HUMAN BIOLOGICAL SCIENCE

NEW ASSESSMENT TYPE - INVESTIGATION

CASE STUDIES ....an alternative to a laboratory investigation.

One of the new components of the HBS Course of Study is assessment type - "Investigation". Whilst investigations have always been encouraged in the WA Human Biology course, its weighting in the assessment scheme was minimal. The new course states that this assessment type must be addressed and given a particular weighting according to whether students are studying Stage 1,2,or 3. Please refer to p8 of the HBS Course Document.

In addition to a structured and open ended investigation, an alternative which teachers may consider appropriate to include in their program is a Case Study.

What is a Case Study?

- A Case Study is a long term study of a using a range of media articles focusing on one topic of interest.
- A Case Study is designed to motivate students and give them an insight into how science is reported to the public, and to teach them how to assess the validity of underlying research and claims or recommendations based on research.
- Ideally, the study should arise from such a media source. Suitable topics involve some degree of controversy, or disagreement, either about the interpretation of the scientific evidence, or about how individuals or society should respond.
- The title for a case study is best phrased as a question with a yes/no answer, to be answered by careful balancing of evidence and opinions from a variety of sources.

Format of the Case Study

Case studies can often take the form of a "formal" report. Students should not be discouraged from other styles of presentation, for example:

- PowerPoint presentation
- Poster or booklet
- A script from a radio programme or play
- A teaching or learning activity such as a game.

In all cases, sufficient detail must be included to allow evaluation in all of the performance areas. Some types of presentation would require supporting notes to explain the choice of reporting medium chosen.

Choice of topic for a Case Study:

Students should select a topic in discussion with teachers and should be seen as an extension or consolidation of studies undertaken as a normal part of the course.

Suitable topics often fall into 1 of 3 main types:

1 Evaluating claims where there is uncertainty in scientific knowledge (e.g. Does DNA hold the answer to all disease cures) Controversies of this type focus attention on the relationship between data and explanations in science and on the quality of research which underlies competing claims

2 Contributing to decision making on a science -related issue (e.g. should the government restrict research into human cloning?) Studies in this category are more likely to involve elements of personal choice, values and beliefs, and may involve balancing of risks and benefits of any proposed action.

3 Personal or social choices (e.g. "Should my child receive the triple MMR vaccine?) Ethical and personal issues are likely to figure in such studies, but it is important to evaluate these in relation to what is known about the science which underlies the issue.

A List of ideas for Case Studies ....

- *Should gene therapy be allowed?*
- *Should gene therapy be allowed to prevent Huntington's disease?*
- *Human Cloning - should it be banned?*
- *Designer Viruses - good or bad?*
- *Is genetic testing ethically right?*
- *Antibiotics - is there a crisis?*
- *How safe is MMR vaccination?*
- *Is animal testing justified?*
- *Should cannabis be used as a medical drug?*
- *Are edible vaccines best?*
- *Should we produce designer babies?*
- *Can brain exercises really keep you young?*

How is a Case Study marked?
Teachers can assess a Case Study in a similar way to assessing other practical tasks.

Here is an example of a Marking Guide for a Case Study:

Sample Case Study Marking Guide:

Essential Components	Possible Marks	Allocated Marks	Teachers Comments
Sources Used :			
• Stimulus material /articles used are from a variety of sources.	2		
• At least **10** articles are reviewed (e.g. websites, encyclopedias, newspapers, magazines, excerpts from tv programs.)	2		
• Materials used are referenced correctly.	2		
• Acknowledgment of quotes	2		
Background Science :			
• Relevant background science is described in detail during the report.	5		
Recognition of Evidence :			
• Categorises information from different viewpoints as "for" or "against".	2		
• Review and evaluation of article identifies a "style" of reporting, use of scientific language, any use of emotive language, misuse of language, bias.	6		
Data Analysis :			
• Use of appropriate graphs, tables, tally's as basis for data analysis	5		
• Clear and detailed analysis of data	5		
• An evaluation and conclusion of validity of articles	2		
• A conclusion is made and justified by clearly linking it to evidence from the background information	2		
Structure and Organisation :	5		
• Report has an appropriate structure with suitable sub-headings -:			
Title Page:			
• Title of case study written in the form of a question			
Contents Page:			
• Sections, sub-sections and appropriate page numbers included.			
Introduction :			
• Explanation of what the case study is about and how the report is structured.			
Scientific Theory :			
• Relevant background science included.			
Evidence :			
• Relevant information from sources collected with detailed references in each case			
• Evidence from both sides of the case			
• Authenticity and reliability of the evidence recognized;explanation of the evidence using underlying science			
Conclusion:			
• Evidence evaluated and compared			
• Conclusion written and justified, pointing out any limitations or alternative interpretations			

