THE SCIENCE OF FRINGE

EXPLORING: FINGERPRINT FORENSICS

A SCIENCE OLYMPIAD THEMED LESSON PLAN
SEASON 2 - EPISODE 20: **BROWN BETTY**

Overview:
Students will learn about fingerprints and how they can be collected and used as evidence to identify an individual.

Grade Level: 9–12

Episode Summary:
As Walter frets about trying to find Peter, Olivia asks him to help babysit her niece Ella while she follows some leads. Walter tells Ella a story loosely based upon reality in which Olivia is a private investigator hired to track down Peter, who has allegedly stolen a special glass heart. During the course of the investigation Olivia and her partners must use various forensic techniques to solve a murder, identify various people involved in the case, and ultimately ensure that the heart ends up with its rightful owner.

Related Science Olympiad Event:
Forensics - Students will identify polymers, solids, fibers, and other materials in a crime scenario.

Learning Objectives:
Students will understand the following:
- Forensics often involves the collection of minute pieces of evidence such as fingerprints.
- Fingerprints contain unique features that allow them to identify the person they came from.
- It is easy to capture a fingerprint either directly from a finger or left behind on a surface.

Episode Scenes of Relevance:
- Olivia and Broyles discussing the evidence left at the murder scene.
- Astrid helping Olivia identify the weapon that was used to attack her.
- View the above scenes: http://www.fox.com/fringe/fringe-science

Online Resources:
- Fringe “Brown Betty” full episode: http://www.fox.com/watch/fringe
- Science Olympiad Forensics event: http://soinc.org/forensics_c
- FBI Fingerprint Identification overview: http://www.fbi.gov/hq/cjisd/ident.htm
- The Science of Fingerprints EBook: http://www.gutenberg.org/etext/19022
- The Fingerprint Society: http://www.fpsociety.org.uk/
- National Institute of Standards and Technology fingerprint research: http://fingerprint.nist.gov/

Procedures:

1. Tell your students that they are going to learn about fingerprints and how they can be recorded and used to identify an individual.
2. Have your students research fingerprints and evidence collection in resources such as anatomy textbooks and law enforcement organizations' websites and discuss what they have learned.
3. Divide your class into groups. Have each group complete the following activity:
    a. Materials: blank index cards, pencils, clear scotch tape
    b. Rub the pencil on a 1 inch square spot on the index card so that the spot is completely covered with pencil marks
    c. Tear off several pieces of tape, each approximately 2 inches long.
    d. Each student should strongly press their left index finger against the dark spot to transfer some pencil lead to their finger.
    e. Next they should strongly press their finger to the sticky side of one of the tape pieces.
    f. Finally, apply the tape to another blank index card such that the fingerprint is easily viewable.
    g. Each student should repeat this process with their right index finger and place the tape on the same index card.
    h. Observe the fingerprints on the cards and write down next to each one the main types of features that are present.
    i. Compare the various fingerprints amongst the team members to see the variations that are present.
4. Discuss with the class the process of obtaining the fingerprints and the features present. Be sure to address:
    a. The relative ease of creating the fingerprints
    b. The three main types of patterns: arches, loops, and whorls
    c. The various types of ridge features, such as bifurcation, ending, crossover, and island
    d. The fact that the left and right fingerprints can be very different

Additional Discussion Suggestions:

- Bring in your own 'baby fingerprints' from a ceremonial birth certificate and let the class compare them to your current fingerprints.
- Have someone use the same process to create toe prints and see that they also show unique characteristics.
- Discuss the many ways in which people often have their fingerprints officially recorded, such as at birth, during 'ident-a-kid' programs, when cashing a check at a bank, during background checks, or when arrested by the police.

Extension to Other Subjects:

History: Research the history of fingerprints as a means of identification, going all the way back to the Babylonian empire in ~1900 BC.

Mathematics: Tally up the number of arches, loops, and whorls in the classroom. See how their relative distribution compares to the general population's distribution, which is ~65% loops, ~30% whorls, and ~5% arches.

Social Studies: Fingerprints are often the primary piece of evidence linking a suspect to a crime. Review recent several cases in the news and discuss how fingerprints played a role in the investigation. What other forensic evidence was found and how does it support or refute the conclusions of the fingerprint evidence?

National Science Standards Alignment:

A. Science as Inquiry – Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

H.A.1 Abilities necessary to do scientific inquiry

c. Use technology and mathematics to improve investigations and communications.

d. Formulate and revise scientific explanations and models using logic and evidence.

f. Communicate and defend a scientific argument.

U. Unifying Concepts and Processes – Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.

H.U.2 Evidence, models, and explanation

a. Evidence–Evidence consists of observations and data on which to base scientific explanations. The goal is to help students use evidence to understand interactions and predict changes.

c. Explanations–Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories. The goal is to help students create explanations which incorporate a scientific knowledge base, logic, and higher levels of analysis.