Name: _____ Group: _____

THE STRUCTURED CONTROVERSY

Saguenay, May 19, 2009

Dear Sir or Madam,

We are pleased to invite you to participate in a televised debate on modern biotechnology. The topics to be discussed are:

- Should we impose large-scale vaccination?
- Should we allow the marketing of raw milk (unpasteurized)?
- Should we allow parents to select the gender of their child with assisted reproduction?
- Should we limit the marketing of genetically modified organisms (GMOs)?
- Should we support stem-cell research?

As an expert, you are to briefly state your opinion on one of the topics and answer questions on that topic. You must also prepare questions for the other participants.

Knowing of your marked interest in the clash of ideas and democratic rights, we are certain that you will contribute to the smooth operation and success of this debate.

Julie Tremblay
Researcher and Producer

In this simulation exercise, you will take on the role of participant in a debate. To play this part effectively, you must provide a brief summary of your opinion on the chosen topic and formulate at least three questions to support your opinion.

Notes _____

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Name: _____ Group: _____

CREATING THE CONTEXT

Chosen topic: _____

I ask myself questions

1. What is a debate?

_____

_____

2. What aspects of a subject would be interesting to discuss during a debate?

_____

_____

3. Who are the players in this structured controversy?

_____

_____

4. What questions would be useful to help me gather information for a structured controversy?

_____

_____

_____

I must

5. Restate the goal of the controversy.

_____

_____

_____

_____

I think

6. Briefly state your opinion on your topic.

_____

_____

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Name: _____ Group: _____

CREATING THE CONTEXT (*continued*)

7. Give an example of a question you would like to ask that pertains to another topic.

_____

_____

What I know and what I must find out

8. Write down the information you have and the information you have to research.

What I know . . .	What I must find out . . .

I prepare my work

9. Where will you find the information you need?

_____

_____

10. Define, in chronological order, the main steps of your work.

_____

_____

_____

_____

_____

_____

_____

_____

Reflection

	Yes	No
Do I fully understand what I have to do?	☐	☐

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Name: _____ Group: _____

GATHERING INFORMATION

TOPIC: Should we impose large-scale vaccination?

I research

Answer the questions below to better understand the topic.

1. What is immunity?

2. The body produces antibodies to defend itself. How long does it take the immune system to produce antibodies after being exposed to an infectious agent?

3. What are the effects of this delay on the organism?

4. What happens in the event of a second exposure to the same infectious agent?

5. What is a vaccine?

6. What are the two main types of vaccines? Which ones are usually the most effective?

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Name: _____ Group: _____

GATHERING INFORMATION (*continued*)

TOPIC: Should we allow the marketing of raw milk?

I research

Answer the questions below to better understand the topic.

1. What is pasteurization?

2. What is raw milk?

3. What year did the Québec government make the pasteurization of milk mandatory?

4. What diseases were spread through the consumption of raw milk at the time?

5. What were the consequences of these diseases on children?

6. What are the main reasons to pasteurize milk?

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Name: _____ Group: _____

GATHERING INFORMATION (*continued*)

TOPIC: Should we allow parents to select the gender of their child with assisted human reproduction (AHR)?

I research

Answer the questions below to better understand the topic.

1. What is infertility from a medical point of view?

2. What is assisted reproduction?

3. Name different assisted reproduction techniques and briefly explain each one.

4. Briefly explain how it is possible to choose the sex of an unborn child.

5. Under what circumstances can a fertile couple use in vitro fertilization?

6. Frozen embryos not transferred during in vitro fertilization can be used for what purpose?

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Name: _____ Group: _____

GATHERING INFORMATION (*continued*)

TOPIC: Should we limit the marketing of genetically modified organisms (GMOs)?

I research

Answer the questions below to better understand the topic.

1. Give an example of a genetic adaptation.

_____

_____

_____

2. What is a genetic transformation?

_____

_____

_____

_____

3. Give an example of a genetic transformation.

_____

_____

_____

4. What is a genetically modified organism (GMO)?

_____

_____

_____

_____

5. List three examples of traits added to plants through genetic transformation to improve crop yield or shelf life.

_____

_____

6. Give three examples of genetic transformations of plants made to improve their nutritional properties.

_____

_____

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Name: _____ Group: _____

GATHERING INFORMATION (*continued*)

TOPIC: Should we support stem-cell research?

I research

Answer the questions below to better understand the topic.

1. What is a specialized cell?

2. What is a stem cell?

3. What can stem cells be used for?

4. Where are stem cells located in the organism?

5. Name other sources of stem cells.

6. Cloning is achieved with the use of stem cells. What is cloning?

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Name: _____ Group: _____

GATHERING INFORMATION (*continued*)

TOPIC: _____

7. Read the information documents at your disposal. Don't forget to look through your textbook! Extract the elements of information that could help fuel a debate on your topic. Record their source.

Elements of information	Sources

I apply my research results

8. Sort the extracted elements of information into affirmative or negative arguments. Highlight each type of argument in a different colour.

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Reflection

	Yes	No
Do I understand the concepts relating to my topic?	☐	☐

Name: _____ Group: _____

COMPLETING THE STRUCTURED CONTROVERSY

TOPIC: _____

I make suggestions

1. Take a position with regards to the topic.

I am _____ the topic under debate. My position is supported by the following arguments:

a) _____

_____

_____

_____

b) _____

_____

_____

_____

c) _____

_____

_____

_____

2. What questions will you ask the experts of the other topics debated?

_____

_____

_____

_____

_____

_____

_____

Reflection

	Yes	No
• Have I provided several explanations?	☐	☐
• Have I formulated several questions to ask during the debate?	☐	☐

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Name: _____ Group: _____

VALIDATING THE STRUCTURED CONTROVERSY

TOPIC: _____

I justify my approach

1. Your arguments come from various sources of information. Correctly cite these sources.

a) _____

_____

b) _____

_____

c) _____

_____

2. You have supported your position with three arguments. How will you justify these arguments? Does the credibility of your sources add weight to your arguments? Explain your answer.

_____

_____

_____

_____

_____

_____

_____

REFLECTING ON THE PROJECT

Answer this question only after all the debates have concluded.
Has your opinion on the topic debated evolved during the course of this learning and evaluation situation? Justify your answer.

_____

_____

_____

_____

_____

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Name: _____ Group: _____

MY EVALUATION

Use the evaluation grid on the next page to evaluate yourself. Write A, B, C, D or E in the appropriate column.

SSC2 Makes the most of his/her knowledge of science and technology				
Criteria*	**Observable indicators**	**Me**	**Teacher**	**Comments**
1	**Creating the context** Definition of the goal and formulation of questions for information gathering		☐ With help	
2	**Gathering information** Classification of arguments for and against and citation of sources		☐ With help	
3	**Completing the structured controversy** Formulation of arguments supporting the student's position		☐ With help	
4	**Validating the structured controversy** Justification of arguments and citation of sources		☐ With help	

*** Evaluation criteria**

1 Formulation of appropriate questions
2 Appropriate use of scientific and technological concepts, laws, models and theories
3 Relevant explanations or solutions
4 Suitable justification of explanations, solutions, decisions or opinions

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Name: _____ Group: _____

EVALUATION GRID

SSC2 Makes the most of his/her knowledge of science and technology

Criteria*	Observable indicators	A	B	C	D	E
1	**CREATING THE CONTEXT** Definition of the goal and formulation of questions for information gathering	The formulated questions are relevant. The goal of the controversy is very clearly defined.	The formulated questions are relevant. The goal of the controversy is clearly defined.	The formulated questions are more or less relevant OR the goal of the controversy is more or less clearly defined.	The formulated questions are more or less relevant AND the goal of the controversy is more or less clearly defined.	The work needs to be redone.
2	**GATHERING INFORMATION** Classification of arguments for and against and citation of sources	All arguments are correctly classified for and against. All sources are cited.	Most arguments are correctly classified for and against. Sources are cited.	The classification of arguments for and against contains several errors. Sources are cited.	The classification of arguments for and against contains major errors.	The work needs to be redone.
3	**COMPLETING THE STRUCTURED CONTROVERSY** Formulation of arguments supporting the student's position	The three arguments provided support the student's position and are formulated very clearly.	The three arguments provided support the student's position and are formulated clearly.	One of the arguments provided more or less supports the student's position.	The arguments provided do not adequately support the student's position.	The work needs to be redone.
4	**VALIDATING THE STRUCTURED CONTROVERSY** Justification of arguments and citation of sources	The three arguments are backed by relevant justifications. Sources are cited correctly.	Two of the three arguments are backed by relevant justifications. Sources are cited correctly.	Fewer than two arguments are backed by relevant justifications OR sources are cited incorrectly.	Fewer than two arguments are backed by relevant justifications AND sources are cited incorrectly.	The work needs to be redone.

