

Caffeine Toxicity

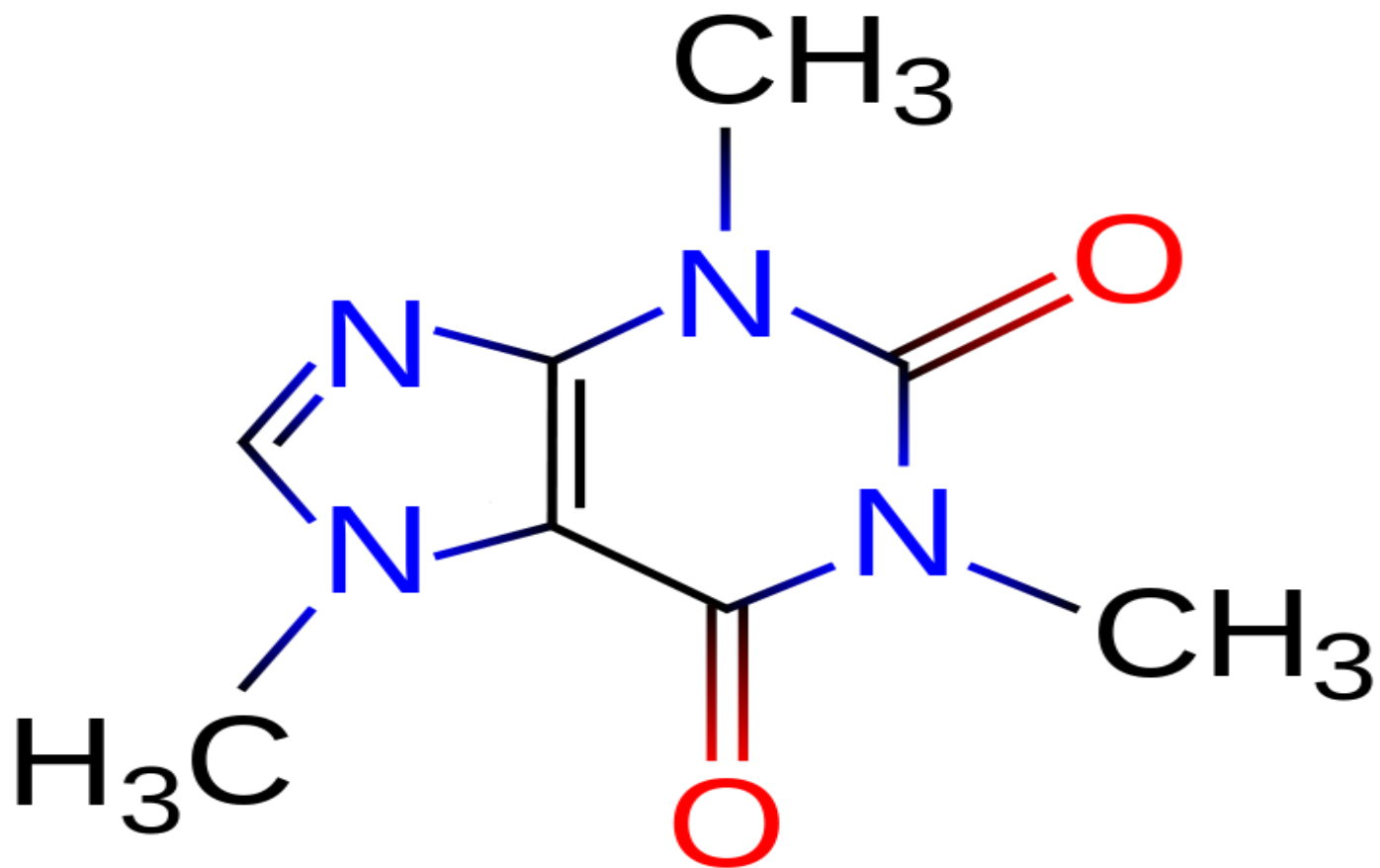
Caffeine (1,3,7-trimethylxanthine) is a purine alkaloid that occurs naturally in coffee beans.

Some physiological effects associated with caffeine administration include central nervous system stimulation, acute elevation of blood pressure, increased metabolic rate, and diuresis.

