What happens when you take 550 doses of LSD? Well…

There's a recent resurgence of interest for psychedelic drugs, and extreme cases can be very valuable for researchers.

by **Mihai Andrei (https://www.zmescience.com/author/osamik/)**

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AA

What happens when you take 10 doses of LSD? Wait, what happens when you take 550? The answer (and I say this in full responsibility) will surprise you.

Substance abuse

In 1997, a 12-year-old anonymous girl (which researchers called VA) became acquainted with the mental health system. She reported suffering from hallucinations and had numerous behavioral problems, as well as severe depression. She reported hearing voices in her head for many years.

Her story is detailed in a new study (https://www.jsad.com/doi/abs/10.15288/jsad.2020.81.115?journalCode=jsad) by researchers from the University of British Columbia, who looked at a couple of examples of extreme LSD ingestion.

Doctors started VA on antidepressants for a diagnosed bipolar illness, but the situation was problematic from the start. The girl's home life was turbulent and she had already been familiar with cannabis since she was 11. By 13-14, she reported irregular consumption of magic mushrooms and a one-time consumption of MDMA and LSD. But the extreme episode happened when she was 15, during a summer party.

The supplier of liquid LSD made a decimal error — what the dealer had intended to be 100 mcg doses (a "normal" dose), were actually 1,000 mcg doses. AV drank her glass, and then drank the leftovers from two other glasses, raising her total intake to around 11-12 doses.

She had taken the drugs at 10 PM, on a relatively empty stomach. Her friends and other observers reported erratic behavior for the next 6.5 hours — even more erratic than what you'd expect from a typical LSD dose. Then, she exhibited what they believed to be a seizure.

Locked in a fetal position, with her arms and fists tightly clenched, AV simply stopped. An ambulance was called, though by the time paramedics arrived 10 minutes later, she was alert and active. She was transported to a local hospital, where doctors diagnosed her with a seizure.

This is where things get even weirder.

According to the paper's authors, the seizure diagnosis is extremely questionable, as she did not exhibit any seizure symptoms. When her dad came in to visit at the hospital, AV told him "It's over."

He believed she was referring to the LSD incident, but she was instead referring to her bipolar illness. What she was saying was her bipolar illness was cured.

Subsequently, AV's mental health psychiatrist and therapist reported significant changes in her mental health.

After one year, she appeared to be completely free of any major symptoms, was taken off medication. Her doctors wholesomely noted that "AV has stable employment, stable positive friendships, and good work relationships."

Thirteen years later, she still appears to be mentally healthy. The LSD overdose appears to, indeed, have cured her mental illness.

Interestingly enough, at the same party where AV had her overdose, a 26-year-old woman (NM), ingested half a glass of LSD-laced water. She thought it was half a dose, but it was actually five doses (as the dealer messed up and put 10 times more LSD than he thought).

NM was pregnant, though she did not know it at the time. She subsequently gave birth to a healthy son who is now 18 years old. He has been easy to parent, is intelligent, does well academically (mostly A's in high school), is well adjusted socially (many healthy friends), and is fit (runs and goes to the gym). The LSD overdose did not seem to affect him in any way, the researchers write.

Substance ABUSE

If the first two stories aren't impressive enough, you might want to hold on to your jaw for this one.

The final case discussed in the study documents the story of CB, a 49-year-old woman, and her roommate, who witnessed the event.

CB had contracted Lyme disease in her early 20s, and by the LSD event, she experienced significant pain in her feet and ankles, routinely taking morphine for a decade.

In September 2015, CB snorted what she believed to be cocaine. In fact, the powder was actually pure LSD — 550 times the normal recreational dosage of 100 mcg.

In 15 minutes, she realized something was wrong. She called her roommate, who noticed that the bottle of LSD had been moved. When he weighed the bottled, he figured out what happened; by then, CB was violently vomiting.

She vomited frequently for the next 12 hours, which she remembers as being mostly "blacked out". She felt "pleasantly high" for the next 12
hours, although she was still vomiting infrequently.

According to her roommate who witnessed the entire experience, she mostly sat still in a chair with her eyes either open, closed, or rolled back, frothing at the mouth, occasionally vocalizing random words and vomiting frequently.

Ten hours later she became somewhat coherent, and another 12 hours later, she appeared to have recovered. During this time, her roommate stayed with and regularly fed and gave her water.

