

# Newer Technologies to Treat Mental Illnesses

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Todu Guam Foundation



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- Welcome to the *31<sup>st</sup> Annual Guam System for Assistive Technology Conf & Expo.*
  - *Empowering Mental Health through Assistive Technology.*
  - *CONNECT*
  - *COPE*
  - *THRIVE*
- Special Thank you to the following:
  - GSAT Advisory Council Officers
  - Agency Representatives
- And thank you to each of you in attendance



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# The History of Psychiatric Interventions



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# Ancient and Medieval Times: Early Treatments

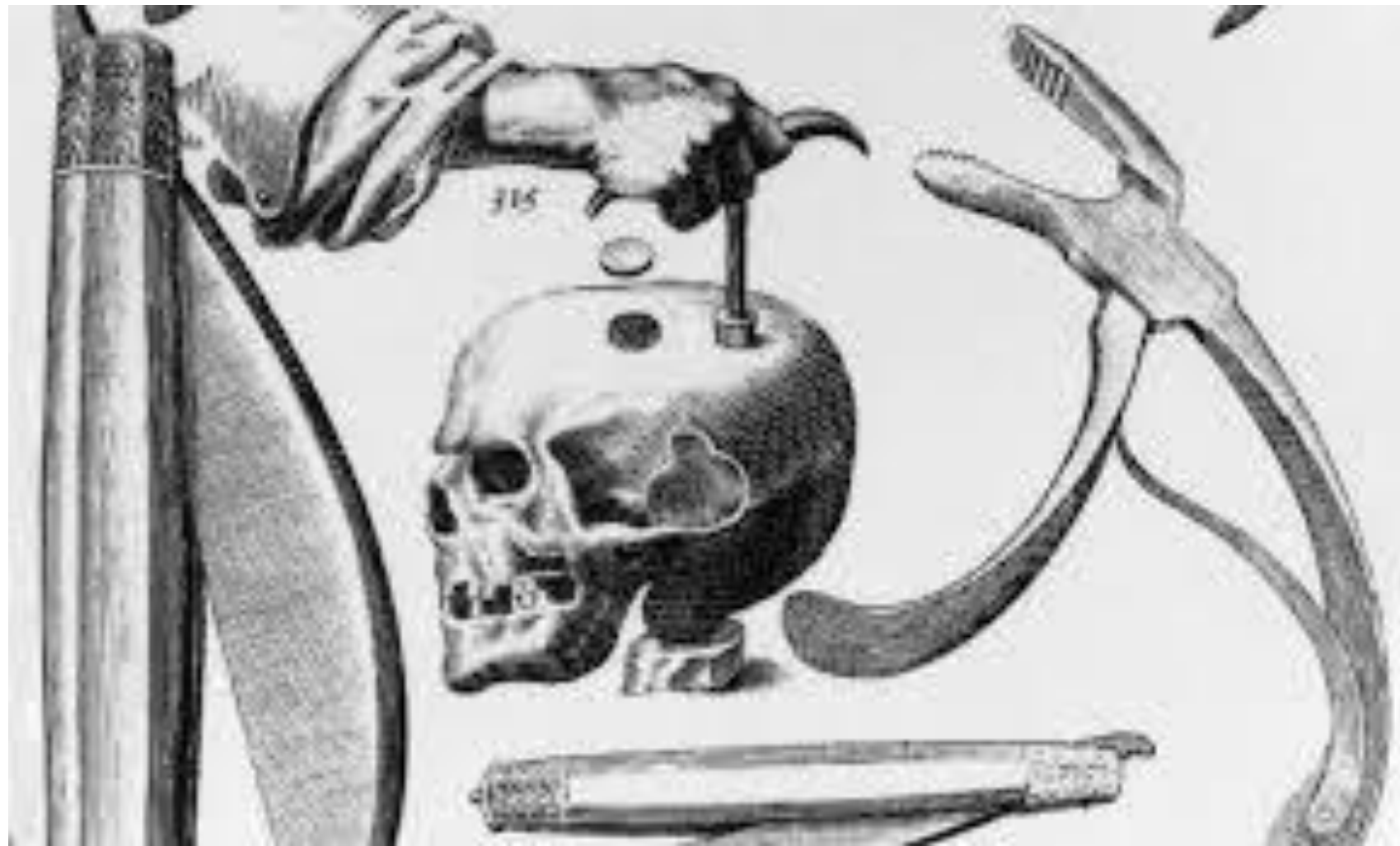
- **Exorcism and religious rituals:** Common belief in demonic possession.



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# Ancient and Medieval Times: Early Treatments

- **Trepanation:** Drilling holes in the skull to release evil spirits.



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# Ancient and Medieval Times: Early Treatments

- **Bound in Fetters:** In many ancient cultures, individuals with mental illnesses were physically restrained with shackles and fetters. This was seen as a way to control or protect society from perceived dangerous behaviors.

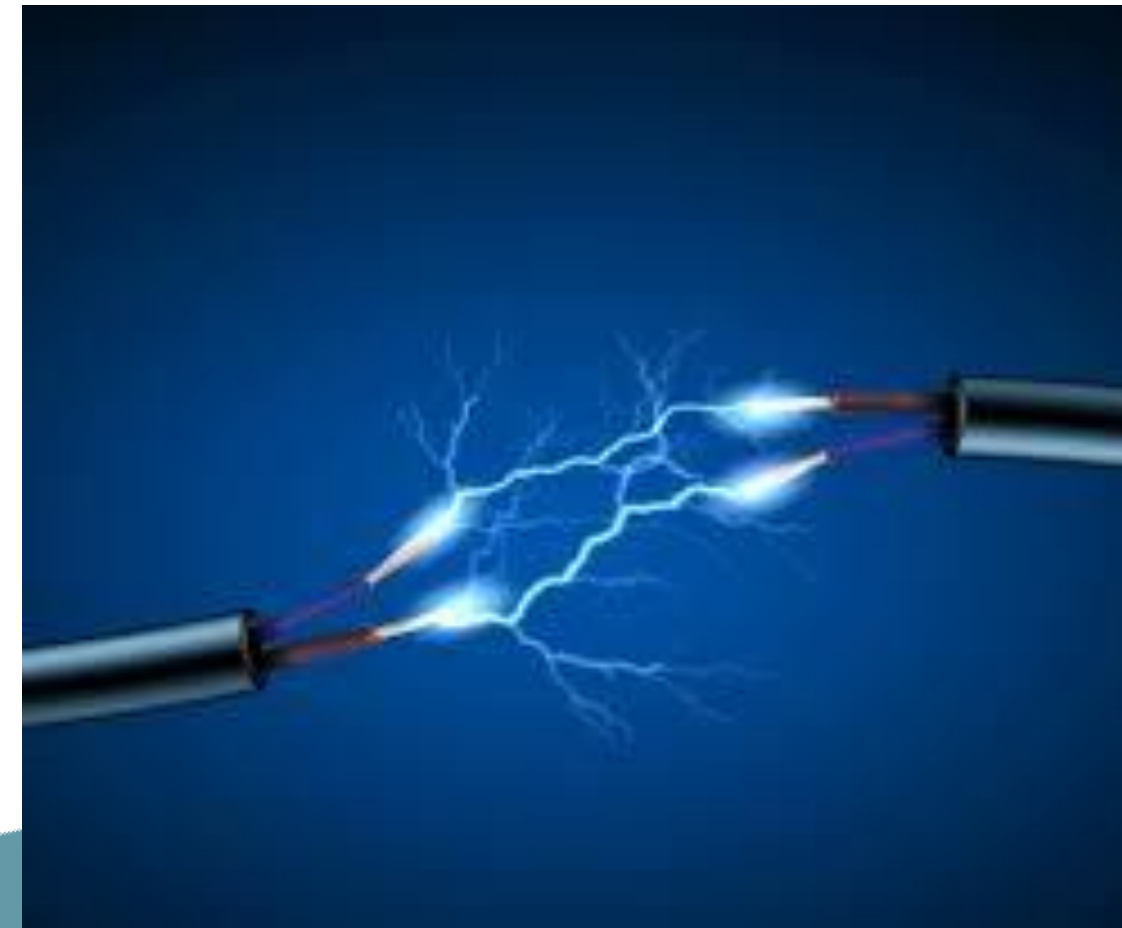
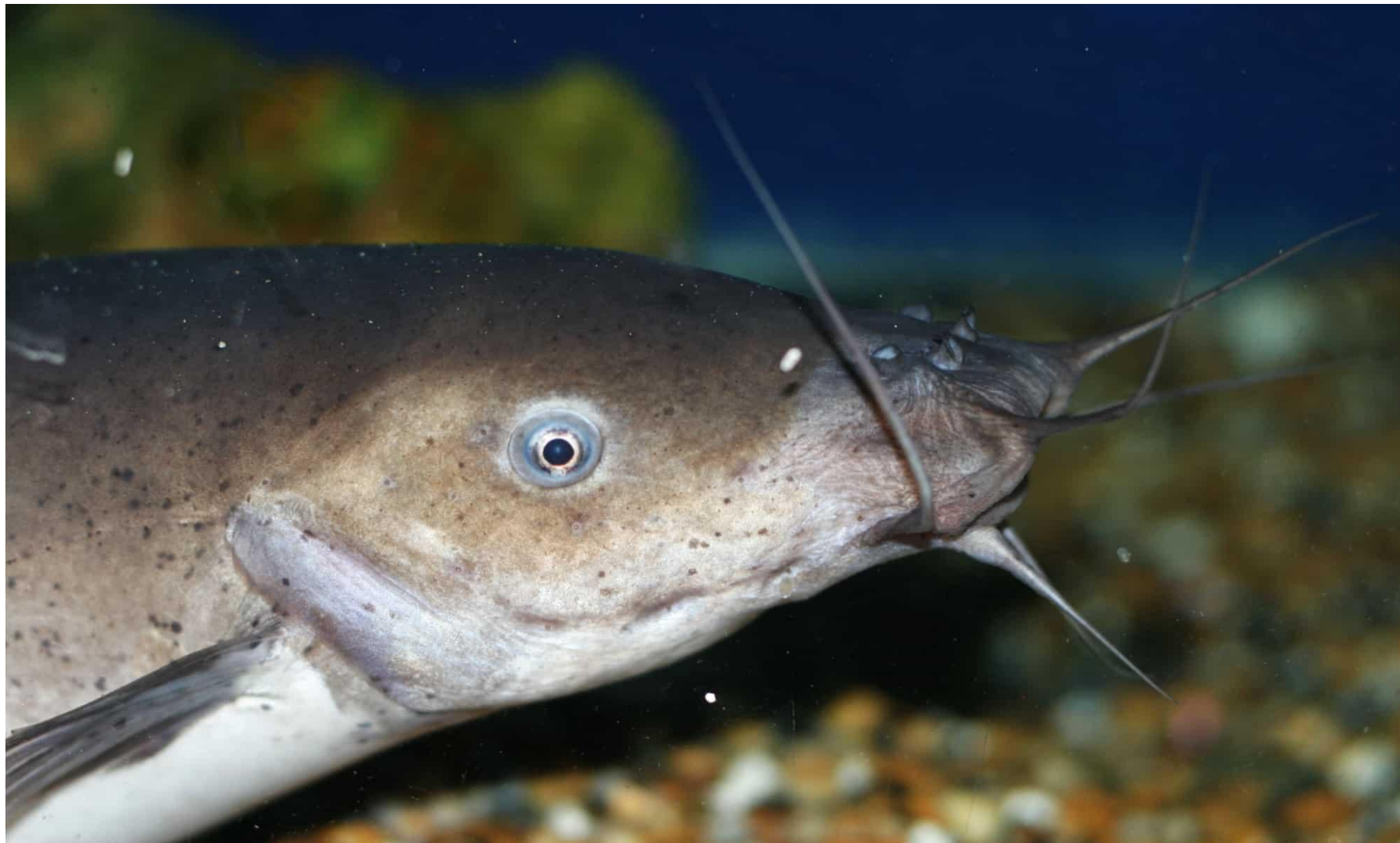


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# Ancient Egyptian Use of Electrical Fish for Treatment

- Ancient Egyptians are believed to have used electric fish, specifically the **electric catfish**, as a form of treatment for various ailments, including mental health disorders, long before modern electrotherapy was developed.



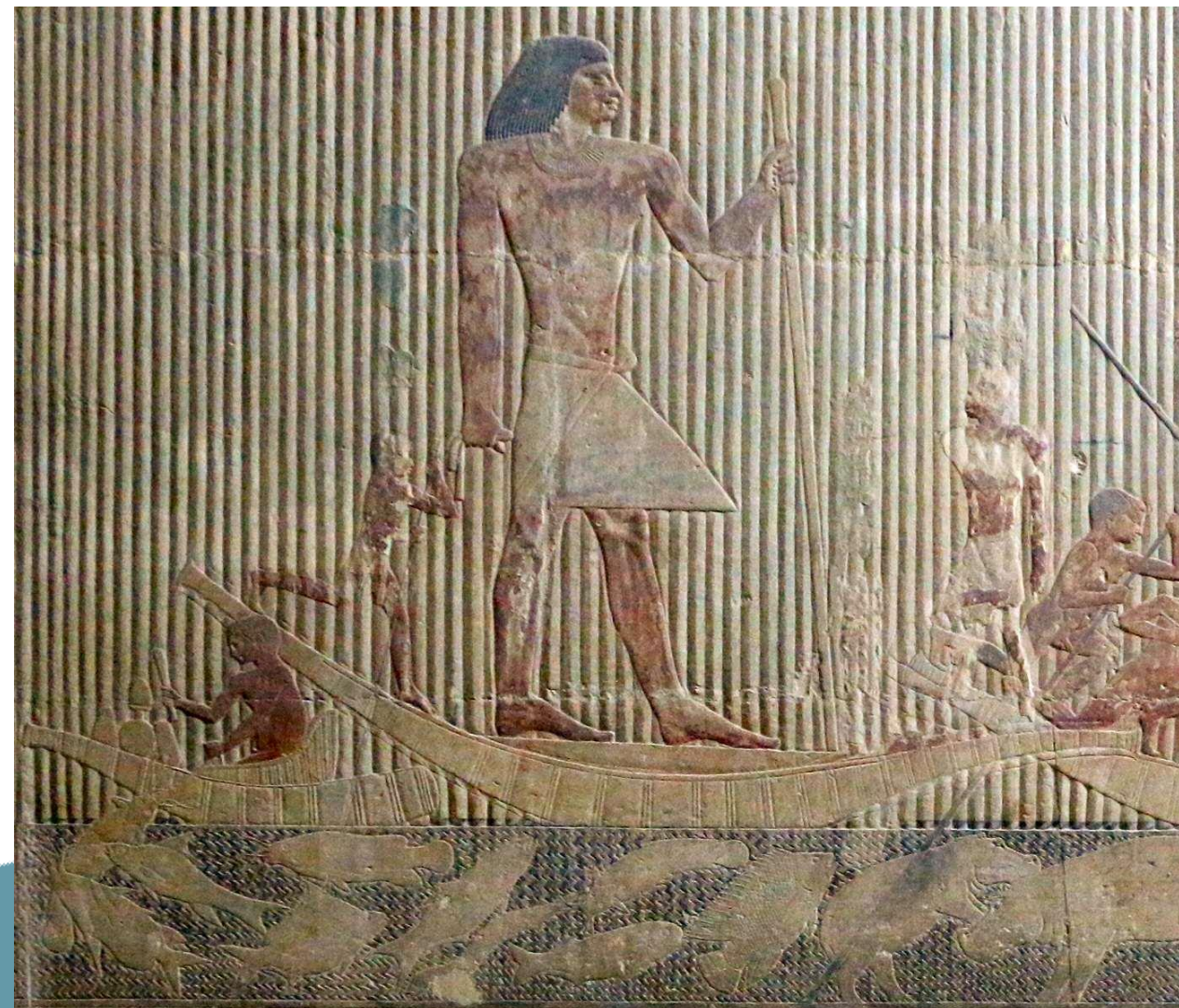
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# Ancient Egyptian Use of Electrical Fish for Treatment

## Historical Context:

**Electric Fish in Ancient Egypt:** The ancient Egyptians utilized the **electric catfish** (also known as the **electric eel** in some contexts, although it is technically a different species) for medicinal purposes. This fish can generate a mild electric shock, which the Egyptians may have used as a form of **electrotherapy**.