*** Evaluation criteria**

1 Formulation of appropriate questions
2 Appropriate use of scientific and technological concepts, laws, models and theories
3 Relevant explanations or solutions
4 Suitable justification of explanations, solutions or opinions

Name: _____ Group: _____

QUESTION 1: SHOULD WE IMPOSE LARGE-SCALE VACCINATION?

Immunization against diseases of public health importance

The benefits of immunization

Vaccines—which protect against disease by inducing immunity—are widely and routinely administered around the world based on the common-sense principle that it is better to keep people from falling ill than to treat them once they are ill. Suffering, disability and death are avoided. Immunization averted about two million deaths in 2002. In addition, contagion is reduced, strain on health-care systems is eased, and money is frequently saved that can be used for other health services.

Immunization is a proven tool for controlling and even eradicating disease. An immunization campaign carried out by the World Health Organization (WHO) from 1967 to 1977 eradicated the natural occurrence of smallpox. When the programme began, the disease still threatened 60% of the world's population and killed every fourth victim. Eradication of poliomyelitis is within reach. Since the launch by WHO and its partners of the Global Polio Eradication Initiative in 1988, infections have fallen by 99%, and some five million people have escaped paralysis. Between 1999 and 2003, measles deaths dropped worldwide by almost 40%, and some regions have set a target of eliminating the disease. Maternal and neonatal tetanus will soon be eliminated in 14 of 57 high-risk countries.

...

An estimated 2.1 million people around the world died in 2002 of diseases preventable by widely used vaccines. This toll included 1.4 million children under the age of five. Among these childhood deaths, over 500 000 were caused by measles; nearly 400 000 by Hib; nearly 300 000 by pertussis; and 180 000 by neonatal tetanus.

...

Effectiveness and safety

All vaccines used for routine immunization are very effective in preventing disease, although no vaccine attains 100% effectiveness. More than one dose of a vaccine is generally given to increase the chance of developing immunity.

Vaccines are very safe, and side effects are minor—especially when compared to the diseases they are designed to prevent. Serious complications occur rarely. For example, severe allergic reactions result at a rate of one for every 100 000 doses of measles vaccine. Two to four cases of vaccine-associated paralytic polio have been reported for every one million children receiving oral polio vaccine.

The cost-effectiveness of immunization

Immunization is considered among the most cost-effective of health investments. ...

A recent study estimated that a one-week “supplemental immunization activity” against measles carried out in Kenya in 2002—in which 12.8 million children were vaccinated—would result in a net saving in health costs of US$ 12 million over the following ten years; during that time it would prevent 3 850 000 cases of measles and 125 000 deaths. In the United States, cost-benefit analysis indicate that every dollar invested in a vaccine dose saves US$ 2 to US$ 27 in health expenses.

...

The World Health Organization. *Immunization against diseases of public health importance* [Fact Sheet No. 288, online document], March 2005. Retrieved from www.who.int/entity/mediacentre/factsheets/fs288/en/ (accessed July 13, 2009).

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Name: _____ Group: _____

QUESTION 1: SHOULD WE IMPOSE LARGE-SCALE VACCINATION? (*continued*)

Autism: why the debate rages

With the first autism case now being heard in federal vaccine court in Washington D.C., it makes sense to ask: Why is anyone even still debating the possibility of a link between vaccines and autism? After all, for years, many government health officials, advisors and vaccine manufacturers have said there's no association.

Here are a number of reasons why the question remains open:

1. While public health officials, government scientists, advisors and pharmaceutical companies have been responsible for innumerable lifesaving and life-improving medical advances, they are not infallible.

- For many years, public health officials thought it was safe to use X-ray machines in shoe stores and allowed mercury in medicines. Doctors prescribed Thalidomide—a drug marketed as a sleep aid—to pregnant women to treat morning sickness. In the case of Thalidomide, it came with no warning against use by pregnant women and the drug maker apparently did not predict it could cause fetuses the devastating damage that it did. ... The medical establishment assured us Vioxx and Duract were safe painkillers, prescribed Rezulin for diabetics and then denied any of them were responsible for patient deaths. ...

- When it comes to vaccines, the same group failed to predict that the 1990s' rotavirus (diarrhea) vaccine would have to be pulled from the market after infant deaths. They encouraged use of the oral polio vaccine (eventually discontinued after it gave too many children polio). And they allowed the use of a mercury neurotoxin preservative in childhood vaccines, only to admit later that they hadn't thought to calculate the cumulative amount kids were getting as more and more vaccines were added to the childhood immunization schedule.

- Recent history demonstrates that too often, government health officials, mainstream doctors and pharmaceutical companies aren't on the leading edge of alerting us to health risks; they're bringing up the rear. Patients feel left to fend for themselves, seeking independent research and opinions on their own. They and their dogged, relentless determination have often been the catalyst that eventually brings medical dangers to the forefront.

2. Government scientists, advisors and vaccine manufacturers often take an all-or-nothing approach to vaccinations.

...

3. Government officials and mainstream scientists who dispel any vaccine/autism/ADD link have ties to vaccine makers.

- There's so much overlap among pharmaceutical companies, government scientists and advisors that the information they provide at least has the appearance of a conflict of interest. ...

President of the International Federation of the Pharmaceutical Manufacturers' Association. ...

4. Non-profits which dispel any vaccine/autism/ADD link have ties to vaccine makers.

...

- Another example of a non-profit tied to the industry is "The Vaccine Fund." Its President from 2000-2005 was Jacques-François Martin, formerly CEO of vaccine maker Sanofi-Pasteur, CEO of vaccine maker Chiron, and President of the International Federation of the Pharmaceutical Manufacturers' Association. ...

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Name: _____ Group: _____

QUESTION 1: SHOULD WE IMPOSE LARGE-SCALE VACCINATION? (*continued*)

Autism: why the debate rages (*continued*)

5. The dual role of the CDC undermines the appearance of fairness.

- There is a perceived, if not real, conflict of interest with the government's Centers for Disease Control (CDC) heavily promoting vaccines, but also responsible for monitoring adverse events. At least two respected medical journals, *The American Journal of Public Health* and *Pediatrics* have published letters or articles recommending "greater independence in vaccine safety assessments" apart from "the highly successful program to promote immunizations." In short, the CDC's bread and butter is achieving high vaccination rates. ...

6. There is no definitive research proving a link between vaccines and autism or ADD, but there is also no definitive research ruling it out.

- Something rarely reported is that while there's no definitive study linking vaccines to autism or ADD, there is also no study definitively disproving a link. And there's a substantial body of peer-reviewed, published science from places like Columbia, Yale and Northeastern suggesting a link, or pointing to the need for further study.

- Many credible voices deny a link. But many other credible voices support the idea of a link. One example of the latter is George Wayne Lucier, formerly a senior official at the National Institutes of Health in Environmental Toxicology, an NIH advisor, member of the National Academy of Sciences Committee on Toxicity Testing and a scientific advisor for EPA who concludes "... it is highly probably that use of thimerosal as a preservative has caused developmental disorders, including autism, in some children." ...

7. Those who say autism and ADD are not linked to vaccines do not know what is causing the epidemics.

- The most frightening part of the autism/ADD epidemics is that if, indeed, they're unrelated to vaccinations, that our best, brightest public health experts still have no idea what is causing it. Excluding ADD, one out of every 150 American children are now being diagnosed with autism.

...

CBS News.com. Attkisson, Sharyl. *Autism: why the debate rages* [blog entry], June 15, 2007. Retrieved from http://www.cbsnews.com/blogs/2007/06/15/couricandco/entry2934107.shtml?source=search_blog (accessed July 19, 2009).

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Name: _____ Group: _____

QUESTION 1: SHOULD WE IMPOSE LARGE-SCALE VACCINATION? (*continued*)

Vaccinations and public health

...

In 2002, more than 2 million of the world's children could have been saved if they had been vaccinated (figures from WHO). The two principal diseases which could have been addressed by a wide scale vaccination campaign are measles and viral hepatitis B (nearly 300 000 child deaths for each disease).

	Mortality Rates per million persons source: INSERM				
	Diphtheria	**Tetanus**	**Poliomyelitis**	**Tuberculosis**	**Pertussis**
In 1950	50 – 100	20 – 50	5 – 10	300 – 1000	20 – 50
After 1990	0	0.25 – 0.5	0	13	0.1

Nevertheless, there is still more to be done in the field. For example, vaccination campaigns for influenza, hepatitis B and tetanus are now falling short.