After this experience, she reported that her feet and ankle pain were mostly gone. She discontinued the morphine and all pain medication, but restarted morphine treatment as her pain increased — thought at a substantially lower dose.

Ultimately, she started microdosing LSD alongside the morphine, and was able to give up on the morphine altogether in 2018.

Conclusions?

It's becoming increasingly clear that psychedelic drugs have some therapeutic potential. They are not the panacea some would have them to be, and under no circumstances are LSD overdoses a medical treatment.

Researchers further emphasized that all these cases studies are anecdotal and don't include any urine or blood samples, so it's not exactly clear what happened in any of these cases.

However, LSD studies are still relatively rare, and overdoses have not been studied in a medical context, so these cases offer valuable insight into what can be expected in this type of situation.

Ultimately, researchers note that the experience was distressing for all three participants — but there were important and unpredictable effects.

> "Although this experience was distressing for all participants, there appear to be unpredictable, positive sequelae that ranged from improvements in mental illness symptoms to a reduction in physical pain and morphine withdrawal symptoms. Also, an LSD overdose while in early pregnancy did not appear to cause harm to the fetus."

The findings in these case studies are reported in the *Journal of Studies on Alcohol and Drugs* (https://doi.org/10.15288/jsad.2020.81.115).

Mihai Andrei (https://www.zmescience.com/author/osamik/)

Andrei's background is in geophysics, and he's been fascinated by it ever since he was a child. Feeling that there is a gap between scientists and the general audience, he started ZME Science -- and the results are what you see today.

What makes a good hypothesis?

Formulating a good hypothesis is the backbone of the scientific method.

by **Tibi Puiu (https://www.zmescience.com/author/tibipuiu/)**

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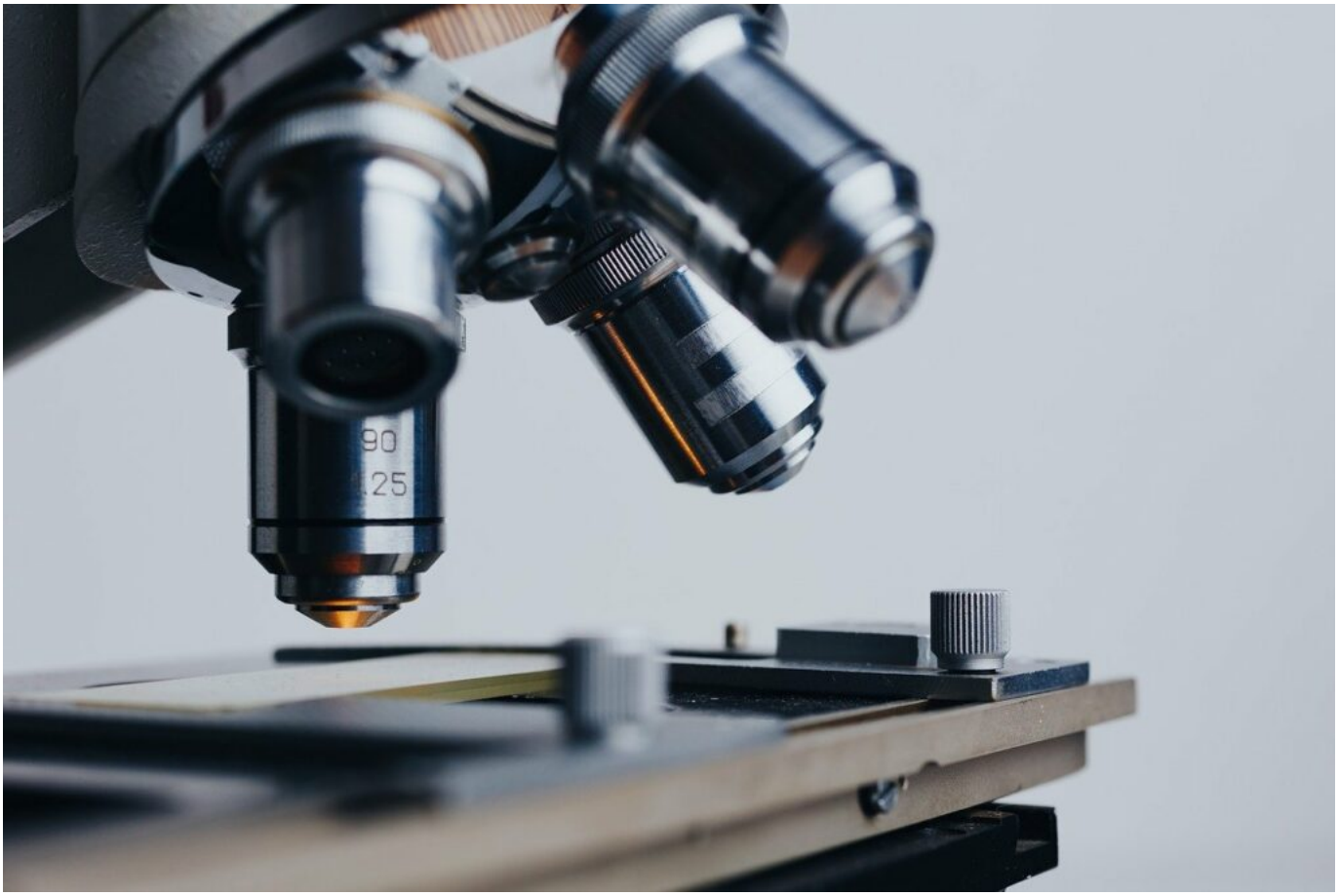