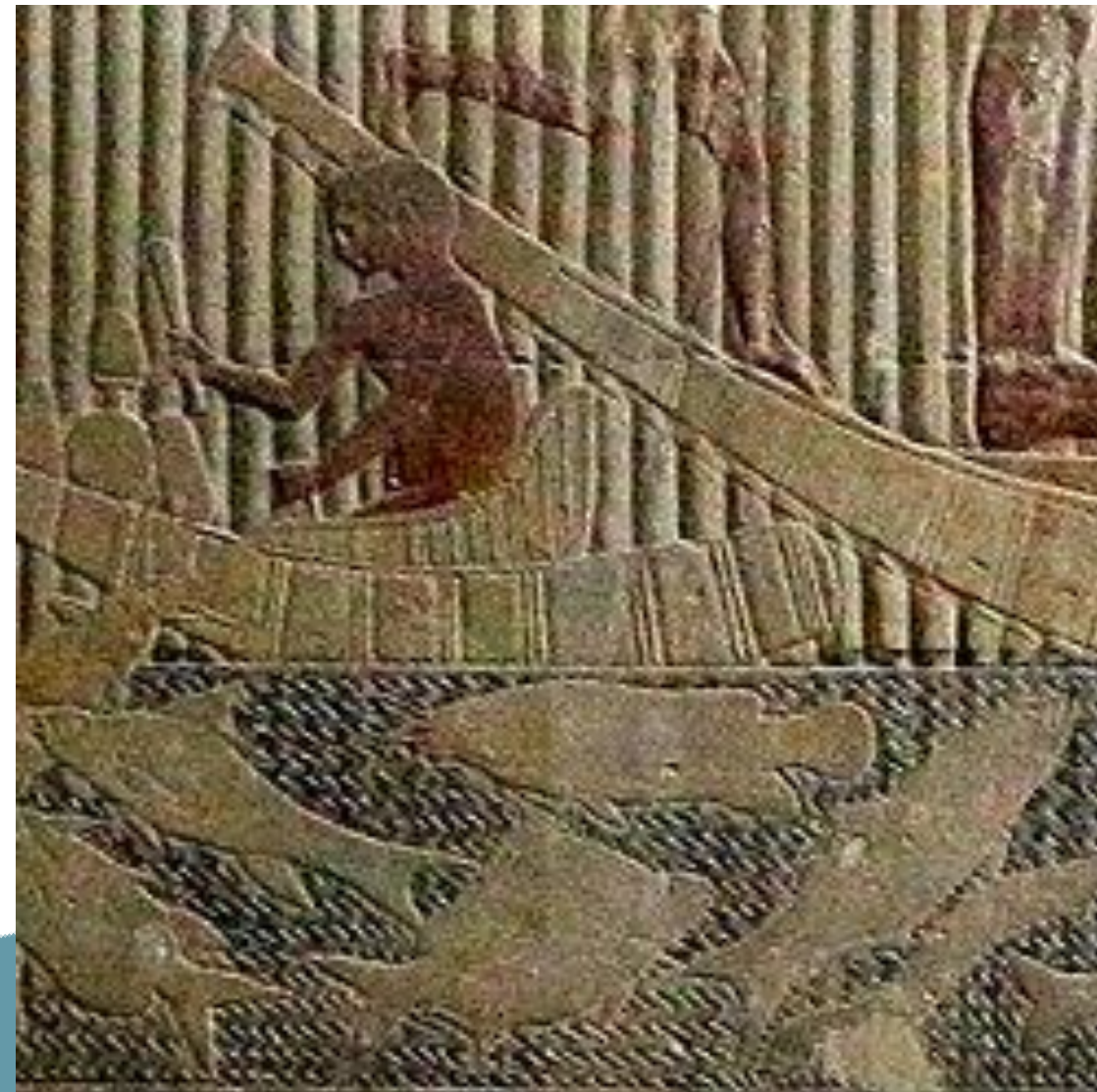
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# Ancient Egyptian Use of Electrical Fish for Treatment

## Historical Context:

**Records and Evidence:** Ancient Egyptian texts and murals suggest that electric fish were used to treat **headaches, pain,** and potentially even **mental health conditions.** The therapeutic properties of the fish's electric shock were believed to help alleviate physical and psychological ailments.



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# Ancient Egyptian Use of Electrical Fish for Treatment

## How It Worked:

The **electric catfish** was known to produce electrical discharges, which were likely used in a form of **electro-stimulation therapy**. It is hypothesized that the electric shock may have been used to stimulate nerves, much like modern-day electrotherapy, potentially providing relief for certain mental health symptoms.



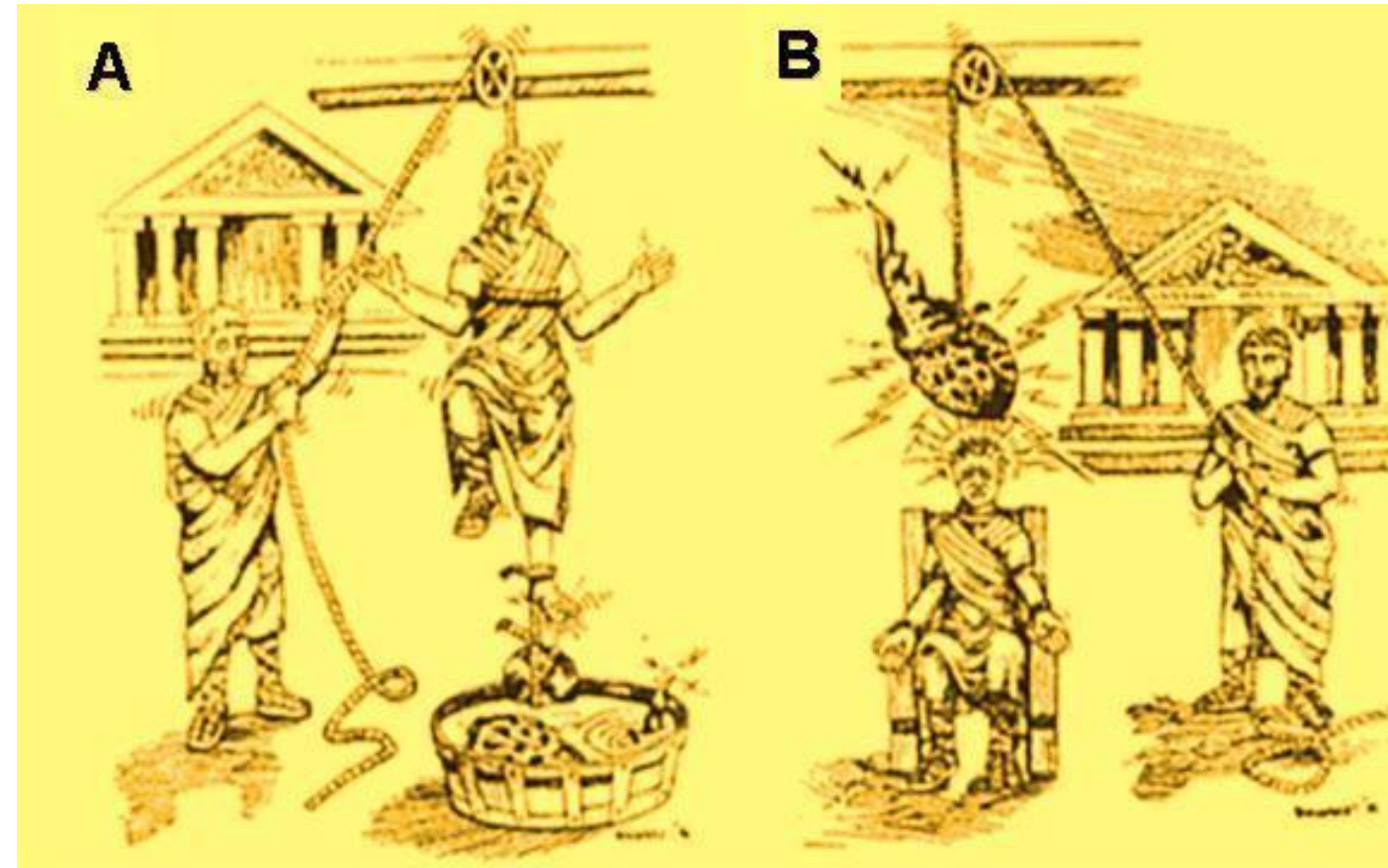
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# Ancient Egyptian Use of Electrical Fish for Treatment

## How It Worked:

**Possible Treatment for Mental Illness:** The Egyptians may have applied the shock to patients' heads or limbs as a form of **psycho-physical stimulation**, which could have been aimed at improving mood or even reducing the symptoms of **mental fatigue, melancholy, or psychotic behaviors**.

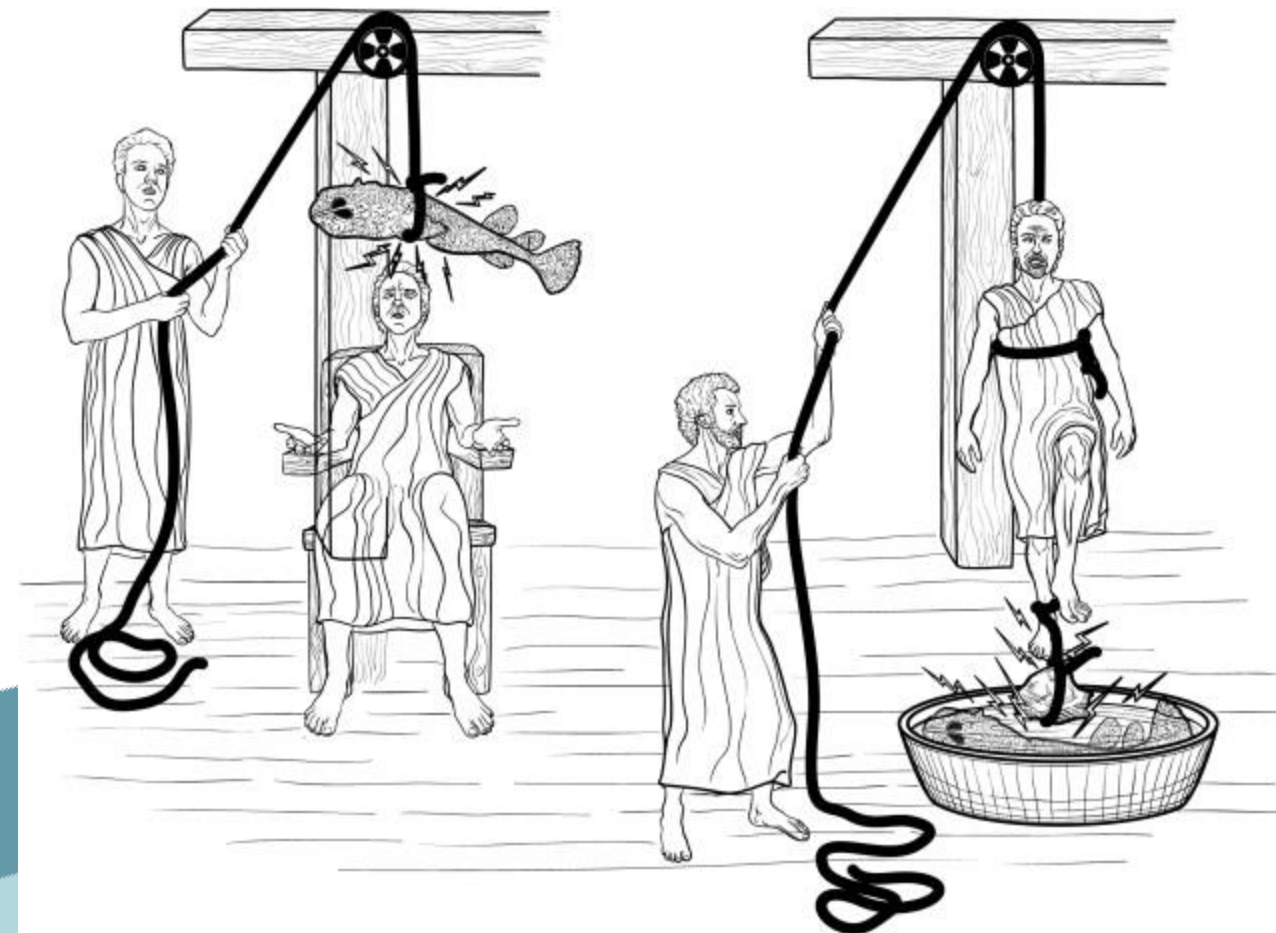


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# Ancient Egyptian Use of Electrical Fish for Treatment

## Legacy and Influence:

- **Early Electrotherapy Influence:** The ancient Egyptians' use of electrical fish represents one of the earliest known attempts to apply **electrical stimulation** for therapeutic purposes, predating modern techniques like **electroconvulsive therapy (ECT)** by thousands of years.
- **Long-Lasting Impact:** While the scientific understanding of electricity and its therapeutic benefits would not emerge until much later, these ancient practices laid the groundwork for future innovations in electrotherapy.



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# Ancient Herbs for Treating Mental Illnesses

## Overview:

In ancient times, herbs and plants were widely used to treat various physical and mental ailments. Many cultures, including the Egyptians, Greeks, Romans, and Chinese, relied on the healing properties of plants to manage symptoms of mental illness, anxiety, and depression.



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# Ancient Herbs for Treating Mental Illnesses

## Ancient Cultures and Herbal Remedies:

### Ancient Egyptians:

Egyptians utilized a variety of herbs for both physical and mental health, including **opium** (for pain and calming), **mandrake** (a psychoactive plant), and **thyme** (used for mental clarity and relaxation).



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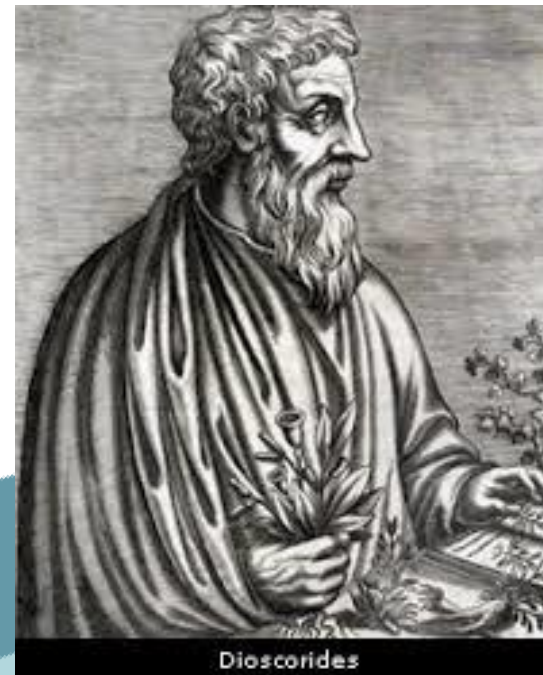
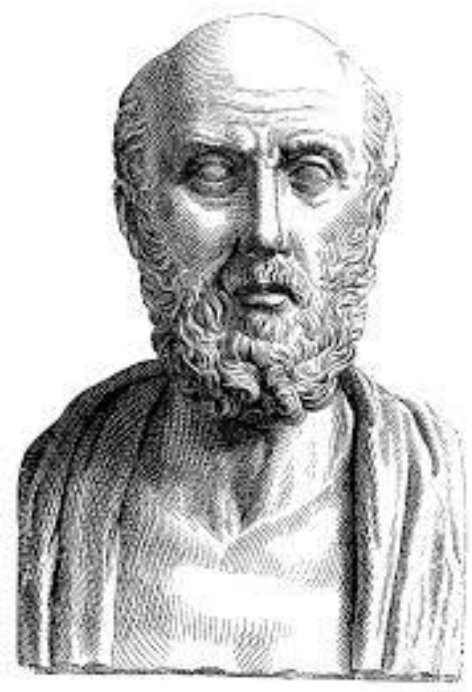
# Ancient Herbs for Treating Mental Illnesses

## Ancient Cultures and Herbal Remedies:

### Ancient Greeks and Romans:

Herbal medicine was fundamental in Greek and Roman healing practices. Well-known figures like **Hippocrates** and **Dioscorides** recommended various herbs for treating mental health issues.

- **Valerian root** was commonly used as a remedy for **anxiety, insomnia, and nervous disorders**.
- **Saffron** was used to treat **depression and melancholy**, with historical texts noting its mood-enhancing properties.



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# Ancient Herbs for Treating Mental Illnesses

## Ancient Cultures and Herbal Remedies:

### Traditional Chinese Medicine (TCM):

Chinese herbal medicine, still widely used today, has roots going back thousands of years. Herbs like **ginseng** and **licorice** were often prescribed for **mental fatigue** and **stress relief**.



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# Ancient Herbs for Treating Mental Illnesses

## Key Ancient Herbs for Mental Health:

### Valerian Root:

Known for its calming effects, **valerian root** has been used for **anxiety, insomnia,** and **nervous disorders** for over 2,000 years. It was commonly recommended by Greek physicians for treating **melancholy** and **depression**.



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# Ancient Herbs for Treating Mental Illnesses

## Key Ancient Herbs for Mental Health:

### St. John's Wort:

First recorded by the Greeks, **St. John's Wort** was used for a variety of mental health issues, especially **depression** and **anxiety**. It is still widely used today as an herbal treatment for mild to moderate depression.



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# Ancient Herbs for Treating Mental Illnesses

## Key Ancient Herbs for Mental Health:

### Lavender:

The ancient Egyptians and Greeks used **lavender** for relaxation, calming the mind, and alleviating anxiety. It was commonly used in baths or as an essential oil for stress relief and mental clarity.



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# Ancient Herbs for Treating Mental Illnesses

## Key Ancient Herbs for Mental Health:

### Mandrake Root:

Used for centuries, **mandrake root** contains **hallucinogenic properties** and was believed to have healing powers, especially for **psychosis** or **mania** in ancient times. It was also used as an anesthetic in ancient surgeries.



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# Ancient Herbs for Treating Mental Illnesses

## Key Ancient Herbs for Mental Health:

### Ginseng:

In ancient Chinese medicine, **ginseng** was revered as a herb for **vitality, energy, and mental clarity**. It was used to combat **mental fatigue** and enhance cognitive function.



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# Ancient Herbs for Treating Mental Illnesses

## How Herbal Remedies Were Used:

- **Teas and Tinctures:** Herbs were commonly brewed into teas or made into tinctures for regular consumption.
- **Poultices and Ointments:** Some herbs were applied topically in the form of poultices or ointments, especially for conditions like **headaches** or **nervous disorders**.
- **Ritualistic Use:** In many ancient cultures, herbs were also used in **spiritual and healing rituals**, often in combination with **prayers** or **offerings** to deities for mental health and well-being.