The role of vaccination is less clear than for other medical issues: if we look at the regression of tuberculosis since the 19th century (a proven fact in many countries), it is proven fact that the disease has been waning since before the discovery of anti-tubercular drugs or vaccination. Epidemiologists claim that in fact it is the amelioration of living conditions; in particular hygiene and nutrition that are responsible for the declining death rates. Based on large studies commissioned by the World Health Organization (WHO) some researchers believe that the effects of Bacillus Calmette-Guérin (BCG) vaccination are minimal: in a study done on 260 000 persons in India, where the disease is prevalent, the authors could not find a significant difference between the group who had received the BCG and the group who had not. Another study also done in India on 366 625 persons showed that the BCG had no preventative effect on the adult form of pulmonary tuberculosis.

Actually, the effectiveness of vaccination against cholera is not yet proven either: in a clinical study to test its effectiveness on 60 000 persons in Indonesia, in the context of a low incidence of cholera, no significant prevention could be discerned.

Side effects and risks according to vaccines

Side effects can be very frequent (post-vaccination fever) but are most often mild. Serious accidents remain rare, though they have occurred.

...

The first mass vaccination campaign was against poliomyelitis in the 1950s. The campaign was marred by a faulty batch of the vaccine (the live virus had not been attenuated) which resulted in the infection of nearly 220 000 persons, of which 70 000 became ill, 164 were severely paralyzed and 10 died.

...

Wikipedia. *Vaccins et santé publique* [online document], July 2009. Retrieved from http://fr.wikipedia.org/wiki/Vaccination (accessed July 14, 2009). [*Translation*]

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Name: _____ Group: _____

QUESTION 1: SHOULD WE IMPOSE LARGE-SCALE VACCINATION? (*continued*)

Vaccine safety. Frequently asked questions

1. Do vaccines work?

Answer: Yes, vaccines work very well. We know that in countries where vaccination rates are high, disease rates are low. We also know that the opposite is true. In countries where vaccination rates are low, disease rates are high.

2. Are vaccines safe?

Answer: Yes. Vaccines are among the safest tools of modern medicine. Serious side effects are rare. [...] In Canada, this kind of reaction has occurred less than once in every 1 million doses of vaccine, and there are effective treatments for this condition. The dangers of vaccine-preventable diseases are many times greater than the risks of a serious adverse reaction to the vaccine.

3. How are vaccines made and licensed in Canada?

Answer: ... Like all medicines, vaccines must undergo several stages of rigorous testing before they are approved for use.

4. What would happen if we stopped immunizing?

Answer: Experience from other countries shows that diseases quickly return when fewer people are immunized:

Ireland saw measles soar to more than 1200 cases in the year 2000, as compared with just 148 the previous year, because immunization rates fell to around 76%. Several children died in this outbreak. ...

5. Why do we still need vaccines if the diseases they prevent have disappeared from our part of the world?

Answer: It is important to continue vaccine programs for four basic reasons:

- First, unless a disease has completely disappeared, there is a real risk that small outbreaks can turn into large epidemics if most of the community is not protected. ...
- Second, no vaccine is 100% effective. There will always be some people who are not immune, even though they have had their shots. This small minority will be protected as long as people around them are immunized.
- Third, there are a small number of people who cannot receive vaccines. These may be people who have previously had a severe allergic reaction to a component of the vaccine, or they have a medical condition that makes receiving vaccines too risky for them. These people are not protected from disease, and for some diseases it is very important that people around them are immune and cannot pass disease along to them. ...
- And fourth, most vaccine-preventable diseases are still common in other parts of the world. Travellers can carry them from country to country. If we are not protected by immunization, these diseases will quickly spread. ...

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Name: _____ Group: _____

QUESTION 1: SHOULD WE IMPOSE LARGE-SCALE VACCINATION? (*continued*)

Vaccine safety. Frequently asked questions (*continued*)

6. Do vaccines contain toxic ingredients?

Answer: The main ingredient in most vaccines is the killed or weakened germ (virus or bacterium), which stimulates our immune system to recognize and prevent future disease. ...

A preservative called thimerosal received attention in the U.S. in 1999 because it contains mercury and it is used in some vaccines for children. As a precaution, U.S. authorities recommended that the use of vaccines containing thimerosal be reduced or eliminated. ... In Canada, the only routine vaccine for children that contained thimerosal was the hepatitis B vaccine. Canadian infants were never subject to the same level of mercury exposure from vaccines as U.S. infants. A new formula for hepatitis B vaccine, with no thimerosal, is now available. ...

7. Can vaccines transmit animal disease to people?

Answer: Because vaccines are a natural product, they sometimes require the use of animal cells during production. This process is strictly controlled so that it does not pose a risk to people. No brain cells are used in manufacturing vaccines in Canada. During the manufacturing process, the vaccines are purified, and all animal cells are removed. However, each batch of vaccine is tested to ensure that it is free from infectious agents. ...

8. Do vaccines weaken the immune system?

Answer: No. Vaccines strengthen the immune system to protect children and adults from specific diseases. This is true even for newborn infants. Infants and children are exposed to many kinds of germs every day, through normal eating, drinking and playing. Scientists estimate the immune system can recognize and respond to hundreds of thousands, if not millions, of different organisms. The vaccines recommended for children and adults use only a small portion of the immune system's "memory." ...

9. I've heard that MMR can cause autism. Is that true?

Answer: Medical researchers and scientists around the world have studied information collected over many years to see whether there is a link between measles vaccine and autism, a lifelong developmental disorder. They have not found any evidence of a link. ... The symptoms of autism include problems with social interaction, behaviour and communication. Doctors don't know exactly what causes this developmental disorder. The symptoms usually appear during the first three years of life—when most children are receiving their vaccines. The idea that the MMR vaccine is linked to autism began in 1998, when one study claimed that the measles vaccine could lead to the development of autism. The study, which involved a very small number of children, was flawed in many ways from a scientific point of view, and numerous studies on this topic since then have not found any evidence of such a link.

Public Health Agency of Canada. *Vaccine Safety. Frequently Asked Questions* [online document], July 2008. Retrieved from http://www.phac-aspc.gc.ca/im/vs-sv/vs-faq-eng.php (accessed July 14, 2009).

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Name: _____ Group: _____

QUESTION 2: SHOULD WE ALLOW THE MARKETING OF RAW MILK (UNPASTEURIZED)?

Legalization of the sale of unpasteurized milk from the farm

by Carol Vachon, PHD Biology, Post doctorate in Medicine, who is the founder of the Québec Coalition for Unpasteurized Milk Cheeses in 1996. ...

... In the countryside, we know that unpasteurized milk is healthy milk, but the authorities continue to ignore this for many reasons. This is unwise because the heavily processed milk sold in grocery stores ... is increasingly criticized. ...

What are the fundamental issues which are never discussed?

Science demonstrates more and more clearly that unpasteurized milk is truly healthy. A study on several hundred children indicates that those who consumed unpasteurized milk suffer considerably less from asthma, allergies and hay fever. (*Readers Digest*, May 2002, p. 22). Many studies show that if breast-fed infants are more vigorous and resistant to illness, it is largely because the milk is unpasteurized. All raw milk, whether human or bovine, etc., has anti-bacterial properties, which are due to a multitude of natural factors.

...

Grocery store milk; pasteurized, homogenized, skimmed, enriched, processed, contaminated by different chemical residues and whatnot, has little to do with good traditional milk. And science is clear: a food so heavily processed is suspect and may even become harmful. It is a brazen distortion of the facts to continue to claim that milk processed in this way retains all its nutritional properties. ...

...

Is unpasteurized milk really dangerous?

More than a half a million Quebeckers regularly consume unpasteurized milk: among them the 10 000 dairy farmers and 10 000 other types of farmers who own dairy cattle, their families, friends and neighbours.

As you can see unpasteurized milk is consumed by almost 100% of a population composed of farmers, in spite of the fact that it has been declared to be dangerous and is illegal as well. … Would farmers take unnecessary risks with their health in this way? ...

In any case, there is no such a thing as a “zero” risk. The “Hamburger Disease,” caused by the bacterium *E. coli* in ground beef, has regularly resulted in deaths in Québec. According to a report in November 1999, 73 000 people are poisoned annually in the U.S., resulting in 600 deaths. Do we ban beef? …

On the other hand, the direct sale of raw milk from the farm (as is done in almost every country in the world) is the best guarantee of quality because it is based on a relationship of trust: the direct contact between the producer and the consumers: the customer is the best inspector because he knows where the milk came from.