(https://cdn.zmescience.com/wp-content/uploads/2021/10/analysis-g8bcd9eb40_1280.jpg)

Credit: Pixabay.

A hypothesis is a precise and testable statement of what a researcher predicts will be the outcome of a study. This usually involves proposing a relationship between two or more variables.

Verifying a hypothesis, also sometimes referred to as a *working statement*, requires using the scientific method (https://www.zmescience.com/science/scientific-method-steps/), usually by designing an experiment.

For instance, one common adage is 'an apple a day keeps the doctor away'. If we use this aphorism as our hypothesis then we can make a prediction that consuming at least one apple per day should result in fewer visits to the doctor than the general population that eats apples sparingly or never.

In 2015 (https://www.health.harvard.edu/blog/an-apple-a-day-may-not-keep-the-doctor-away-but-its-a-healthy-choice-anyway-201504027850), researchers at Dartmouth College, the University of Michigan School of Nursing, and the Veteran Affairs Medical Center in White River actually investigated this hypothesis. They combed national nutrition data collected from nearly 8,400 men and women — 753 of whom ate an apple a day. The study found (http://archinte.jamanetwork.com/article.aspx?articleid=2210883)that "evidence does not support that an apple a day keeps the doctor away; however, the small fraction of US adults who eat an apple a day do appear to use fewer prescription medications."

So perhaps there's a glimmer of truth to this hypothesis, but not necessarily because apples are some miracle foods. It could be that people who eat apples every day also consume other fresh produce and less processed foods than the general population, a diet that helps to prevent obesity, a huge risk factor for a myriad of illnesses such as hypertension and diabetes that require prescription medication. This is why hypotheses need to be defined as precisely and as narrowly as possible in order to isolate confounding effects.

Types of hypothesis

The ‘apple a day’ study is an example of an **alternative hypothesis**, which states that there is a relationship between two variables being studied, the daily apple consumption and visits to the GP. One variable, called the *independent variable*, has an effect on the other, known as the *dependent variable*. The independent variable is what you change and the dependent variable is what you measure. For example, if I am measuring how a plant grows with different fertilizers, the fertilizers are what I can change freely (independent) while the plant’s growth would be dependent on what it is given. In order for an alternative hypothesis to be validated, the results have to have statistical significance in order to rule out chance.

Examples of alternative hypotheses:

- Dogs wag their tails when they’re happy.
- The accumulation of greenhouse gases in the atmosphere raises global average temperature.
- Wearing a seatbelt reduces traffic-related fatalities.
- Students who attend class earn higher scores than students who skip class.
- People exposed to higher levels of UV light have a higher incidence of skin cancer than the general population.

Another common type of hypothesis used in science is the **null hypothesis**, which states that there is no relationship between two variables. This means that controlling one variable has no effect on the other. Any results are due to chance and thus pursuing a cause-effect relationship between the two variables is futile.

The null hypothesis is the polar opposite of the alternative hypothesis since they contain opposing viewpoints. In fact, the latter is called this way because it is an alternative to the null hypothesis. An apple a day doesn’t keep the doctor away, you could propose if you were designing a null hypothesis experiment.

