

Teacher Guide: Tour of the Basics Web Quest

ACTIVITY OVERVIEW

Abstract:

Students navigate the *Tour of the Basics* in the *Basics and Beyond* module to complete a web quest to learn basic genetics.

Module:

The Basics and Beyond

Prior Knowledge Needed:

None

Key Concepts:

DNA structure; genes; chromosomes; heredity; proteins; traits

Materials:

Computers with Internet access, student handouts

Appropriate For:

Ages: 10 - 18

USA grades: 5 - 12

Prep Time:

15 minutes

Class Time:

30 minutes

Activity Overview Web Address:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=tourquest>

Other activities in the *Basics and Beyond* module can be found at:

<http://gslc.genetics.utah.edu/teachers/tindex/>

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I. PEDAGOGY

A. Learning Objectives

- Students will learn about DNA structure.
- Students will learn what a gene is.
- Students will learn what a chromosome is and how many are found in human cells.
- Students will learn how proteins encoded by genes provide structure and help the body function.
- Students will learn that parents pass chromosomes to their offspring in a random fashion and the combination of these chromosomes make each offspring unique.
- Students will learn that the interactions between genes determine traits.

B. Teaching Strategies

1. Timeline

- 2-3 weeks before activity:
 - Reserve a computer lab with Internet access
- 1 day before activity:
 - Make copies of the student pages (S-1 –S-2), one for each student
- Day of activity:
 - Take students to the computer lab and pass out student handouts for them to complete

2. Classroom Implementation

- Hand out the *Tour of the Basics* web quest (student pages S-1 – S-2)
- Bring your class to the computer lab and have them log on to:
<http://gslc.genetics.utah.edu/> and click on *The Basics and Beyond* module.
Next, open *Tour of the Basics*.
- Instruct your students to use this module to answer the questions on the *Tour of the Basics (pages S-1– S-2) web quest*.

3. Assessment Suggestions

- Use the completed web quest as an assessment.

4. Extensions

- See Additional Resources for more activities covering basic genetics concepts.

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II. ADDITIONAL RESOURCES

A. Activity Resources linked from the online Activity Overview at:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=tourquest>

- Website: Classroom Activities Index: *The Basics and Beyond* - Online and Print-and-Go™ activities covering DNA structure, heredity, transcription, translation, and protein function.

III. MATERIALS

A. Detailed Materials List

- Computers with Internet access
- Student handouts (S-X – S-Y)

IV. STANDARDS

A. U.S. National Science Education Standards

Grades 5-8:

- Content Standard C: Life Science - Structure and Function in Living Systems; specialized cells perform specialized functions in multicellular organisms.
- Content Standard C: Life Science - Reproduction and Heredity; sexually produced offspring never are identical to either of their parents.
- Content Standard C: Life Science - Reproduction and Heredity; every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.
- Content Standard C: Life Science - Reproduction and Heredity; hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait.
- Content Standard C: Life Science - Reproduction and Heredity; the characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment.

Grades 9-12:

- Content Standard C: Life Science - The Cell; cells have particular structures that underlie their functions.
- Content Standard C: Life Science - The Cell; cells store and use information to guide their functions. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins that each cell requires.

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- Content Standard C: Life Science - The Molecular Basis of Heredity; in all organisms, the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (A, T, C, G).
- Content Standard C: Life Science - The Molecular Basis of Heredity; most human cells contain two copies of each of 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome - and therefore two copies of each gene - explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next.

B. AAAS Benchmarks for Science Literacy

Grades 6-8:

- The Living Environment: Cells - all living things are composed of cells, from just one to many millions, whose details usually are visible only through a microscope. Different body tissues and organs are made up of different kinds of cells.

Grades 9-12:

- The Living Environment: Heredity - the sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents.
- The Living Environment: Heredity - the information passed from parents to offspring is coded in DNA molecules.
- The Living Environment: Heredity - genes are segments of DNA molecules.
- The Living Environment: Heredity - the many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. Different parts of the instructions are used in different types of cells, influenced by the cell's environment and past history.
- The Living Environment: Cells - within every cell are specialized parts for the transport of materials, energy transfer, protein building, waste disposal, information feedback, and even movement. In addition, most cells in multicellular organisms perform some special functions that others do not.
- The Living Environment: Cells - the genetic information encoded in DNA molecules provides instructions for assembling protein molecules.

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C. Utah Secondary Science Core Curriculum

Seventh Grade Integrated Science

STANDARD IV: Students will understand that offspring inherit traits that make them more or less suitable to survive in the environment.

Objective 1: Compare how sexual and asexual reproduction passes genetic information from parent to offspring.

- Distinguish between inherited and acquired traits.
- Compare inherited structural traits of offspring and their parents.

Biology (9-12)

STANDARD IV: Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction. The basic structure of DNA is the same in all living things. Changes in DNA may alter genetic expression.

Objective 2: Predict and interpret patterns of inheritance in sexually reproducing organisms.