Caffeine is rapidly and almost completely absorbed in the stomach and small intestine and distributed to all tissues, including the brain.

It is found in varying quantities in the seeds, leaves fruits of some plants, where it act as a natural pesticide.

Beverage containing coffee such as coffee, tea , soft drinks, & energy drinks.



Caffeine's primary mechanism of action is as an antagonist of adenosine receptors in the brain.

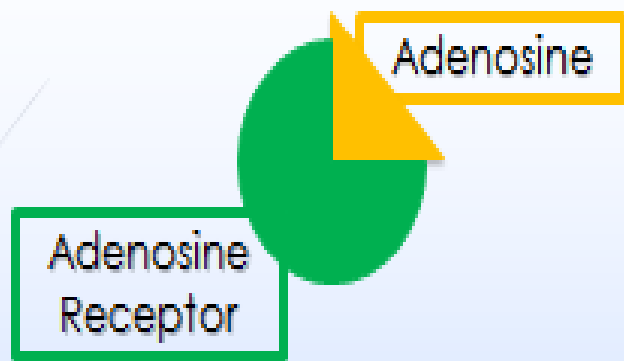
Adenosine in the Brain

In the brain neurons are transmitting electrical energy.

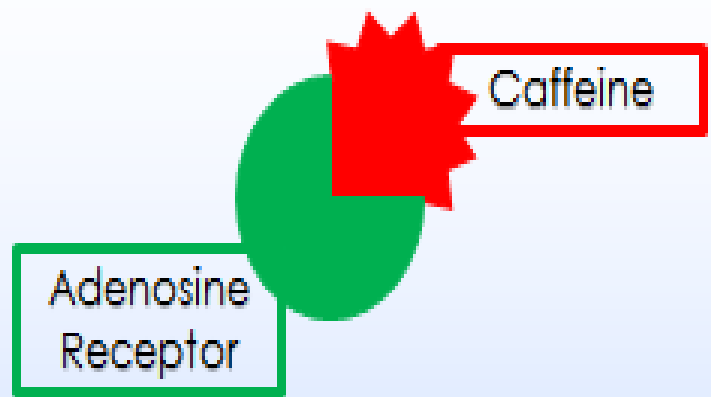
When activity is too high adenosine molecules stop the neuron cells from firing.

➤ Caffeine blocks adenosine receptors with its own molecule preventing the adenosine molecule from binding.

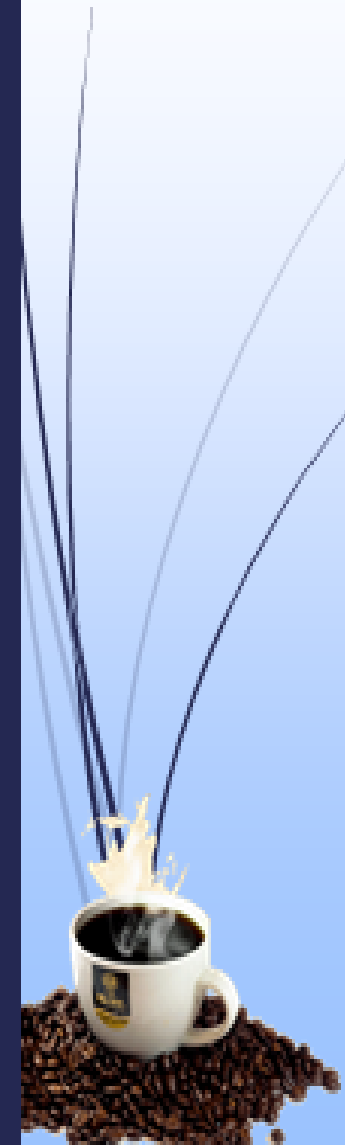
➤ Brain activity remains at its excited state and can even increase in activity because adenosine is unable to slow it down.



The binding of Adenosine to an adenosine receptor causes the receptor to undergo a shape change which triggers a biochemical cascade. The end result is the opening of ion channels and the slowing of activity.

