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|  | Caffeine, as most people know, is the most common psychoactive drug used today. Over 85% of all Americans consume an average of 200 mg of caffeine per day. This is why it has been the subject of many studies concerning how it interacts with the nervous system to whether or not it causes cancer.  Caffeine is of particular interest to those who consume it often, like my friends and me. Consuming caffeine morning, noon, and night takes its toll on the body, but exactly what kind of toll is what we were interested in.  Caffeine's Chemistry  Caffeine is a bitter-tasting white powder that is soluble in water. It's technical name 3,7-dihydro-1,3,7-trimethyl-1H-purine-2,6-dione tells us that it is a form of purine.Purine is not found in the body in its pure form, but two purines are quite abundant. Adenine and guanine, bases for DNA, are purines.  When purines are broken down, they form xanthine, which is where caffeine gets its more common technical name, 1,3,7-trimethylxanthine. Xanthine is then broken up further by the liver.  Since adenine and guanine are responsible for making up a person's genetic code, researchers believe that because caffeine is a purine, it might interfere with that code causing tumors. This research, however, is inconclusive.  Researchers do, however, know how caffeine is absorbed into the body. Caffeine, as mentioned as above, is moderately soluble in water. So, caffeine is present in the body wherever water is, which is virtually everywhere. Caffeine can pass through cell membranes also. These properties mean that if caffeine is ingested, it will be absorbed by the stomach and the intestines and passed quickly into the blood stream, where it's distributed to all parts of the body. When it reaches the liver, it's broken down into theobromine, theophylline, and dimethylxanthine, also known as paraxanthine. These metabolites produced by the liver are even more similar to the purines adenine and guanine than caffeine. Researchers speculate that these metabolites may have a huge impact on the actual effects caffeine takes on the nervous system.  Effects of Caffeine  Caffeine's effects are directly related to the chemical adenosine, which plays a major role in the transmission of signals by nerves. Adenosine binds to a receptor site on the cell inhibiting the release of neurotransmitters. Because caffeine is so similar in make up to adenosine, it will bind to those receptor sites as well, preventing adenosine in doing so. This makes the nerve cells fire more rapidly. Researchers have also found that 1-methylxanthine and paraxanthine, metabolites of caffeine, are even closer to adenosine, therefore competing more for receptor sites than caffeine itself.  Caffeine is absorbed through the stomach and small intestines within thirty minutes of ingestion. It reaches its peak concentration in the blood between thirty and sixty minutes, and continues to have an effect as long as it is in the blood. The enzymes in the liver may digest all the caffeine ingested anywhere from two to ten hours after it has been ingested. Smokers tend to metabolize caffeine faster than non-smokers. In addition, nicotine and caffeine have opposite effects on the nervous system, which is probably why smokers generally drink more coffee than non-smokers. Alcohol, on the other hand, slows the rate of metabolism of caffeine  Because caffeine is a drug a personís tolerance has a lot to do with how caffeine affects them. Rate of absorption, rate of metabolism and body weight also contribute to a person's response to caffeine. Also, caffeine's effect is determined by when it's taken and the circumstances that follow, which is what our study focuses on.  Caffeine's Effect on the Brain  Although caffeine is thought to effect the brain by having rousing effects, very little research has actually been done on the brain regarding caffeine. It is known that caffeine effects the activity of the cells in the cortex as well as the deeper structure of the brain. In other words, complex sensations and behaviors as well as primitive behavior are thought to be influenced. Exactly how they are influenced is still not completely understood.  Behavior  Caffeine has been known to affect sleep, but the next most obvious effect it takes is in the body's movement. Caffeine releases fatty acids into the blood stream, which makes for a greater supply of energy. Occasionally, reductions in movement has been observed in studies with animals, usually when extremely high doses of caffeine were given.  In general, people have been known to have mood-altering experiences with caffeine. Research in this area is highly contradictory, but when given 300 mg of caffeine or more, people generally feel more anxious or tense. At lower, more moderate doses, caffeine heightens alertness which will cause a person's mood to improve. In one study, people were told they were given caffeine, but really werenít. The subjects still felt awake, so the psychological effects of caffeine have a huge impact on the overall effect.  The Dangers of Caffeine  Many people are weary of caffeine because there is a lot of inconclusive evidence about exactly what caffeine does to the body. Researchers also don't know if it causes any damage, irreversible or not.  Researchers have carefully studied caffeine's effect on the cardiovascular system. Studies have shown that blood pressure increases in those individuals who normally have large amounts of caffeine and have been without it. It can be considered a symptom of withdrawal. It goes away after a few days. Also, caffeine increases heart rate, but most of the time the increase is very slight. Some studies have also shown that caffeine can induce arrhythmia's (heart palpitations) if the person has had previous symptoms. All of these studies have proved inconclusive at best.  Caffeine has also been known to increase the rate of breathing. Another study showed it heightened awareness in the part of the brain that controls carbon dioxide levels. Theophylline, a metabolite of caffeine, has been commonly used for treatment of asthmatic patients. Caffeine can have a similar effect, but causes strong side effects.  Caffeine can also contribute to problems in the digestive track. It increases the secretion of digestive acids, and has a greater affect on those people who already have an ulcer. Coffee and tea reduce the bodyís ability to absorb certain nutrients like iron. Whether or not this is caused by caffeine is unknown, but it is a current belief. Caffeine also increases the body's rate of urination by as much as 30%. This means essential nutrients, especially calcium are passed through the body rather than absorbed by it.  Positive Effects of Caffeine  Other than helping people wake up and stay awake; caffeine has many side-effects. Of these there are several positive ones that aid people in various ways.  Caffeine is used in many weight loss pills because of it's short term effects. Caffeine increases the rate and therefore the amount at which food is converted to usable energy. If caffeine is taken between meals, it causes fat deposits to be released into the blood stream. These are called free fatty acids which are usable energy for most organs in the body. It also increases body temperature and the activity level in the body. So food that would normally be stored as fat is used up.  Caffeine is found in a wide variety of products today. Surprising to some is that it is found in most pain relievers. Although little has been proven on caffeine's actual effectiveness, it helps in two ways. For headaches, caffeine is known to constrict the blood vessels in the head, helping to reduce the pain felt there. Caffeine also expedites the pain relievers' relief. Precisely why it does this is unknown.  This graph shows some amounts of caffeine in common Over the Counter drugs.  Caffeine Dependence  Caffeine dependence, otherwise known as caffeinism, is currently a theory that is being tested. Because of caffeine's effect on neurotransmitters and parts of the brain, researchers believe caffeine may cause a physical dependence. It is known that a psychological dependence to caffeine is common, but whether or not a physiological dependence exists is still unknown. It is also thought that a person's tolerance to caffeine has to do with whether or not he or she develops a physical dependence to it.  Caffeine is an old substance that has just recently come under the public's eye of observation. Since coffee drinking has so many social aspects to it, the average American has taken an increased interest in caffeine and the possible dangers of it. With any luck, researchers will have a lot more conclusive evidence on caffeine, it's uses, and it's dangers in the next few years. |

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