Examples of null hypotheses:

- Taking an aspirin a day doesn’t reduce the risk of a heart attack.
- Playing classical music doesn’t help plants grow more biomass.
- Vaccines don’t cause autism.
- Hyperactivity is unrelated to sugar consumption.

The acceptance of the alternative hypothesis, often denoted by H_1, depends on the rejection of the null hypothesis (H_0). A null hypothesis can never be proven, it can only be rejected. To test a null hypothesis and determine whether the observed data is not due to change or the manipulation of data, scientists employ a significance test.

Rejecting the null hypothesis does not necessarily imply that a study did not produce the required results. Instead, it sets the stage for further experimentation to see if a relationship between the two variables truly exists.

For instance, say a scientist proposes a null hypothesis stating that “the rate of plant growth is not affected by sunlight.” One way to investigate this conjecture would be to monitor a random sample of plants grown with or without sunlight. You then measure the average mass of each group of plants and if there’s a statistically significant difference in the observed change, then the null hypothesis is rejected. Consequently, the alternate hypothesis that “plant growth is affected by sunlight” is accepted, then scientists can perform further research into the effects of different wavelengths of light or intensities of light on plant growth.

At this point, you might be wondering why we need the null hypothesis. Why not propose and test an alternate hypothesis and see if it is true? One explanation is that science cannot provide absolute proofs, but rather approximations. The scientific method cannot explicitly “prove” propositions. We can never prove an alternative hypothesis with 100% confidence. What we can do instead is reject the null

hypothesis, supporting the alternative hypothesis.

It just so happens that it is easier to disprove a hypothesis than to positively prove one. But the supposition that the null hypothesis is incorrect allows for a stable foundation on which scientists can build. You can view it this way: the results from testing the null hypothesis lay the groundwork for the alternate hypothesis, which explores multiple ideas that may or may not be correct.

The alternative and null hypotheses are the two main types you'll encounter in studies. But the alternative hypothesis can be further broken down into two categories: directional and nondirectional alternative hypotheses.

The directional alternative hypothesis predicts that the independent variable will have an effect on the dependent variable and the direction in which the change will take place. The nondirectional alternative hypothesis predicts the independent variable will have an effect but its direction is not specific, without stating the magnitude of the difference.

For instance, a non-directional hypothesis could be "there will be a difference in how many words children and adults can recall," while the directional hypothesis could predict that "adults will recall more words than children."

Hypotheses can be simple or complex. A simple hypothesis predicts a relationship between a single dependent variable and a single independent variable while a complex one predicts a relationship between two or more independent and dependent variables. An example of a complex hypothesis could be "Do age and weight affect the chances of getting diabetes and heart diseases?" There are two independent and two dependent variables in this statement whose relationship we seek to verify.

How to write a good hypothesis

The way you formulate a hypothesis can make or break your research because the validity of an experiment and its results rely heavily on a robust testable hypothesis. A good research hypothesis typically involves more effort than a simple guess or assumption.

Generally, a good hypothesis:

- is testable, meaning it must be possible to show that a hypothesis is true or false, and the results of this investigation have to be replicable;
- includes both an independent and dependent variable.
- allows for the manipulation of the variables ethically.
- has clear and focused language. Don't be vague.
- is related to other published research.
- is written, either explicitly or not, as an "if-then" statement because we can then make a prediction of the outcome of an experiment.

An example of a testable good hypothesis is a conjecture such as "Students recall more information during the afternoon than during the morning." The independent variable is the time of the lecture and the dependent variable is the recall of the information presented in the lecture, which can be verified with standardized tests.

A bad hypothesis could be something like "Goldfish make better pets than cats." Right off the bat, you can see a couple of problems with this statement. What constitutes a good pet? Is a good pet fluffy and interactive or one that is low maintenance? Can I predict whether a cat or goldfish will make for a good pet? This is more a matter of opinion that doesn't provide any meaningful results.

Often, the best hypotheses start from observation. For instance, everybody has witnessed that objects that are thrown into the air will fall toward the ground. Sir Isaac Newton formulated a hypothesis in the 17th-century that explains this observation, stating that 'objects with mass attract each other through a gravitational field.'