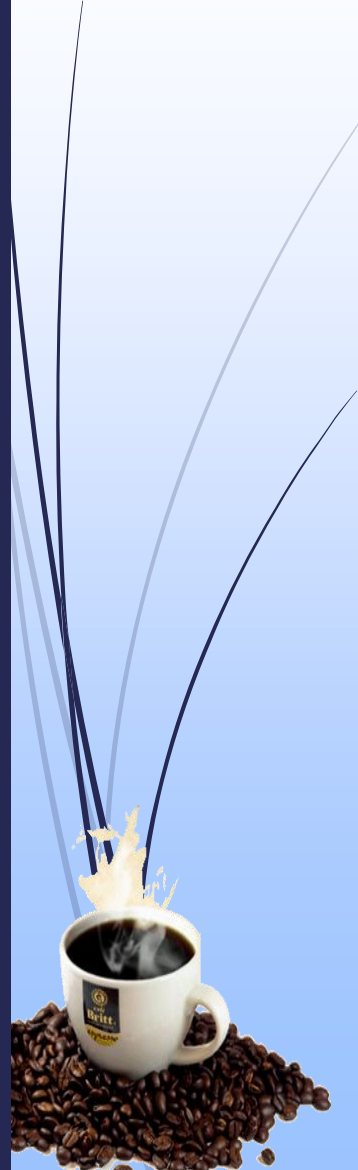


The binding of caffeine to a adenosine receptor causes a shape change that does not initiate a biochemical cascade. Instead, neuronal activity remains the same or increase.



Caffeine Metabolism

- Caffeine is metabolized in liver results into three metabolic dimethylxanthines, each of which has its own effects on the body:
 - **Paraxanthine** : Increases lipolysis, leading to elevated glycerol and free fatty acid levels in the blood plasma.
 - **Theobromine** : Dilates blood vessels and increases urine volume.
 - **Theophylline** : Relaxes smooth muscles of the bronchi, and is used to treat asthma.