…

Another promising advantage for the future; unpasteurized milk is protected against the effects of globalization, since it must be distributed locally. On the other hand, there are rumours that large Québec processors import milk from the United States. The more unpasteurized milk is consumed, the greater the proportion of our milk that will be protected from the effects of globalization

Vachon, Carole. *Légalisation de la vente de lait cru à la ferme* [PDF document]. Retrieved from: www.lelaitcru.com/légisfermevachon.pdf (accessed July 14, 2009). *[Translation]*

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Name: _____ Group: _____

QUESTION 2: SHOULD WE ALLOW THE MARKETING OF RAW MILK (UNPASTEURIZED)? (*continued*)

Pasteurization and its effect on the vitamin content of milk

Pasteurization and sterilization have an influence on the presence of certain water soluble vitamins (vitamins B6, B12, B9 and C), which are affected by heat.

The fat soluble vitamins (A and D) and certain water soluble vitamins (B1, B2, B5, B8 and P) remain stable during the pasteurization and sterilization processes.

Because the quality of hygienic techniques has progressively improved … and with the technological advances in equipment, heating methods have become less and less destructive compared with those used 50 years ago; as well, many milks are vitamin enriched.

Vitamin content of milk according to heat treatments

100 g Milk	Whole raw milk	Whole pasteurized milk	Sterilized whole milk	UHT whole milk
Vitamin C (mg)	1.4	2	traces	1
Vitamin B6 (mg)	0.05	0.03	0.02	0.02
Vitamin B9 (µg)	5	4	1	3
Vitamin B12 (µg)	0.43	0.4	0.14	0.2
Vitamin B2 (µg)	0.17	0.17	0.17	0.17
Retinol (µg) (or Vitamin A)	41	40	38	40
Vitamin D (µg)	0.055	0.05	0.05	0.03
Vitamin B1 (mg)	0.04	0.05	0.04	0.05

Source: Translated from: Table de composition, REGAL Produits Laitiers (2002 edition)

Les produits laitiers. *Influence des traitements thermiques sur les vitamines du lait* [online document], 2002. Retrieved from http://www.produits-laitiers.com/les-produits-laitiers/le-lait/catégories/aller-plus-loin/#c2827 (accessed July 15, 2009). *[Translation]*

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Name: _____ Group: _____

QUESTION 2: SHOULD WE ALLOW THE MARKETING OF RAW MILK (UNPASTEURIZED)? (*continued*)

Health Canada reminds Canadians about the risks of drinking raw milk

OTTAWA - Health Canada would like to remind Canadians not to drink raw (unpasteurized) milk because it could contain bacteria that can make you seriously ill.

Several different kinds of bacteria that could be found in raw milk, such as Salmonella, E. coli and Listeria, have been linked to food-borne illness. These bacteria can lead to very serious health conditions ranging from fever, vomiting and diarrhea to life-threatening kidney failure, miscarriage and death. Children, pregnant women, the elderly and individuals with compromised immune systems are particularly at risk.

Because of these health concerns, Food and Drug Regulations require that all milk available for sale in Canada be pasteurized. Pasteurization kills the organisms that cause disease while keeping the nutritional properties of milk intact. Raw milk has not been treated to make it safe, but instead has been refrigerated at the farm where it was collected.

Milk is an important food and contains many nutrients essential for good health, especially calcium and vitamin D.

Unpasteurized milk has historically been linked to many serious diseases. However, the number of food-borne diseases from milk has dramatically decreased since pasteurization was introduced in the early 1900s.

The sale of raw milk has been strictly prohibited under the Food and Drug Regulations since 1991. Raw milk cheese is allowed for sale and considered safe because the manufacturing process for cheese helps to eliminate many pathogens found in raw milk.

Although raw milk is not allowed to be sold in Canada, people have become ill after drinking raw milk when visiting farms. Some dairy farmers are also consuming milk from their own animals. While pasteurized milk is now the standard, there are some Canadians who continue to prefer raw milk because of perceived health benefits. However, any possible benefits are far outweighed by the serious risk of illness from drinking raw milk.

Health Canada. *Health Canada Reminds Canadians about the Risks of Drinking Raw Milk* [online document], August 2006. Retrieved from http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/_2006/2006_65-eng.php (accessed July 15, 2009).

Food safety in sustainable development

When milk pasteurization was introduced about 100 years ago in North America, Europe, and other parts of the world, the transmission of bovine tuberculosis, brucellosis and other milkborne diseases was widespread. In spite of its health benefits, this technology was not immediately adopted as some consumers still preferred raw milk. As an illustrative example of the importance of pasteurization, milk-borne salmonellosis was a particular health problem in Scotland during the period from 1970 to 1982 when more than 3500 people fell ill and 12 died. After the introduction of milk pasteurization in Scotland in 1983, milk-borne salmonellosis virtually disappeared and can now only be found among those in the farming community who continue to drink raw milk. Today, pasteurization of milk is almost universally accepted as an essential public health technology that enjoys the confidence and support of the consuming public.

World Health Organization. *Food Safety in Sustainable Development* [online edition], 1999. Retrieved from http://www.who.int/foodsafety/publications/general/en/fos_brochure1999_2en.pdf (accessed July 16, 2009).

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Name: _____ Group: _____

QUESTION 2: SHOULD WE ALLOW THE MARKETING OF RAW MILK (UNPASTEURIZED)? (*continued*)

Why we should consume raw milk

… This phobia of germs that could be found in raw milk has no basis, neither empirical nor scientific. There have been no clinical tests conducted on people who drink raw milk containing the bacteria which are so frightening, thereby either proving or disproving the theory that the bacteria consumed with the raw milk can cause harmful effects to the health of those who drink it.

Pasteurization involves heating milk to 150°F for at least 15 seconds. It became very popular because farmers didn't have the technology in the past, that was needed for the production, packaging and delivery of raw milk. The only justification for pasteurization is that it extends the shelf life of milk in stores and in the refrigerators of consumers. … Not only does pasteurization destroy most of the vitamins, enzymes and factors necessary for health, but it eventually provokes changes of certain nutrients in the milk. … Pasteurization reduces the quantity of biological antibodies and enzymes present in the milk, constituents which are necessary for a good digestion and the proper assimilation of its nutrients, some of which have a preventive effect against a range of diseases, including cancer.

…

Action pour la défense du lait cru et les produits laitiers au lait cru. *Pourquoi il faut consommer du lait cru* [online document], March 2005. Retrieved from http://adeftra.free.fr/vrailait/07.htm (accessed July 15, 2009). *[Translation]*

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Name: _____ Group: _____

QUESTION 3: SHOULD WE ALLOW PARENTS TO SELECT THE GENDER OF THEIR CHILD WITH ASSISTED REPRODUCTION?

Choosing the sex of one's baby

Last September, Dr. Frank Comhaire [of] the University of Ghent (Belgium), announced that he had a method allowing a couple to choose the sex of their child. … This month, he announced the first birth of a child born using this technique. The birth took place in February in southern Europe. …

The sorting of chromosomes

Developed some 10 years ago by the U.S. Department of Agriculture to select animals based on their gender, this technique has been called "MicroSort." It has been adapted to [humans] in 1998 by researchers working for the Institute of Genetics and In Vitro Fertilization, in Virginia. The technique then underwent clinical trials under the supervision of the Food and Drug Administration, with the collaboration of numerous American, Canadian and Belgian physicians.

The method consists of sorting sperm by identifying those carrying the X chromosome (female) and those bearing the Y chromosome (male). The team uses a laser that is able to differentiate between these two types of chromosomes so that they can be sorted into two tubes. Then, the sperm obtained is "enriched" and inseminated in the womb of the mother or is used for in vitro fertilization.

A technique for testing

The method is limited in its effectiveness because it is a particularly difficult process to eradicate the unwanted sperm. The technique has been tested on a thousand couples in the United States and resulted in the birth of 400 children. The rates of success were 88% for girls and 73% for a boy. …

Movement towards a balanced family?