But despite Newton's hypothesis being very well written, in the sense that it is testable, simple, clear, and universal, we now know it was wrong. In the 20th-century, Albert Einstein showed that a hypothesis that more precisely explains the observed phenomenon is that *'objects with mass cause space to bend.'* The lesson here is that all hypotheses are temporary and partial, they're never permanent and irrefutable. This is also a good example of why the null hypothesis is so paramount.

Hypothesis formulation and testing through statistical methods are integral parts of the scientific method, the systematic approach to assessing whether a statement is true or false. All the best stories in science start with a good hypothesis.

Tags: hypothesis (https://www.zmescience.com/tag/hypothesis/) scientific method (https://www.zmescience.com/tag/scientific-method/)

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Conversation

Australia returns control of the world's oldest tropical forest to indigenous First Nations

This was done in the spirit of reconciliation and to promote the conservation of this unique ecosystem.

by **Alexandru Micu (https://www.zmescience.com/author/alexandrumicu/)**

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AA

The Daintree Rainforest is part of the oldest continuous-growth rainforests in the world and is recognized as such, being part of a UNESCO World Heritage site. Now, Australia's government has returned control over this ancient forest to the First Nations peoples as the first step towards reconciliation.

(https://cdn.zmescience.com/wp-content/uploads/2021/10/daintree-gf463301fb_1920.jpg)

The Daintree National Park, part of the Wet Tropics of Queensland World Heritage Site, protects a 135-million-year-old tropical rainforest. Before European settlers ever set foot on Australian soil, the indigenous First Nations peoples lived in this area, as they did in others across the continent.

As a first step towards addressing an "uncomfortable and ugly" past, the Australian government will be returning this land to its original owners.

Returning the heritage

> "The Eastern Kuku Yalanji people's culture is one of the world's oldest living cultures and this agreement recognises their right to own and manage their country, to protect their culture and to share it with visitors as they become leaders in the tourism industry," said Queensland state environment minister Meaghan Scanlon.

The Daintree jungle is a rich ecosystem (https://www.zmescience.com/ecology/ecosystems-what-they-are-and-why-they-are-important/), harboring ancient and rare species. Some of the plants and animals here have remained relatively unchanged for millions of years. Some of the fern species here have been around since dinosaurs still roamed the Earth.

Its wealth of biodiversity (https://www.zmescience.com/science/what-is-biodiversity-feature/) and sheer age have won Daintree and the wider Queensland Wet Tropics a World Heritage status. Much like the rest of the continent, this land is under the administration and care of the Australian government. The Ngalba-bulal, Kalkajaka, and the Hope Islands National Parks will also be returned alongside Daintree. In total, this amounts to 160,000 hectares (around 395,000 acres) of land on the Cape York peninsula.

Initially, this land will be jointly managed by the First Nations and the Queensland state government, to ensure a smooth transition. In the end, however, First Nation peoples will retain sole administrative power over the area.

To date, the Australian government has returned roughly 3.8 million hectares on Cape York to Indigenous traditional owners.

> "Our goal is to establish a Foundation to provide confident and competent people with pathways and opportunities for mentoring, training, apprenticeships, work experience and employment for our Eastern Kuku Yalanji Bama to fill positions from a wide range of skilled trades, land and sea management, hospitality, tourism, and research so that we are in control of our own destinies," said Chrissy Grant, Eastern Kuku Yalanji Traditional Owners Negotiating Committee Member, in an official statement (https://statements.qld.gov.au/statements/93360).
>
> "On 29 September 2021, this significant historic event becomes legal and a reality for the Eastern Kuku Yalanji Bama to realise our vision for a more promising future for all our people."

This handback will create the first place in Australia where Traditional Owners will both receive ownership of and have an important part in jointly managing an UNESCO World Heritage Area, according to the same statement. Officials are confident that giving administrative power over this unique ecosystem to those whose cultures and customs were shaped in their midst is the best way to ensure that they remain protected and preserved for future generations.

Tags: Daintree (https://www.zmescience.com/tag/daintree/) First Nations (https://www.zmescience.com/tag/first-nations/) Indigineous (https://www.zmescience.com/tag/indigineous/) jungle (https://www.zmescience.com/tag/jungle/) rainforest (https://www.zmescience.com/tag/rainforest/)

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Stunningly charming pun connoisseur, I have been fascinated by the world around me since I first laid eyes on it. Always curious, I'm just having a little fun with some very serious science.

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Conversation

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