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# **The Neuroscience of Spirituality and 12 Step Recovery**









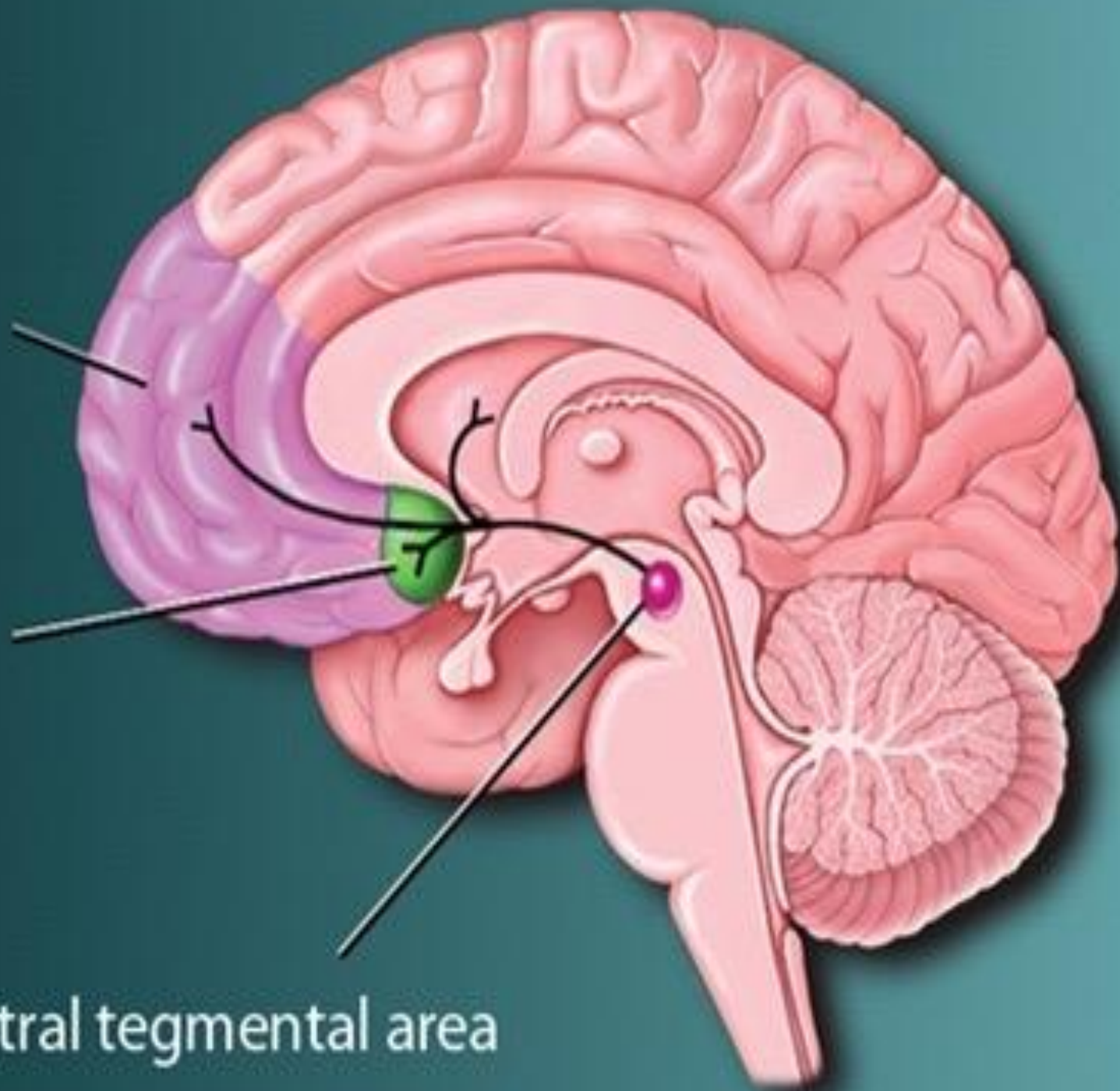


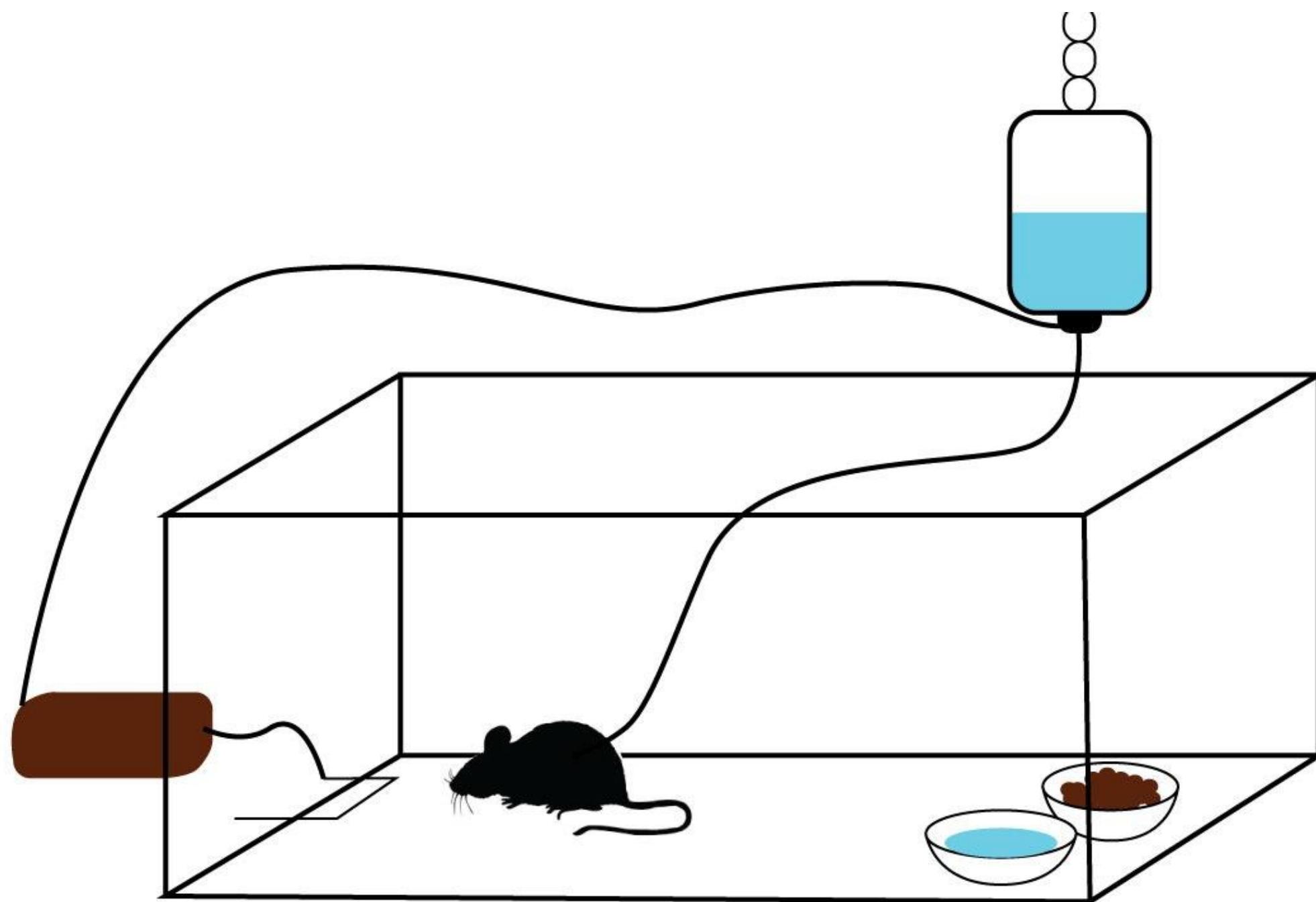
- ▶ Addiction encompasses a relapsing cycle of intoxication, bingeing, withdrawal, and craving that results in excessive chemical use despite adverse consequences
- ▶ Impairment of mechanisms involved in reward from natural processes leads to impulsive and compulsive and addictive behaviors in some part governed by genetic polymorphic antecedents. The “trait” plus/minus stress leads to a hypo-dopaminergic state and desire to treat the reward deficiency syndrome.