Bibliography : • References listed in detail ***Presentation:*** • Report clearly organized into appropriately headed sections and in a suitable sequence • Report includes diagrams, data tables, graphs etc. to illustrate ideas and concepts • Report is concise, uses relevant scientific terminology and has correct spelling, punctuation and grammar.			
TOTAL	**40**		

Examples of possible stimulus material/.articles for a case study...

"Should the use of Stem Cells be controlled by the government?"

Artificial sperm ban reconsidered
10th March 2008, 6:30 WST
[The West Australian]
http://www.thewest.com.au/default.aspx?MenuID=158&ContentID=62048.

Artificial sperm ban reconsidered

10th March 2008, 6:30 WST

The British government will review a
ban on the use of artificial sperm or eggs to induce human pregnancies.

British law currently allows the creation of so-called "artificial gametes" — sperm or eggs derived from other types of cells such as stem cells — for research but bars their use in assisted reproduction due to safety and ethical concerns.

The Department of Health said it had agreed to "look further into this matter".

"We recognise that there could be potential uses in assisted reproduction treatments, or in embryo research, for sperm or eggs derived from other cells. For example, in cases where a man was not able to produce sperm naturally, the development of artificial gametes could allow him to father a child," the department said in a statement.

Over the past few years, scientists reportedly have created egg and sperm precursor cells from embryonic mouse cells, raising the possibility that researchers might someday be able to manufacture human sperm and egg cells as well.

Some say the technique could also allow same-sex couples to have children carrying genetic material from both partners.

More controversially, it might also allow one person to create egg and sperm cells from their own tissue, effectively becoming the child's mother and father.

LONDON

Insulin cells produced by stem cells
22nd February 2008, 9:30 WST
[Reuters]
http://www.thewest.com.au/aapstory.aspx?StoryName=461814

Insulin cells produced by stem cells

22nd February 2008, 9:30 WST

Results of recent experiments provide "definitive evidence" that human embryonic stem cells can be used to generate cells that secrete insulin in response to glucose, like the beta-cells in the pancreas.

"Development of a cell therapy for diabetes would be greatly aided by a renewable supply of human beta-cells," Dr Emmanuel E Baetge and colleagues, from Novocell Inc in San Diego, comment in the research journal Nature Biotechnology.

In the study, the researchers show that pancreatic tissue, derived from human embryonic stems cells, can generate cells that are "morphologically and functionally similar" to beta-cells after being implanted into mice.

In addition, the team goes on to show that implantation of the stem cell-derived tissue stops glucose levels rising excessively in the animals.

These findings suggest that human embryonic stem cells could, in fact, represent a renewable supply of insulin-producing cells for treating diabetes, the researchers conclude.

REUTERS

washingtonpost.com
http://www.washingtonpost.com/wp-dyn/articles/A52471-2004Sep26.html.

