The Effects of D-Lysergic Acid Diethylamide (LSD) On The Brain

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Outline

1. History of LSD
2. LSD Users and Classification
3. Demographics
4. Biochemical Properties and Mechanism of Action
5. Effects on the Brain
6. Uses and Potential as a Therapeutic Agent
7. Short Term Effects/Overdosing
8. Long Term Effects
9. Current Research
10. Social Implications/Conclusion
History

- Albert Hofmann ingests experimental drug LSD-25 in 1938
- Retook the drug intentionally again and bicycled home while undergoing its effects
- Origin of ‘Bicycle Day’
- Usage of LSD began in 1960s

“Last Friday, April 16, 1943, I was forced to interrupt my work in the laboratory in the middle of the afternoon and proceed home, being affected by a remarkable restlessness, combined with a slight dizziness. At home I lay down and sank into a not unpleasant, intoxicated-like condition characterized by an extremely stimulated imagination. In a dreamlike state, with eyes closed (I found the daylight to be unpleasantly glaring), I perceived an uninterrupted stream of fantastic pictures, extraordinary shapes with intense, kaleidoscopic play of colors. After some two hours this condition faded away.” --- Albert Hofmann

("Hallucinogenic Effects of LSD Discovered", n.d.)
Famous LSD Users

- Bill Gates
- Steve Jobs
- The Beatles
- Francis Crick
- Kary Mullis

(Smith, 2017)
Classification

- A psychedelic drug (psychological effects)
- Hallucinogenic
- Recreational
- Over 40 Street Names
- Tolerance Building

http://brokeassstuart.com/blog/2015/09/25/30-days-micro-dosing-with-lsd/

(Blachford & Krapp, 2010)
Demographics

- Middle/Upper-Middle Class Whites
- Men Use More Often
- Rarely Taken Beyond Age 28
- Declining Usage Rates
- One Time Use Common

(Krebs & Johansen, 2013)

Biochemical Properties

- Tasteless odorless and colorless
- Water Soluble
- Decomposes in light and high temperature
- Similar structure to serotonin


Mechanism of Action

Step 1
LSD interacts with 5-HT receptors

Step 2
Interaction with the 5-HT receptors results in an agonist or partial antagonist on serotonin activity

Step 3
Glutamate release in thalamocortical terminals

(Schiff, 2006)
Effects on the Brain

- More “unified” brain
- Network(s) break down leading the activity to become entropic
- Disconnections between the parahippocampus and retrosplenial complex
- Feeling of “ego dissolution”
- Psychologically addictive not physically

(Carhart-Harris et al., 2016; Cormier, 2016; Das et al., 2016)
Uses of LSD

Recreational Purposes
- Mood-changing
- Delusions
- Hallucinations
- Boosts creativity

Spiritual Purposes
- Enhances religious experiences
- Cleansing
- Display love for God

(Das et al, 2016; NIDA, 2016)

https://thethirdwave.co/lsd-myths/
Therapeutic Agent?

- LSD + counseling → reduced anxiety, depression and pain in patients with advanced cancer
- Research potential in psychiatry, psychology & psychotherapy
- Antianxiety agent
- Helped with
  - Addictions
  - Obsessive-compulsive disorders
  - Severe depression

(http://curioustendency.blogspot.ca/2012/05/psychoanalysis-part-i-transference-and.html#WfPyxdenHIU)

(Das et al., 2016; Kast & Collins, 1964)
LSD Dosage Effects

- Moderate effects: 0.5 mg
- Lethal dose: 20 mg

(image)

Effects First Observed  Peak  Dissipate

(Das et al., 2016; Erowid LSD (Acid) Vault: fatalities/deaths, 2010)
Image source: https://depositphotos.com/19273659/stock-illustration-12-hours-clock-set.html
Acute Toxicity Effects

- Upset GI system
- Causes chills
- Hypothermia
- Palpitation
- Hypertension
- Hyperglycemia
- Tachycardia
- Panic
- Rapidly changing emotions
- Muscle incoordination

(NIDA, 2016; Das et al., 2016; NIDA, 2009)

Source: https://www.recovery.org/topics/lsd-facts/
Effects of Overdosing

- Delusions and visual hallucinations
- Altered sense of self
- Cross-over of senses

- Feelings of despair, insanity, death etc.
- Impaired perception of depth, time, size, movements, etc.
- Sudden or delayed flashbacks (HPPD)
- “Bad trips”

https://b.passagesmalibu.com/tag/side-effects-of-lsd/

(NIDA, 2009; Das et al., 2016; NIDA, 2016)
Current Research

- LSD Effect on Brain
- LSD to Treat Alcoholism
- Studies on LSD Effects on Thoughts
- LSD as Treatment for End-of-Life Anxiety/Pain
- LSD as Treatment for Cluster Headaches
LSD Effects on Brain

- Cerebral Blood Flow (CBF) Tracking
- Positron Emission Tomography (PET) and Functional Magnetic Resonance Imaging (fMRI)
- Complex Imagery in Altered State of Consciousness (ASC)

(Carhart-Harris et al., 2016)
LSD to Treat Alcoholism

- Meta-Analysis
- Significant Decrease in Short-Term
- No Success in Long-Term
- Similar With Other Addictions

(Krebs et al., 2012)

https://www.pinterest.ca/explore/psychedelic-drugs/
LSD Effects on Thoughts

- Only required 1/10 dosage
- Increased:
  - Optimism
  - Openness
  - Creativity
  - Imagination

(Lebedev et al., 2014)

http://www.openculture.com/2013/10/artist-draws-nine-portraits-on-lsd-during-1950s-research-experiment.html
LSD Treatment for End-of-Life Anxiety & Pain

- Reduction in Anxiety
- Rise in Their Quality of Life
- Decreased Blood Pressure and Heart Rate

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4086777/

<table>
<thead>
<tr>
<th>Time Post-LSD (hour)</th>
<th>Experimental Dose Group (n = 8)</th>
<th>Active Placebo Group (n = 4)</th>
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<td>HR (bpm)</td>
<td>SBP (mm Hg)</td>
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<td>Mean</td>
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</tbody>
</table>

bpm indicates beats per minute; DBP, diastolic blood pressure; HR, heart rate; SBP, systolic blood pressure.

(Gasser et al., 2014)
LSD Treatment for Cluster Headaches

- Reduce Cluster Pain
- Interrupt the Cluster-Headache Cycle
- Micro-Dosage (Sub-Psychadelic)

https://www.pinterest.ca/louise3816/headaches-and-migraine/

(Passie et al., 2008)
Conclusion/Social Implications

- LSD is a hallucinogenic drug
- Recreational usage prevalent
- Potential for ‘more’...
- Don’t Do Drugs!

http://www.nomeatathlete.com/long-run-bad/

(MAPS, n.d.)

http://www.maps.org/
Multiple Choice #1:
LSD (Lysergic Acid Diethylamide) has a similar structure to which neurotransmitter?

a) Serotonin
b) Histamine
c) Dopamine
d) Epinephrine
e) Norepinephrine
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Which of the following statements is incorrect?

a) Dustin Hoffman was credited with being the first to synthesize LSD

b) LSD is a classified as an Hallucinogenic drug

c) LSD interacts with 5-HT receptors

d) Ego Dissolution is an effect LSD has on the brain

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