In France, selecting the sex of an embryo is admissible in order to avoid a serious genetic disorder. …

The bioethics laws of 1994 prohibit the selection of a child's sex for other reasons. Similarly in Belgium, Article 5 of the law on research done on embryos in vitro prohibits research or procedures that allow the selection of an embryo except to avoid a serious genetic disorder. But Professor Comhaire does not consider what he does to be illegal. … "We are selecting sperm before any creation of embryos even occurs." …

The Belgian bioethics committee is divided on the issue of the selection of embryos by their sex. Some members are not opposed to the "family-balancing" aspect: i.e. giving a couple the option to choose the sex of their child in order to balance the number of girls or boys in the family. …

Gènéthique. *Commander le sexe de son bébé* [online document], May 2003. Retrieved from http://www.genethique.org/parus/lettres/2003/lettre_mai.htm#2 (accessed July 16, 2009). *[Translation]*

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QUESTION 3: SHOULD WE ALLOW PARENTS TO SELECT THE GENDER OF THEIR CHILD WITH ASSISTED REPRODUCTION? (*continued*)

Risks of Assisted Human Reproduction (AHR) and purpose of AHR counselling

Broadly, AHR involves the use of medical and scientific technologies to facilitate reproduction. The most commonly known procedures are artificial insemination (or intrauterine insemination) and in vitro fertilization, although the fast pace of scientific developments are constantly increasing possibilities for achieving pregnancies. These AHR procedures can be done with a person or couple's own gametes, or with gametes donated by another person (also referred to as gametes donated for third-party use). During the course of a particular treatment, patients may be faced with a wide range of options and decisions, such as how many in vitro embryos to transfer, … whether to freeze unused gametes or in vitro embryos, whether to donate unused in vitro embryos to someone else or to research, etc.

AHR procedures can present physical risks to patients, women in particular, as well as to the children born. … However, there are psychological risks to individuals, including children. …

… These challenges may vary and can include: feelings of guilt, anger, shame and depression regarding infertility; coping with grief and loss; learning how to manage the stress of treatment, and in some cases treatment failure; deciding whether and how to disclose AHR procedures to others, including children, family members and friends; learning how to accept a non genetically-related child. …

Health Canada. *Risks of AHR and Purpose of AHR Counselling* [online document], February 2007. Retrieved from http://www.hc-sc.gc.ca/hl-vs/reprod/hc-sc/public/_counsel/2-eng.php (accessed July 16, 2009).

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QUESTION 3: SHOULD WE ALLOW PARENTS TO SELECT THE GENDER OF THEIR CHILD WITH ASSISTED REPRODUCTION? (*continued*)

Couples are choosing the sex of their child

Thousands of couples around the world hoping to choose the sex of their future child come to the United States, where access to this controversial cutting-edge technology is possible. Most countries prohibit the procedure on ethical grounds and cite the danger of eugenics. However, at a cost of approximately $19 000, a handful of U.S. clinics offer a "Preimplantation Genetic Diagnosis" (PGD) which is deemed to be 99% reliable.

… "Balancing the family" is the argument that comes up most often among the 2000 couples seeking the help of Dr. Jeffrey Steinberg, one of the pioneers of this procedure. "In general, these couples have four or five children of the same sex and want at any cost, to have one of the other sex," says Director Steinberg of the Fertility Institute in Los Angeles. …

The technique, made possible by the decoding of the human genome, consists of having the mother undergo fertility treatments so that she will produce several ovules, which are then fertilized in vitro. DNA analysis shows which eggs will produce a boy or a girl. They are then implanted into the mother's uterus.

Caveats

Specialists in bioethics have warned against the risk of demographic imbalances that this method could produce and the possible tendency toward the choice of physical characteristics in children. In China and India, where parents prefer boys, abortions of female fetuses and even infanticide have resulted in a shortfall of girls. "In some countries, if the parents could determine the sex of their child, the results would be striking," says David Magnus, professor of bioethics at Stanford University (California), while stressing the fact that the current price of the procedure limits the scope of PGD, even in rich countries. But nevertheless, there remains a risk of "a world in which only the poor will be fat or bald," he warns. The technique is also challenged by the influential American religious right, which believes that life begins with the formation of the embryo.

Doctor Steinberg dismisses these criticisms, emphasizing that his customers choose to retain the majority of their eggs in the bank of fertilized ova, rather than discarding them. As well, the practitioner says, not all his clients prefer boys. …

Maman pour la vie. *Commander le sexe de son bébé* [online document], May 2006. Retrieved from http://www.mamanpourlavie.com/grossesse-maternité/actualités/678-choisir-le-sexe-de-son-enfant.thtml (accessed July 16, 2009). *[Translation]*

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Name: _____ Group: _____

QUESTION 3: SHOULD WE ALLOW PARENTS TO SELECT THE GENDER OF THEIR CHILD WITH ASSISTED REPRODUCTION? (*continued*)

Thinking about sex selection

…

But if the central importance of the baby's sex and our desire to choose one sex over the other is not new, the techniques for making our desires come true are new. Today, it is possible, at a price, to guarantee the sex of our children. The principal means for doing so are: prenatal diagnosis (either through a sonogram or amniocentesis) followed by abortion of fetuses having the unwanted sex; preimplantation genetic diagnosis (PGD) followed by selective implantation based on sex; and (a less certain technique) prefertilization separation of sperm into X- and Y-bearing ones followed by selective transfer. The first two techniques select postconception; the last seeks to determine sex at the time of conception.

PGD is a relatively new medical technique, introduced about 10 years ago for the purpose of screening early IVF embryos for genetic diseases. However, as with other medical technologies, many other uses for PGD were quickly discovered and put into practice, including sex selection for nonmedical purposes. PGD is expensive, costing on average $3 000 for the test and upwards of $20 000 for the subsequent in vitro fertilization.

The newer and less tested sperm-sorting technology was originally a creation of the U.S. government, invented by a Department of Agriculture scientist in the 1980s for the purposes of selecting sex in livestock. The Genetics and IVF Institute in Fairfax, Virginia developed the technology for humans and currently has an exclusive license on it—the technology is known as "MicroSort." The Genetics and IVF Institute charges about $2300 per try and currently boasts a 90 percent success rate for girls and 73 percent success rate for boys. It offers this service only for the end of "family balancing."

It is difficult to determine how widely either of these methods would be used were they to gain moral acceptance and to become affordable. Of course, we know that sex ratios have already been affected in such countries as China and India as a result of aggressive sex selection. What would happen in the United States, where cultural preferences are quite different and the desire for sons is possibly not as pronounced, is perhaps unknowable in advance. Of course, the effect on the sex ratio is only one of the issues at stake. Here's how *Fortune* magazine recently summed up at least the potential market for MicroSort alone: "Each year, some 3.9 million babies are born in the U.S. In surveys, a consistent 25 percent to 35 percent of parents and prospective parents say they would use sex selection if it were available. If just 2 percent of the 25 percent were to use MicroSort, that's 20 000 customers . . . [and] a $200-million-a-year business in the U.S. alone."

…

In 1999, the ASRM issued a report that criticized the use of PGD exclusively for sex selection. … The ASRM noted in its 1999 report that there is little cause for concern when sex selection is used to prevent the transmission of sex-linked genetic disorders such as certain types of hemophilia, muscular dystrophy, and Hunter syndrome. The report examined several possible objections to PGD for sex selection, including whether it would lead to imbalances in society's sex ratio, or become a gateway to other forms of selection (say for eye colour or intelligence), or whether it might raise matters of economic inequality and the misallocation of scarce medical resources. … Instead, the report placed most of the weight of its ethical analysis on the problem of how PGD for sex selection would "contribute to a society's gender stereotyping and overall gender discrimination." …

…

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QUESTION 3: SHOULD WE ALLOW PARENTS TO SELECT THE GENDER OF THEIR CHILD WITH ASSISTED REPRODUCTION? (*continued*)

Thinking about sex selection (*continued*)

Many questions might be taken up in reference to sex selection for nonmedical reasons, in particular:

1. What are the current and future techniques of sex selection, as well as their effectiveness, cost and prevalence?
2. What is the ethical basis or defence of sex selection for nonmedical purposes? (… the burden of proof should lie with those who are proposing the new technique, not those who oppose it.)
3. Nonetheless, it is still useful for opponents to think through the grounds of their objection to sex selection. What are the human goods being defended? Is there a concern about sexism? About the effect on society's natural sex ratio? About the new relation developed between parent (as chooser) and child (as product)? About a slippery slope to other forms of selection, and thus eventually to a world of eugenics? About the destruction of embryos (in the case of PGD)? Moreover, where lies the preponderance of our ethical objection to sex selection: Is it with the means of selection, or its effects on parents, children, and parent-child relationships, or its likely societal impact both in terms of the sex-ratio and established norms, or as a gateway to other types of selection and enhancement?
4. If it is decided that sex selection for nonmedical reasons is unacceptable, what are the remedies? Legislative bans? Regulation of the IVF industry? Self-regulation by IVF practitioners and bodies like the ASRM?
5. What role do for-profit fertility clinics and consumer demand play in the progress of sex-selection therapies?
6. In light of its objections to sex selection by PGD in its 1999 report, which centred on gender bias, why exactly did the ASRM approve of sex selection by sperm sorting in its 2001 report?