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# The Rise of Asylums (16th–19th Century)

- **Overview:** Establishment of asylums to house individuals with mental illnesses.



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# The Rise of Asylums (16th–19th Century)

- **Key Figures: Philippe Pinel** and **William Tuke**, who advocated for more humane treatment.



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# The Rise of Asylums (16th–19th Century)

## Treatments:

**Moral therapy:** Pinel and Tuke promoted a more compassionate approach, emphasizing a calm, structured environment.



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# The Rise of Asylums (16th–19th Century)

## Treatments:

**Music Therapy:** Music was increasingly used in asylums as a therapeutic tool. It was thought to soothe patients, reduce anxiety, and help regulate emotions. Patients would engage in playing instruments, listening to music, or singing as part of their treatment.



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# The Rise of Asylums (16th–19th Century)

## Treatments:

**Poetry Therapy:** Writing poetry or engaging with poetic forms was encouraged in some asylums as a means of expression and catharsis. This form of therapy helped patients articulate emotions and experiences that might otherwise be difficult to express verbally.



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# The Rise of Asylums (16th–19th Century)

## Treatments:

**Restraints and confinement:** Often used in asylums.

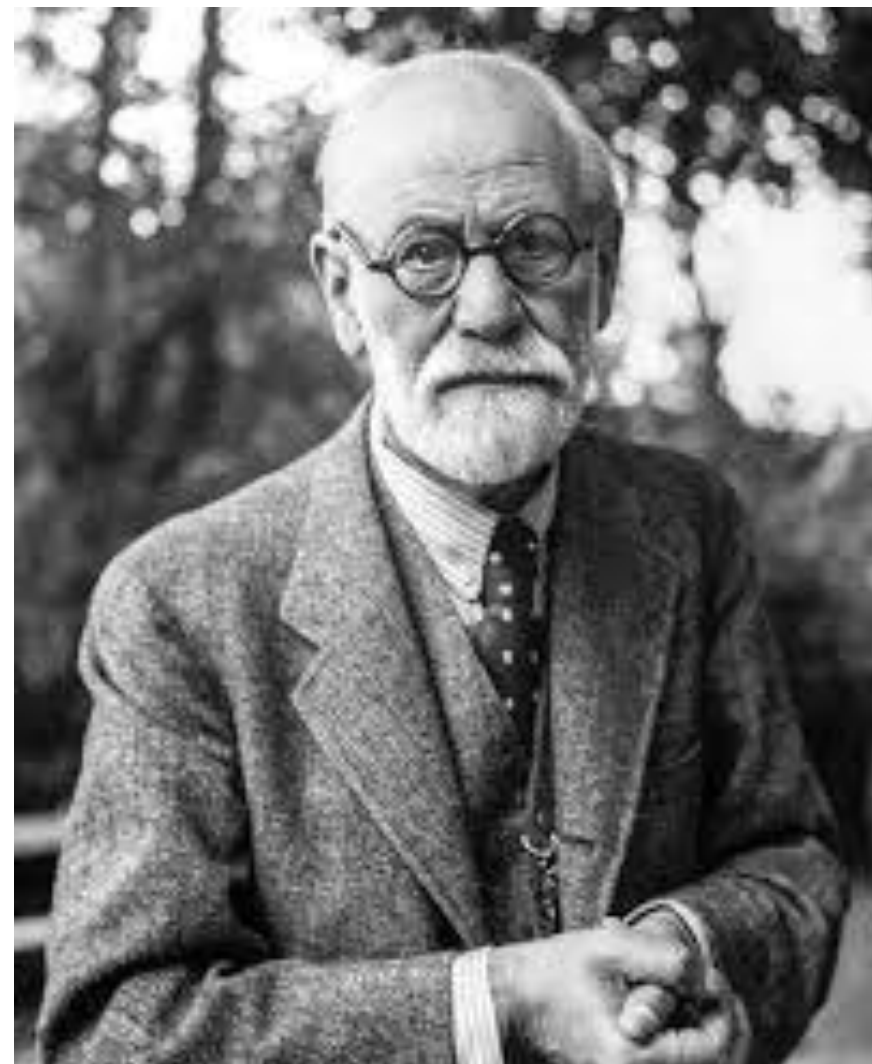


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# The Advent of Psychoanalysis (Late 19th–Early 20th Century)

- **Overview:** Sigmund Freud introduced psychoanalysis as a method for treating mental illness.



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# The Advent of Psychoanalysis (Late 19th–Early 20th Century)

## Key Concepts:

**Talking cure:** The idea that discussing issues could heal the mind.



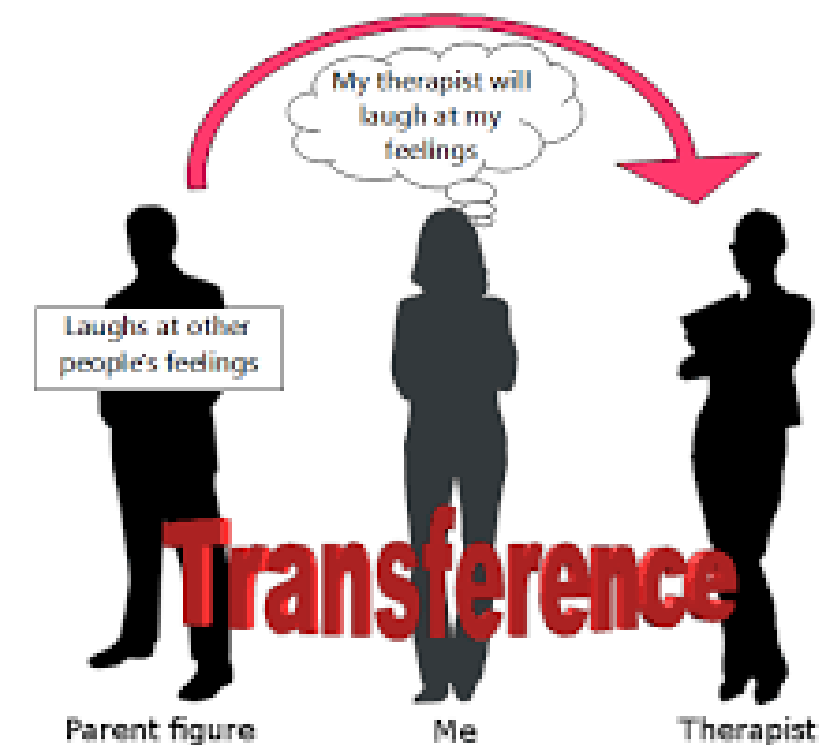
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# The Advent of Psychoanalysis (Late 19th–Early 20th Century)

## Treatments:

Dream analysis, free association, and transference.



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# The Advent of Psychoanalysis (Late 19th–Early 20th Century)

- **Impact:** Psychoanalysis became the dominant form of psychotherapy for much of the 20th century.
- Has led to the plethora of various psychotherapies commonly offered to patients today.



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# Seizure Therapy for Mental Illnesses

## **Link Between Seizures and Mental Health:**

In the early 20th century, it was hypothesized that seizures might somehow "reset" the brain, clearing up mental confusion or severe psychological distress. The idea that a seizure could "cure" or alleviate mental health symptoms grew out of this observation.



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# Fever-Induced Seizures and Seizure Therapy for Mental Illnesses

## Fever-Induced Seizures:

**Ancient and Early Observations:** It was observed that people with **high fevers**, often due to infection, sometimes experienced seizures. Interestingly, these individuals sometimes showed **improvement in psychiatric symptoms** (e.g., psychosis or severe depression) after the seizure.



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# Fever-Induced Seizures and Seizure Therapy for Mental Illnesses

- **Malaria Therapy:**
- In the **early 20th century, malaria therapy** was developed as a method to treat **neurosyphilis**, a severe brain infection that caused psychiatric symptoms like delusions and paranoia. The treatment involved infecting patients with **malaria** intentionally by injecting them with the malaria parasite. The resulting fever was believed to help eliminate the syphilis infection and improve mental health symptoms. This practice became particularly popular from the 1910s to the 1930s.



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# Fever-Induced Seizures and Seizure Therapy for Mental Illnesses

- **Malaria Therapy:**
  - **How It Worked:**
    - The high fever caused by malaria would induce a seizure-like response in the body, and this was thought to have a therapeutic effect on mental illnesses associated with infections, especially in **neurosyphilis**. The therapy was considered effective in some cases, but it came with significant risks, such as brain damage, organ failure, and even death.



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# Fever-Induced Seizures and Seizure Therapy for Mental Illnesses

## The First Use of Seizure Therapy:

The practice of deliberately inducing seizures for psychiatric treatment was popularized in the **1930s** by **Manfred Sakel**, who developed the technique of **insulin coma therapy**. In insulin coma therapy, patients were injected with large doses of insulin to induce a coma and a seizure, based on the belief that the shock to the system could treat schizophrenia.



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# Electroconvulsive Therapy (ECT) (early 20<sup>th</sup> Century)

- **First Use:**
  - ECT was first introduced in **1938** by Italian psychiatrists **Ugo Cerletti** and **Lucio Bini**. They discovered that applying electrical currents to the brain could help treat patients with severe mental disorders, particularly those suffering from schizophrenia and depression.
  - Performed without anesthesia or pain treatment



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# Electroconvulsive Therapy (ECT) (early 20<sup>th</sup> Century)

- **Early Use:**
  - ECT was initially used more widely in the mid-20th century for various mental health conditions, including severe depression, bipolar disorder, and even as a last resort for patients with schizophrenia.



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# Electroconvulsive Therapy (ECT) (early 20<sup>th</sup> Century)

## Advantages of ECT:

- **Effectiveness for Severe Depression:** ECT is often very effective for patients with **severe, treatment-resistant depression**, especially when other treatments (such as medications and therapy) have failed.
- **Rapid Results:** ECT can provide faster relief than antidepressants, making it useful for patients in extreme distress or with suicidal ideation.
- **High Success Rate:** It has shown to be a highly successful treatment for some patients, especially those with **bipolar disorder** or **major depressive disorder**.



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# Electroconvulsive Therapy (ECT) (early 20<sup>th</sup> Century)

## Disadvantages of ECT:

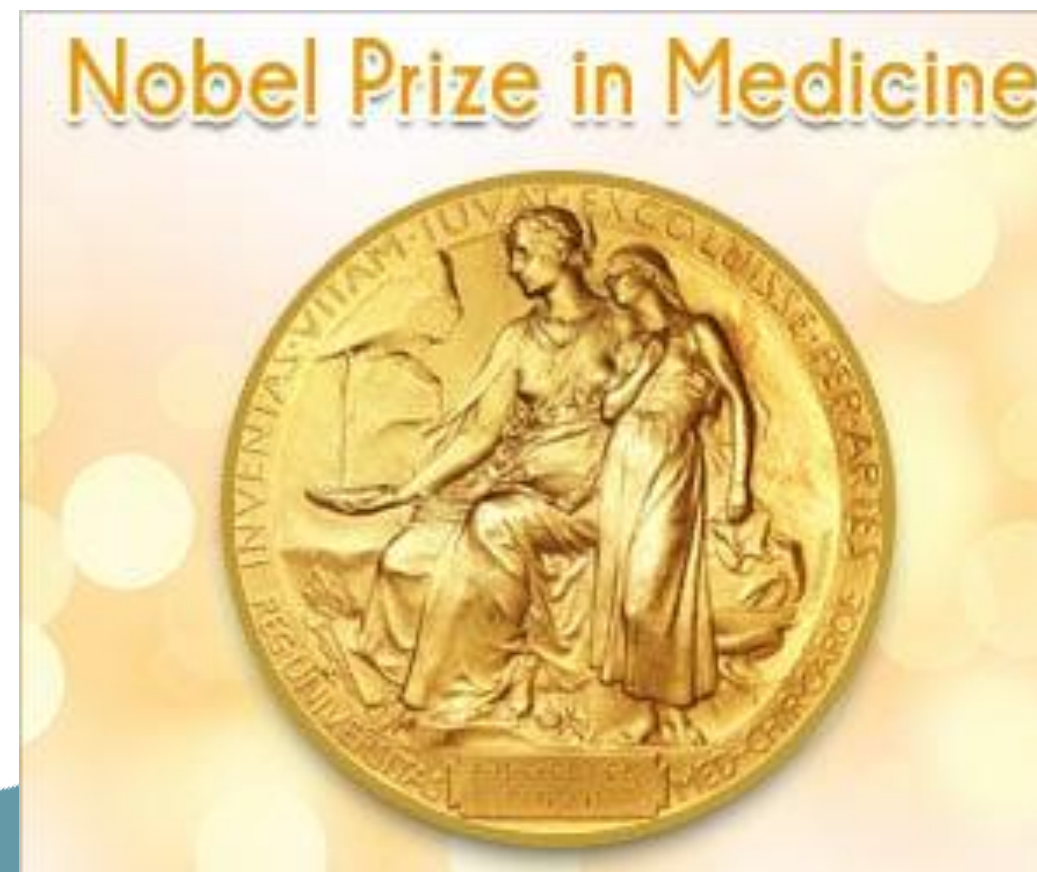
- Amnesia, confusion, hypertension, headaches, nausea
- Multiple treatment sessions
- High costs
- stigma



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# Frontal Lobotomy (early 20<sup>th</sup> Century)

- Developed by Portuguese neurologist **Egas Moniz** in **1935**
- Procedure called "**leucotomy**": involved cutting white matter in the frontal lobes
- Aimed to treat **severe psychiatric conditions** like schizophrenia and depression
- Moniz awarded the **Nobel Prize in Physiology and Medicine (1949)**
- Seen initially as a **groundbreaking treatment** before antipsychotics were available

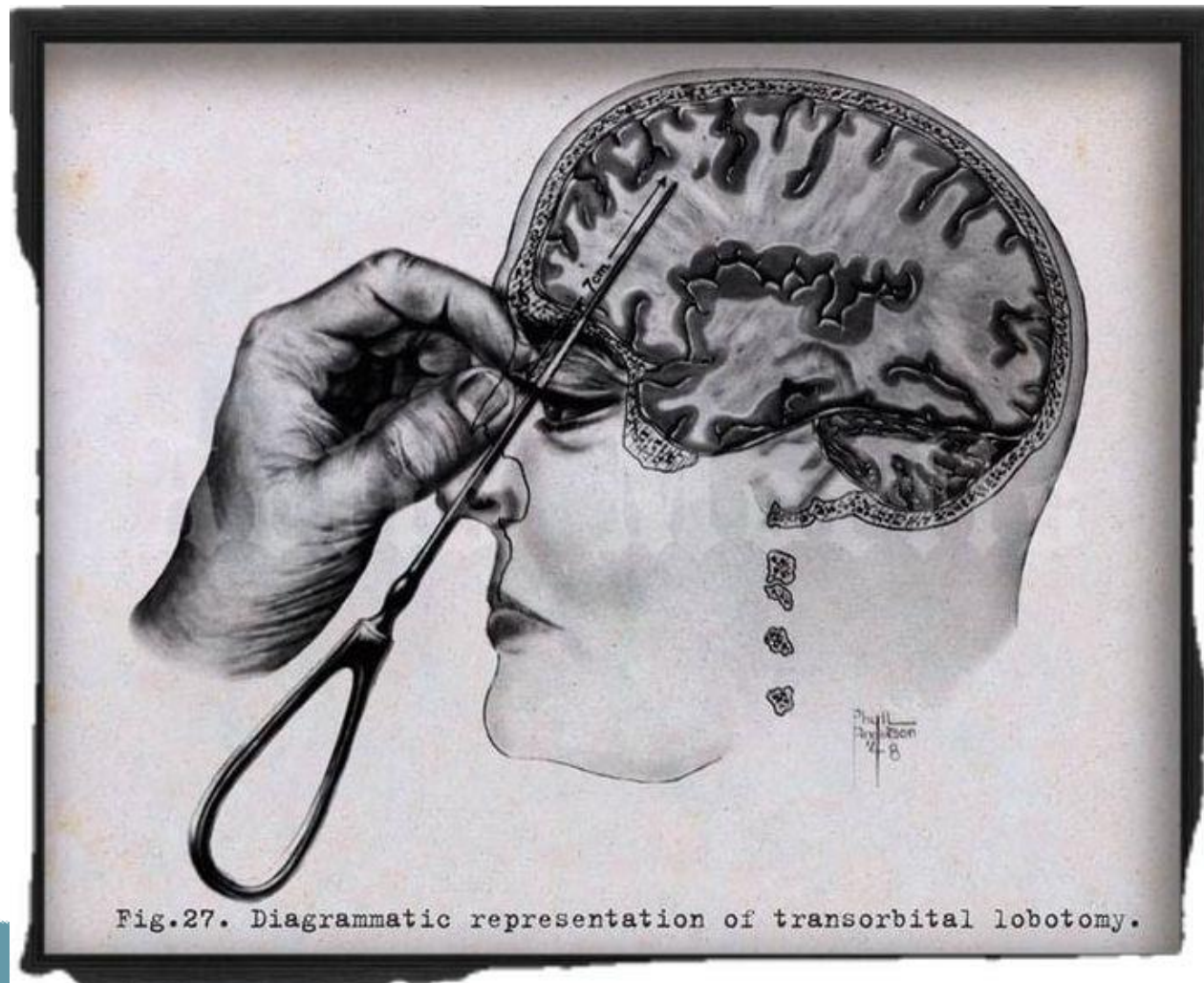


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# Frontal Lobotomy (early 20<sup>th</sup> Century)

