Genetic Diversity in Leukemia Cells

The Problem
Biodiversity comes in many forms; the most common is when we look at the variety of life on Earth. Species diversity occurs in isolated small ecosystems, such as a pond ecosystem. Diversity can also occur within a species, such as different breeds of dogs. This genetic diversity doesn’t only have to occur between the individuals of a species, it can all occur in one individual.

Doctors at the Ontario Cancer Institute and St. Jude’s Hospital discovered that leukemia cells in ALL (acute lymphoblastic leukemia) patients are composed of a variety of genetic cell families. The leukemia cells develop changes that alter their genetics. One patient’s leukemia cells have multiple genetic cell families. The dominant cell families make it appear that the patient is showing only certain signs and symptoms of the disease. The more rare cell families’ actions are masked, and their damage is being hidden. The doctors have discovered that the families of cells respond to treatments very differently.

Guiding Question
How can genetic biodiversity within one person affect their medical treatment?

Mission Deliverable
With a partner, choose one of the three occupations: oncologist, pharmacologist, and stem cell scientist. Research the occupation, and write a one page single-spaced paper on how this person’s role in the medical treatment of an individual.

Key Concepts Addressed
Scientists contribute to real world problem-solving in every industry and work collaboratively. They review journals, news and current events as individuals and with peers.

Key Concept #1: The principles of natural selection state that overpopulation results in competition and struggle for existence; populations have variation; and populations have an unequal ability of individuals to survive and reproduce. Only the best fit individuals survive and get to pass on their traits to their offspring.

Key Concept #2: Natural selection takes many generations and changes do not happen to individuals; they happen to populations.

Related Career Roles:
Oncologists diagnose and treat cancer.
Pharmacologists study the effects of drugs on humans.
Stem cell scientists research and perform clinical studies on stem cells and their medical uses.
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Getting Started Videos

Vimeos:
“Animated Pocket Dictionary - Oncology - Acute Lymphoblastic Leukemia”
http://vimeo.com/28109796
“Baseball: Evan Garrett’s story”
http://vimeo.com/7604124

Internet Resources

National Marrow Donor Program:
“Acute Lymphoblastic Leukemia”
http://www.marrow.org/Patient/Disease_and_Treatment/About_Your_Disease/ALL/Acute_Lymphoblastic_Leukemia_%28ALL%29.aspx

“Pharmacist”
http://www.bls.gov/oco/ocos079.htm
“Stem Cell researcher”
http://www.bls.gov/oco/ocos309.htm

StateUniversity.com
“Oncologist”

Performance Goals:
College and Career Readiness

Science Standards

III. Foundation Skills: Scientific Applications of Communication
A. Scientific Writing
   1. Use correct applications of writing practices in scientific communication.

IV. Science, Technology, and Society
A. Interactions between innovations and science
   1. Recognize how scientific discoveries are connected to technological innovations.
C. History of Science
   2. Recognize the role of people in important contributions to scientific knowledge.

VI. Biology
C. Evolution and Populations
   1. Know multiple categories of evidence for evolutionary change and how this evidence is used to infer evolutionary relationships among organisms.

Cross Disciplinary Standards

II. Foundational Skills
B. Writing across the curriculum
   1. Write clearly and coherently using standard writing conventions.
### Genetic Diversity in Leukemia Cells

**Student Checklist**

<table>
<thead>
<tr>
<th>TASK</th>
<th>DUE DATE</th>
<th>STATUS/NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>View the “Getting Started Videos” Resources on page 2. Select one career role from the list.</td>
<td></td>
<td>□ Complete □ Not Complete</td>
</tr>
<tr>
<td>Use the “Internet Resources” from page 2 to research your selected career role.</td>
<td></td>
<td>□ Complete □ Not Complete</td>
</tr>
<tr>
<td>Produce the first draft of your short research paper. Your paper should address the following topics:</td>
<td></td>
<td>□ Complete □ Not Complete</td>
</tr>
<tr>
<td>1. An explanation of why the genetic diversity is important and how it provides so many types of blood cells in Acute Lymphoblastic Leukemia, ALL;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. A description of your selected career role;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. An explanation of how your selected career role assists with the detection treatment or understanding of ALL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Produce the final draft of your short research paper.</td>
<td></td>
<td>□ Complete □ Not Complete</td>
</tr>
<tr>
<td>Print and share your research paper with your fellow scientists.</td>
<td></td>
<td>□ Complete □ Not Complete</td>
</tr>
</tbody>
</table>

**FINAL DUE DATE:**
# Genetic Diversity in Leukemia Cells
## Rubric and Grade Sheet

<table>
<thead>
<tr>
<th>Category</th>
<th>Exceeds Expectations 3 points</th>
<th>Meets Expectations 2 points</th>
<th>Below Expectations 1 point</th>
<th>SCORE</th>
<th>Teacher Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content Mastery</strong></td>
<td>Included detail on all components and SCOPE Key Concepts.</td>
<td>Included some detail on most components and SCOPE Key Concepts.</td>
<td>Included little to no detail on components and SCOPE Key Concepts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Application of Content</strong></td>
<td>Student correctly supported all SCOPE content AND goals.</td>
<td>Student correctly supported most SCOPE content AND goals.</td>
<td>Student did not support SCOPE content AND goals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td>All information is accurate and is taken from at least four sources.</td>
<td>Most information is accurate and is taken from 2-3 sources.</td>
<td>Little to no information is accurate and is taken from one to no sources.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
<td>Final product is attractive, all components are easily identifiable, and the student can clearly dialogue about the project.</td>
<td>Final product is somewhat attractive, most components are easily identifiable, and the student can somewhat dialogue about the project.</td>
<td>Final product is not presented well, components are difficult to identify, and the student cannot clearly dialogue about the project.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SCORE:**

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