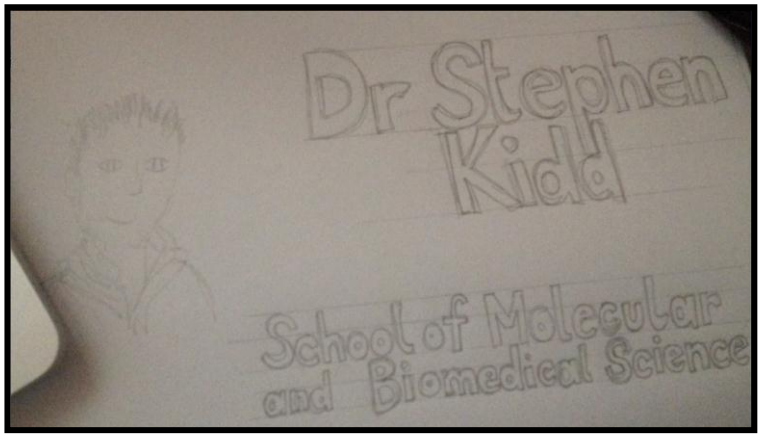
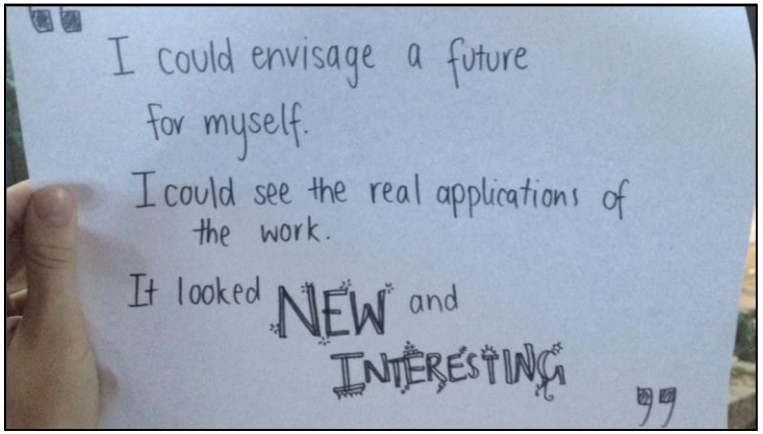
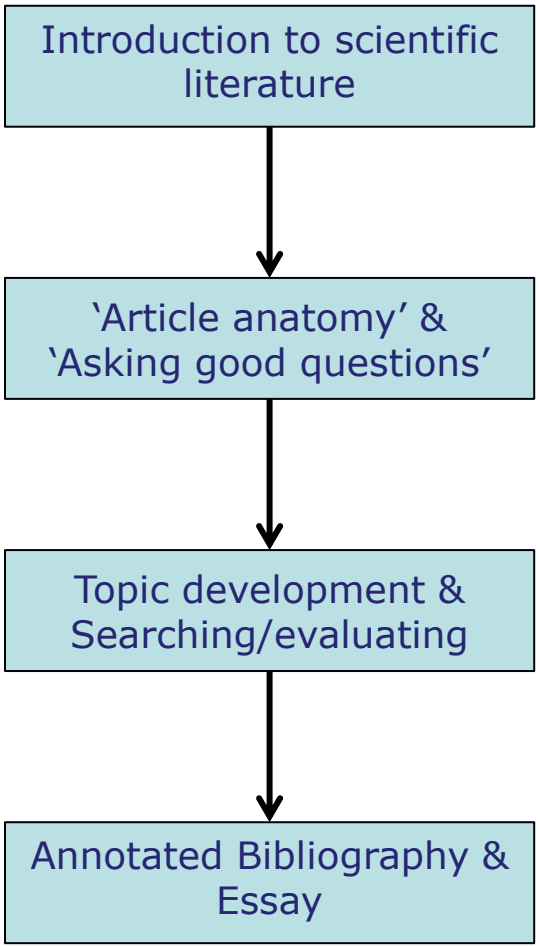
Researcher Profile:
Interviewing a researcher





Line of Inquiry #2



Journal task

For each journal that your group has been assigned, start a new post (**titled by the name of the journal**). Include answers to each of the following questions:

1. What is the full name of the journal?
2. What is the volume number and issue number of the most current issue?
3. What year was the journal first published?
4. Where is the journal published?
5. Who publishes the journal?
6. Who is the chief/managing editor of the journal?
7. What is the journal's scope?
8. How many scientific articles does the current issue of the journal contain?
9. How many scientific review articles does the current issue of the journal contain?
10. What else (if anything!) does the journal contain?
11. What are the common sections used in the scientific articles in this journal?