United States Government, The President's Council on Bioethics. *Thinking About Sex Selection* [online document], October 2002. Retrieved from http://www.bioethics.gov/background/background2.html (accessed July 18, 2009).

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Name: _____ Group: _____

QUESTION 4: SHOULD WE LIMIT THE MARKETING OF GENETICALLY MODIFIED ORGANISMS (GMOS)?

Potential risks of consuming foods containing GMOs

…

We do not yet know very well what the long-term impact of GM foods on health will be, since they are relatively new. The World Health Organization (WHO) considers that GM foods present the same health risks as conventional foods do.

In a report entitled "Modern food biotechnology, human health and development: a study based on real-life examples" published on June 23, 2005, WHO presented a risk analysis of the possible dangers to health and the environment of GMOs.

According to the report, the new GM food can help enhance health and development.

WHO states that the GMOs currently marketed have been subjected to all necessary risk assessments before going to market and that they are examined more carefully than traditional foods for their potential effects on human health and the environment.

To date, the consumption of GMOs has not caused any recognized adverse effects on health.

However, the need for assessments of their safety before marketing remains, to prevent any risk to health and the environment because certain genes used in their design may not have been present in the food chain before. Moreover, long-term monitoring to rapidly detect any possible adverse effect should be maintained.

No rigorous scientific study has yet shown that eating foods with GMOs has greater risk than consumption of traditional foods. … However, we must remain alert to potential impacts on long-term health. Scientific organizations, such as The Royal Society of Canada and The British Medical Association are of the opinion that GM crops should be studied before being brought to market.

…

Government of Québec. *Risques potentiels associés à la consommation d'aliments avec OGM* [online document], 2009. Retrieved from http://www.ogm.gouv.qc.ca/santé_risques.html (accessed July 18, 2009). *[Translation]*

The potential health benefits of GMOs

The first commercialized GMOs were used for agriculture: plants resistant to insects and viruses, plants tolerant of herbicides, etc. These GMOs for example, could minimize crop contaminations and chemical use, and indirectly improve the health of the population because of fewer chemicals and less mildew on maize.

As well, scientists soon noted that genetic engineering could be used to directly impact the field of health. Through transgenesis, it is possible to create GMOs that improve health and nutrition in human beings. Some of these GMOs are approved but not yet commercialized, but many are still in development:

- more "healthy fats" in plants
- more nutritious food
- less allergenic food
- crop plants that produce medic–inal drugs.

Government of Québec. *Bénéfices potentiels pour la santé liés aux OGM* [online document], 2009. Retrieved from http://www.ogm.gouv.qc.ca/santé_avantages.html (accessed July 18, 2009). *[Translation]*

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Name: _____ Group: _____

QUESTION 4: SHOULD WE LIMIT THE MARKETING OF GENETICALLY MODIFIED ORGANISMS (GMOS)? (*continued*)

The hazards of GMOs

The debate against:

…

The principal arguments against GMOs concern public health:

- Health risks of contamination for humans or animals (through the digestive tract)
- The risk of contamination of neighbouring fields (through pollination)
- The risks to genetic diversity (all genetically modified plants will be identical and hence more vulnerable to new diseases)
- [risks associated with new tolerances in parasites (researchers have been criticized for playing God with genetics and plants)]

Or economic issues:

- Farmers, dependence on seed suppliers (every year they would have to buy their seed…)

The risks of GMOs

There is no unanimity regarding the risks of GMOs. … Because of pressure exerted by ecologists, the parameters for testing on animals … was lengthened to a minimum of three months. In fact, where public health is concerned, it is actually impossible to prove anything conclusively without epidemiological studies of several years.

…

The advantages in the fields of agriculture and medicine put forward by the promoters of GMO are:

- [the nominal risks]:
  - … the risk, even if it existed, would be nominal given that GMOs are only cells that have had a gene inserted (a protein) …, so that the combination of genetic characteristics of the two products to obtain a third has existed for more than a millennium (the grafting of branches onto plants, for example).
- The fight against famine and malnutrition, which becomes more of an issue with overpopulation:
  - GMOs could be more resistant to drought.
  - GMOs could improve crop yields.
  - GM plants could be supplemented with a molecule that could combat malnutrition
- GMOs could contribute to peoples' health [by permitting];
  - [reduction of] the quantity of products used in agriculture such as pesticides and insecticides (GM plants can be made more resistant to diseases and insects)
  - … the production of nutraceuticals (food with medicinal properties) in large quantity, thus reducing their costs
  - … the mass production of new biological products with new therapeutic properties
  - … to fight certain diseases or allergies (plants stripped of their allergenic or toxic molecules …)
- GMOs are the technology of the future for agriculture, medicine and the pharmaceutical industry because of the enormous potential they offer for improvement and variety.

Wikipedia. *Enjeux liés aux OGM* [online document], July 2009. Retrieved from http://fr.wikipedia.org/wiki/Enjeux_li%C3%A9s_aux_OGM (accessed July 18, 2009). *[Translation]*

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Name: _____ Group: _____

QUESTION 4: SHOULD WE LIMIT THE MARKETING OF GENETICALLY MODIFIED ORGANISMS (GMOS)? (*continued*)

Weighing the GMO arguments: for
The principal arguments that have been put forward for the use of GMOs in agriculture include:

Potential benefits for agricultural productivity

- **Better resistance to stress:** If crops can be made more resistant to pest outbreaks, it would reduce the danger of crop failure. Similar benefits could result from better resistance to severe weather, such as frost, extreme heat or drought. …
- **More nutritious staple foods:** By inserting genes into crops such as rice and wheat, we can increase their food value. …
- **More productive farm animals:** Genes might be inserted into cattle to raise their milk yield, for example.

Potential benefits for the environment

- **More food from less land:** Improved productivity from GMOs might mean that farmers in the next century won't have to bring so much marginal land into cultivation.
- **GMOs might reduce the environmental impact of food production and industrial processes:** Genetically engineered resistance to pests and diseases could greatly reduce the chemicals needed for crop protection. … Farmers are growing maize, cotton and potatoes that no longer have to be sprayed with the bacterial insecticide Bacillus thuringiensis. … Scientists are developing trees that have a lower content of lignin, a structuring constituent of woody plant cells. This could reduce the need for noxious chemicals in pulp and paper production. These developments could not only reduce environmental impact—they could also improve the health of farm and industrial workers.
- **Rehabilitation of damaged or less-fertile land:** Large areas of cropland in the developing world have become saline by unsustainable irrigation practices. Genetic modification could produce salt-tolerant varieties. Trees might also be improved or modified to become more tolerant of salt and drought. …
- **Bioremediation:** Rehabilitation of damaged land may also become possible through organisms bred to restore nutrients and soil structure.
- **Longer shelf lives:** The genetic modification of fruits and vegetables can make them less likely to spoil in storage or on the way to market. This could expand trade opportunities as well as reduce massive wastage incurred in transport and supply.
- **Biofuels:** Organic matter could be bred to provide energy. Plant material fuel, or biomass, has enormous energy potential. For example, the waste from sugar cane or sorghum can provide energy, especially in rural areas. …

Potential benefits for human health

- **Investigation of diseases with genetic fingerprinting:** "Fingerprinting" of animal and plant diseases is already possible. This technique allows researchers to know exactly what an organism is by looking at its genetic blueprint. One benefit may be that veterinary staff can know whether an animal is carrying a disease or has simply been vaccinated—preventing the need to kill healthy animals. …
- **Vaccines and medicines:** Similar to the long-established development of biotechnological vaccines for humans, the use of molecular biology to develop vaccines and medicines for farm animals is proving quite successful and holds great promise for the future. Plants are being engineered to produce vaccines, proteins and other pharmaceutical products. This process is called "pharming".
- **Identification of allergenic genes:** Although some are worried about the transfer of allergenic genes (see Brazil nut example under arguments against GMOs), molecular biology could also be used to characterize allergens and remove them. Indeed, the Brazil nut incident actually led to identification of the allergenic protein.

Food and Agriculture Organization of the United Nations, FAO Newsroom. *Weighing the GMO arguments: for* [online document], March 2003. Retrieved from http://www.fao.org/english/newsroom/focus/2003/gmo7.htm (accessed July 18, 2009).

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QUESTION 4: SHOULD WE LIMIT THE MARKETING OF GENETICALLY MODIFIED ORGANISMS (GMOS)? (*continued*)

Weighing the GMO arguments: against
The principal arguments that have been put forward against the use of GMOs in agriculture include:

Potential negative effects on the environment

- **Genes can end up in unexpected places:** Through "gene escape" they can pass on to other members of the same species and perhaps other species. … Problems could result if, for example, herbicide-resistance genes got into weeds.

