

## THE SCIENCE OF “FRINGE”

### EXPLORING: BONES

A SCIENCE OLYMPIAD THEMED LESSON PLAN  
EPISODE 312: **CONCENTRATE AND ASK AGAIN**

**Overview:**

Students will learn about bones and the nature of their chemical and physical composition.

**Grade Level:** 9-12

**Episode Summary:**

The Fringe team investigates a victim who was exposed to a blue cloud of smoke that resulted in all of his bones dissolving. The team quickly realizes that a specialized chemical warfare agent is being utilized and works to identify the culprits and additional targets before they are attacked.

**Related Science Olympiad Event:**

Anatomy & Physiology - This event encompasses the anatomy and physiology of selected body systems, this year limited to respiratory, muscular and endocrine systems.

**Learning Objectives:**

Students will understand the following:

- Bones are rigid organs comprised mainly of a dense connective tissue.
- Bone is made of a bone matrix that has inorganic and organic parts.
- Some diseases, such as osteoporosis, result in reduced bone mineral density.

**Episode Scenes of Relevance:**

- Warren being exposed to the blue smoke (5:11 ‘thanks Grace’ – 6:07 ‘screams’)
- Astrid and Walter analyzing the chemical agent (8:58 ‘thousands of people’ – 9:45 ‘into the host’)



## Online Resources:

- Fringe “Concentrate and Ask Again” full episode: <http://www.fox.com/watch/fringe>
- Science Olympiad Anatomy & Physiology event: [http://soinc.org/anatomy\\_physiology\\_c](http://soinc.org/anatomy_physiology_c)
- American Society for Bone and Mineral Research:  
<http://www.asbmr.org/Education/BoneCurriculum.aspx>
- Bone biology for kids: <http://depts.washington.edu/bonebio/>
- National Osteoporosis Foundation: <http://www.nof.org/>

## Procedures:

1. Tell your students that they are going to learn about bones and what can impact their composition.
2. Have your students research bones in resources such as biology textbooks and websites and discuss what they have learned.
3. Divide your class into groups. Have each group complete the following activity:
  - a. Materials: cups, chicken bones, vinegar, water, protractor
  - b. Thoroughly clean the chicken bones
  - c. Use the protractor to measure how much the bone can bend with minimal force. Record the result.
  - d. Put vinegar in a cup and completely submerge the chicken bone.
  - e. After 1 day, remove the bone and measure how much it can bend again.
  - f. Return the bone to the vinegar and let sit for another day.
  - g. Repeat the process of measuring bendability and soaking in vinegar for a total of 5 days.
  - h. Make a chart showing how much the bone could bend versus elapsed days.
4. Discuss with the class the results of the activity. Be sure to address:
  - a. Do the results differ for different size chicken bones?
  - b. Are there any other physical properties of the bone that changed, such as weight?
  - c. What causes the bubbles that came off of the bone while in the vinegar?

## Additional Discussion Suggestions:

- How does what happened to the chicken bone compare to the process of osteoporosis in humans?
- If the flexible chicken bones were immersed in a calcium rich solution for a period of time would they return to their original state?
- What possible things could be done to the chicken bone to make them harder and more brittle as opposed to softer and more flexible?

## Extension to Other Subjects:

Social Sciences: Average bone mineral density varies by ethnicity. Research what the differences are and discuss possible reasons for them.

History: Anthropologists often only have skeletons to analyze for clues about a civilization. What types of things can a researcher tell about a person from their bones?

Art: Ivory is a dense tissue similar to bone that has been used for art for centuries but is currently trade restricted due to poaching. Research some of the more common artistic uses of ivory and why it is such a popular medium.

## National Science Standards Alignment:

C. Structure and function in living systems

M.C.1 Structure and function in living systems

- e. The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.