- Popularized in the U.S. by **Dr. Walter Freeman** and **Dr. James Watts**
- Freeman developed the **transorbital lobotomy** (“ice pick” method) in the 1940s
- Procedure was **quick, inexpensive**, and used widely in state mental hospitals
- Over **40,000 lobotomies** performed in the U.S.
- Applied to a wide range of patients, sometimes without consent



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# Frontal Lobotomy (early 20<sup>th</sup> Century)

- Mounting evidence of **severe side effects**: personality change, cognitive decline, disability
- Rise of **antipsychotic medications** like **chlorpromazine (Thorazine)** in the 1950s
- Procedure fell out of favor by the **late 1950s–60s**
- Now viewed as a **controversial and unethical practice**
- Sparked debate on medical ethics and **informed consent in psychiatry**



"Case 624. Simple schizophrenia patients make nice household pets after operation"



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# Rise of the Chemists (late-19<sup>th</sup> and early-20th Centuries)

- **Cocaine:**
  - An extract of the coca plant from northern and western South America.
  - first isolated in 1860 by **German chemist Albert Niemann**.
  - It gained widespread medical use in the late 19th century as a local anesthetic and stimulant.
  - However, its addictive and harmful properties soon became apparent, leading to its restricted use in the early 20th century



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# Rise of the Chemists (late-19<sup>th</sup> and early-20th Centuries)

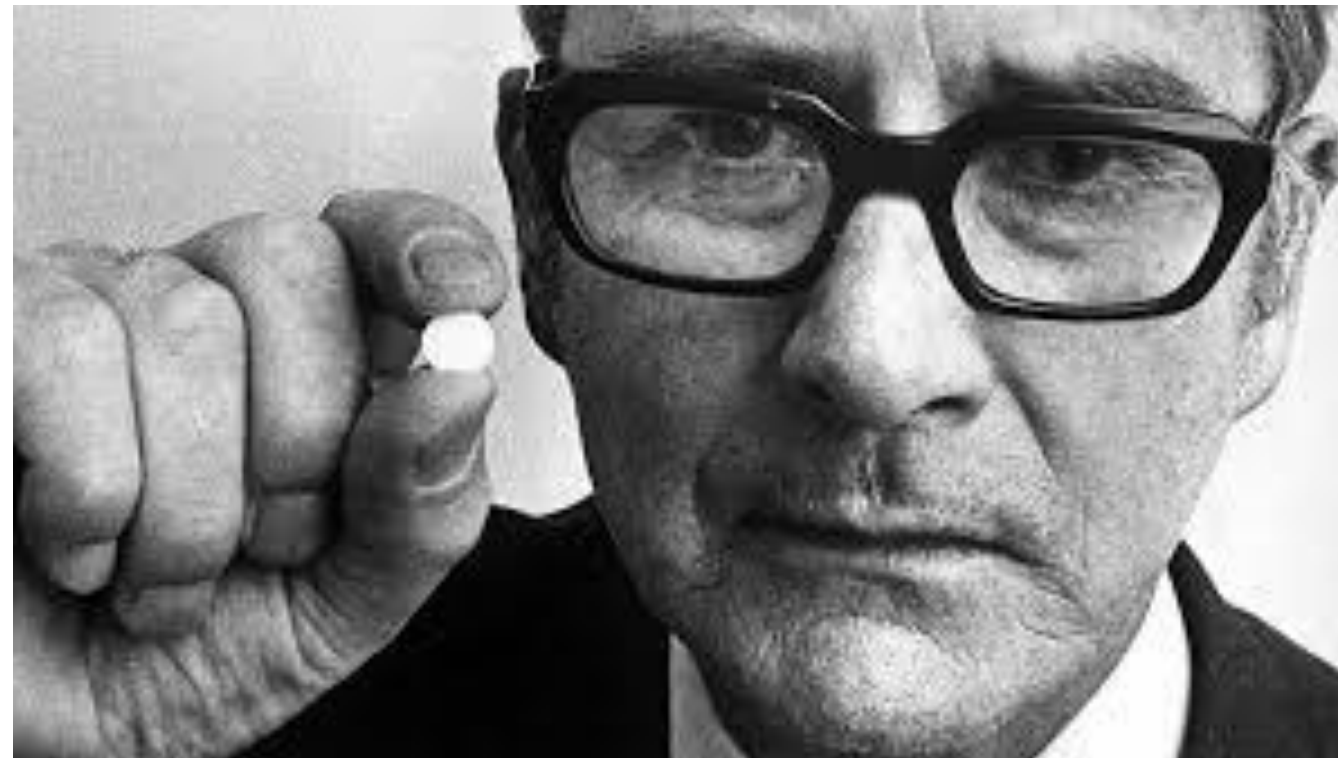
- **Coca-cola:**
  - In the late 19th and early 20th centuries, Coca-Cola originally contained an estimated 9mg of cocaine per serving. It was marketed as a medicinal tonic for various ailments, including mental fatigue and depression, due to the stimulating effects of cocaine.
  - The cocaine was gradually reduced and eventually removed from the beverage by 1929 due to increasing concerns over the drug's addictive properties.



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# Rise of the Chemists (late-19<sup>th</sup> and early-20th Centuries)

- **Lithium:**
  - While lithium had some early use in psychiatry, it was largely forgotten until **Australian psychiatrist John Cade** reintroduced it in 1949 for treating mania.
  - The FDA approved lithium for the treatment of bipolar disorder in 1970, marking a significant step in the treatment of mental illness.

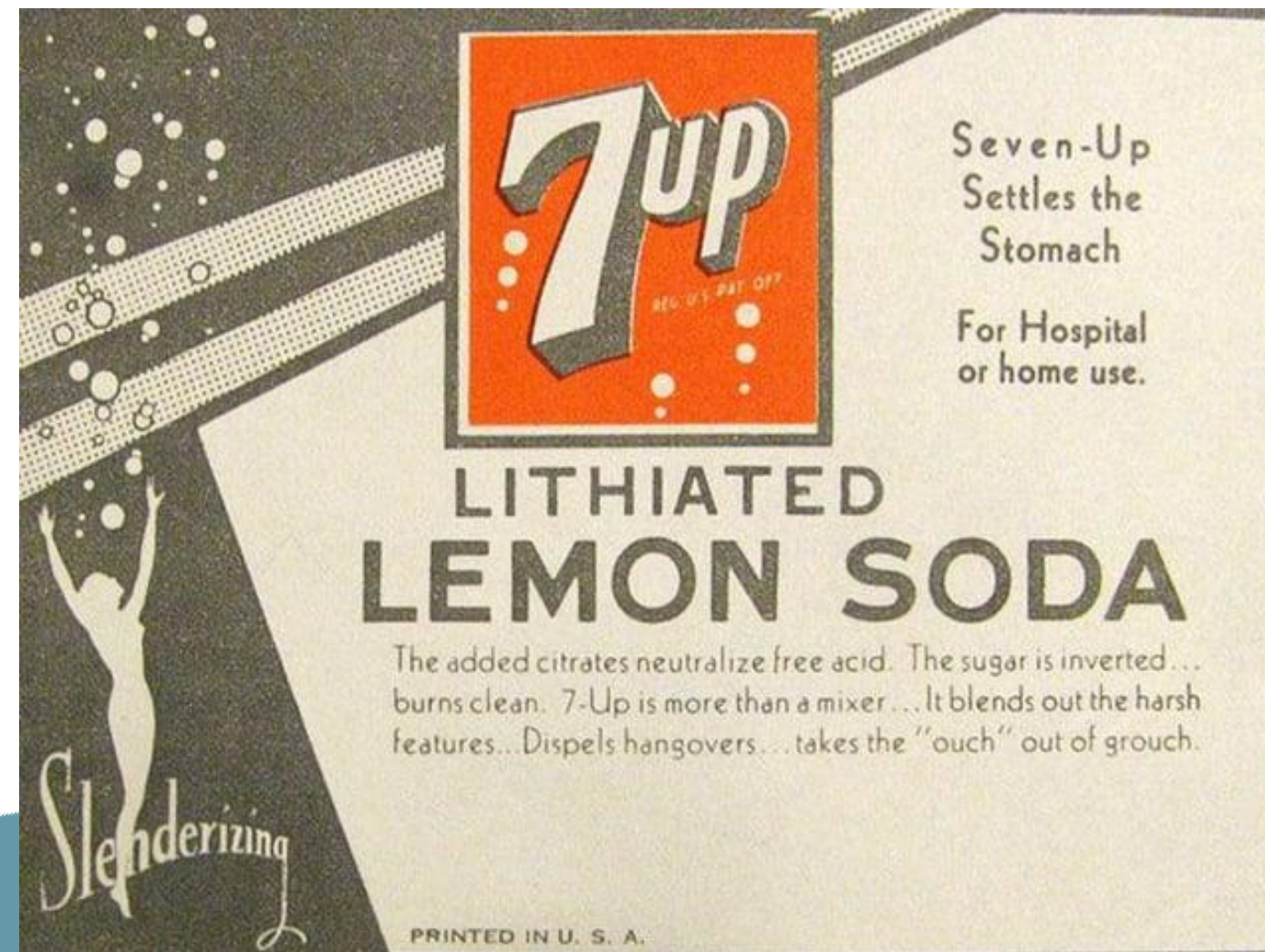


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# Rise of the Chemists (late-19<sup>th</sup> and early-20th Centuries)

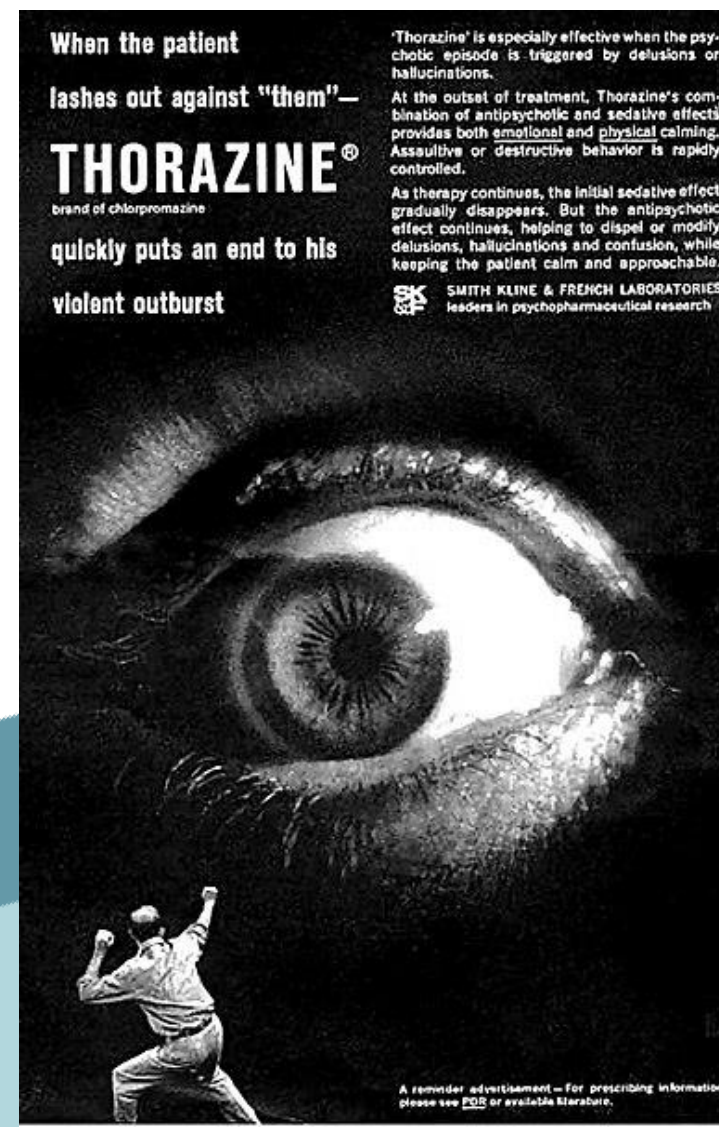
- **7-up**
  - In the 1940s, 7-Up contained a small amount of lithium citrate, which was originally used as a mood stabilizer for patients with bipolar disorder.
  - The drink was marketed as a "tonic" and claimed to have a calming effect. Lithium was removed from 7-Up in 1950 after regulations surrounding its use became stricter.



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# The Introduction of Medications (Mid-20th Century)

- **Thorazine (chlorpromazine)**
  - Pursuing an anesthetic, **French Chemist Paul Charpentier** created this molecule in 1950.
  - **French psychiatrist Henri Laborit**, seeing the calming and soothing effects used it in patients with schizophrenia in 1954, found drastic improvements of hallucinations, delusions, and agitation.
  - It quickly became a mainstay treatment and revolutionized the care of patients with schizophrenia and other psychotic disorders.

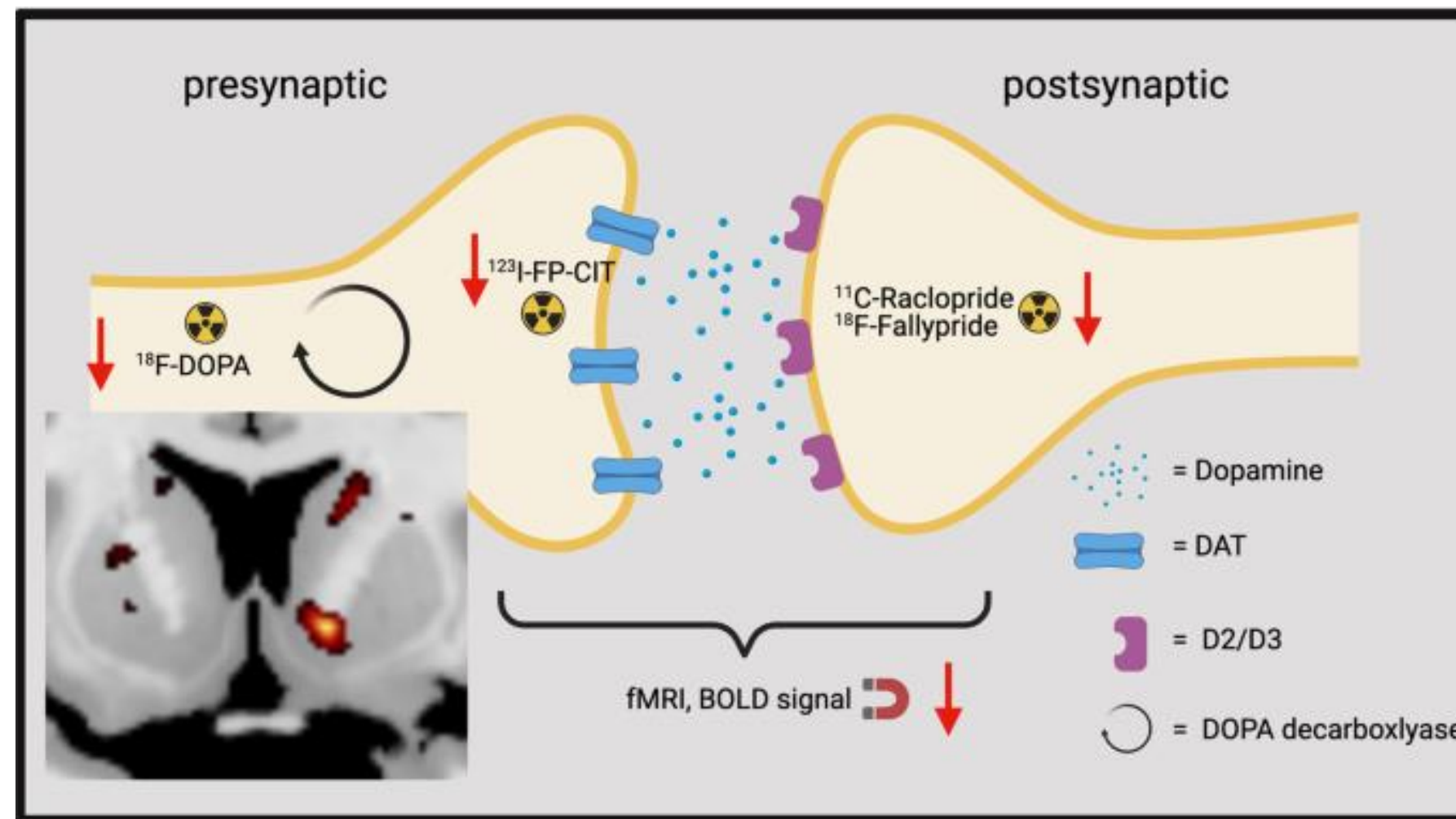


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# The Introduction of Medications (Mid-20th Century)

- **Thorazine (chlorpromazine)**
  - Found to block dopamine



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# The Introduction of Medications (Mid-20th Century)

- Cascade Thorazine (chlorpromazine) - like medications



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# The Introduction of Medications (Mid-20th Century)

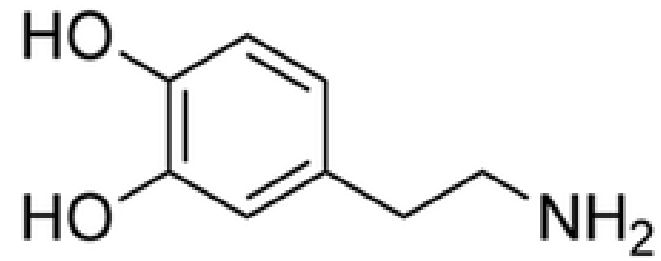
- **Iproniazid**
  - First introduced in 1951 to treat tuberculosis
  - In 1952 was found to improve symptoms of depression.
  - By 1957, the mechanism of action of iproniazid was discovered.



