DNA at the Dentist

Curriculum-Linked Education Program
Teacher's Kit

This Teacher's Kit offers supplementary materials for the ***DNA at the Dentist*** Education Program. It is designed to be used in your classroom before and after your program booking. We hope it will help you and your students make the most of your visit to the Museum of Health Care.

Please make use of the activities included in this kit as appropriate to your schedule and objectives. If you have any questions about the materials included here or the upcoming visit, please do not hesitate to contact the Museum.

Thank you very much, and we look forward to working with you and your class.

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Curriculum Links

Health and Physical Education
Strand: Healthy Living
Topic: Making Connections to Healthy Living

Overall Expectations
C1 Demonstrate an understanding of factors that contribute to healthy development;
C2 Demonstrate the ability to apply health knowledge and living skills to make reasoned decisions and take appropriate actions relating to their personal health and well-being;
C3 Demonstrate the ability to make connections that relate to health and well-being – how their choices and behaviours affect both themselves and others, and how factors in the world around them affect their own and others' health and well-being.

Science and Technology
Strand: Understanding Matter and Energy
Topic: Pure Substances and Mixtures

Fundamental Concepts: Matter

Big Ideas: Matter can be classified according to its physical characteristics

Overall Expectations: Investigate the properties and applications of pure substances and mixtures

Social Studies
Strands: Change and Continuity, Systems and Structures, the Environment

Fundamental Concepts and Big Ideas:
Systems and Structures – the way humans and nature are organized, causation/cause and effect, community
Change and Continuity – time, cause and effect, human and natural patterns
Environment –human and natural systems and patterns

Pre-visit activities

1. As a class, discuss the role of the dentist. What do they do? How do they help? What kinds of dentists are there (ex orthodontist, periodentist, prosthodentist)?

2. Divide the class into groups of three or four. Each group discusses DNA. What is DNA? Where do we find DNA? How is DNA expressed (ex eye colour)? How can DNA be useful? Come together as a class and share answers.

2.5 Focus on teeth and DNA. How can teeth provide answers as to who you are (think of crime shows that use death to identify people)? All teeth are unique. Think about how skeletons still have teeth, this allows us to identify who's skeleton it is, provided we have their dental records. S

DNA at the Dentist In–Museum Program

Description

Participants conduct an experiment to extract DNA from their saliva. Museum volunteers will lead discussions on the definitions and properties of DNA. A discussion will be held on the double helix structure of DNA, and matching nucleotide pairs. The function of genes, DNA sequence, and why DNA research is important will also be explored.

Educational Outcome

At the end of the visit, participants will be able to:

- Understand some of the developments in dental science over the past 200 years
- Understand the basic structure and make-up of DNA
- Understand how DNA can be extracted from saliva

Length

- Approximately 30 minutes

Post Visit Discussion

Class discussion: who was able to see a change in their saliva-solution? What did you see?

Why were you able to see the DNA?
Answer: Dish soap helps to remove the cell membranes so that the DNA can be exposed. The alcohol removes DNA from the soap-saliva liquid since DNA is unable to dissolve in alcohol.

Why is it beneficial for scientists to study DNA? What can analysis of DNA teach us about human life?

Discuss with the class some of the innovations that have occurred in the field of dentistry.
Possible answers: steam autoclave to sterilize tools, change in materials used to make dentures, toothbrush (from animal hair to synthetic brushes), toothpaste (originally made with abrasive materials like porcelain), and anaesthetic.

Key Words

Vocabulary Word	Definition
Chromosome Pairs	Thread-like pairs containing genetic information that are located inside cells, humans have 23 chromosome pairs, half from each parent.
Deoxyribose Nucleic Acid	Also called DNA, found inside most cells, controls how a cell replicates and functions, and how traits are passed down from generation to generation.
Nucelotide Base Pairs	Comprised of phosphate, sugar and a nitrogen base. Arranged in pairs to form DNA structure. The base pairs are Adenine and Thymine, and Cytosine and Guanine.
Traits	Characteristics inherited from your parents
Double Helix Model	The structure of DNA, made from two coiled strands of nucleotides.
Forensics	The use of science and technology to investigate facts used in courts of law.

Post Visit Activities

Activity One: Constructing a DNA Double Helix Model

In this activity, students can use what they learned at the museum and create their own Double Helix Model.
Activity Found at: http://www.ehow.com/how_6246283_make-3d-dna-model-kids.html

Materials:
4 different colors of thick pipe cleaners – 6 of each color
Scissors
Yarn
Glue
Cardboard box – shoe box size
Pencil
Tape
Pen

