Lesson Plan: Human Genomic Controversies

Key Concepts Covered[1,2]

NATURE OF GENETIC MATERIAL; REPRODUCTION:

- DNA is the genetic material for all living organisms.
- Genes are segments of DNA that encode information critical for development. DNA is organized into structures called chromosomes.
- The genome is all the genetic information within an organism.
- Humans receive half their genetic information from each parent through the processes of replication, meiosis and fertilization.
- Relate the processes of cell division and emerging reproductive technologies to embryonic development.

Overview:

This 45 min lesson plan guides grade 9 students through the examination of two issues that have arisen from the understanding and utilization of the information from the Human Genome Project, namely personal genomics and human reproduction. The lesson explores how understanding and use of genetic information impacts many aspects of society (health, crime and justice, arts, environment, human history, human behavior). The lesson also highlights how it is currently possible to obtain genetic information, whether about specific genes, certain traits or the entire genome of both living people and embryos or unborn children.

Learning Objectives:

By the end of this lesson, students will be able to discuss key issues surrounding two controversies raised by human genomics: personal genomics and pre-implantation diagnosis.

Resources Needed:

Roll of masking tape
Projector and laptop
Worksheets (page 2 and 3 of this document)

Pre-Assessment: Create a value line in the classroom using a piece of masking tape across the floor. A "value line" ascertains students' opinions in a quick and visual way by asking them to line up according to how strongly they agree or disagree with a statement or proposition[3].
Question 1: " How often do you hear mention of DNA, genes, and genomics?" Label one end of the value line as "A lot," the other as "Never". Ask the students who stand closer to "A lot" where they have heard mention of these topics.
Question 2: "How big an impact do you think human genomics has on your life?" One extreme of the value line is "A big impact" the other "No impact". Ask students to explain their positions.

Introduction:

Watch the video: Human Genome Project- Ethical, Legal, & Social Implications
http://www.youtube.com/watch?v=gkQJ26DAxfs

Activity: Personal Genomics
Hand out controversy worksheets to groups of 4-6 students. Read through the introductions together. Students work through scenario 1 individually, by writing down their answers. Students share their answers with their small groups. Ask for summaries of main findings from groups. Each small group then works through the second scenario. Bring the discussion back to the large group.

Activity: Human Reproduction
Watch the video: A natural selection.
http://www.youtube.com/watch?v=FqcA7jlqBN4
Have students in their small groups discuss the question on Human Reproduction Controversy worksheet. Discuss as large group.

Post- test/ Summary Have students stand on the value line according to their answers.
Question 1: "How big of an impact do you think human genomics has on your life?"
(A big impact- no impact)
Question 2: "How important is discussing and understanding the controversies around human genome sequencing? (Very important - Not important at all)

Key Concepts adapted from:
[1] B.C. Ministry of Education. Grade 9 Curriculum Package, online. www.bced.gov.bc.ca/irp [April 11, 2012]
[2] Dougherty M, Pleasants C, Solow L, Wong A, et al. (2011) A Comprehensive analysis of High School Genetics Standards: Are States Keeping Pace with Modern Genetics? CBE- Life Sciences Education (10): 318-327.
[3] Value Line definition from: http://www.humboldt.edu/celt/tips/value_line/

Credits: This lesson plan was developed by Jennifer McQueen, Jody Wright, and Joanne Fox as part of the science outreach efforts at the Michael Smith Laboratories at the University of British Columbia, http://bioteach.ubc.ca

Human Genomic Controversies: Personal Genomics

We are now in a genomic age! The cost of sequencing genes and entire genomes is greatly decreasing. There are companies such as “23 and me”, that can do genetic testing for you. They can tell you your probability of developing certain diseases, or traits. Some of these include hair colour, lactose intolerance, and preference to working late at night. Something we still don’t know is how people will react to this type of information and how it will impact their lives and that of their families. Please read through the following situations and discuss as a group the questions.

Situation 1:
You submit a sample of saliva to 23 and me for genetic testing. You find out that you have an increased chance (5%) of developing Alzheimer's, which destroy memory functions of the brain. You also find out that you have a mutation in a gene that gives you resistance to many types of the stomach flu.

1. ***How do you feel about this information? (Are you confused, upset, curious, excited....)***
2. ***Who would you share this information with? (Your family, friends, a life partner....)***
3. ***Would this information change the way you lived?***

Situation 2:
A friend of yours has just had their genome sequenced and suggests you should too. It will cost about $1000 to have it done.

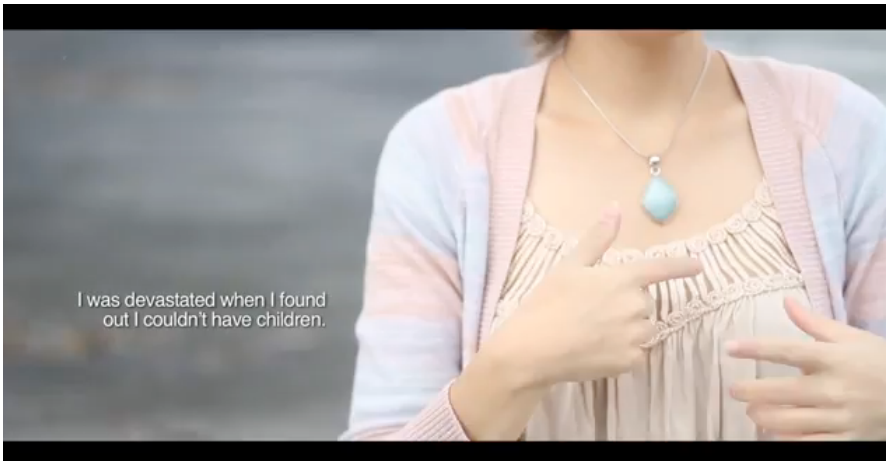
4. ***Would you have your full genome sequenced?***

You share 50% of your genetic material with each of your siblings and each of your parents. Many people today are making their genetic information publicly accessible. Making your information public can also help researchers study human DNA.

5. ***Should you require your family’s consent for this?***

6. ***What if you have an identical twin who shares 100% of your genetic sequence, should you require their consent before have a genetic test or making your genetic information public?***

Human Genomic Controversies:
Human Reproduction:



Canadians are choosing to have fewer children and at an older age. Many prospective parents are choosing to give their children the “best” possible chance they can by having their embryos screened for many genetic diseases and traits. Currently, many of the genetic diseases screened for are untreatable, effect patients early in life and have a known genetic basis. These can be disorders such as Hemophilia, a disorder that prevents patients from clotting blood, or Cystic Fibrosis that causes thick mucus to build up in the lungs and other parts of the body. As we increasingly understand the genetic causes of certain diseases or disorders, we can screen embryos for these as well. A recent example is the common breast cancer gene (*BRCA1* and *BRCA2*). Breast cancer occurs later in life and can be treatable, but patients can now screen for the genetic mutations in their embryos and choose to implant and carry to full term those embryos that do not have the mutations. While our understanding of the human genome has increased so to has the requirement to act responsibly with this information.

Please watch the accompanying video and answer the following questions.

- ***Should we decide which traits are screened for and which are not? How would you decide?***