  …
- **Genes can mutate with harmful effect:** It is not yet known whether artificial insertion of genes could destabilize an organism, encouraging mutations, or whether the inserted gene itself will keep stable in the plant over generations. …
- **"Sleeper" genes could be accidentally switched on and active genes could become "silent":** Organisms contain genes that are activated under certain conditions—for example, under attack from pathogens or severe weather. … This is especially relevant in long-lived organisms—such as trees. …
- **Interaction with wild and native populations:** GMOs could compete or breed with wild species. Farmed fish, in particular, may do this. GM crops could pose a threat to crop biodiversity. … In addition, GM crops could compete with and substitute traditional farmers' varieties and wild relatives that have been bred, or evolved, to cope with local stresses. For example, local varieties in Latin America permitted the recovery from the catastrophic potato blight in Ireland in the 1840s. Today such plants often help improve climate tolerance and disease resistance. If genetically modified crop varieties substitute them, they could be lost, but the same applies to improved varieties developed by conventional breeding methods.
- **Impact on birds, insects and soil biota:** Potential risks to non-target species, such as birds, pollinators and micro-organisms, is another important issue. Nobody quite knows the impact of horizontal flow of GM pollen to bees' gut or of novel gene sequences in plants to fungi and soil and rumen bacteria. Besides, it is feared that widespread use of GM crops could lead to the development of resistance in insect populations exposed to the GM crops. …

Potential negative effects on human health

- **Transfer of allergenic genes:** These could be accidentally transferred to other species, causing dangerous reactions in people with allergies. For example, an allergenic Brazil-nut gene was transferred into a transgenic soybean variety. Its presence was discovered during the testing phase, however, and the soybean was not released.
- **Mixing of GM products in the food chain:** Unauthorized GM products have appeared in the food chain. For example, the GM maize variety Starlink, intended only for animal feed, was accidentally used in products for human consumption. Although there was no evidence that Starlink maize was dangerous to humans, strict processing controls may be required to avoid similar cases in the future.
- **Transfer of antibiotic resistance:** Genes that confer antibiotic resistance are inserted into GMOs as "markers" to indicate that the process of gene transfer has succeeded. Concerns have been expressed about the possibility that these "marker genes" could confer resistance to antibiotics. This approach is now being replaced with the use of marker genes that avoid medical or environmental hazards.

Potential socioeconomic effects

- **Loss of farmers' access to plant material:** Biotechnology research is carried out predominantly by the private sector and there are concerns about market dominance in the agricultural sector by a few powerful companies. This could have a negative impact on small-scale farmers all over the world. Farmers fear that they might even have to pay for crop varieties bred from genetic material that originally came from their own fields. …

Food and Agriculture Organization of the United Nations, FAO Newsroom. *Weighing the GMO arguments: against* [online document], March 2003. Retrieved from http://www.fao.org/english/newsroom/focus/2003/gmo8.htm (accessed July 18, 2009).

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QUESTION 4: SHOULD WE LIMIT THE MARKETING OF GENETICALLY MODIFIED ORGANISMS (GMOS)? (*continued*)

Frequently asked questions: biotechnology and genetically modified foods

…

What are the potential benefits of the application of genetic modification to foods?

Benefits resulting from such changes may include longer lasting and better tasting fruits and vegetables, crops which require less use of pesticides, improved nutrient content in certain foods, etc. In general, food production could be more efficient or more inexpensive and may contribute to enhancing the global food supply.

Is there a mechanism for considering ethical issues in the application of genetic modification to foods?

The government recognizes that ethical considerations are important issues related to consumer choice. Potential ethically sensitive modifications such as the inclusion of animal or fish genes into crops will need to be collectively examined and agreed upon. For some people, the use of genetically modified products to any extent is an ethical issue. To that end, the federal government announced the creation of the Canadian Biotechnology Advisory Committee (CBAC) as part of its renewed biotechnology strategy in 1999.

CBAC is an expert, arm's length committee formed for the purposes of advising the ministers on issues related to biotechnology such as ethics but also including the scientific, social, economic, regulatory, environmental and health aspects. CBAC is working to raise the public's awareness of the regulatory process and provides an ongoing forum for the public to voice their views. The Advisory Committee under the Canadian Biotechnology Strategy is expected to consider ethical issues in a broader scope than product-by-product approvals covered under the Novel Foods regulations. In addition, CBAC's report entitled “Improving the Regulation of Genetically Modified Foods and Other Novel Foods In Canada,” released in 2002, included recommendations on how to address ethical issues in the regulatory framework for novel foods. Health Canada led the interdepartmental review of CBAC's recommendations, many of which are already being implemented.

Health Canada. *Frequently Asked Questions. Biotechnology and Genetically Modified Foods* [online document], June 2006. Retrieved from http://www.hc-sc.gc.ca/fn-an/gmf-agm/fs-if/faq_4-eng.php (accessed July 18, 2009).

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Name: _____ Group: _____

QUESTION 5: SHOULD WE SUPPORT STEM CELL RESEARCH?

Stem cells: FAQs

Scientists have been all abuzz in the last few years over stem cells—cellular magicians that promise to dazzle and amaze. In December 1999, the editors of *Science*, the journal devoted to scientific and medical matters, called stem cell research the "Breakthrough of the Year." Since then, there has been a flurry of announcements about developments in stem cell research and hints of promising treatments for diseases such as Alzheimer's, Parkinson's and cancer. In May 2007, Ontario and California announced a $30-million stem cell research deal aimed at finding new therapies for those diseases. … But there has been intense debate over the use of stem cells. Scientists say embryonic stem cells are the most useful type because they have the potential to become any type of cell within the body. However, they are harvested from embryos grown in the lab. Opponents argue that any embryo has the potential to develop into a mature human. Some argue that the possibility of mimicking stem cells without acquiring them from embryos, sidesteps that moral dilemma. However, researchers at the Harvard Stem Cell Institute say reprogrammed cells won't eliminate the need or value of studying embryonic stem cells.

What are stem cells?

Stem cells can be thought of as blank slates or cells that have yet to become specialized. They are in an early stage of development and have the ability to become any type of cell to form skin, bones, organs or other body parts.

Are there different kinds of stems cells?

Yes. Stem cells come in three forms: embryonic stem cells, embryonic germ cells and adult stem cells. Embryonic stem cells come from embryos, embryonic germ cells from testes, and adult stem cells can come from bone marrow.

Embryonic stem cells are pluripotent—they have the ability to become virtually any type of cell within the body. Adult stem cells are more limited. They are found in adult organs. They are still developing and they have the potential to become any of the major specialized cell types within that organ. But recent evidence suggests it may be possible to reprogram adult stems to repair tissues.

In a study published in the online journal *Nature* on March. 1, 2009, Canadian researcher described a new method for generating stem cells from adult human tissue. The researchers, at Mount Sinai Hospital in Toronto, say the development could bring personalized regenerative medicine a step closer to reality.

"This new method of generating stem cells does not require embryos as starting points and could be used to generate cells from many adult tissues, such as a patient's own skin cells." …

What could stem cells be used for?

Scientists are fascinated by the ability of stem cells to become any type of cell. This makes them perfect for a wide range of medical uses, from repairing tissue to treating diseases such as Parkinson's and Alzheimer's.

Doctors can already transplant tissue and organ cells but they are limited by a lack of donors. Stem cells could allow them to grow the tissue they need, when they need it.

What do stem cells have to do with cloning?

When people think of cloning they usually think of copying people from head to toe. But human cloning also includes making copies of just cells.

Researchers don't necessarily need to clone stem cells, but cloning would make their work a whole lot easier. Instead of having to collect the millions of stem cells needed to grow a patch of skin for a patient who suffered a severe burn, for example, doctors could collect only a few stem cells and make millions of copies.

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Stem cells: FAQs (*continued*)

What are the ethical issues involved?

Currently, the best source for stem cells is a human embryo. But using human material, such as aborted fetuses, in research is a contentious issue because it can be construed as the sacrifice of human life for scientific progress.

Former U.S. President George W. Bush struck down proposed legislation to expand embryonic stem cell research in July 2006. The Stem Cell Research Enhancement Act, which passed in the Senate, would have eased limits on human embryonic stem cell research. It had been restricted to cell lines, or colonies, that were derived on or before August. 9, 2001, the day the policy was announced.