The structure of scientific articles - Task #1

In this activity, you will examine a number of primary scientific articles. The questions here will be useful in assessing the relevance and reliability of an article.

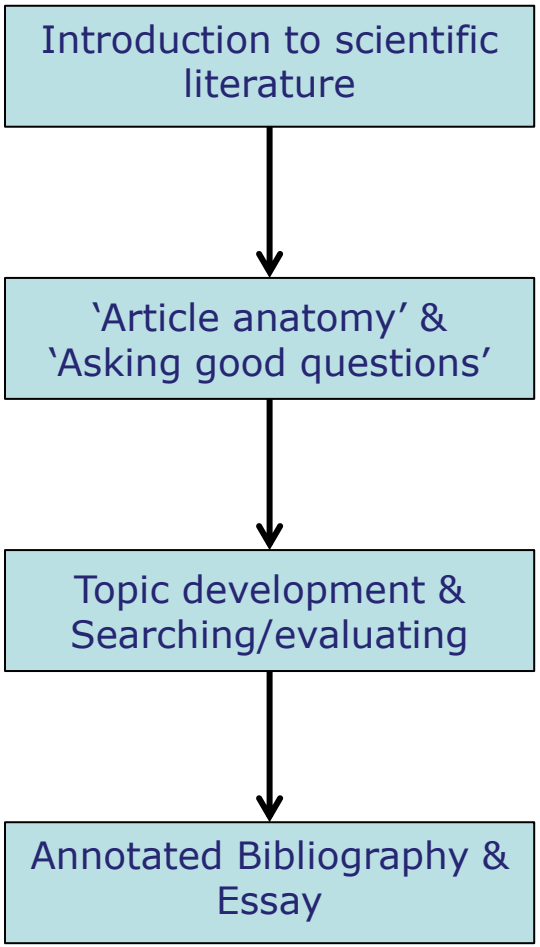
Tip: Depending on your articles, you might not be able to answer all of the questions. If you cannot answer all the questions, think about and write down why the information may be 'missing' from that particular journal article.

For each scientific article, post your responses to each section of the "Task #1 Note taking template" under the relevant wiki entry (wiki entries are named according to the entries in the table). Each article has more than one group assigned to read it. If you are the group responsible for the primary response to a particular article (your group name is in CAPITALS), then your task is to populate the appropriate wiki entry; all other groups working on the same article will then act as "peer reviewers" of your entry and should respond by adding specific comments.

The structure of scientific articles - Task #2

For each scientific article, post your responses to each section of the "Task #2 Note taking template" under the relevant wiki entry (wiki entries are named according to the entries in the table). Each article has more than one group assigned to read it. If you are the group responsible for the primary response to a particular article (your group name is in CAPITALS), then your task is to populate the appropriate wiki entry; all other groups working on the same article will then act as "peer reviewers" of your entry and should respond by adding specific comments.

Line of Inquiry #2



1. Asking good research questions

Asking good questions is a vital part of scientific research. The way that a research question is asked can influence the approach and methods scientists decide to use, affect the interpretation of research results and determine how these results are applied. Research questions might stem from a scientist's previous work (either their own or that of others), be developed collaboratively as a result of discussion with peers, or arise spontaneously after observation of some phenomenon.

Asking research questions is a creative process that different scientists will approach in their own way. However, the development of good research questions is almost always an iterative process in which questions are continually revised and refined. In general, scientists tend to begin with a primary research question that might be quite broad and then narrow this down into a series of more specific secondary questions which focus on particular aspects that can be examined by controlled experiments or surveys.

