Class VI  PowerPoint

What Makes Us Human

Human Enhancement
Inheritance in One Page

- Two copies
- One from each parent
  - random
- Dominant and recessive

<table>
<thead>
<tr>
<th>Trait</th>
<th>Dominant</th>
<th>Recessive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue rolling</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Earlobe attachment</td>
<td>free</td>
<td>attached</td>
</tr>
<tr>
<td>Pinky shape</td>
<td>bent (crooked)</td>
<td>straight</td>
</tr>
<tr>
<td>Arm folding</td>
<td>right on top</td>
<td>left on top</td>
</tr>
<tr>
<td>Cheek dimple</td>
<td>dimple</td>
<td>no dimple</td>
</tr>
<tr>
<td>Cleft chin</td>
<td>right</td>
<td>left</td>
</tr>
<tr>
<td>Hitchhiker thumb</td>
<td>straight</td>
<td>hooked</td>
</tr>
<tr>
<td>Toe length</td>
<td>2nd toe longer</td>
<td>1st toe longer</td>
</tr>
<tr>
<td>Widow’s peak</td>
<td>peak</td>
<td>no peak</td>
</tr>
</tbody>
</table>
• Personal eugenics, also known as liberal eugenics advocates enhancing human characteristics and capacities using reproductive technology and human genetic engineering.

• It is called personal eugenics for those who advocate new eugenics generally think selecting or altering embryos should be left to the preferences of parents, rather than forbidden or left to the preferences of the state.

• Medical genetics, a post-World War II medical specialty, encompasses a wide range of health concerns, from genetic screening and counseling to fetal gene manipulation and the treatment of adults suffering from hereditary disorders. Because certain diseases (e.g., hemophilia and Tay-Sachs disease) are now known to be genetically transmitted, many couples choose to undergo genetic screening, in which they learn the chances that their offspring have of being affected by some combination of their hereditary backgrounds.

• The term eugenics is not used generally with these practices.
Genetic Engineering of Humans

• Three forms of human enhancement currently exist:
  • Reproductive
    • embryo selection by
      • Preimplantation genetic diagnosis and positive choice of best embryo
      • Prenatal genetic diagnosis and negative choice by abortion
      • Cytoplasmic transfer of genes,
      • and in vitro-generated gametes
  • Somatic cell (Body cells not passed onto offspring) enhancement
    • Gene addition is to add a copy of a defective gene to supplement bad gene
    • Gene replacement/editing is to correct the bad gene
      • (CRISPR)/Cas9
  • Germ cell (Gametes of sperm and egg which are passed onto offspring) enhancement
    • Gene addition is to add a copy of a defective gene to supplement bad gene
    • Gene replacement/editing is to correct the bad gene
      • (CRISPR)/Cas9
Correct Deficits (Genetic Diseases)

• Genetic diseases range from major catastrophic impact diseases to minor or little impact diseases.
  • Tay Sachs
    • The condition is usually fatal by around 3 to 5 years of age, often due to complications of a lung infection (pneumonia).
    • an infant usually begins showing symptoms by about 6 months of age. Signs and symptoms of Tay-Sachs disease can include the following: Loss of motor skills, including turning over, crawling and sitting up, exaggerated reactions when the baby hears loud noises, seizures, vision and hearing loss, and muscle weakness
Correct Deficits (Genetic Diseases)

• In the United States, sex selection using prenatal diagnosis and selective abortion is not permissible.

• This is the process of a couple or individual choosing the genetic sex of the child, boy or girl, by testing the embryo(s) created through IVF before one is implanted in the uterus. Sex selection is only possible using IVF embryos.

• Deafness
  • Is it moral?
# Gene Therapy

## Differences in Gene Therapy Techniques

<table>
<thead>
<tr>
<th>Overall technique</th>
<th>Gene Addition</th>
<th>Gene Editing</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><em>Adds functioning genetic material to do the work of a faulty gene</em>&lt;sup&gt;2,3&lt;/sup&gt;</td>
<td><em>Creates targeted breaks in DNA with instructions to repair those breaks, with the aim of disrupting or inactivating the function of a gene</em>&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Common research targets</td>
<td>Genetic disease and immuno-oncology&lt;sup&gt;6&lt;/sup&gt;</td>
<td>Oncology, genetic disease, infectious disease, and neurodegenerative disease&lt;sup&gt;6-8&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Gene Addition

- Add a copy of a functional gene
- Use viruses to transfer gene into recipient
  - Integration into human genome and unintended consequences.

Examples of Gene Therapy Trials

- Adenosine deaminase gene transfer to treat Severe Combined Immuno-Deficiency (SCID)
- CFTR gene transfer to treat Cystic Fibrosis (CF)
- Advanced Central Nervous System (CNS) Malignancy
- Mesothelioma
- Ornithine Transcarbamylase Deficiency
- Hemophilia
- Sickle Cell Disease
Gene Disruption

• Get rid of gene whose work is causing disease
  • Cancer promoting
Discussion

1. Is it ethical to use technology to select the sex of a child?
   1. Why or why not?

2. Some deaf parents say that deafness is not a disability and in fact is a positive attribute to their lives. They argue that they should be able to use genetic procedures to have a child that is deaf. Is this moral?
   1. Members of the signing Deaf community argue that research which aims to eliminate or cure deafness is a form of cultural genocide. The argument goes like this: the use of gene therapy to cure hereditary deafness would result in smaller numbers of deaf children. This, in turn, would reduce the critical mass of signing Deaf people needed for a flourishing community, ultimately resulting in the demise of the community.
   2. Why or why not

3. Should a child who is deaf receive gene therapy or medical treatment to cure deafness? Will this change their identity and how they are treated by their community?

4. How do we decide which genetic diseases should be eliminated by screening and selection?