Prefrontal cortex

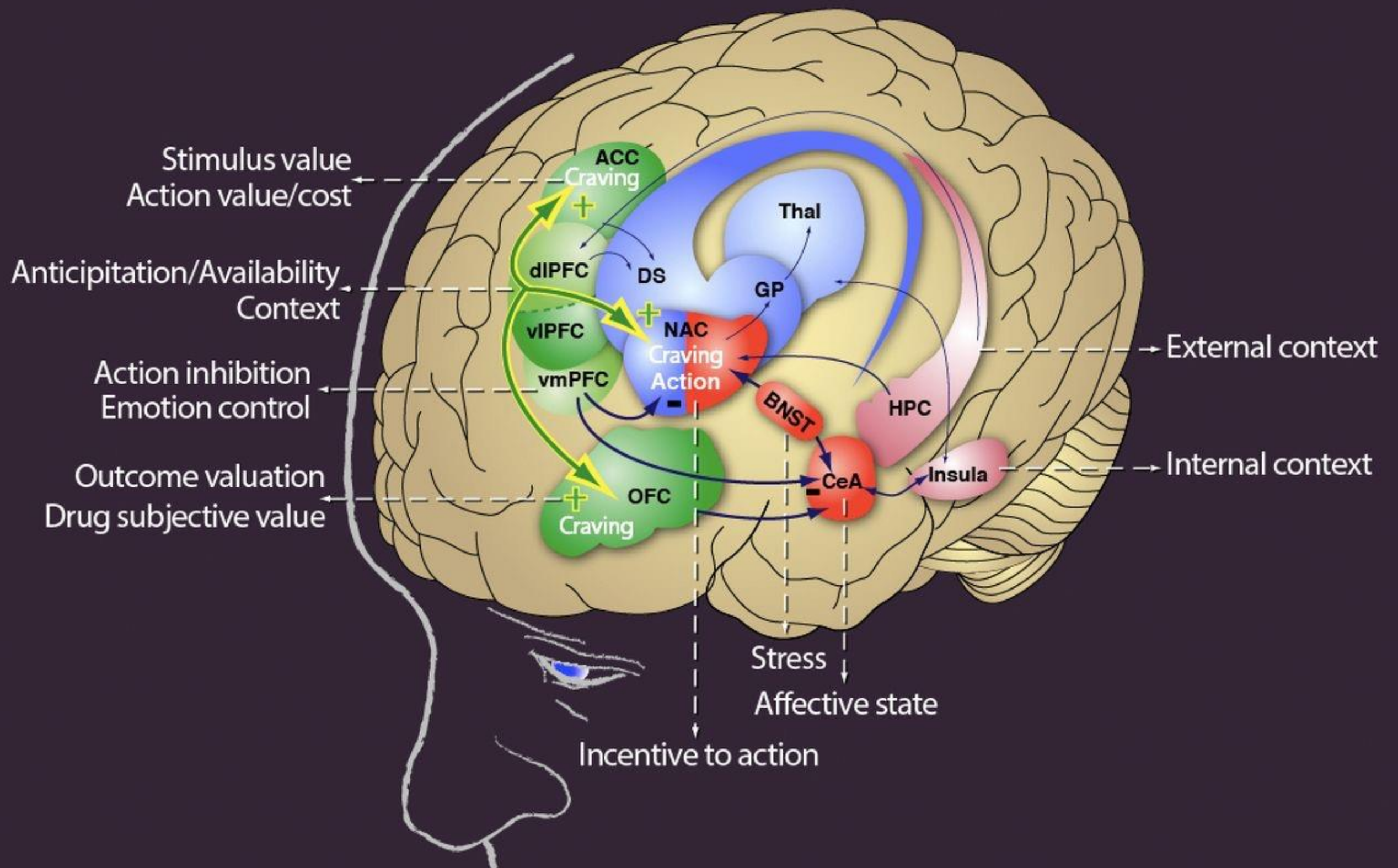
Nucleus accumbens

Ventral tegmental area









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Disruption of the prefrontal cortex leads to a syndrome of impaired Response Inhibition and Salience Attribution (iRISA). Goldstein, Volkow 2011

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Attributing excessive salience to drug and drug related cues, decreased sensitivity to non-drug reinforcers and decreased ability to inhibit maladaptive or disadvantageous behaviors.