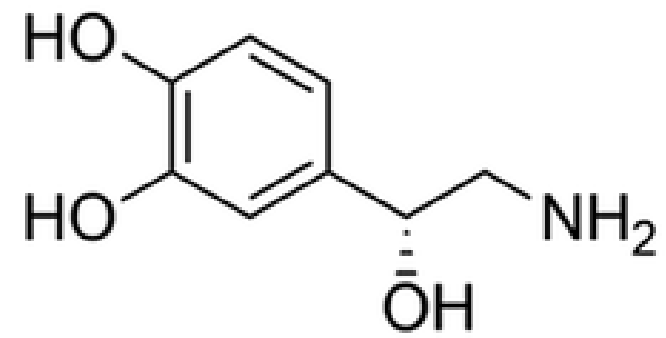
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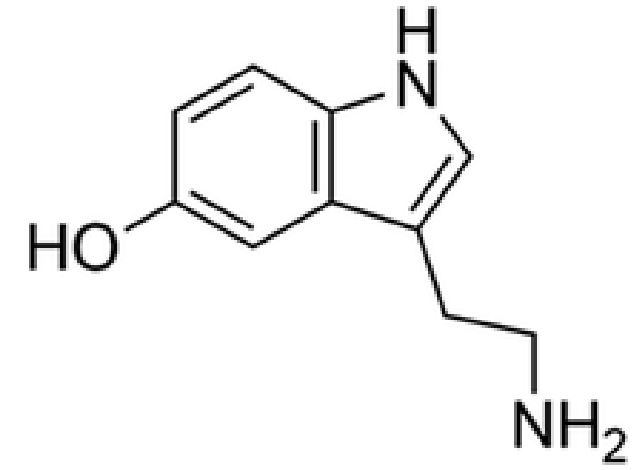
# The Introduction of Medications (Mid-20th Century)



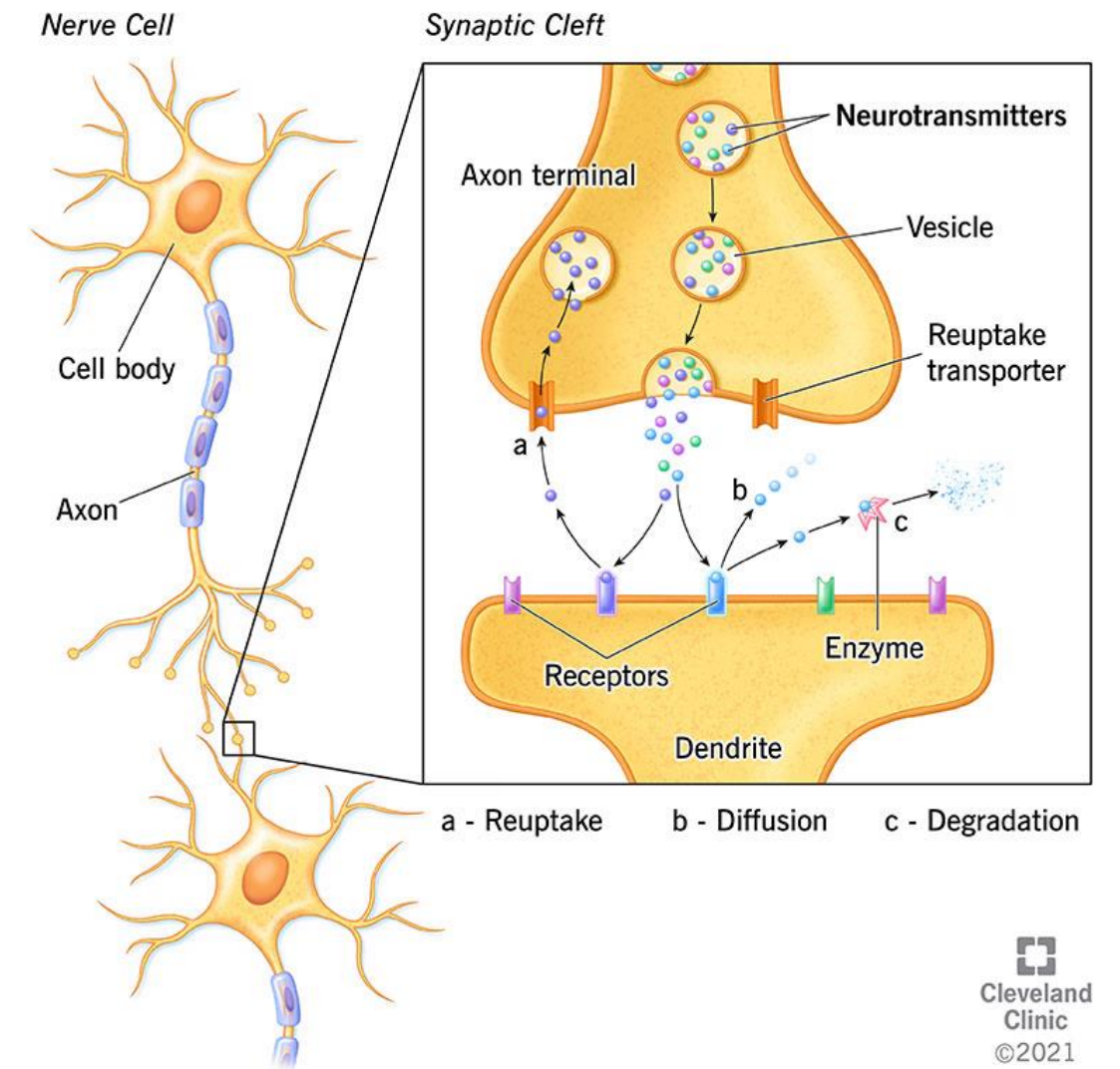
dopamine



norepinephrine



serotonin





# The Introduction of Medications (Mid-20th Century)

- The cascade of Serotonin, Norepinephrine, and Dopamine Medications.



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TODAY

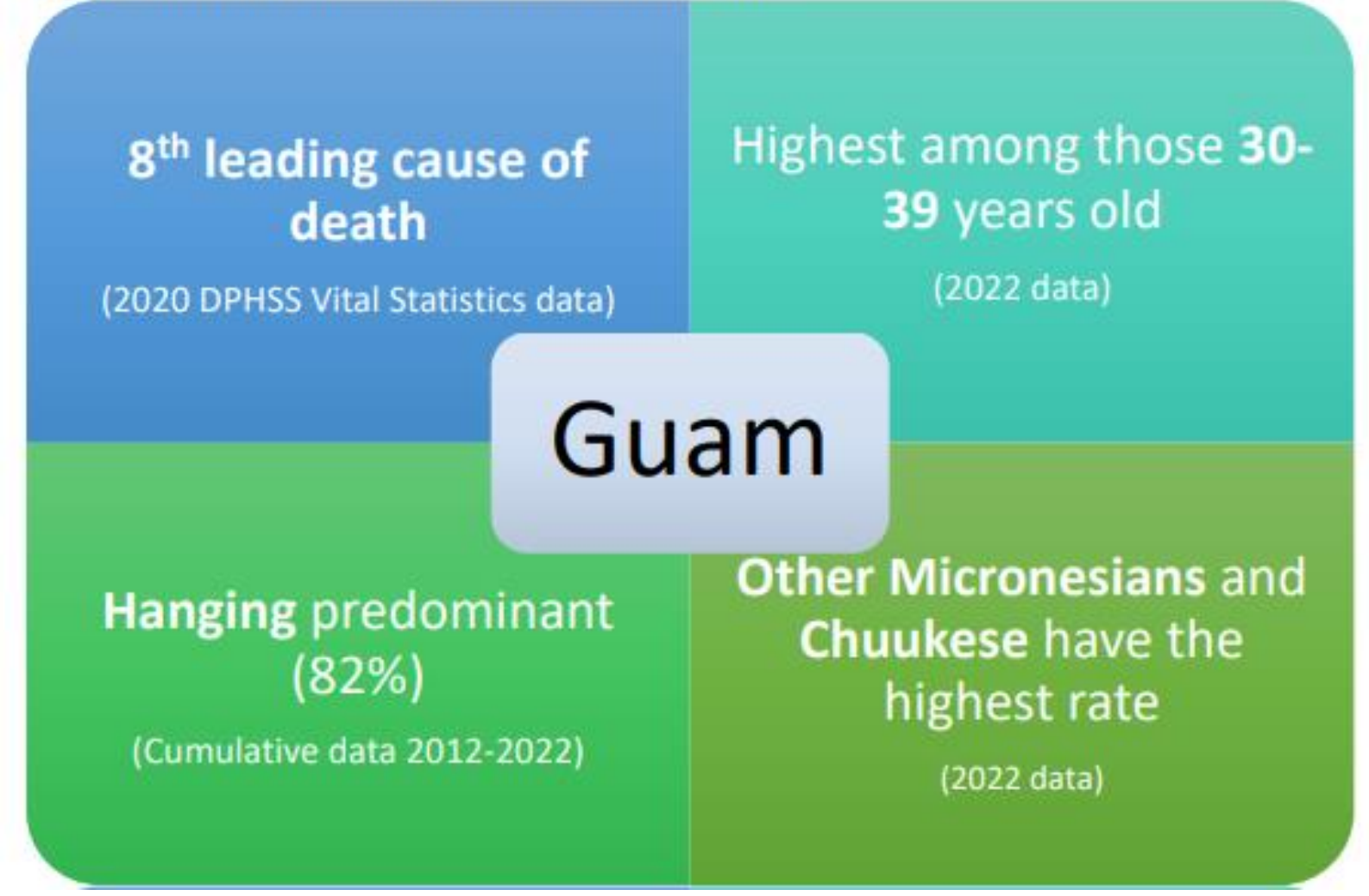
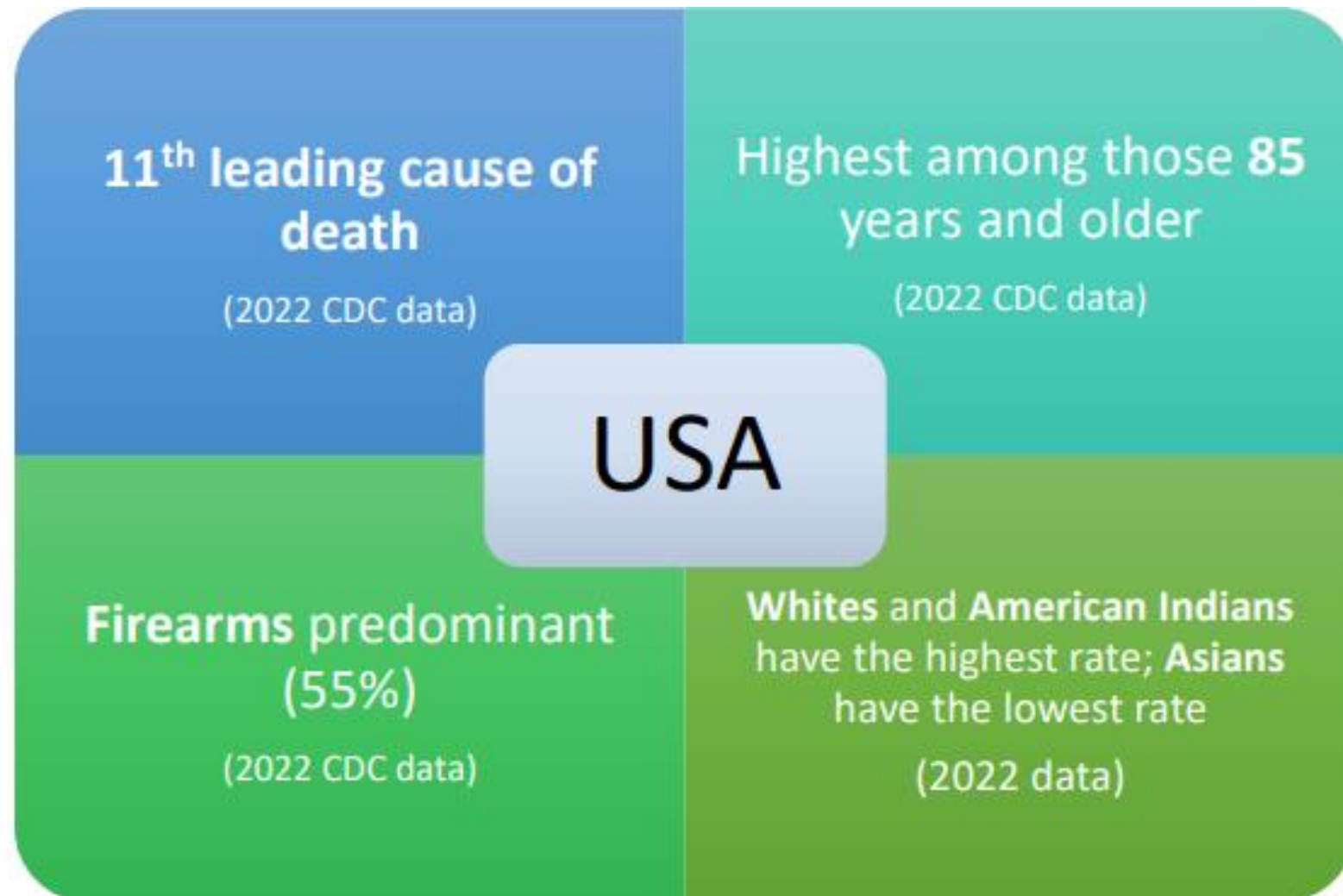


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# Despite the Efforts, Too Many Patients Suffer

Figure 15. Suicides, Guam 2022 vs. USA 2022



Source: Guam data from Office of the Chief Medical Examiner, suicide data 2010-2021 and DPHSS Vital Statistics; US data from CDC National Vital Statistics System-Mortality Data (2022) via CDC WONDER, as reported in

<https://www.cdc.gov/nchs/fastats/suicide.htm>

Note: US data for 2022 is provisional.



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# Despite the Efforts, Too Many Patients Suffer

*Suicide risk and prevention in Guam: Clinical and research considerations and a call to action*

- “Finally, given the geographic isolation of Guam, access to healthcare is likely an important facet of suicide risk.”



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# Despite the Efforts, Too Many Patients Suffer

