

Cytogenetics

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Primary Learning Outcomes

After receiving information from PowerPoint lectures, the students will learn how to make a karyotype, learn how to read a karyotype, and be able to identify conditions and syndromes exhibited by a karyotype. In addition, students will be able to describe symptoms that might be exhibited by these conditions or syndromes.

Additional Learning Outcomes

The students will be able to synthesize and present scientific information. The students will also learn to gain some understanding concerning the complexity of the role of a genetic counselor.

Materials

1. Computers with PowerPoint and Internet access
2. Supplies to create the brochures including construction paper, colored pencils, crayons, and other various art supplies
3. Publishing software such as Microsoft Publisher, Microsoft Word or Works, or Print Shop to create brochures (optional)

Technology Connection

The Internet will be used to access sites on various activities with karyotyping. Students could use desktop publishing software to create their brochures.

Total Duration

3 hours, 30 minutes

Procedures

Step 1

Duration: 1 hour, 15 minutes

Use the “Chromosomal Karyotypes” PowerPoint presentation followed by the “Chromosomal Variations” presentation to teach the subject of cytogenetics, the study of chromosomes and their genetic effects. The students should take notes during the presentations or they can be given handouts of each PowerPoint presentation. A script with detailed content and supplemental information is provided in the notes section of each PowerPoint presentation.

Supplemental Documents

Title: Karyotype PowerPoint Presentation

File Name: [Chromosomal Karyotypes.ppt](#)

Description: This presentation discusses human chromosomes and karyotypes including making a karyotype and analyzing a karyotype.

Title: Chromosomal Abnormalities PowerPoint Presentation

File Name: [Chromosomal Variations.ppt](#)

Description: This presentation describes variation in chromosomal number and the conditions and syndromes that can result from these variations.

Step 2**Duration: 45 minutes**

Discuss notes from the two presentations and make clarifications as necessary. Students can then go through the Web resource to improve their understanding of karyotypes. This interactive site allows students to practice arranging chromosomes, view completed karyotypes, and identify possible abnormalities. This practice activity will not be assessed or graded; however, students can be encouraged to share and compare their results and conclusions.

Web ResourceTitle: Karyotyping ActivityURL: http://www.biology.arizona.edu/human_bio/activities/karyotyping/karyotyping.htmlAnnotation: This site from the University of Arizona's biology project contains a karyotype activity in which patient's karyotypes are completed, variations are determined, and diagnoses are made.**Step 3****Duration: 1 hour, 30 minutes**

As a culminating activity, students will create a brochure that illustrates a chromosomal variation and its resulting condition or syndrome. They will choose one of the aneuploidy variations presented in the "Chromosomal Variations" presentation in Step 1 as their topic. Then, using the Web resource(s) provided for their specific topic, students will create a brochure that could be used in a genetic counseling center. A description of the assignment is included in the "Cytogenetics Brochure" document. For more information about genetic counseling, students can visit the "Genetic Counseling – Human Genome Project Information" Web resource or request example brochures from local genetic counseling centers.

Students could create their brochure using construction paper and art supplies, or they could use desktop publishing software such as Microsoft Publisher, Print Shop, or other available software. The brochures will be evaluated using the rubric included in the "Cytogenetics Brochure" document.

Web ResourcesTitle: Trisomy 13 – National Organization for Rare DiseasesURL: http://www.rarediseases.org/search/rdbdetail_abstract.html?disname=Trisomy%2013%20Syndrome.Description: This National Organization for Rare Disorders site contains a description of Trisomy 13 and organizations related to Trisomy 13.Title: Trisomy 18 – National Organization for Rare DiseasesURL: http://www.rarediseases.org/search/rdbdetail_abstract.html?disname=Trisomy%2018%20Syndrome.Description: This National Organization for Rare Disorders site contains a description of Trisomy 18 and organizations related to Trisomy 18.Title: Down Syndrome (Trisomy 21) – March of DimesURL: http://www.marchofdimes.com/professionals/681_1214.aspDescription: This March of Dimes site contains information about Down Syndrome including description, possible causes, diagnosis, and treatment.Title: Down Syndrome (Trisomy 21) – National Organization for Rare DiseasesURL: http://www.rarediseases.org/search/rdbdetail_abstract.html?disname=Down%20Syndrome3

Description: This National Organization for Rare Disorders site contains a description of Down Syndrome (Trisomy 21) and organizations related to Trisomy 21.

Title: Klinefelter Syndrome (XXY) – American Association for Klinefelter Syndrome Information and Support

URL: <http://www.aaksis.org/bock.cfm>

Description: The American Association for Klinefelter Syndrome provides general information about Klinefelter Syndrome, a description of current research, and other resources.

