

The Elixir of Energy: Caffeine, and the Myth Behind It

Mornings are always a struggle. You sit at the kitchen table, droopy-eyed, with your head almost falling into your bowl of cereal. Seems familiar? You've seen adults sipping on the magic potion that keeps them fully alert. Coffee, one of the most popular drinks around the world, has long established itself as a necessity in people's daily lives.



In addition to coffee, many other drinks can have a similar, stimulating effect. Soft drinks like Pepsi, energy drinks like Red Bull, etc., are also very effective at keeping you alert and active for hours. What do all these drinks have in common? They all possess the secret ingredient—**caffeine**.

Without Caffeine—why do we feel tired?

Throughout the body, we can find a special type of web-like cell called a **neuron**. Connected in a chain-like fashion, they relay messages from different parts of the body to the brain, the command center of the body. The brain interprets the message and triggers an appropriate response. Neurons fire countless messages to the brain per second to keep us thinking, moving, and functioning. When neurons fire in our brain over time, a chemical called adenosine builds up. Adenosine is the “tired” chemical that makes us want to go to sleep. Our neurons rest and activate based on the level of adenosine in our body, and they do that by having adenosine **receptors**.



Neuron

Think of these receptors as sensors on the surface of the cell that detect the presence of a specific molecule, called a **ligand**. When a receptor and its ligand bind, a message is transmitted into the cell and a response is generated. In our case, adenosine binding to its receptor would create a message that says “there are too many adenosine molecules built up outside, it's time to slow down!” and our neuron would respond by firing at a slower pace. Now zooming out from a single neuron's perspective to our everyday life, we experience this effect as tiredness.



Adenosine binding to its receptor

Caffeine: a molecule found in many types of plants that makes us feel awake. It is a component of coffee, a popular drink.

Receptor: a receptor is often found on the surface of a cell and is able to recognize a specific ligand, triggering a response.

Ligand: a molecule that can bind to a receptor, which leads to a response.

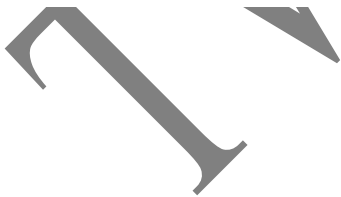
With Caffeine

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Competitive inhibition: describes the scenario where the binding of one molecule to a receptor blocks the binding of another molecule

Adrenaline: fight-or-flight hormone that keeps us awake, excited, and alert, particularly in response to stress or activity.

Caffeine side effects:

A person with caffeine in his or her body can be jittery, have an increased heart rate, get headaches and/or stomach aches, and feel dehydrated—but it's important to remember everyone reacts



differently. Consumption of caffeine can also disrupt the sleep cycle, leading to insomnia (difficulty falling or staying asleep, and waking up feeling tired). Although sometimes unpleasant, caffeine's effects are not likely to be harmful. Scientists have found out that around 10 grams (between 80-100 cups!) of caffeine in the adult body is lethal (Neuroscience for Kids—Caffeine, n.d.). Though there is some controversy, it's not necessarily considered unhealthy to consume about 4 cups of coffee per day (Caffeine: How much is too much?, 2014).

Coffee is not recommended for kids, and doctors advise adolescents to consume under 1 gram of caffeine (1 cup of coffee) per day (Caffeine: How much is too much?, 2014). People with anxiety disorders, heart conditions, or other health concerns, or are taking certain medications, are not advised to drink a lot of coffee (Caffeine in the diet, 2015). Caffeine is, though, considered a drug, and can become addictive. So while it's okay to enjoy that new Starbucks latte or just a plain cup of coffee, it's important to monitor our caffeine habits and, of course, to understand the science behind it.

Reading Comprehension Questions

1. What is caffeine?
2. What is the role of a neuron?
3. Describe
4. What
5. What is competitive inhibition? How does it relate to caffeine and adenosine?
6. How
7. What is adrenaline?
8. Why do we feel more tired than usual a few hours after consuming caffeine? How does this relate to the amount of adenosine in the body?

Extension Question

9. If you were a doctor, how would you advise a patient on caffeine use? Why? Focus on/research how caffeine relates to sleep, energy, medication, and other health aspects.
 - a) If the patient were a child ...
 - b) If the patient were between 12-17 years old ...
 - c) If the patient was an adult ...

10. Perform some research

Reading Comprehension Questions

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