THE SCIENCE OF “FRINGE”

EXPLORING: PHARMACOLOGY

A SCIENCE OLYMPIAD THEMED LESSON PLAN
EPISODE 310: **THE FIREFLY**

Overview:
Students will learn about pharmacology and the interactions that occur between a living organism and chemicals that affect normal or abnormal biochemical functions.

Grade Level: 9-12

Episode Summary:
The Fringe team discovers that the Observer has returned and is directly involved in a series of incidents, including an old man being visited by his long dead son and a woman saved during a jewelry store robbery. Meanwhile, Walter is working on creating special chemicals that will help him become smarter. The incidents end up being an elaborate chain reaction of events that result in Peter ingesting the chemicals to near disastrous results.

Related Science Olympiad Event:
Chemistry Lab - Teams will demonstrate chemistry laboratory skills related to selected topics.

Learning Objectives:
Students will understand the following:

- Pharmacology is the study of drugs, of the reactions of the body and drug on each other, the sources of drugs, their nature, and their properties.
- Many different parameters can affect the extent and rate of absorption, distribution, metabolism and excretion of a drug.
- The majority of drugs mimic or inhibit normal physiological, biochemical or pathological processes.

Episode Scenes of Relevance:

- Roscoe and Walter discuss the process of ‘mind mapping’ (20:55 ‘ what is all this’ – 22:02 ‘disguise the taste’)
- Walter and Olivia rush to inject an antidote in Peter (40:22 ‘ Peter’s collapsed’ – 41:29 ‘quickly’)

FOX CODE
FOR SMARTPHONES

Online Resources:

- Fringe "The Firefly" full episode: http://www.fox.com/watch/fringe
- Science Olympiad Chemistry Lab event: http://soinc.org/chemistry_lab_c
- U.S. Pharamacopeia: http://www.usp.org/
- Wikipedia page on Pharmacology: http://en.wikipedia.org/wiki/Pharmacology

Procedures:

1. Tell your students that they are going to learn about pharmacology.
2. Have your students research pharmacology and drug discovery 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: Various antacid tablets such as Tums and Alka-Seltzer, beakers or glasses, hot water, ice, stirring sticks, stopwatches
    b. For each type of antacid tablet available, prepare a beaker of hot water and a beaker of ice water.
    c. Drop the tablets into the beakers and start the stopwatch.
    d. While stirring, watch the tablet dissolve. Note the elapsed time when each tablet completely dissolves.
    e. Make a chart showing the relationship between water temperature and tablet dissolving rate.
4. Discuss with the class the results of the activity. Be sure to address:
    a. Which brand of tablet dissolved the fastest? Is there something special about that tablet that caused it to be faster?
    b. What general impact did the temperature of the water have on the rate of dissolving?
    c. What would the rate be if boiling water were used?
    d. How does this relate to the effectiveness of an antacid when in your stomach?

Additional Discussion Suggestions:

- Water is at a neutral pH, while the stomach is normally acidic. What is it that antacids actually do in an acidic environment?
- Drugs come in many physical forms, including tablets, capsules, patches, and liquids. What impact does each of these forms have on the interaction of the medication with the body?

Extension to Other Subjects:

Social Sciences: The abuse of prescription drugs use is a major problem in society. Why is it that some medications are more likely to be abused and what are the dangers drug abusers face?

History: The discovery of penicillin is a famous historical moment. What were the circumstances surrounding it and why do historians view it as such a significant event?

Literature: Strange side-effects of medications are often the key plot device in popular movies and novels. Research some examples and discuss whether or not they have any basis in reality.

National Science Standards Alignment:

H.B.3 Chemical reactions

a. Chemical reactions occur all around us, for example in health care, cooking, cosmetics, and automobiles. Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our bodies.

b. Chemical reactions may release or consume energy. Some reactions such as the burning of fossil fuels release large amounts of energy by losing heat and by emitting light. Light can initiate many chemical reactions such as photosynthesis and the evolution of urban smog.

c. A large number of important reactions involve the transfer of either electrons (oxidation/reduction reactions) or hydrogen ions (acid/base reactions) between reacting ions, molecules, or atoms. In other reactions, chemical bonds are broken by heat or light to form very reactive radicals with electrons ready to form new bonds. Radical reactions control many processes such as the presence of ozone and greenhouse gases in the atmosphere, burning and processing of fossil fuels, the formation of polymers, and explosions.

d. Chemical reactions can take place in time periods ranging from the few femtoseconds (10-15 seconds) required for an atom to move a fraction of a chemical bond distance to geologic time scales of billions of years. Reaction rates depend on how often the reacting atoms and molecules encounter one another, on the temperature, and on the properties– including shape–of the reacting species.

e. Catalysts, such as metal surfaces, accelerate chemical reactions. Chemical reactions in living systems are catalyzed by protein molecules called enzymes.