Title: Turner Syndrome (XXX) – National Institutes of Health

URL: <http://turners.nichd.nih.gov>

Description: This site contains information about Turner Syndrome's genetic and clinical features. In addition, this site provides information about current Turner Syndrome research. It is provided by the National Institutes of Health

Title: Turner Syndrome (XXX) – Turner Syndrome Society of the United States

URL: <http://www.turner-syndrome-us.org/resource/faq.html>

Description: This site, provided by the Turner Syndrome Society of the United States, presents frequently asked questions and answers for basic information about Turner Syndrome.

Title: XYY – California Center for Health Improvement.

URL: <http://www.ddhealthinfo.org/ggrc/doc2.asp?ParentID=5199>

Description: This California Center for Health Improvement site includes information on XYY's description, causes, diagnosis, occurrence, and characteristics.

Title: XYY – Texas Department of Health

URL: <http://www.tdh.state.tx.us/tbdmd/risk/risk26-XYY.ht>

Description: Provided by the Texas Department of Health, this site includes a description of XYY, its diagnosis, and occurrence information. This site also includes an extensive list of references.

Title: Genetic Counseling – Human Genome Project Information

URL: http://www.ornl.gov/sci/techresources/Human_Genome/medicine/genecounseling.shtml

Description: This site contains educational information about the human genome project and is affiliated with the US Department of Energy. This particular page includes a basic description of genetic counseling.

Supplemental Document

Title: Cytogenetics Brochure

File Name: [Cytogenetics Brochure.doc](#)

Description: This document contains the information sheet for the students' creation of their brochure. Also, it contains the rubric that will be used to grade the brochure.

Assessment

Assessment

Students will be evaluated using the “Cytogenetics Brochure” included in Step 3.

Modifications

Extension

The students could create several brochures illustrating various chromosomal variations. The students should follow the exact procedures as given for this lesson plan for each brochure.

Remediation

If students have difficulty with writing and creating a brochure, they could be grouped with students that are stronger in those areas.

Education Standards

National Science Education Standards

LIFE SCIENCE, CONTENT STANDARD C:

As a result of their activities in grades 9-12, all students should develop understanding of

- The cell
- **Molecular basis of heredity**
- Biological evolution
- Interdependence of organisms
- Matter, energy, and organization in living systems
- Behavior of organisms

SCIENCE AND TECHNOLOGY, CONTENT STANDARD E:

As a result of activities in grades 9-12, all students should develop

- Abilities of technological design
- **Understandings about science and technology**

HISTORY AND NATURE OF SCIENCE, CONTENT STANDARD G:

As a result of activities in grades 9-12, all students should develop understanding of

- **Science as a human endeavor**
- **Nature of scientific knowledge**
- Historical perspectives

Georgia State Science Standards

Grade: 9-12, Science, Biology 3

Topic: Nature of Biology

Standard: Explains the significance of biology (e.g. impact on daily life).

Grade: 9-12, Science, Biology 11

Topic: Genetics (Patterns of Inheritance)

Standard: Describes patterns of inheritance and genetic engineering.

Cytogenetics Brochure

Cytogenetics
Dawn Adams, CDC's 2003 Science Ambassador Program



After learning about some chromosomal variations and resulting conditions and syndromes, you are to choose one aneuploidy variation presented in the "Chromosomal Variations" presentation to research. You are going to create a brochure or pamphlet that could be given to a parent seeking genetic counseling for your researched condition or syndrome. Compose your pamphlet as if it will be distributed by the genetic counselors around the country.

Your pamphlet must include the following items. Points are shown for each requirement of the brochure.

Cover with graphic and name of the disorder/syndrome	/10
General description of the disorder/syndrome	/10
Possible causes of the disorder/syndrome	/10
Characteristics of a person with the disorder/syndrome	/10
Possible Web sites or groups to help parents with children who have the disorder/syndrome	/10
Illustrated karyotype for the person with the researched disorder/syndrome /10	
Advertisement that includes a product that could assist someone who has the disorder/syndrome	/10
Total	/70

You may want to visit the following resource to find out more about genetic counseling: Human Genome Project Information. Genetic Counseling [online]. 2004. [cited 2004 March 14]. Available from URL: http://www.ornl.gov/sci/techresources/Human_Genome/medicine/genecounseling.shtml.

Brochures will be shared with classmates. You and five of your peers will share brochures on the due date of the assignment. The sharing portion is not to be graded, but allows students to present their hard work.

Please write your name, section, and date on this description/rubric sheet and attach it to your brochure when handing in assignment.

Graphic's Source: Microsoft Office 2000. Microsoft Office Clip Art Gallery. [cited 2004 Feb 23].