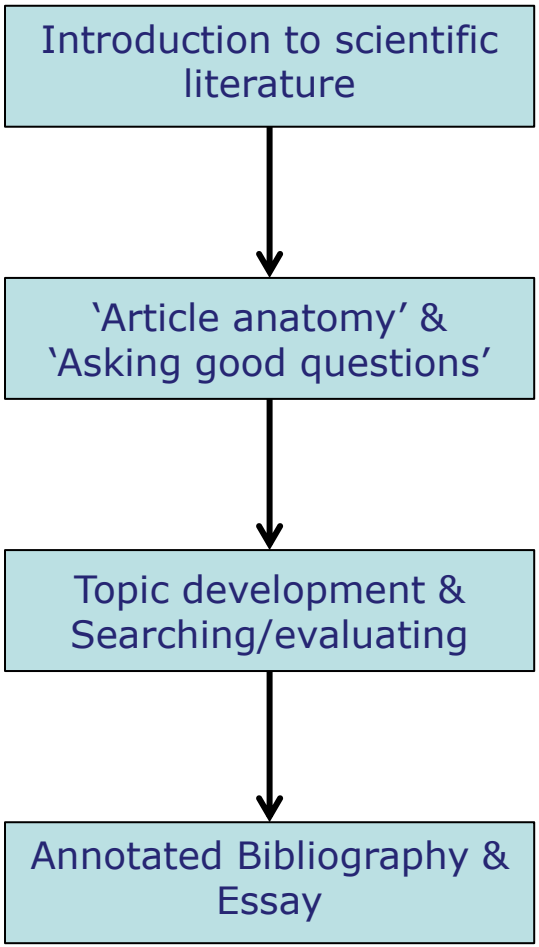
In your two written assignments, the Annotated Bibliography and Essay, you will need to develop a primary research question and several secondary research questions that are suitable for investigating by reviewing recent scientific literature. The process below will assist you to develop and refine appropriate research questions relating to your chosen scientific review topic that will provide the basis for these tasks/

To begin with, you need to work out what particular aspect of your chosen scientific review topic you are interested in researching and frame this as a suitable primary research question (if it is a broad topic). You might want to keep the scope of your research question reasonably broad or, alternatively, you might decide to concentrate on quite a narrow and specific area of research within the overall topic. Often, it is easier to write a good literature review if you have a narrow and well defined scope. However, this may be difficult if relevant recent scientific literature is limited. Choosing an appropriate primary research question for your scientific literature review therefore involves a bit of a balancing act between asking specific and clearly defined questions and being able to find enough appropriate papers to address these questions with.

Drawing on your general knowledge, studies in other units and your reading to date, answer each of the following questions.

1. What is your **interest** in the scientific review topic you have chosen?
2. What are the **major areas** of recent scientific research relating to this topic?
3. What are the **major questions** being considered by recent scientific research in this topic?
4. What are the common **scientific approaches** being used by scientists researching this topic? (e.g. experiments, surveys, conceptual models - try to be as specific as you can)
5. Are there any **disagreements or debates** in the recent scientific literature about any aspects of this topic?
6. What are the **major gaps** in knowledge relating to this topic?
7. What are the **implications** of recent research into this topic for society?
8. What are the **implications** of recent research into this topic for scientific thinking in this field?

Line of Inquiry #2



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08/03/12 12:56	Cartoon physics	Sophie Oerlemans	Published 0	10
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08/03/12 12:57	Dark matter	Joe Crowhurst	Published 0	2
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08/03/12 13:00	Disease Ecology	Matthew Bowie	Published 0	5
08/03/12 13:00	Future of robotics	David Lawton	Published 0	3
08/03/12 13:00	How did the evolution of science impact ww2 ?	Matthew Musolino	Published 0	2
08/03/12 13:00	What are the real and perceived dangers of the use of nuclear power? Is the upgrading and recommissioning of older generation nuclear reactors safe?	David Bleckly	Published 0	2
08/03/12 13:01	Planets beyond our solar system	Matthew Chugg	Published 0	2
08/03/12 13:01	Satellites	Rohan Hudson	Published 0	7
08/03/12 13:01	Helium 3 as the next energy source	Kabo Mokone	Published 0	6
08/03/12 13:01	Cloning	Syaheeda Mohammed Akram	Published 0	10
08/03/12 13:02	Mechanised bi-pedal combat units	Steven Martin	Published 0	3
08/03/12 13:02	Influenza	Benjamin Copperwheat	Published 0	2
08/03/12 13:02	Alzheimer's Disease	Kristina Millar	Published 0	2

Line of Inquiry #2

Introduction to scientific literature

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'Article anatomy' & 'Asking good questions'

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Topic development & Searching/evaluating