Two Studies Bolster Stem Cells' Use in Fighting Disease

By Rick Weiss
Washington Post Staff Writer
Monday, September 27, 2004; Page A03

The prospect of using human embryonic stem cells to treat disease appears a small step closer as the result of two new experiments with the cells, which are mired in political controversy because they are derived from human embryos.
In one report released yesterday, researchers showed that the versatile cells can serve as "biological pacemakers," correcting faulty heart rhythms when injected into the failing hearts of pigs.
In another report, scientists demonstrated for the first time that stem cells can become a cell crucial to vision. Many doctors believe that several vision-destroying diseases could be fought by transplanting these cells directly into the eyes.
Human embryonic stem cells, derived from five-day-old embryos, have the biological potential to morph into virtually all of the 200 or so kinds of cells in the body. Researchers are racing to learn how to direct them to develop into specific types of cells that can be transplanted into failing organs. It is an approach that could launch a new era of regenerative medicine -- but only if the cells prove capable of integrating into existing organs and functioning normally there.
Izhak Kehat and Lior Gepstein of the Technion-Israel Institute of Technology in Haifa and their colleagues sought to test that capacity with stem cells that were growing into heart muscle cells.
The team started with masses of stem cells growing in laboratory dishes, from which they isolated those few that were spontaneously developing into heart cells.
They were easy to spot: They were the ones that were pulsing in unison, as heart cells are apt to do.
In one experiment, the scientists isolated small balls of the human cells -- each ball about the size of the head of a pin, or about 1 million cells -- and placed that little mass into a lab dish with rat heart cells.
The cells of each species, rat and human, beat at different rates at first. Within 24 hours of living together, however, the combined masses of cells coordinated their pulsing into a single rhythm.
"At least in the dish, they integrated structurally, mechanically and electrically," Gepstein said.
But could stem-derived heart cells help set the pace of a heart in a live animal?
To find out, the team threaded a probe into the hearts of 13 pigs and made a small burn in the area that regulates the heart beat, causing a permanent severe slowing of those animals' heart rates. The injury mimicked a human heart rhythm disorder that could be caused by disease or a small heart attack.
Then they injected about 100,000 of their human embryo-derived heart cells into the damaged pig hearts. Eleven of the 13 returned to faster heart rates, the team reported in yesterday's advanced online edition of Nature Biotechnology. There was no improvement in control animals that did not receive the cells.
"It's not like tomorrow people are going to be waiting in line for biological pacemakers," Gepstein said. "But we were happy to see after a few days a new rhythm arose," providing what he called "proof of principle."
A second report -- appearing in the fall issue of the journal Cloning and Stem Cells -- describes the first documented growth of retinal pigment epithelial cells, or RPE cells, from human embryonic stem cells.
RPE cells, which are related to nerve cells, live inside the eye and provide essential "housekeeping" duties for the rods and cones -- the light-sensitive cells in the retina. RPE cells scavenge the retinal area for cellular debris, sucking old material up like little vacuum cleaners. And they secrete substances that aid in tissue repair within the eye.
The loss of RPE cells in middle and old age is a major cause of age-related vision loss, including macular degeneration. That disease is the leading cause of blindness in people older than 60, affecting 30 million people worldwide. Doctors have begun to experiment with RPE cell transplants into people's eyes, but the approach has been plagued by problems -- including an inadequate supply of cells.
In experiments led by Irina Klimanskaya and Robert Lanza of Advanced Cell Technology in Worcester, Mass., human embryonic stem cells grown in lab dishes under certain conditions spontaneously became RPE cells, offering a possible solution to the supply problem.
Moreover, the ACT system involves no animal cells or products -- a feature the Food and Drug Administration has said will be important as it considers granting permission to test stem cell-derived cells in people.
Lanza said the company hopes to complete transplant studies in large animals during the next year, after which it will apply for permission to test the cells' safety and therapeutic value in the eyes of people with RPE-related vision loss.
Not all stem cell colonies worked equally well, Lanza noted, touching on a hot area of political debate. Six of the colonies -- those developed by Harvard researcher Douglas Melton with private funds -- "worked like a charm," Lanza said, as did two colonies developed by ACT.
But the three colonies developed by a Wisconsin team -- among the few approved by President Bush for study with federal dollars -- worked only "very reluctantly," Lanza said. Bush has banned federal funding for research on newly derived stem cell lines in order not to encourage the destruction of human embryos, but Lanza said his work shows that policy is short-sighted.
"It's becoming clear that each colony is different and can do different tricks," Lanza said. "To limit federally funded research to just a handful of lines is a mistake."