- Demonstrate possible results of recombination in sexually reproducing organisms using one or two pairs of contrasting traits in the following crosses: dominance/recessive, incomplete dominance, codominance, and sex-linked traits.

Objective 2: Explain how the structure and replication of DNA are essential to heredity and protein synthesis.

- Use a model to describe the structure of DNA.

V. CREDITS

Activity created by:

Molly Malone, Genetic Science Learning Center

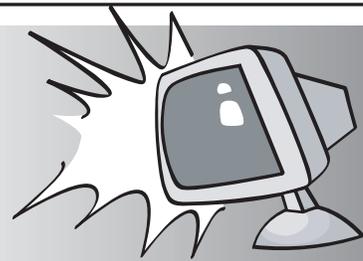
Pete Anderson, Genetic Science Learning Center (illustrations)

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Tour of the Basics Web Quest - Answer Key



Log on to: <http://gslc.genetics.utah.edu/units/basics/tour/>. Explore this activity to find the answers to the questions below.

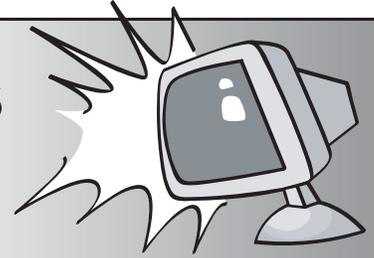
1. What is DNA?
The instructions for building parts of the cell.
2. What does "DNA" stand for?
DeoxyriboNucleic Acid
3. What is the four-letter DNA alphabet and what are the special rules by which the alphabet pieces bind together?
A, C, T, and G. A binds with T, C binds with G.
4. What is a gene?
Genes are instruction manuals for our bodies.
5. What are genes made of?
Genes are made of DNA.
6. How many genes do humans have?
Humans have 25,000 genes.
7. For what molecule do genes contain the instructions for building?
Genes contain the instructions for building proteins.
8. What is a chromosome?
Chromosomes are packages of compact DNA.
9. How many chromosomes does a human cell hold?
Each human cell holds 46 chromosomes.
10. How are the human sex chromosomes labeled?
Sex chromosomes are labeled "X" and "Y".
11. How many different kinds of proteins does one cell contain?
Each cell contains thousands of different proteins.

12. Why do scientists use computer programs to model protein structure and function?
Proteins are very small and hard to see.
13. What provides the “blueprint” for making a protein?
Genes provide the blueprint for making a protein.
14. What is heredity?
The passing of traits from parent to child.
15. Why aren’t children identical to either one of their parents?
Each parent contributes one set of chromosomes to each child. The set of chromosomes is passed on randomly, so each child receives a unique combination.
16. In humans, how many chromosomes does each parent pass on to their offspring?
Each parent passes on 23 chromosomes to their offspring.
17. Does the second baby in the What is Heredity? animation inherit the exact same chromosomes as the first? Do both babies have a complete set?
No, the second baby’s chromosomes are different from the first baby’s. Yes, both babies have a complete set.
18. What is a trait?
A trait is a notable feature or quality in a person.
19. List the types of traits that exist.
There are: physical traits, behavioral traits, and predispositions to medical conditions.
20. Give an example of how an environmental factor can influence a trait.
Answers may include one of the following: exposure to sun or hair dyes can change hair color, you can train retrievers to roll over and play dead instead of fetch, eating healthy foods and exercising can decrease the risk of heart disease.
21. Briefly explain how the Hitchhiker’s Thumb trait is determined using the following words: allele, dominant, recessive, homozygous, heterozygous. You may draw pictures if you wish.

*Answers will vary. Example answer:
If two dominant alleles are inherited, the person is homozygous and will have a hitchhiker’s thumb. If two recessive alleles are inherited, the person is homozygous and will have a straight thumb. If a person is heterozygous, one dominant and one recessive allele are inherited and that person will have a hitchhiker’s thumb.*



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2. *What does "DNA" stand for?*
3. *What is the four-letter DNA alphabet and what are the special rules by which the alphabet pieces bond together?*
4. *What is a gene?*
5. *What are genes made of?*
6. *How many genes do humans have?*
7. *For what molecule do genes contain the instructions for building?*
8. *What is a chromosome?*
9. *How many chromosomes does a human cell hold?*
10. *How are the human sex chromosomes labeled?*
11. *How many different kinds of proteins does one cell contain?*

12. *Why do scientists use computer programs to model protein structure and function?*
13. *What provides the “blueprint” for making a protein?*
14. *What is heredity?*
15. *Why aren’t children identical to either one of their parents?*
16. *In humans, how many chromosomes does each parent pass on to their offspring?*
17. *Does the second baby in the What is Heredity? animation inherit the exact same chromosomes as the first? Do both babies have a complete set?*
18. *What is a trait?*
19. *List the types of traits that exist.*
20. *Give an example of how an environmental factor can influence a trait.*
21. *Briefly explain how the Hitchhiker’s Thumb trait is determined using the following words: allele, dominant, recessive, homozygous, heterozygous. You may draw pictures if you wish.*