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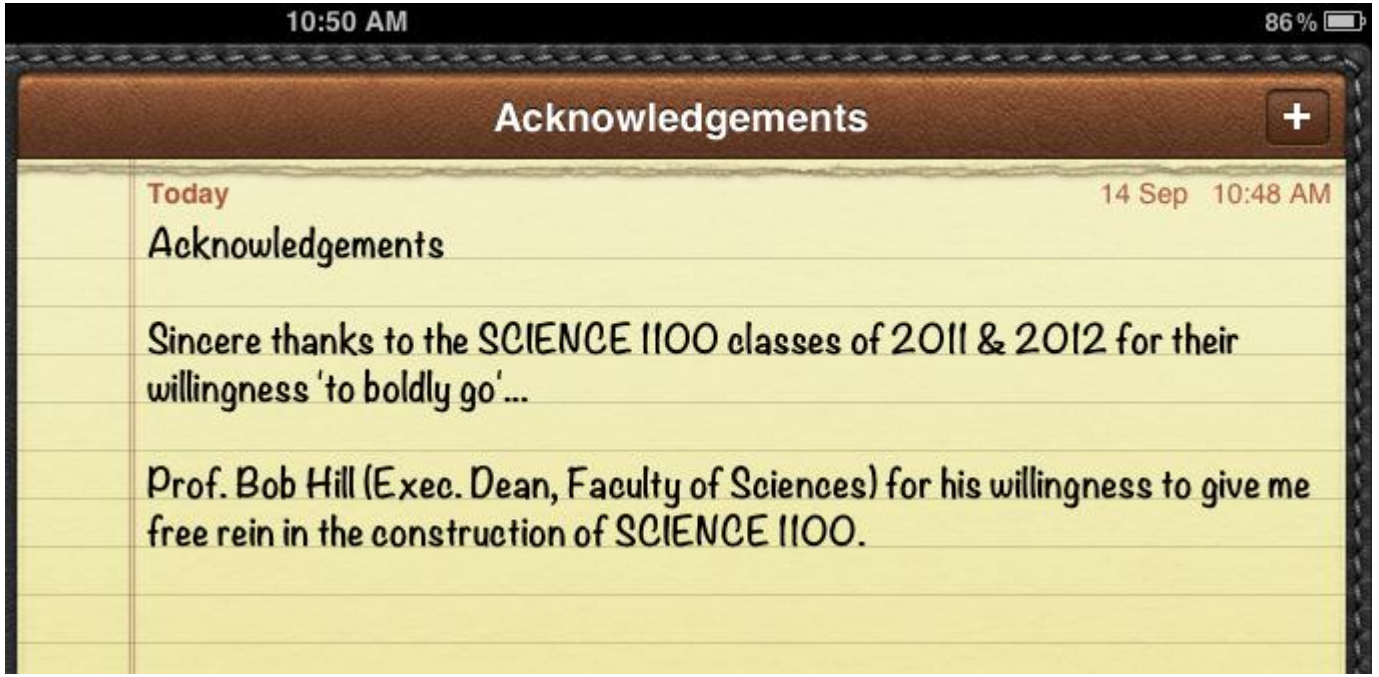
Annotated Bibliography & Essay

Brain Still in Love? Take a Pill to Make it All Go Away.

Although your world may be turned upside down, not everything changes after the phrase: *We need to talk*. Recent studies have shown that the same areas of the brain remain active even after a breakup (Fisher et al., 2010). However, there is an evident increase in the production and release of stress hormones, namely cortisol. An increase in cortisol can cause both physical and emotional pain, often exhibited as depression or grief. This pain is unlike any physical pain where a simple dose of paracetamol or ibuprofen will give the well needed and sometimes necessary relief required to move on. As the neurochemistry of both love and separation becomes better known, the possibility of creating an anti-heartbreak pill becomes more promising. Some forms of depression can be characterised by an increase in cortisol, so, investigating their respective antidepressant medication, could prove to have positive effects in decreasing the pain of a breakup.

According to Zeki (2007), feelings of romantic love are linked to high concentrations of neuromodulators - dopamine, oxytocin and vasopressin - in the brain. It is the fluctuations in concentrations of these chemicals that cause the well-known emotions of desire, addiction and euphoria, commonly associated with being 'in-love'. These high concentrations of dopamine in turn lead to decreased concentrations of serotonin. This is also characteristically common in the early stages of obsessive compulsive disorder (commonly known as OCD) and addiction, (Leckman et al, 2010). Hence the indicators of intense obsessions, craving and distortion of reality appear to be associated with both love and addiction (Fisher, 2010). Dopamine and oxytocin are released from stores in the pituitary gland, and high concentrations of receptors are present in the hypothalamus. In the early stages of love, the amygdala is also engaged. The amygdala is activated during fearful situations. Subsequent deactivation occurs as the relationship progresses as the subjects become more comfortable with their partners. Simultaneously as these areas of the brain are activated, the frontal, parietal and middle temporal cortices are deactivated. These zones are linked to negative emotions, so suppression of these feelings results in the experience of only euphoric feelings. Critical judgement of one's partner is also often suspended.

Thank you!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86%
Acknowledgements
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Acknowledgements
Sincere thanks to the SCIENCE 1100 classes of 2011 & 2012 for their willingness 'to boldly go'...
Prof. Bob Hill (Exec. Dean, Faculty of Sciences) for his willingness to give me free rein in the construction of SCIENCE 1100.