Human Genome Project

Draft research notes to answer these questions. Condense your notes to two (2) sides of an A4 piece of paper.
You can use these notes to help you answer a set of questions provided during one lesson in class on a date negotiated with your teacher.
At the end of the in class hand in both your answers to the in class questions and your 2 pages of research notes.

Due Date: _____

1. What is a genome?

2. The size of an organism's genome is given in the units of kilobases and megabases. Explain the meaning of these units and why new measurements were created to describe a genome.

3. Does the size of an organism's genome relate to the organism's complexity? Use examples to explain your answer.

4. How did the development of technology and academic rivalry influence the Human Genome Project?

5. What is the difference between 'coding' DNA and 'non-coding' or 'junk' DNA?

6. Early in the Human Genome Project, it was decided that sequencing of the human genome should be paralleled with sequencing of some research organisms such as *Escherichia coli* (a bacterium found in the human gut), *Drosophila melanogaster* (fruit fly used in early genetics experiments) and *Mus musculus, the common house mouse*. What benefits would arise form the simultaneous study of these organisms' genomes?

7. By 1997, 350 applications were received by the USA Patents Office covering 50,000 partial DNA sequences. The USA Patents Office has not yet ruled on any.
Outline the factors that would influence your decision on allowing private companies to own a patent over human DNA sequences.

8. Explain the benefits arising from the work done on sequencing the human genome. Use specific examples to illustrate your answer.

9. Researchers are now re-sequencing the human genome using DNA from many different human sources. Explain why this is important. Explain which humans you would select for the re-sequencing.

10. How has the sequencing of genomes of different organisms helped understand evolutionary relationships and evolutionary changes?

Human Genome Project

How much have you understood your research?
Answer questions 1 to 5 before questions 6 and 7

1. When the sequencing of DNA for the human genome project started in 1990, it was projected to take 15 years and cost about $1 for each base sequenced leading to a total cost of over $3 billion. It took 11 years and the final cost per base sequenced was less than 2 cents. Explain the developments in technology that allowed the project to come in under budget and time.

2. Outline the possible impact of the sequencing of the human genome on diagnosis and treatment of human disease. Use a specific example to illustrate your answer.

3. Explain why the human genome has been sequenced on the haploid number of autosomal chromosomes as well as the X, Y and mitochondrial chromosomes and not the total DNA content of a human body cell.

4. Explain why sequencing of the mouse genome is important for research into human genetic disorders.

5. How could sequencing of the genomes of different organisms be used to understand evolutionary relationships and changes?

6. When sequencing the human genome, the Celera company used the DNA from its chairman, Craig Venter, whereas the rival academic consortium used chromosomes from several different people. Explain what differences may arise in the final sequence produced by each groups.

7. Recent studies have suggested that up to 99% of the human genome does not code for genes. It is sometimes called 'junk' DNA. It is also known that the genome of chimpanzees differs from humans by about 2%. Suggest the location of the difference between the genomes of humans and chimpanzees. Explain your answer.

Chemistry Stage 2: Investigations

	Investigation		Investigation
1	Separation techniques on mixtures • pure • heterogeneous • homogenous	11	Solubility rates of different materials
2	Phase changes - influences of • solutes • pressure	12	pH of rain in different locations
3	Pressure, temperature, volume • shrinking balloons/bottles • functioning of the pressure cooker • surfacing from a scuba dive	13	Effects of acid rain on different building materials
4	Crystal gardens • saturation • crystallization	14	Energy content of different liquid fuels
5	Identification of unknown solutions using solubility rules	15	Factors affecting electroplating
6	Why doesn't the Southern Ocean freeze? Why are icebergs made of fresh water? Why is salt put on icy roads? Use of anti-freeze in automotive industry and polar organisms Why is the Alaskan pipeline above ground?	16	Separation of liquids • evaporation • fractional distillation
7	Gas volumes produced by anaerobic respiration - yeast experiments	17	
8	Gas volumes from drink cans	18	
9	Energy changes • making ice cream without a freezer	19	
10	Factors affecting rates of reaction • MnO2/H2O2 and liver - SA:Vol • temperature	20	