

Here Come the Judge: Drug Testing Urine and Hair

Target audience: 9-12

Background and Notes:

For many employers today, job applicants must undergo drug testing. One company's drug policy states that all applicants must be drug free for at least six months prior to application. Applicants are often subjected to hair sample and urine analysis tests.

Hair grows approximately 1 cm / month. Drugs are molecules that can be attracted to the melanin in the hair by chemical bonding and intermolecular forces of attraction. Metabolites found in hair denote drug use at that time. Overall binding to the entire hair shaft denotes secondary exposure, as possibly at a party of concert where drugs are present. Eating poppy seeds may give a false positive result because they contain trace amounts of opiates that can be detected in urinalysis.

Knowledge and skills:

- The basic structure of hair and how drugs can bind to the melanin in the hair via chemical bonding and intermolecular forces of attraction.
- Students should be able to analyze data and reach a conclusion about a person's exposure or use of drugs.

Fundamental understanding:

- Certain drugs such as opiates and marijuana can bind to the hair and be detected months after drug use or exposure.
- This binding is due to the characteristics of the drug molecules and the hair structure at the molecular level i.e. bonding and intermolecular forces due to polarity, charge and geometry of molecules.

Essential Questions:

- What does chemistry have to do with drug and hair interaction? Students need to understand binding (chemical bonds) and binding sites in addition to intermolecular forces of attraction.
- What are the ethics of drug testing and its implications?

National standard (s):

- National content standard C: As a result of activities students should develop an understanding of the cell, molecular basis of heredity, biological evolution, interdependence of organisms, matter, energy and organization in living systems and behavior of organisms.

State standard(s):

- 1.02 and 1.07 Objectives for North Carolina Chemistry Standard Course of Study Objective: Bond Polarity and molecular polarity, including intermolecular forces in order to explain polarity
- 1.01a Objectives for North Carolina Biology Standard Course of Study Chemical processes and regulatory mechanisms of cells
- 1.01b Objectives for North Carolina Biology Standard Course of Study Objective: Bonding patterns.

Purpose: Based on what you have learned about how drugs enter and exit the body and how drugs bind to the melanin in hair, study each applicant's profile and identify applicants who **could be proven** ineligible for employment. Students will analyze a data sheet about different individuals after drug testing and decide whether to hire the person or not.

Materials:**Data Sheet****Profiles:**

- a) White male, 30, alopecia (no hair at all), eats poppy seed muffins almost every day.
- b) Asian male, 24, black hair, 3 cm long, overall binding of entire hair shaft.
- c) Black male, 27, shaved head, eats poppy seed bagels every day.
- d) Hispanic female, 22, auburn hair, 40 cm long, metabolites found 3 cm from root.
- e) White female, 36, dark brown hair, 36 cm long, metabolites found last 20 cm of hair.
- f) White female, 37, prematurely fully gray hair, 22 cm long. Negative urine test.
- g) Black female, 31, albino, hair 28 cm long, eats poppy seed muffins everyday.
- h) White male, 29, blond hair 30 cm long. Smokes cigarettes.

Questions:

- a) Who (if any) were proven drug users during the past 6 months?

- b) What should policy makers know about these tests' results in order to make fair interpretations?
- c) What are the ethical implications of mandatory drug testing?
- d) If you were the employer making the hiring decisions would you eliminate anyone else on this list? (If so, is it legal for you do so?)

Assessment:

Consider the following information and re-examine your applicant list and determine if you would eliminate any additional persons from your hiring list. For each individual, A-H, write a statement of available for hire or not to hire and give reasons for those not to be hired based on drug usage.

References and Resources:

College or High School Biology Textbook
Schwarz-Bloom, Rochelle, Pharmacology Education Project,
<http://www.duke.edu/~schwa001/scienceeducation.htm>

Teacher Notes:

Make available information on hair structure and how molecules i.e. drugs or medicines travel through the blood to reach the hair.

The activity can be used in a group setting or for individual students. The truth table application may be used for those students who have difficulty keeping trace of several facts at one time.

The positive test for opiates after eating poppy seeds should last about 3-5 days. The applicant could be asked to avoid eating poppy seeds and return in five days for re-testing.

Hair for drug testing is usually taken from the head but can be taken from any part of the body.

Additional results:

A, C, G were re-tested. A and C were negative urinalysis and G tested positive

Optional:

When you have numerous facts to consider it is sometimes easier to draw conclusions based on a truth table. This is just a way to organize ones thinking. You should list all the fact you know, then draw conclusions.

Truth Table

Individual	Hair	Urinalysis results	Hair results	Preliminary conclusion	Actions taken	Results	Conclusions (hire/no hire)
A	Alopecia	+ poppy seed			Retest 5 days	- urinalysis	
B	Black hair 3 cm long	-	+ Overall binding				
C	Shaved head	+ poppy seed			Retest take hair from body	Trace in hair, - urine	
D	Auburn hair	?	+ 3 cm from root				
E	Brown hair 36 cm	?	+ last 20 cm				
F	gray	-	-				
G	albino	+ poppy seed			retest	+ urine	
H	blond			smokes			