On March. 9, 2009, U.S. President Barack Obama reversed Bush's restrictions when he signed an executive order clearing the way for federal funding of research using embryonic stem cells.

On July 7, 2009, new rules came into effect governing what types of stem cells would be eligible for funding. The guidelines, which were drafted by the National Institutes of Health, say that only science that uses cells culled from leftover fertility clinic embryos—ones that otherwise would be thrown away—would be eligible.

The guidelines expand the number of stem cell lines available to researchers from 20 to about 700. The agency will also create a registry of qualified stem cells so scientists don't have to second-guess if they're applying to use the right ones.

In August 2006, researchers at Advanced Cell Technology, a biotechnology firm in Alameda, California, published a paper in the journal *Nature*, saying they had found a way to spare embryos by growing lines of stem cells from a single embryonic cell. …

…

Members of the medical community are debating what should and shouldn't be allowed, but the overall consensus seems to be that stem cell research should go ahead, but with strict limitations.

One of the most contentious issues in the stem cell debate is the use of hybrid embryos. These embryos are created by taking nuclei containing DNA from human cells and transferring them into animal eggs that have had almost all of their genetic information removed. The embryos are grown in a lab for a few days and then harvested for stem cells. The embryos are close to 99.9 per cent human.

The creation of hybrid embryos—or chimeras—was first raised as a way of dealing with the shortage of human embryos for research.

…

Britain becomes the first country in the world to allow the creation of hybrid embryos. In Canada, the Assisted Human Reproduction Act—enacted in March 2004—made it illegal to create hybrid embryos.

- In March 2001, the Canadian Institutes of Health Research released its first set of guidelines for the use of stem cells. The guidelines have been updated several times, with the latest revision published on June 29, 2007. They limit scientists to using leftover embryos created to help couples conceive, and only if the couples agree. The embryos also wouldn't be allowed to exceed more than 14 days old. …

CBC. *Stem cells: FAQs* [online document], July 2009. Retrieved from http://www.cbc.ca/health/story/2009/01/07/f-stemcells.html (accessed July 19, 2009).

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The stem cell challenge

What hurdles stand between the promise of human stem cell therapies and real treatments in the clinic?

Stem cells raise the prospect of regenerating failing body parts and curing diseases that have so far defied drug-based treatment. Patients are buoyed by reports of the cells' near-miraculous properties, but many of the most publicized scientific studies have subsequently been refuted, and other data have been distorted in debates over the propriety of deriving some of these cells from human embryos.

Provocative and conflicting claims have left the public (and most scientists) confused as to whether stem cell treatments are even medically feasible. If legal and funding restrictions in the U.S. and other countries were lifted immediately, could doctors start treating patients with stem cells the next day? Probably not. Many technical obstacles must be overcome and unanswered questions resolved before stem cells can safely fulfill their promise.

Left to their own devices in a culture dish, embryonic stem (ES) cells will spontaneously differentiate into a hodgepodge of tissue types. With timed administration of chemicals, we can often direct them to become one cell type or another. But they seem to prefer to become certain tissues—readily proliferating into patches of beating heart cells, for example—whereas other tissues are far more difficult to derive.

Putting cells to work

Because we still do not understand the signals that normally instruct these cells to choose a particular pathway during embryonic development, many researchers are studying the natural embryonic "niche" to understand possible environmental cues. Other scientists are trying to profile embryonic cells' gene expression patterns as they differentiate in order to find genes that could be turned on or off to direct the cells toward a particular tissue type.

Turning back the clock

Cloning can be viewed as a way to restore embryonic potential to a patient's old cells. The human body is made of more than 200 kinds of cells, and in mammals, once a cell is committed to a particular type, there is normally no turning back. It is said to be "terminally differentiated." An exception to this rule is when the nucleus containing an unfertilized egg's genetic material is extracted and the nucleus of a somatic (body) cell is placed into the egg instead. The egg is tricked into behaving as though it has been fertilized and begins dividing like a normal embryo. The ES cells derived from this embryo will contain the donor somatic cell's DNA. But the somatic cell will have been reprogrammed—reset to a state of stemness, capable of generating any tissue type.

What has increasingly been found is extensive fusion of bone marrow stem cells to cells in the heart, liver and brain, offering an alternative explanation for the presumed transdifferentiation. In future studies of adult stem cell potential, it will be crucial to rule out the possibility that stem cells are merely fusing to local cells rather than generating new ones.

Still, tissue-specific cells have already produced encouraging results. In the German TOPCARE-AMI study of patients with severe heart damage following myocardial infarction, the patients' own heart progenitor cells were infused directly into the infarcted artery. Four months later the size of the damaged tissue swath had decreased by nearly 36 percent, and the patients' heart function had increased by 10 percent.

Lanza, Robert and Nadia Rosenthal. *The Stem Cell Challenge.* Scientific American Magazine, June 2004.

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Europe rejects stem cell patent

The European Patent Office (EPO) issued its final ruling last week rejecting a much-contested embryonic stem cell patent—a decision that will likely be cheered by researchers and jeered by biotechs.

The patent covered technology developed by James Thomson, a University of Wisconsin researcher, to culture primate embryonic stem cells derived from preimplantation embryos. In last week's ruling, the EPO upheld a previous decision, made last summer, that rejected the patent.

Earlier this year the U.S. Patent Office upheld this patent, in addition to two others dealing with derivation and replication of embryonic stem cells in culture. The three patents, filed by the Wisconsin Alumni Research Foundation (WARF) in 1995, were reexamined, beginning in October 2006, when challenges were brought by the Public Patent Foundation in New York and the Foundation for Taxpayer and Consumer Rights (FTCR) in Los Angeles. The two organizations argued that the patents impede stem cell research, and that other researchers before Thomson had developed the technology.

In a statement from the EPO regarding the current decision, the Enlarged Board of Appeals said that under the European Patent Convention, "it is not possible to grant a patent for an invention which necessarily involves the use and destruction of human embryos."

…

However, some said the decision could be a setback for biotech companies involved in developing embryonic stem cell technology. The EPO ruling could apply to some 200 other pending patent applications in Europe, *PharmaTimes* reported.

However, the EPO ruling did state that the decision did not apply in general to the patentability of human stem cells. David Earp, chief patent counsel for Geron—a stem cell biotech with several pending patent applications in Europe—told *PharaTimes* that he is confident the ruling only applies to WARF patents and the agency will move quickly to address Geron's remaining applications.

The Scientist.com. Gawrylenwski, Andrea. *Europe rejects stem cell patent* [blog entry], December 1, 2008. Retrieved from http://www.the-scientist.com/blog/display/55249/ (accessed July 19, 2009).

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Cancer stem cells

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Why a does a tumour not respond to treatment? Why do tumours recur? Why do cancer cells develop resistance to treatment? These and many other questions raised may be answered by the new concept of "Cancer Stem Cells."

Cancer stem cells can be defined as cells in the tumour growth with a tumour initiating potential. Normal stem cells are characterized by three properties:

1. Capability of self-renewal;
2. Strict control on stem cell numbers;
3. Ability to divide and differentiate to generate all functional elements of that particular tissue. Compared to normal stem cells, the cancer stem cells are believed to have no control on the cell numbers. Cancer stem cells form very small numbers in whole tumour growth and they are said to be responsible for the growth of the tumour cells.

… At present, the shrinkage in the size of a tumour is considered as a response to the treatment. However, tumours often shrink in response to the treatment only to recur again. This may be explained by cancer stem cells that the treatment targeting the cancer cells may not be able to target. …

… There is evidence that the majority of the cancers are clones and that the cancer cells represent the progeny of one cell, however it is not clear which cells possess the tumour-initiating cell (TIC) function (cancer stem cells) and how to recognize them. Though the idea of cancer stem cells is considered as a new concept in science, it was thought almost 35 years back in 1971 when they were called leukaemic stem cells. …

…

Origin of cancer stem cells

The cancer stem cells may be able to answer some of the questions related to a cancer growth, however the origin of the cancer stem cells is yet to be defined. To recognize the origin of the cancer stem cells, two important factors need to be considered: 1. A number of mutations are required for a cell to be cancerous, and 2. A stem cell needs to overcome any genetic constraints on both self-renewal and proliferation capabilities. It is unlikely that all the mutations could occur in the lifespan of a progenitor/mature cell. Therefore, cancer stem cells should be derived from either the self-renewing normal stem cells or from the progenitor cells that have acquired the ability of self-renewal due to mutations.

Cancer Cell International. *Role of stem cells in cancer therapy and cancer stem cells: a review* [online document], June 2007. Retrieved from http://www.cancerci.com/content/7/1/9 (accessed July 19, 2009).

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