1. Fold each pipe cleaner in half and cut at the fold. Determine what color will represent each nucleotide. For example, you could use red for adenine, green for thymine, yellow for cytosine and blue for guanine. Adenine can only form a pair with thymine and thymine only with adenine. Cytosine can only form a pair with guanine and guanine only with cytosine.
2. Fold each of the pieces of pipe cleaners in half. Thread each adenine (red) through a thymine (green) pipe cleaner where they are bent. Hold the open ends of each pipe cleaner and twist to close so the pipe cleaners stay together, leaving ¼ inch of the ends untwisted. Thread each cytosine (yellow) pipe cleaner through a guanine (blue) pipe cleaner. Hold the open ends and twists to close so the pipe cleaners stay together but ¼ inch of each end remains untwisted.
3. Cut two pieces of yarn 12 inches long. Tie a loop at the top of each piece of yarn large enough to insert a pencil. Lay the two pieces of yarn down on a flat surface so they are parallel to each other and the loops are on the top. Lay the pairs of pipe cleaners between the pieces of yarn to create a ladder pattern. Lay each pair approximately ½ apart vertically on the string. Alternate the pairs randomly so that all 4 nucleotide colors appear on both the left and right side of the ladder rungs.
4. Twist the ends of the pipe cleaners around the string to hold in place. Glue if necessary. Set aside to dry. Turn the shoebox on its side so that the long side is vertical. Cut off the small side that is facing up. Insert a pencil into the loops at the top of the DNA model. Hold the DNA model up by the pencil. Tape the

other ends of the yarn to side opposite the side that was cut off. This end of the DNA strand should be securely taped so it won't move. Twist the pencil 3 complete turns and set the pencil across the open top of the box.

-Create a label on the outside of the box for each color of pipe cleaner. Write the name of the nucleotide and glue or tape an example of the appropriate color pipe cleaner next to the name.

Activity Two: Dental Forensics (The Teeth Can Tell)

Activity can be found at: cyberbee.com/whodunnit/teeth.html

Forensic dentists assist in crime solving by studying teeth and teeth impressions. Dental records are often used to identify people. Because teeth are one of the hardest substances in the human body, they are frequently well preserved. Dental x-rays or records showing fillings, position of teeth, etc. can help forensic dentists find a match of teeth to the individual. Eighty percent of the time teeth impressions are used to identify unknown victims.

As a forensic dentist you will have the chance to match teeth impressions to discover who took the bite.
The procedures for making teeth impressions are:

1. Divide the Styrofoam plate into six equal wedges. Cut the wedges.
2. Take two of the wedges and stack them together. Cut off 1 inch from the pointed end of the wedges.
3. Place the two wedges into your mouth as far as possible.
4. Bite down on the wedges firmly and then remove them. Label the top and bottom wedges Top Teeth and Bottom Teeth.
5. Study the teeth impressions. Count the number of teeth in the top and bottom impressions. What other characteristics of the impressions do you notice? Compare the top teeth impressions to the bottom. Are there teeth missing, spaces, chips, etc.?

Activity Three: Forensics on Television

Watch an episode of Crime Scene Investigation, or a similar show about forensics, with the class. Note: Watch the episode ahead of time to ensure that the content is appropriate for the age of the group. Ask students to write a paragraph response on the role of DNA in the investigative process.

Prompts for the students to consider:

1. How was the DNA collected from the crime scene? How was it analyzed?
2. What conclusions did the forensics team arrive at, as a result of their analysis of the collected DNA?
3. Do you think the forensic process and DNA analysis was portrayed accurately in this television show? Why or why not?

Self Evaluation and Reflection

Name: _____

Learning Skills
N - Need improvement S - satisfactory work G - good work E - excellent work

Independent Work
- ❑ worked well without supervision N S G E
- ❑ followed rules and instructions independently N S G E

Initiative
- ❑ responded to a new situation or challenge N S G E
- ❑ showed interest in the activity and a willingness to learn N S G E

Use of Information
- ❑ asked questions to clarify meaning and ensure understanding N S G E

Cooperation
- ❑ showed positive relationships with other students N S G E
- ❑ helped others N S G E
- ❑ shared in cleaning duties after an activity N S G E

Conflict Resolution
- ❑ resolved conflicts in socially accepted ways N S G E
- ❑ assisted others to resolve conflicts appropriately N S G E

Class Participation
- ❑ willingly worked with a new grouping N S G E
- ❑ took responsibility for my share of the work N S G E
- ❑ encouraged others to participate N S G E

Problem Solving
- ❑ applied successful strategies to new problem situations N S G E

What I did best during this activity	**What I need to improve on and how I will achieve that goal**
What I liked best about the activity and why I liked it	**What I would change about the activity if given the opportunity**
Something new I learned	**What I would like to learn more about**

Teacher Resources

DNA Model Activity
http://www.ehow.com/how_6246283_make-3d-dna-model-kids.html

How to make a model of a DNA double helix.

Kids' Health - Genes
http://kidshealth.org/kid/talk/qa/what_is_gene.html

Information on the structure and function of genes, including information on heredity and genetic disorders.

The Discovery of the Molecular Structure of DNA – The Double Helix
http://www.nobelprize.org/educational/medicine/dna_double_helix/readmore.html

The discovery of the double helix structure of DNA.

Teeth Impressions Activity
http://www.cyberbee.com/whodunnit/teeth.html

Website for the "Teeth Can Tell" dental forensics activity.