1. direct response to drug and drug related cues
2. response to non-drug rewards...money, family, job, etc
3. higher order executive function including inhibitory control
4. awareness of the “illness”



# Specific cortical and prefrontal cortical areas in addiction and relapse

- ▶ Dorsolateral prefrontal cortex shown to be structurally and functionally impaired in addiction and directly related to poor cognitive control (top to bottom executive function) Hayashi et al 2013, Park et al 2010
- ▶ The medial olfactory frontal cortex (mOFC) and the angular cingulate cortex are associated with the craving phenomenon and response to the “reward” and in determining the salience of the event/experience. The OFC highly active in infrared spectrometry to alcohol cues.
- ▶ Alcoholics can demonstrate up to 20% reduction in grey matter in the prefrontal cortex with greatest loss in the dorsolateral prefrontal cortex
- ▶ Amygdala has a key role in Pavlovian conditioned learning and formation and consolidation of emotional memories



# Non Drug Rewards & the Prefrontal Cortex

- ▶ Based on fMRI addicted individuals in a state of craving, intoxication, withdrawal, or early abstinence; sensitivity of the PFC to non drug rewards (money, family, etc) will be markedly attenuated compared with that of healthy non addicted controls
- ▶ fMRI in cocaine addicted individuals show reduced signal in the left olfactory cortex for high gain (50% of cocaine addicted individuals rated the same value of all monetary amounts between \$10 and \$1000)
- ▶ The medial PFC codes subjective value signals for goal directed decision making and the attribution of salience



# Emotional reactivity and disease awareness

The dorsolateral prefrontal cortex is hyperactive during emotional processing of negative emotions along with hypo activation of the anterior cingulate cortex in addicted individuals. Leads to further reduced sensitivity to negative reinforcers in addiction. (adverse consequences do NOT typically change behaviors in the chemically addicted patient)

The capacity for insight into disease is dependent on a healthy PFC.

- ▶ **BOTTOM LINE:** Its all about the prefrontal cortex!!





# Neurobiology of Wisdom (Meeks, Joste)

1. prosocial attitudes/behavior
2. social decision making/pragmatic knowledge of life
3. emotional homeostasis
4. reflection/self understanding
5. value relativism/tolerance
6. acknowledgment of and dealing effectively with uncertainty/ambiguity

# neuroanatomy and the neurobiology of wisdom

- ▶ healthy prefrontal cortical activity (especially the DLPFC) for emotional regulation , decision making and top-down regulation of the limbic and striatal system
- ▶ lateral prefrontal cortex facilitates calculated reason-based decision making and medial prefrontal cortex implicated in emotional valence and prosocial attitudes and behaviors
- ▶ healthy serotonergic and dopaminergic activity influenced by genetic polymorphisms





“We begin to realize that it will take something more powerful than we are to relieve our suffering. This is what we’ve been missing all along...a source of hope”

Marta Mrotek, *Miracle in Progress*



# The 12 Steps of Alcoholics Anonymous

Is it possible that  
the spiritual  
foundation of 12  
step recovery can  
actually strengthen  
the atrophic  
prefrontal cortex?



# Neuroanatomical correlates of religiosity and spirituality. (Lisa Miller, et al)

- ▶ Functional neuroimaging during religious recitations in self identified spiritual subjects showed strong activation of a frontal-parietal circuit composed of the DLPFC, dorsomedial PFC and dorsomedial frontal and medial parietal cortex
- ▶ Beauregard et al described fMRI studies of Carmelite nuns during a mystical experience that revealed significant activation in multiple areas of the prefrontal cortex
- ▶ Subjects who confirmed a strong importance of religion or spirituality demonstrated thicker cortices in the left and right parietal and occipital and mesiofrontal lobes.

# neuroscientific studies of spiritual practices (Andrew Newberg)

- ▶ Cerebral blood flow during meditative prayer in the prefrontal cortex increases by 7.1%, inferior parietal lobe by 6.8%, and in the inferior frontal lobe by 9%
- ▶ decreases in heart rate, blood pressure, respiratory rate, and oxygen consumption



meditation experience is associated with increased cortical thickness (Lazar et al, 2005)

- ▶ 20 participants with extensive insight meditation experience showed thicker cortices compared with matched controls predominantly in the prefrontal cortex and right anterior insula

# spirituality/religiosity and depression

- ▶ American Journal of psychiatry, Miller et al 2012 “Religion or spirituality confers a neuroanatomical resilience in those predisposed to developing depressive illness”
- ▶ 10-year prospective study of offspring of depressed and non depressed parents
- ▶ offspring who reported that religion or spirituality was highly important had 1/4 risk of developing major depression and high-risk offspring (with one or more parent with major depression) had 1/10th risk of developing major depression.
- ▶ Moreira et al, 2006 with meta-analysis of 98,975 patients showed that spirituality was robustly associated with lower levels of depressive symptoms.