*Depression Is the Leading Cause of Disability Around the World*

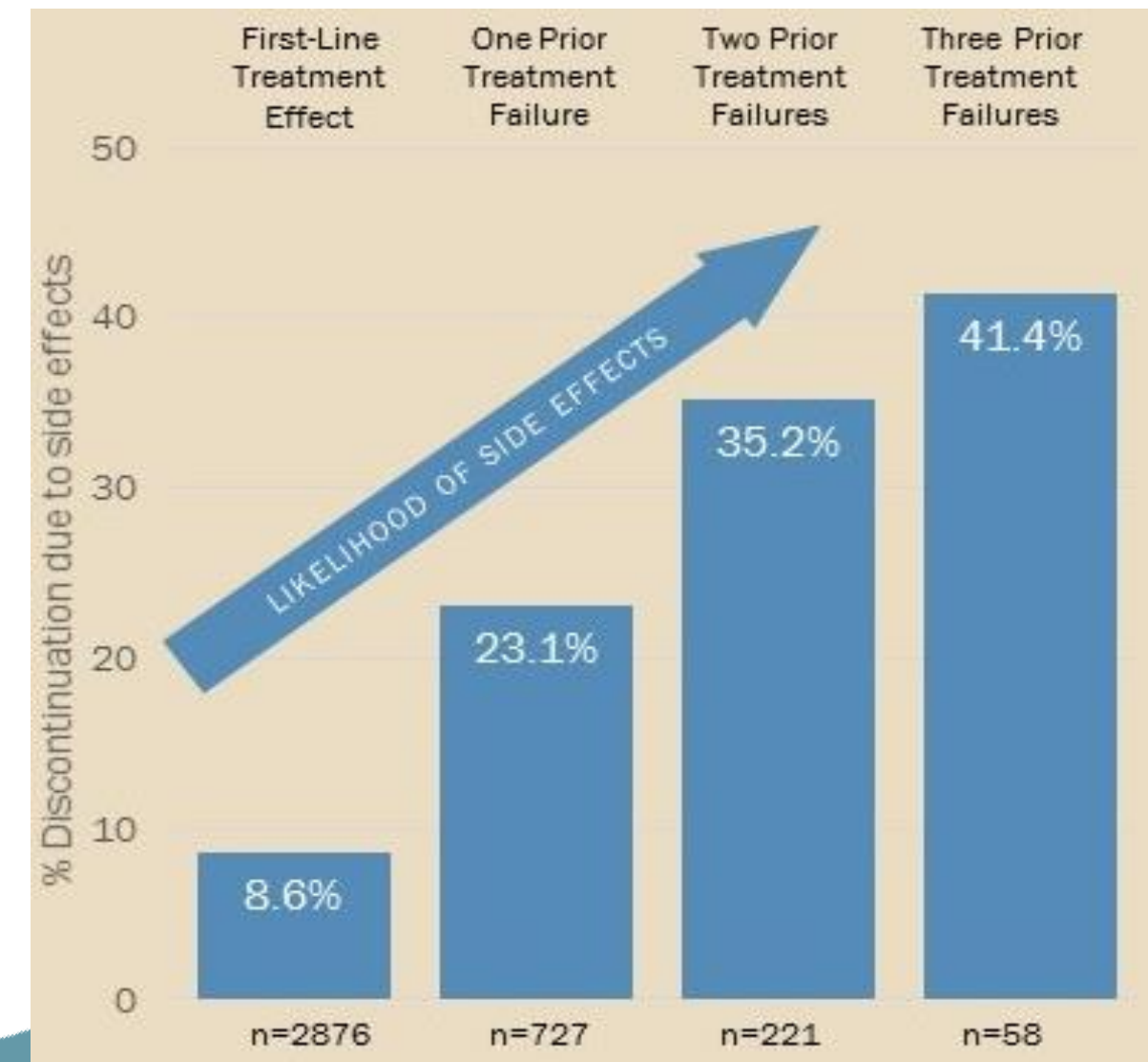
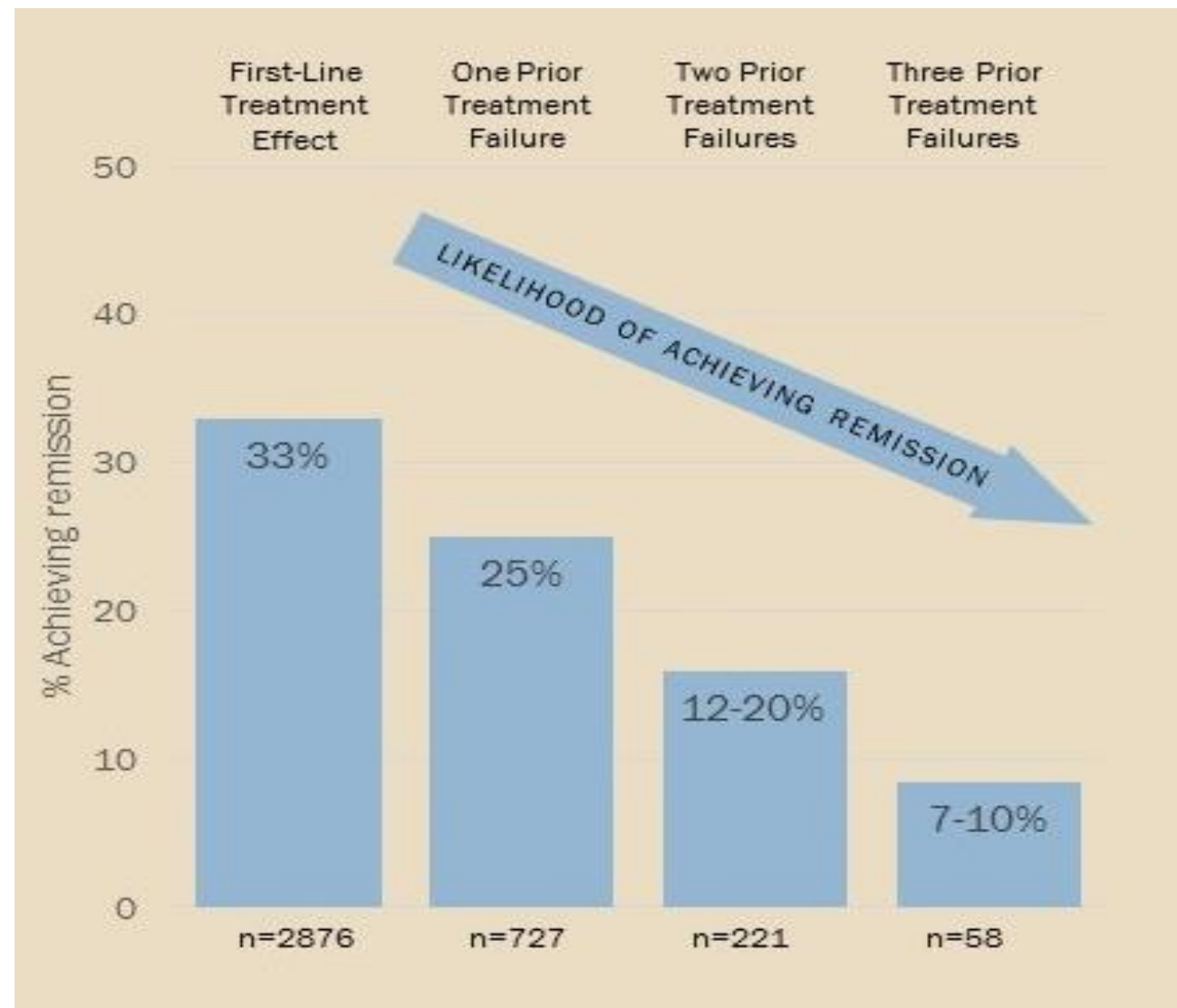


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# Despite the Efforts, Too Many Patients Suffer

National Institute of Mental Health study in 2006

Sequenced Treatment Alternatives to Relieve Depression



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# Newer approaches to care

- Genetic Testing



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# Genetic Testing

## What is Genetic Testing?

- Genetic testing involves analyzing an individual's **DNA** to identify genetic variations that may influence how they metabolize certain medications.
- In **psychiatric treatments**, genetic testing can help predict a patient's response to **antidepressants, antipsychotics**, and other psychiatric drugs.



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# Genetic Testing

## Why is it Important?

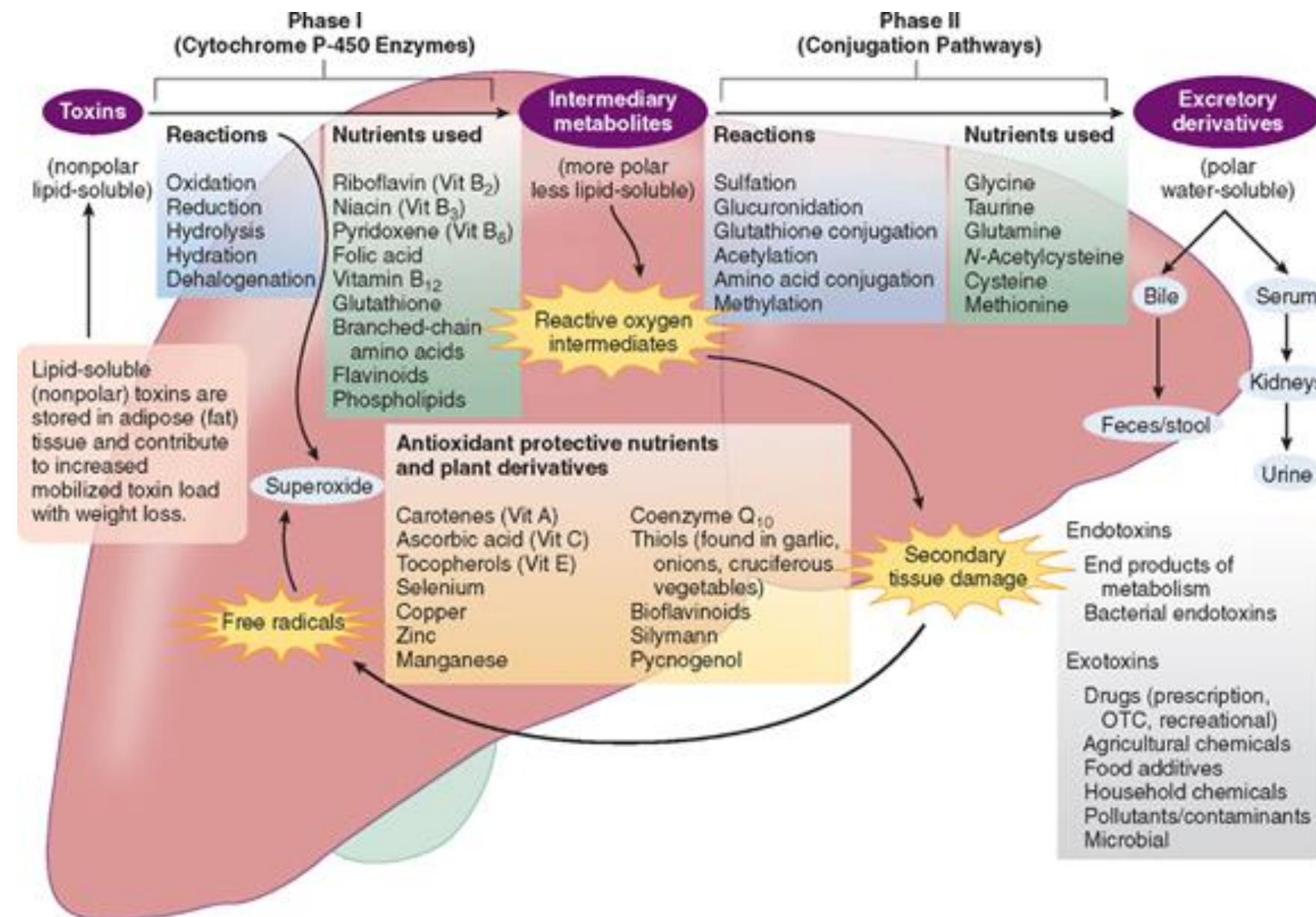
- Understanding a patient's genetic profile can lead to more **personalized treatments**, minimizing side effects and improving drug efficacy.



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# Genetic Testing

- The Liver
  - The Cytochrome P-450 Enzyme System (CYP450)



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# Genetic Testing

## How it Affects Drug Metabolism:

- **Fast Metabolizers:** Individuals with more active enzymes break down medications quickly, which may reduce the effectiveness of certain drugs.
- **Slow Metabolizers:** Individuals with less active enzymes break down medications slowly, potentially increasing the risk of side effects or toxicity.



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# Genetic Testing

## Personalized Medication Treatments Using CYP450 Testing

### Benefits of CYP450 Genetic Testing:

- Helps select the **right medication** at the **right dose**.
- Reduces trial and error, which can often lead to **side effects** and **ineffective treatments**.
- **Improved patient outcomes** by ensuring medications are metabolized in a way that enhances their effectiveness and minimizes risks.



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# Genetic Testing

## Practical Considerations:



[dreamstime.com](https://dreamstime.com)

ID 349482249 © Aquir



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# The Chemical AND Electrical Brain Capacities



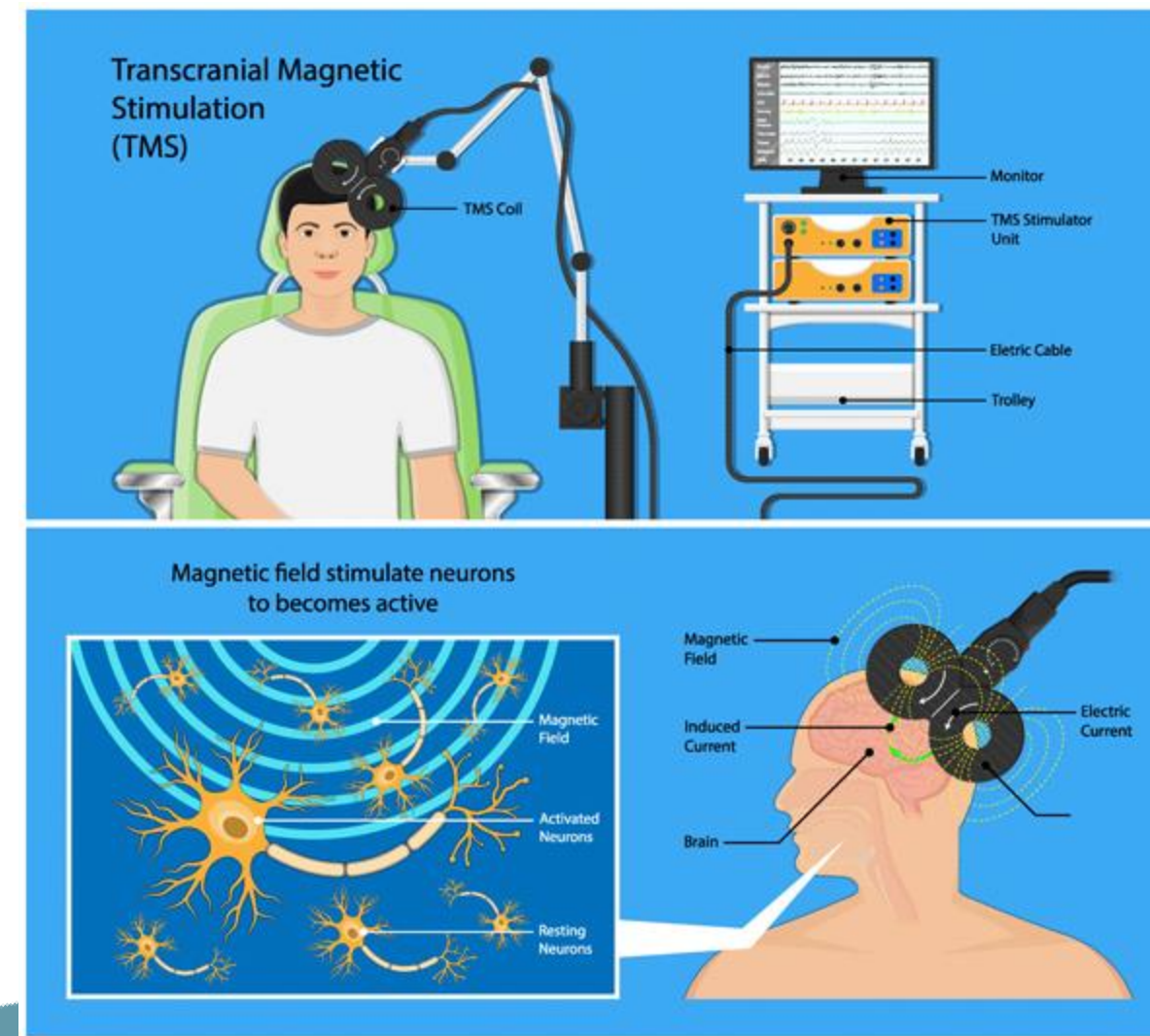
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# Transcranial Magnetic Stimulation

## What is TMS?

- TMS involves the use of a magnetic coil placed near the scalp to generate **magnetic pulses**.
- These pulses are used to stimulate **specific regions of the brain** that are thought to be underactive or overactive.



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# Transcranial Magnetic Stimulation

## History of TMS:

- First developed in the **1980s** and used as a research tool.
- Gained approval for clinical use in treating **major depressive disorder** in the 2000s.



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# Transcranial Magnetic Stimulation

## Major Depressive Disorder (MDD):

- TMS is FDA-approved as a treatment for **treatment-resistant depression**.
- It is used when other treatments, such as medications and psychotherapy, have not been effective.



TMS received approval for treating depression from the FDA in 2008.



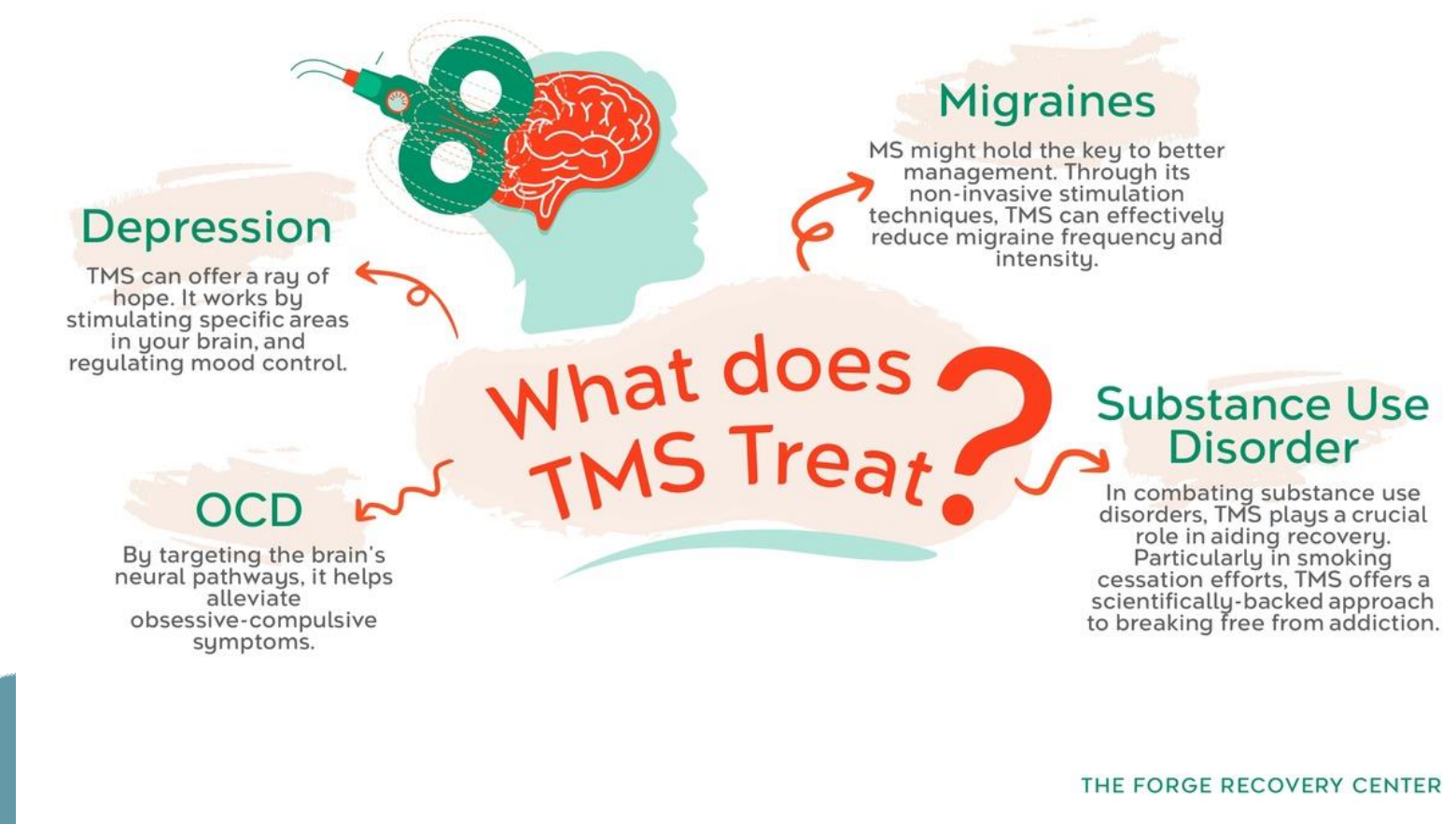
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# Transcranial Magnetic Stimulation

## Other Psychiatric Disorders:

- **Obsessive-Compulsive Disorder (OCD):** TMS can reduce symptoms of OCD, particularly in patients who do not respond to conventional treatments.
- **Post-Traumatic Stress Disorder (PTSD):** TMS has shown potential in treating symptoms of PTSD, including intrusive memories and hyperarousal.

