

[http://www.pfizer.com/brain/teachers\\_html.html](http://www.pfizer.com/brain/teachers_html.html)

## **A Healthy Brain – Caffeine?**

**Subjects:** life sciences, mathematics, language arts

**Grades:** 6 - 8

**Concepts:** predicting, data collecting, comparing, classifying, reasoning, communicating

**Duration:** several 30- to 60-minute and 10- to 15-minute class sessions

**Objectives**

Students will discover that...

caffeine is a drug that interferes with normal brain and body functions.

quitting caffeine consumption causes withdrawal symptoms.

### **Background Information**

Think about all you've had to eat or drink today. Is chocolate, coffee, tea or soda on the list? All these things contain caffeine. Caffeine is a drug that changes the way your brain and body work. People like it because it makes them feel energetic and happy. But it also interferes with concentration and makes some people short-tempered. How does caffeine do all these things?

Caffeine is a stimulant that acts on your brain in several ways. First, it makes neurons (nerve cells) more active. In response, the adrenal glands produce adrenaline (also called epinephrine). Your heart races, your muscles tense, your airways open and blood vessels constrict. You're on the alert.

Because it's a stimulant, caffeine causes insomnia. Throughout the day, the activity of your nerve cells (with or without caffeine) produces a by-product called adenosine. In a caffeine-free brain, as adenosine builds up, it binds to neurons and slows them down. When adenosine build-up reaches certain levels, you get sleepy. But in a brain under the influence of caffeine, the caffeine binds to the neurons instead, blocking the action of adenosine. The result: there's no adenosine build-up and you can't go to sleep.

Caffeine also stimulates the brain to release another chemical called dopamine. Dopamine is a neurotransmitter when released from one neuron it stimulates an adjacent neuron to fire. Caffeine causes neurons in a part of the brain called the 'pleasure center' to release dopamine, bringing out feelings of pleasure and euphoria. This is why many people feel happy after drinking coffee.

Some scientists believe caffeine causes physical dependence because of its withdrawal symptoms. As caffeine levels drop, blood vessels dilate, causing headaches as excess blood flows into the brain. (Some headache relievers and cold medicines contain caffeine to reverse this process.) In addition, dopamine levels in the brain's

## **Activity**

### *Materials*

paper and pencil

reference books, Internet access and/or other research materials

1 copy of the caffeine tables per students (see below)

1 journal per student

reward or prize for each student

posterboards and markers (optional)

### *Questions to Begin*

How many of you ingest caffeine, either in drinks or food?

How many sodas do you drink a day? How much chocolate do you eat?

Do you ingest a lot of caffeine, a little caffeine or no caffeine each day?

### *Procedure*

1. Hand out a copy of the caffeine content chart to each student. Review it for common sources of caffeine and the amounts of caffeine each contains.
2. For the next 3 days, have students keep track of everything they eat or drink that contains caffeine. Beside each item, have them write down the serving size and the amount of caffeine that item contains. Allow 10- to 15-minutes on days 2, 3 and 4 for students to calculate their previous day's caffeine intake.
3. At the end of the third day, have students form teams of 3 or 4. Explain that the next day (day 4) team members will conduct an experiment—they will go without caffeine for 24 hours, starting when they wake up. Have each student sign a team pledge that they will not cheat, and will help each other avoid caffeine. Explain that there will be a reward for all that complete the experiment.
4. During class on day 4, allow two 10- to 15-minute sessions (one in the morning and one in the afternoon) for students to note any symptoms they have from caffeine withdrawal.
5. On the morning of day 5, allow one more note-making session. Have students include how they felt when they resumed ingesting caffeine (if they did). When students are finished, ask volunteers to share their notes.
6. Assign a research project: team members will work together to research the effects of caffeine on the brain and body. Allow two or three 30- to 45-minute class sessions for students to conduct their research.
7. Publish a class website or have each team prepare a poster about caffeine's effects on the brain and body.

## **Caffeine Content of Some Drinks and Foods**

Item  
Serving Size  
Caffeine Content (mg)

Coffee—regular  
7 oz.  
100 - 175

Espresso  
2 oz.  
100

Tea  
7 oz.  
40 - 80

Jolt Cola  
12 oz. can  
71

Mountain Dew  
12 oz. can  
55 (0 in Canada)

Surge soda  
12 oz. can  
51

Cola (most brands)  
12 oz. can  
35 - 48

Chocolate brownie  
2.5 oz.  
16

Chocolate ice cream  
4 oz.  
5 - 10

Chocolate milk  
7 oz.  
2 - 7

Coffee—decaffeinated  
7 oz.  
2 - 5

Hot cocoa mix  
1 packet  
1 - 8

Chocolate bar (most brands)

1 bar  
2 - 12

Chocolate chip cookie

1 oz.  
3 - 5

Frozen chocolate pudding bar

1 bar  
2

7-Up

12 oz. can  
0

Root Beer (most brands)

12 oz. can  
0

### *Questions to Close*

In general, what kinds of foods contain caffeine?

How much caffeine do you ingest in a day? How can you avoid caffeine in your diet?

How do you feel shortly after you eat or drink something that contains caffeine?

What are caffeine's main effects on the brain?

What happens when a person gives up caffeine?

What would you say to someone who drinks sodas every day at breakfast, lunch and dinner?