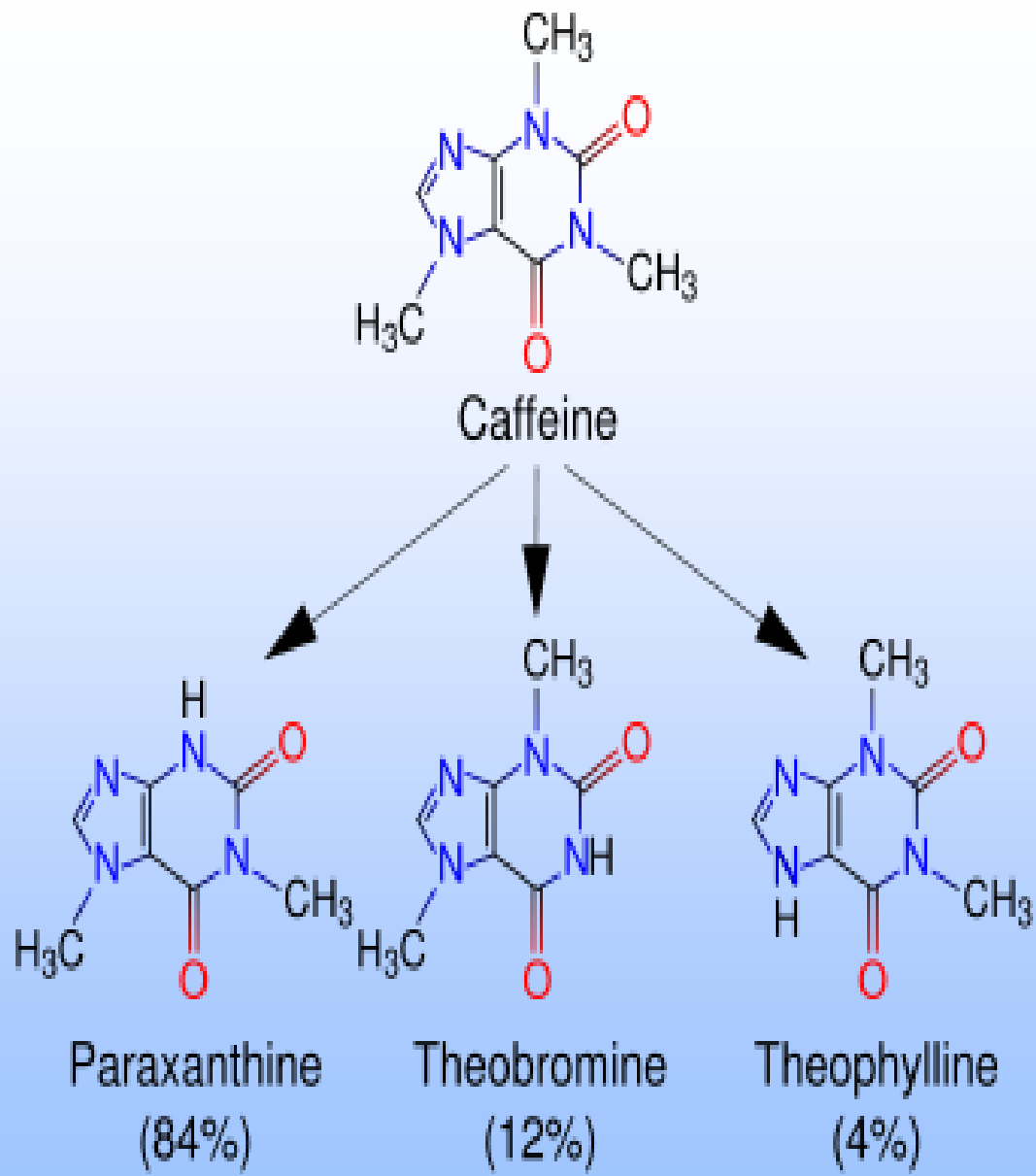
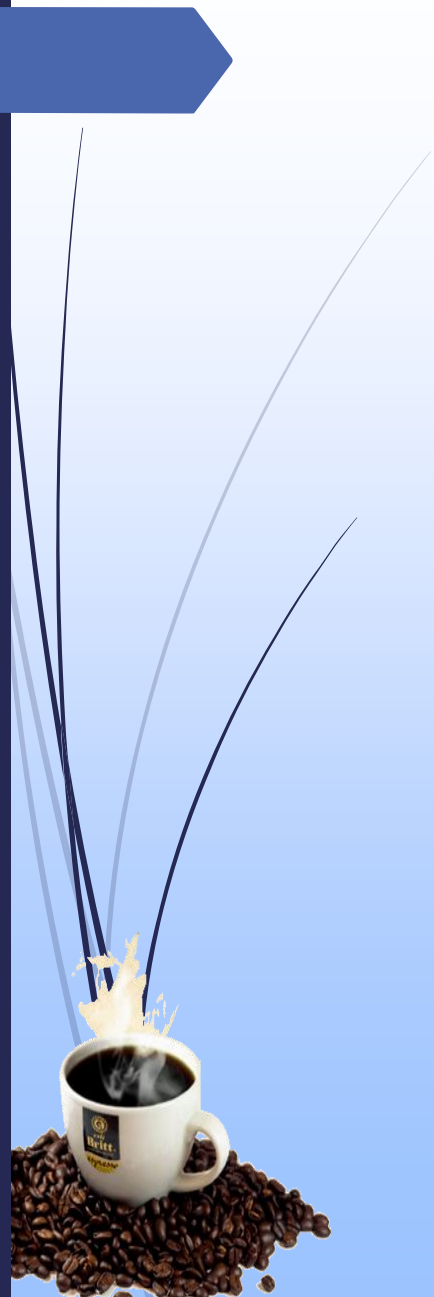


Fig. 2. Caffeine after metabolism in liver





A still from the movie Toy Story showing Woody on the left and Buzz Lightyear on the right. Woody is wearing his signature yellow and red plaid shirt with a cow-print vest and a large gold buckle. He has a worried expression. Buzz is in his green and purple space suit, with "LIGHTYEAR" written on his chest. He is gesturing with his right hand, which has purple rings on each finger. The background is a simple indoor setting.