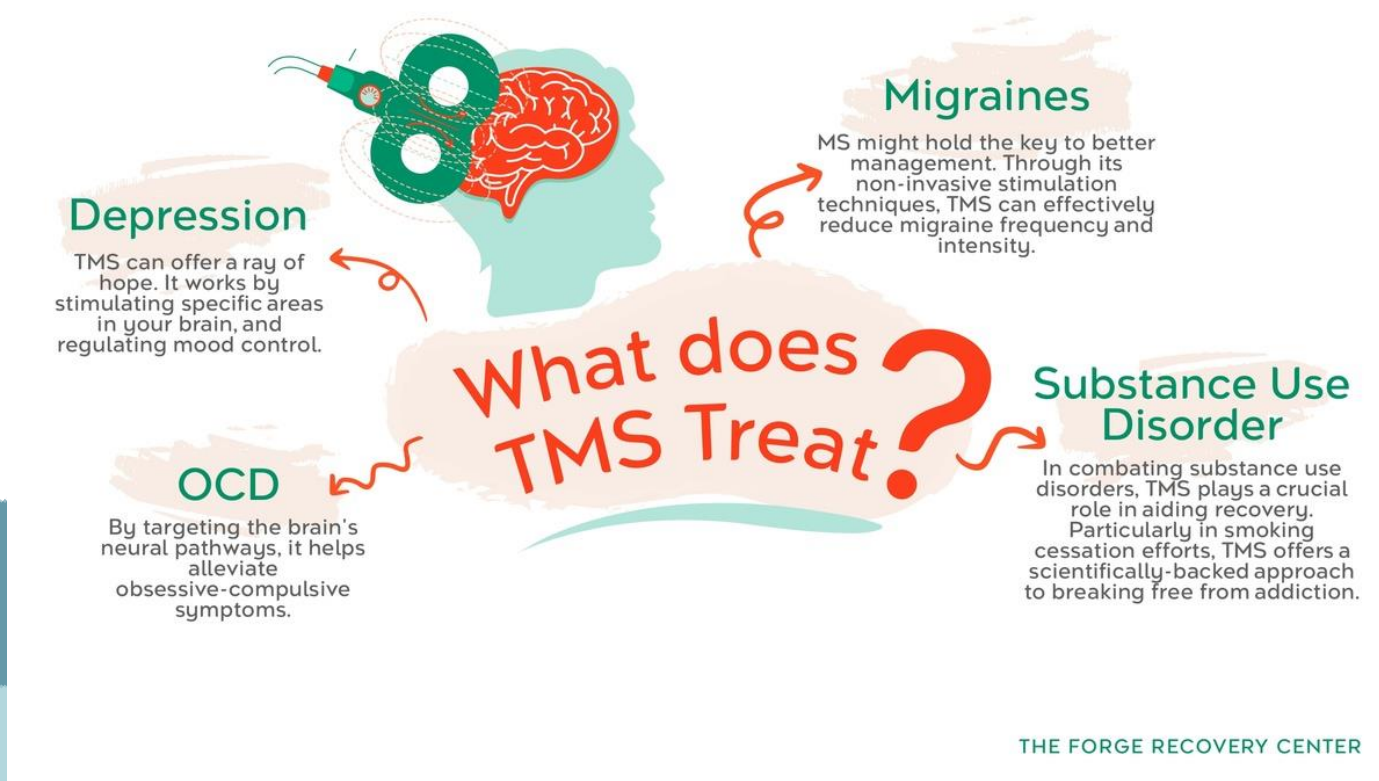


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# Transcranial Magnetic Stimulation

## Neurological Conditions:

- **Chronic Pain:** TMS has been used in some cases to help reduce chronic pain, including fibromyalgia.
- **Stroke Rehabilitation:** TMS may help improve motor function in stroke patients by stimulating brain regions involved in movement.
- **Parkinson's Disease:** TMS can help manage motor symptoms in Parkinson's patients.



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## Substance Use Disorders

- **Nicotine Use / Smoking Cessation:**



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# Transcranial Magnetic Stimulation

## Benefits:

- **Non-Invasive** – TMS does not require surgery or implants.
- **Minimal Side effects** – The most common side effects are mild and temporary including headaches and scalp discomfort.
- **Improved Efficacy** – 86% response rate and 67% remission rates in “treatment resistant depression.”



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# Transcranial Magnetic Stimulation

## Practical Considerations in TMS Treatment:

### Duration of Treatment:

- Each session lasts approximately **30-40 minutes** and involves no downtime post-treatment.

### Treatment Sessions:

- TMS typically requires **daily sessions** (5 days a week) over **4-6 weeks** for maximum effect.



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# Transcranial Magnetic Stimulation

## Practical Considerations in TMS Treatment:

### Patient Eligibility:

- **Contraindications:** Not recommended for patients with **implanted devices** (e.g., pacemakers, cochlear implants) due to magnetic interference.

### Insurance and Costs:

- TMS is often **not covered by insurance** for all conditions, and out-of-pocket costs can be significant.



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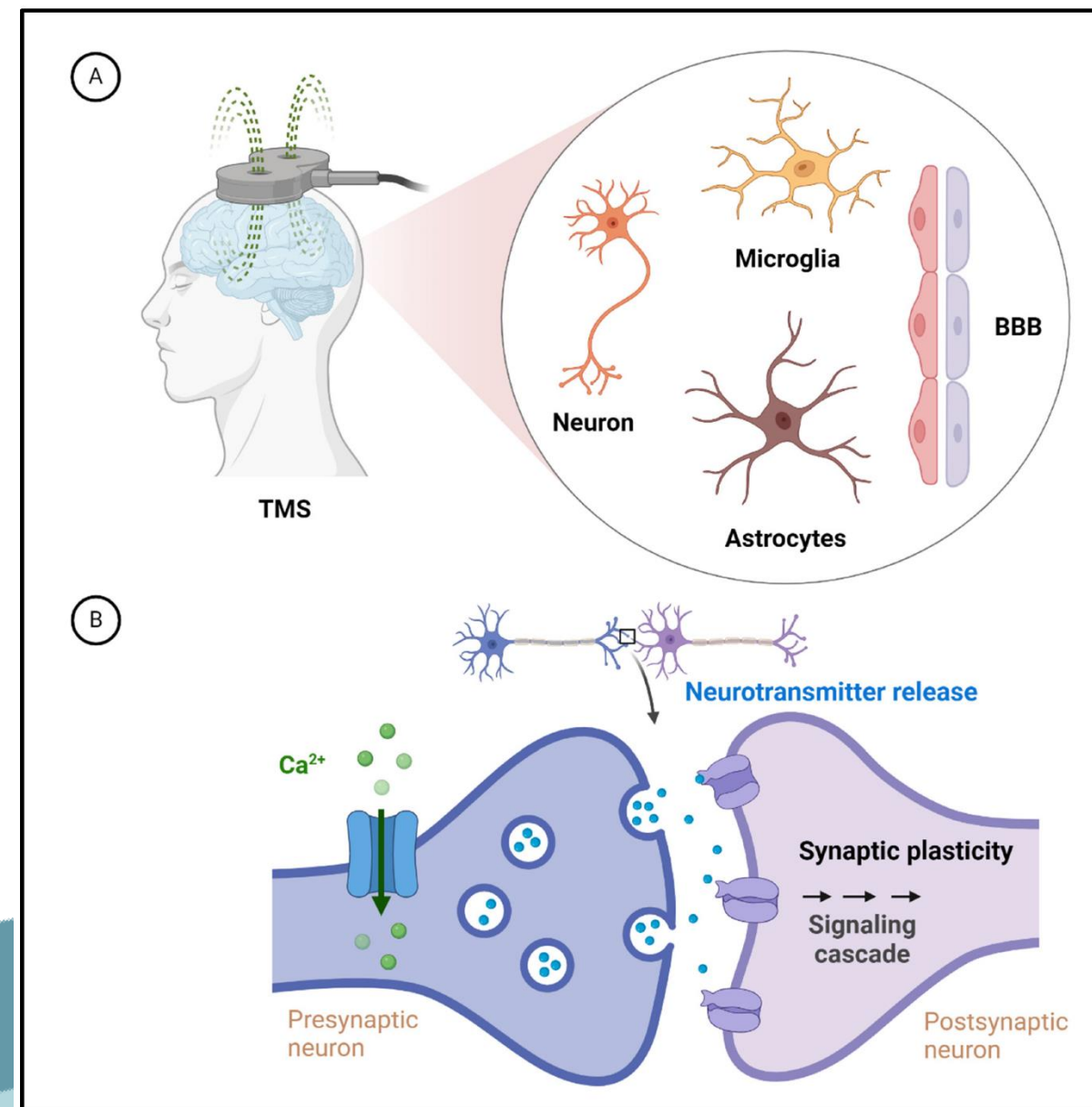


# Transcranial Magnetic Stimulation

## Mechanisms Behind TMS Effectiveness

### Modulation of Neurotransmitters:

- TMS influences neurotransmitter systems such as **dopamine**, **serotonin**, and **glutamate**, all of which play a key role in mood regulation.



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# Transcranial Magnetic Stimulation

## Mechanisms Behind TMS Effectiveness

### Neuroplasticity:

- TMS promotes **neuroplasticity** by stimulating brain regions, leading to changes in brain structure and function over time.



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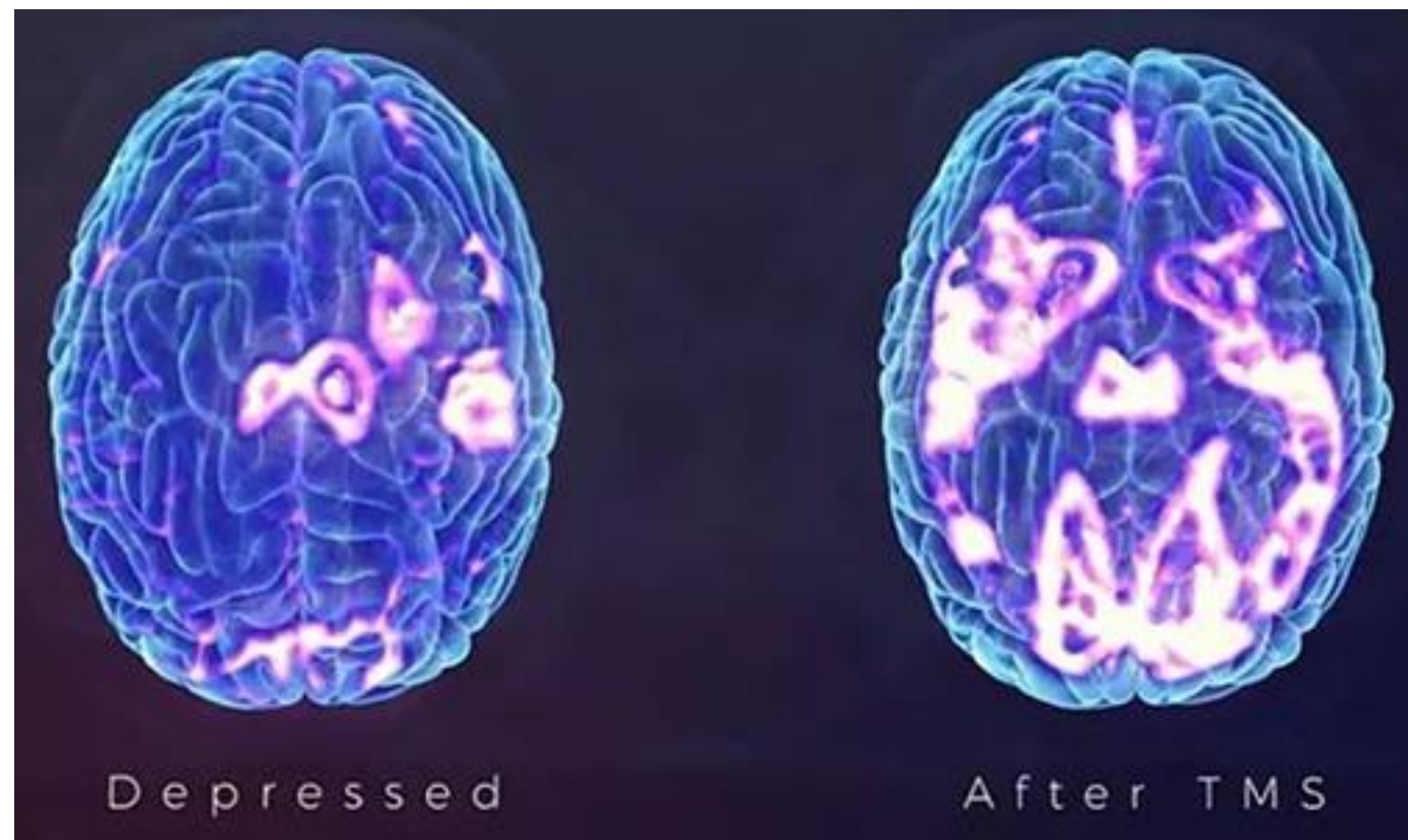


# Transcranial Magnetic Stimulation

## Mechanisms Behind TMS Effectiveness

### Targeting Brain Networks:

- TMS can help **restore balance** in brain networks that are dysregulated in disorders like depression or OCD.

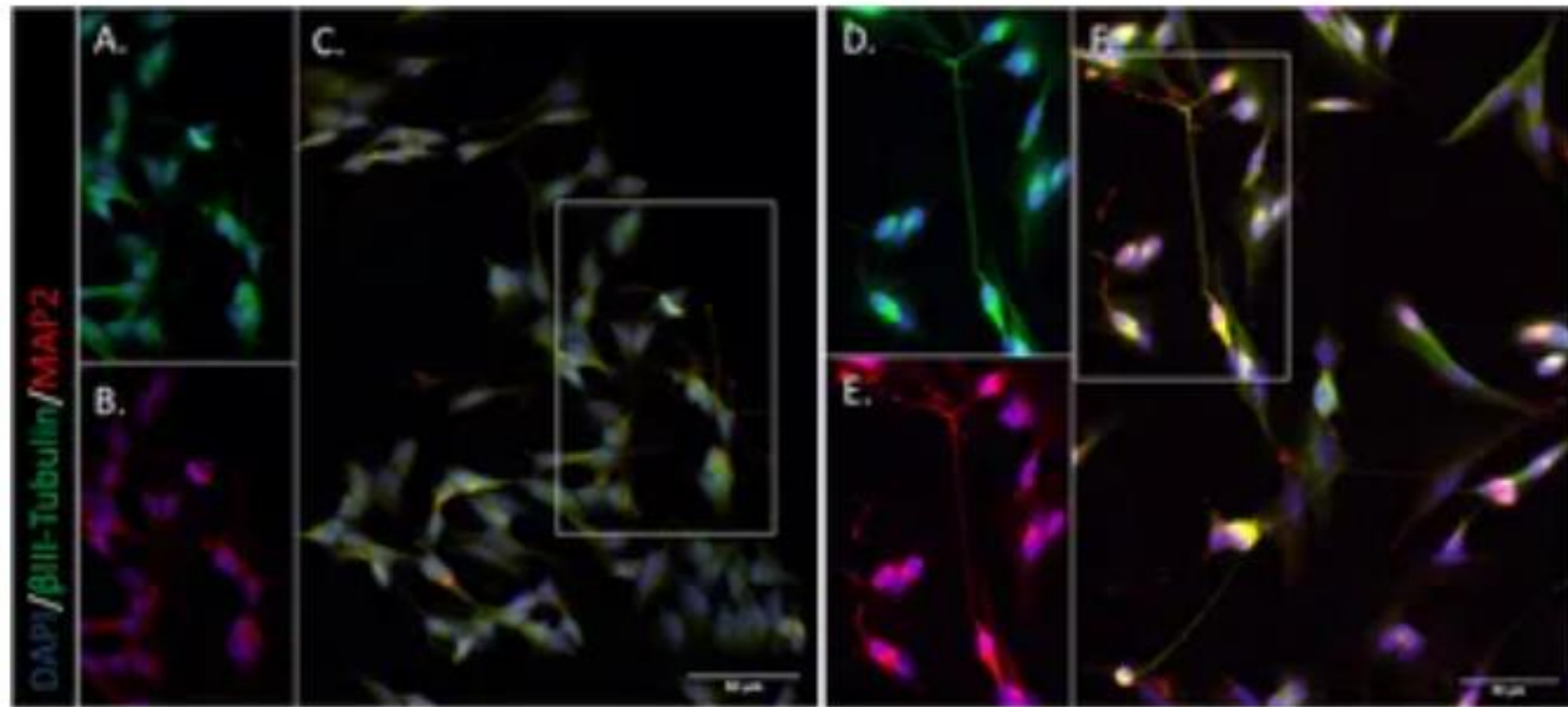


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# TMS Research

- Transcranial Magnetic Stimulation Mechanism of action
- *Transcranial Magnetic Stimulation-Induced Plasticity Mechanisms: TMS-Related Gene Expression and Morphology Changes in a Human Neuron-Like Cell Model*
  - Synaptogenesis, neural network reconfiguration



“We found evidence for specific increase in the expression of plasticity genes in the BDNF-TrkB pathway at 24hr following TMS, and we identify several gene expression changes that support TMS-induced plasticity.”



