

# Smart drugs pose special risks to the developing brain of young people

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Over a million American students misuse prescription drugs or take illegal stimulants to increase their attention span, memory, and capacity to stay awake. Such "smart drugs" become more and more popular due to peer pressure, stricter academic requirements, and the tight job market. But young people who misuse them risk long-term impairments to brain function, warn Kimberly Urban at the University of Delaware and Wen-Jun Gao at Drexel University College of Medicine, USA, in a NIH-funded review published in the open-access journal *Frontiers in Systems Neuroscience*.

The latest research on the potential lasting side-effects of the most important smart drugs on the uniquely delicate, developing brain of young people was reviewed. It was found that any short-term boost in mental performance due to smart drugs may come at a heavy cost: a long-term decrease in brain plasticity, necessary for task switching, planning ahead, and adaptive flexibility in behavior.

## Special risks for young brains

Methylphenidate is the most popular smart drug among kids today and often sold on the black market. It was originally developed as a prescription-only drug (sold as Ritalin and Concerta) to treat ADHD, and works by increasing the level of neurotransmitter in the nervous system. Around 1.3 million American teenagers misused or abused methylphenidate without prescription in the previous month, according

to The Partnership at Drugfree.org and the MetLife Foundation.

Trials on rats have shown that young, developing brains are particularly sensitive to methylphenidate: even low dosages early in life can reduce nerve activity, working memory, and the ability to quickly switch between tasks and behaviors. Such mental flexibility is important for complex motoric learning, interpersonal skills, and work performance.

Another popular smart drug is modafinil, sold under the name Proviigil against narcolepsy and other sleep disorders. Believed to work by raising the levels of dopamine in between synapses of [brain nerve cells](#), it can boost memory as well as the ability to work with numbers and do other mental tasks. But research indicates that modafinil could have similar long-term undesired effects as methylphenidate on the developing brain.

## **New smart drugs also pose risks**

Not yet widely used are ampakines, an emerging class of drugs currently studied by the US military with the aim of increasing alertness in soldiers. Ampakines bind to so-called AMPA receptor molecules in the nervous system and boost the response of nerve cells and strengthen connections between them. Known to improve memory and cognition in rats and healthy humans volunteers, ampakines are often considered to be relatively safe potential smart drugs. But they are not without dangers for young people: uncontrolled use might over-excite the [nervous system](#), damaging or killing [nerve cells](#), caution the authors.

## **Many "known unknowns"**

More research on the long-term effects of methylphenidate, modafinil, ampakines, and other smart drugs, especially in [young people](#), is urgently needed, the authors caution.

"What's safe for adults is not necessarily safe for kids," warns Urban. "The human brain continues to develop until our late twenties or early thirties. Young people are especially prone to abuse [smart drugs](#), but also more vulnerable to any side-effects. We simply don't know enough about the long-term effects of these drugs on the developing brain to conclude they are safe."

**More information:** Paper: [journal.frontiersin.org/Journal/2014.00038/abstract](https://journal.frontiersin.org/Journal/2014.00038/abstract)

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