Caffeine

Caffeine everywhere

Health effects of **caffeine**

Positive effects

increased attention
and alertness,
decreased fatigue

lower risk of
cardiovascular
disease

lower risk of
diabetes

increased
metabolic rate

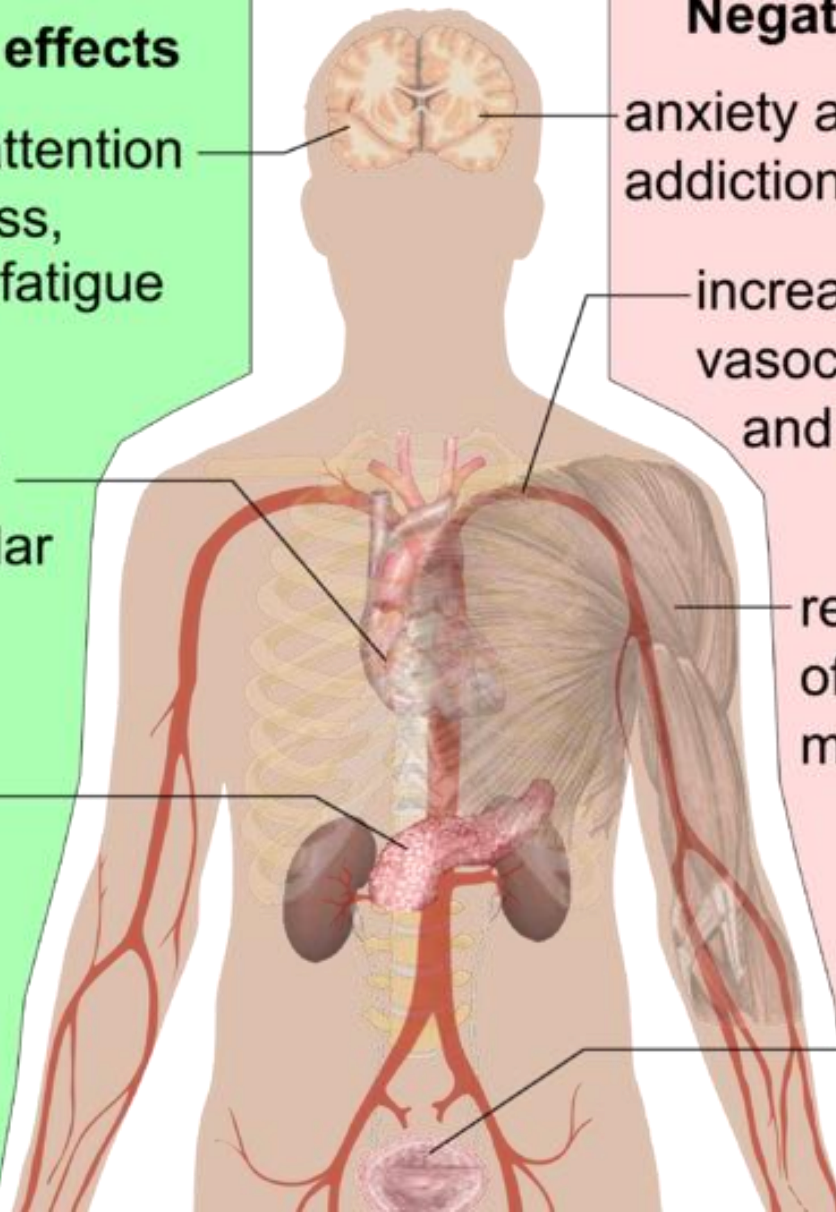
Negative effects

anxiety and
addiction

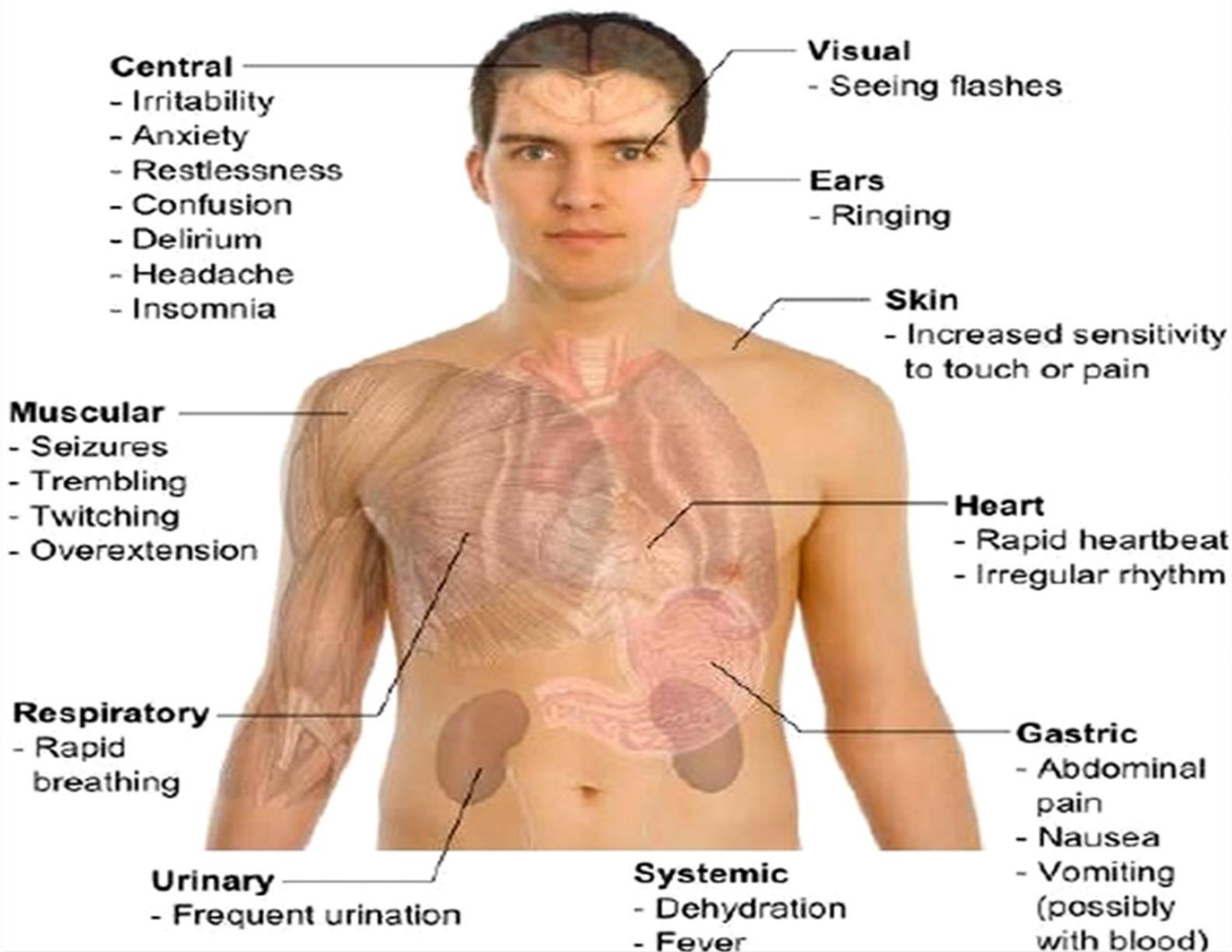
increased
vasoconstriction
and blood pressure

reduced control
of fine motor
movements

stimulation of
urination



Main symptoms of Caffeine overdose



When ingested in excessive amounts for extended periods, caffeine produces a specific toxidrome (caffeinism)

which consists primarily of the following:

-Central nervous system (CNS) features – Headache, lightheadedness, anxiety, agitation, tremulousness, perioral and extremity tingling, confusion, psychosis, seizures

-Cardiovascular features – Palpitations or racing heart rate, chest pain

-Gastrointestinal (GI) features – Nausea and vomiting, abdominal pain, diarrhea, bowel incontinence, anorexia

Management

Prehospital care is primarily supportive, and most cases resolve. Emergency management of more severe cases includes the following:

- ABCs (*A* irway, *B* reathing, *C* irculation)
- Management of hypotension
- Correction of dysrhythmias
- Management of seizures (with benzodiazepines or barbiturates)
- Correction of metabolic disturbances (hypokalemia, rhabdomyolysis, hyperglycemia, metabolic acidosis)
- Treatment of prolonged vomiting
- Decontamination with activated charcoal, sorbitol, or both
- In rare severe cases, hemoperfusion or hemodialysis