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# Transcranial Magnetic Stimulation

## Limitations and Challenges of TMS

### Limited Access and Availability:

- TMS is not available everywhere and requires specialized equipment and trained clinicians.



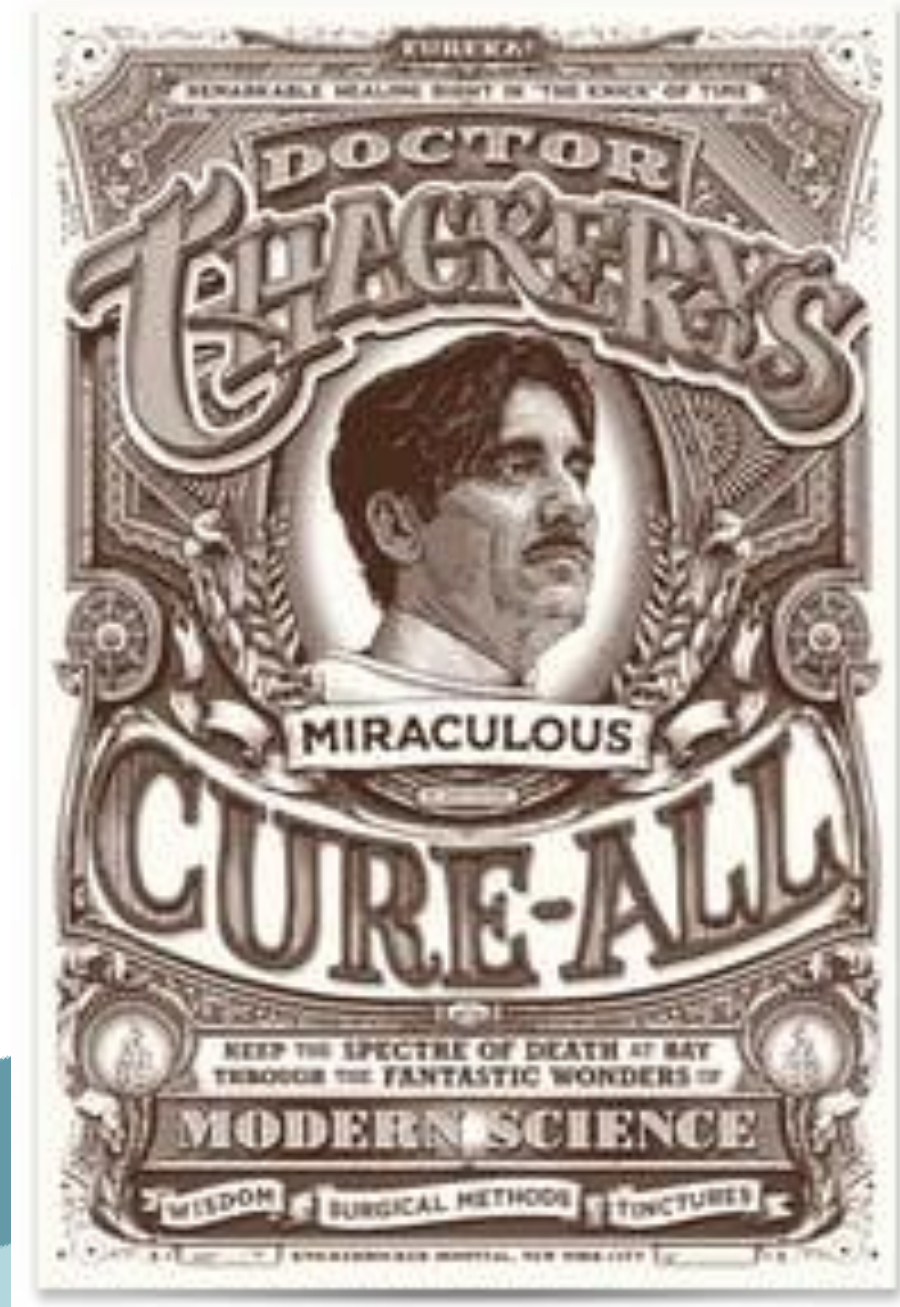
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# Transcranial Magnetic Stimulation

## Limitations and Challenges of TMS

### Not a Cure-All:

- TMS is not effective for everyone, and its success may vary based on individual differences and severity of the condition.



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# Transcranial Magnetic Stimulation

## Limitations and Challenges of TMS

### Side Effects:

- While side effects are generally mild, there is a rare risk of **seizures**, especially in patients with a history of seizures.



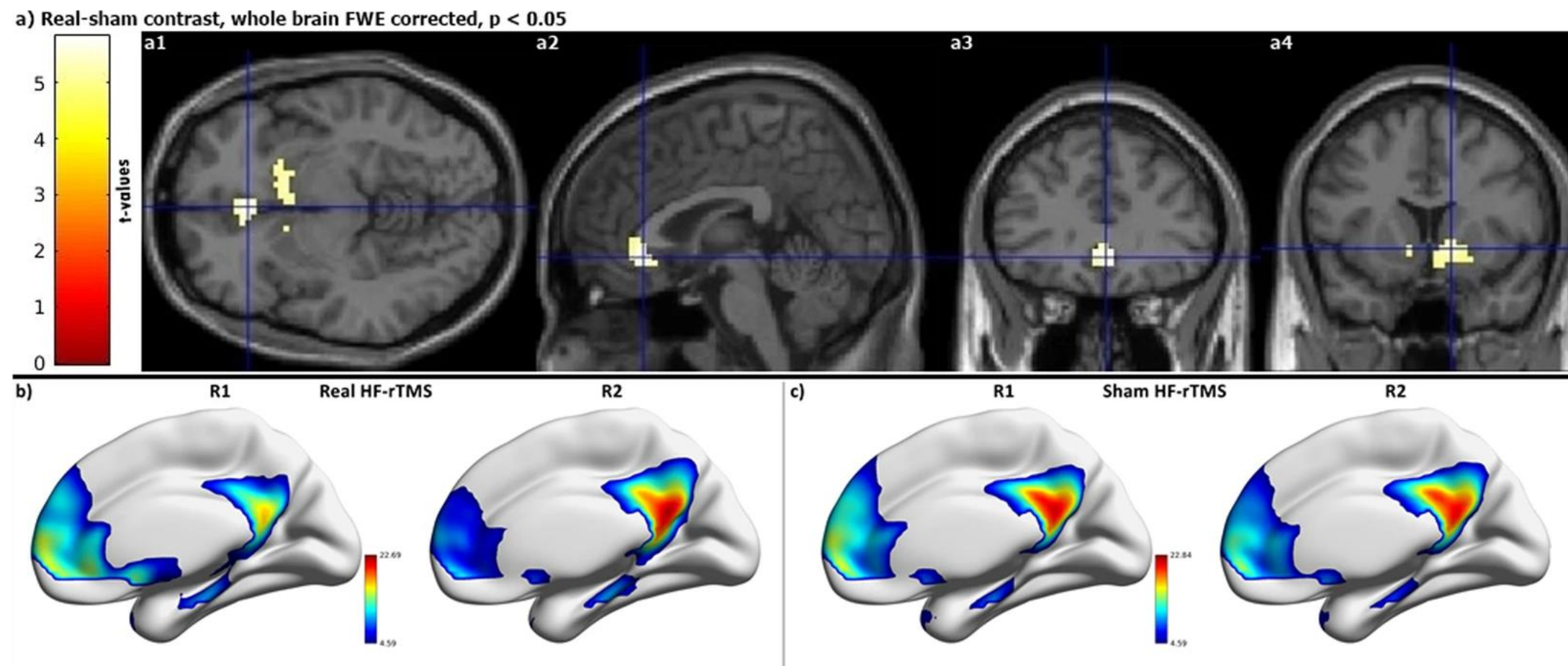
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# Transcranial Magnetic Stimulation

## Future Direction for TMS

### New Applications:

- TMS for substance use disorders, bipolar disorder, and schizophrenia is under investigation.



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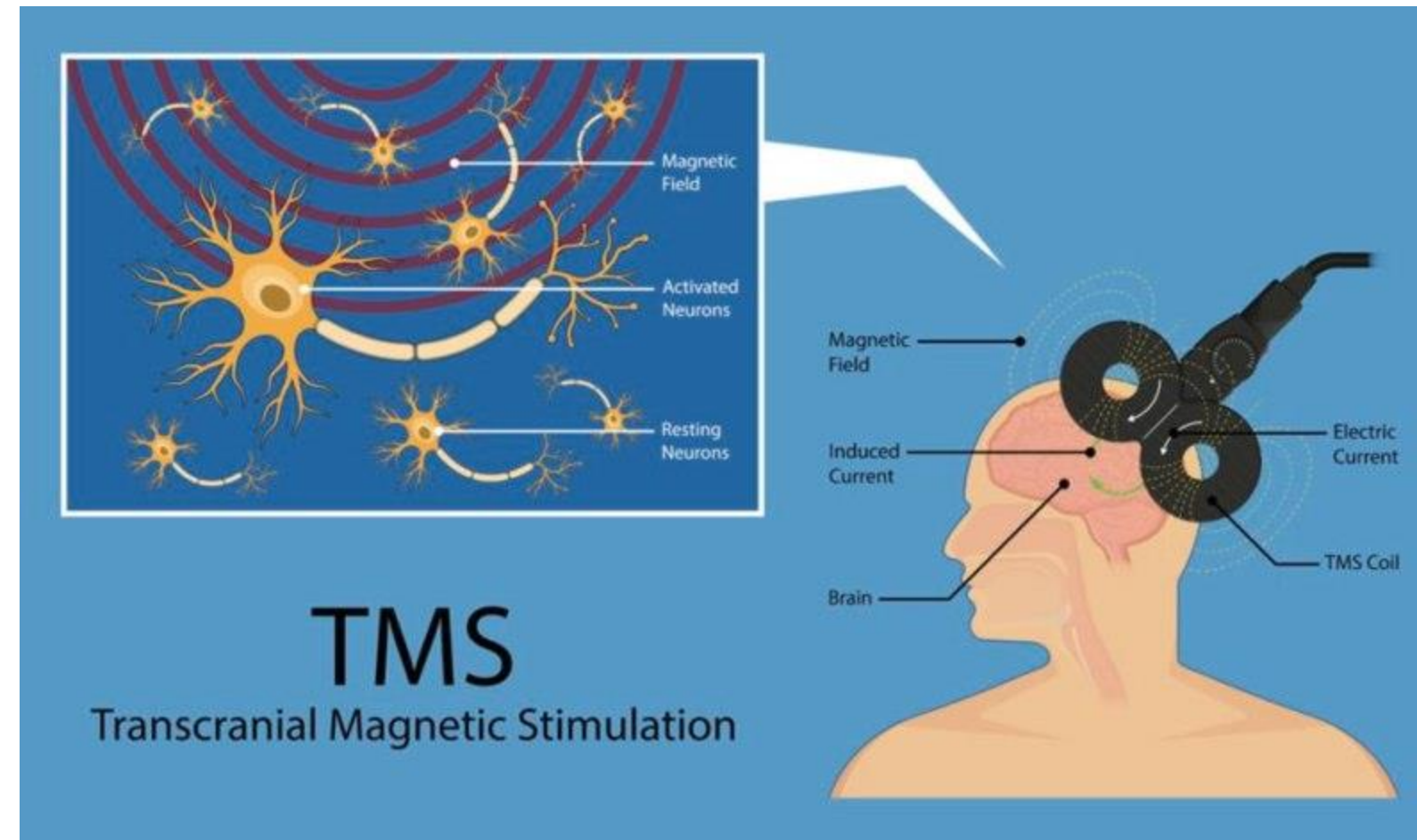


# Transcranial Magnetic Stimulation

## Future Direction for TMS

### Improved Technologies:

- Advancements in **deep TMS (dTMS)** and **theta-burst stimulation (TBS)** are making TMS more effective and accessible.



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# Transcranial Magnetic Stimulation

## Future Direction for TMS

### Combination Therapies:

- TMS is being studied in combination with **medications, psychotherapy, and other neuromodulation techniques** for enhanced outcomes.



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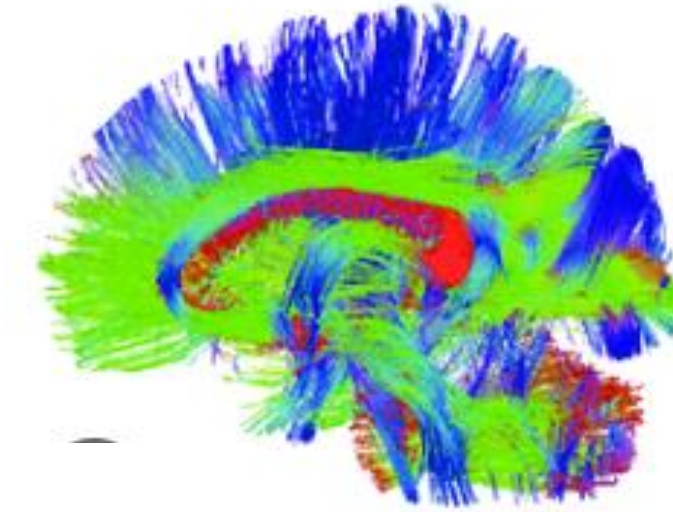
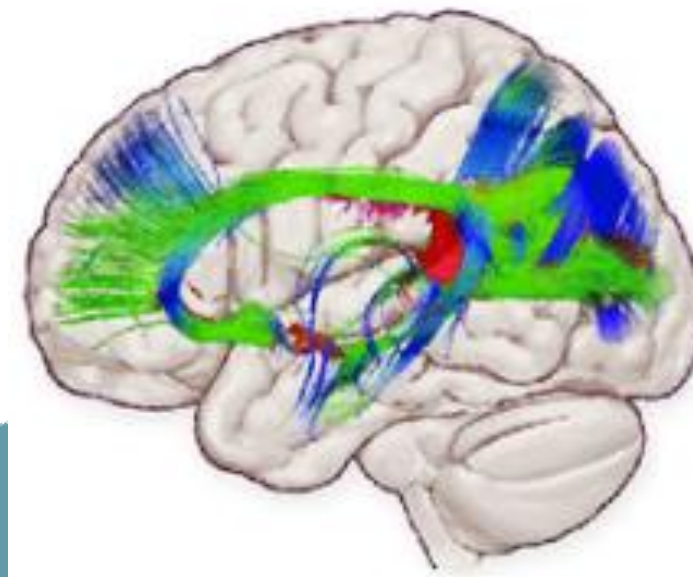
## Future Direction for TMS

### New Target Sites:

- TMS is being studied in combination with **medications, psychotherapy, and other neuromodulation techniques** for enhanced outcomes.

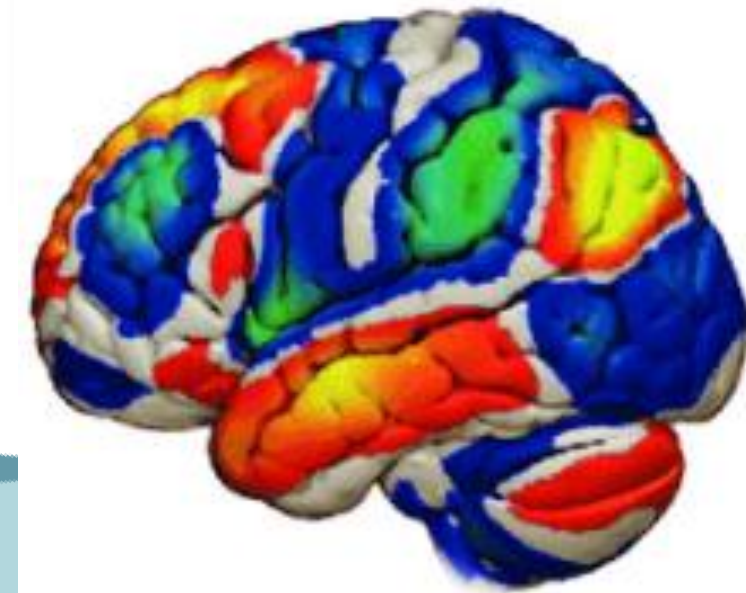


B Specific Fiber Tracts



A Map of Anatomical Connectivity

C Map of Functional Connectivity



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# Closing

- The Current Treatments for Behavioral Health Services Seem Very Bright!
- The FUTRE of Behavioral Health Services Seems Even MORE BRIGHT!
- Questions or Comments?

Thank you



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