# Substance abuse, religion, and spirituality

- ▶ 11/2001 was the 2 year study from Columbia University and CASA
- ▶ Adults who did not consider religious beliefs important were more than 1 1/2 times more likely to use etoh and cigs, >3X more likely to binge drink, 4X more likely to use illicit drugs other than MJ, and 6X more likely to use MJ than adults who believed religion was important
- ▶ Teens who never attended religious services were 2X more likely to drink, 3X more likely to use MJ and binge drink, and 4X more likely to use illicit drugs

# NIDA-Drug Addiction Treatment Outcome Study Relapse as a Function of Spirituality/Religiosity (DATOS) Schoenthaler et al

- ▶ 2947 of 2966 patients followed for 1 year
- ▶ 5 different measures of spirituality including strength of religious beliefs, frequency of attending religious services, religious books, programs, and frequency of prayer and meditation
- ▶ Percentage who achieved remission rises significantly as spirituality rises across all 5 measures ( $P < .0005$ )
- ▶ Those who attended religious services more than one time per week had 16.4% higher remission rates

# Sir Austin Bradford Hill: Smoking and Carcinoma of the lung (1950)

- ▶ magnitude: more smokers among patients with lung cancer
- ▶ dose effect: the more you smoke the higher the risk
- ▶ consistency: same findings in multiple studies
- ▶ temporality: smoking preceded lung cancer
- ▶ plausibility: carcinogens in tobacco smoke
- ▶ specificity: removal of all confounding factors that could explain the finding by correlation and not causation



“If we had any thought or knowledge that in any way we were selling a product harmful to consumers, we would stop business tomorrow”

George Weissman, VP Philip Morris 1954

# AA: Bradford Hill criteria

- ▶ Magnitude of effect: Abstinence is 2X higher in AA
- ▶ dose response: frequency of attendance correlates with abstinence
- ▶ consistency: same results in different groups worldwide
- ▶ temporality: prior attendance predicts future abstinence
- ▶ plausibility: behavioral and neurobiological explanations
- ▶ specificity: causation or correlation???

# We know it works!!

- ▶ Project Match: 1998 3 arms: 12 step facilitation, CBT, and motivational enhancement therapy with 12 steps statistically superior when total abstinence the goal
- ▶ Longabuagh's study of those with high social support for drinking showed markedly higher success with 12 step approach
- ▶ Fiorientine looked at 12 step recovery after treatment and found the highest success rate with longer treatment, completion of treatment and weekly 12 step group attendance



# Is Alcoholics Anonymous religious, spiritual, neither? Findings from 25 years of mechanisms of behavior change research John Kelly PhD Addiction 6/2017

- ▶ Twelve Step Facilitation in Project Match 60% and 71% more sobriety at 1 year than CBT and MET and 50% higher sobriety at the 3 year mark than CBT
- ▶ “TSF treatments that engage patients with AA not only produce significantly higher rates of abstinence post treatment compared to comparison treatments, but result in lower health care costs”
- ▶ “six previously validated mechanisms consist of spirituality, social abstinence self-efficacy, negative affect abstinence self-efficacy, depression symptoms, dropping heavy drinkers from the social network, and positive social networks (gaining abstainers/recovering individuals into the social network”

# Is Alcoholics Anonymous religious, spiritual, neither? Findings from 25 years of mechanisms of behavior change research John Kelly PhD Addiction 6/2017

- ▶ “Without any formally agreed upon definition of what “spirituality” actually is, AA’s focus on gratitude, hope, forgiveness, and compassion might be considered spiritual in essence.”
- ▶ “shining spirituality through a prism uncovers its own multiple constituent parts- the positive emotions such as gratitude, hope, forgiveness, ecstasy, bliss, compassion, awe, and empathy. These positive emotions lie within the biology of the brain’s limbic system. These spiritual emotions are thus a universal reality of humankind”
- ▶ “...and the fact that AA is ubiquitous, effective, and free of charge might make AA the closes thing we have to a free lunch in public health”

# An initial fMRI study on neural correlates of prayer in member of Alcoholics Anonymous

Marc Galanter et al    The American Journal of Drug and Alcohol Abuse 3/2017

- ▶ Methods: 20 AA members with long term recovery with functional MRI imaging of differential neural response to alcohol-craving-inducing images were obtained in 3 conditions: after reading of AA prayers, after reading irrelevant news, and with passive viewing.
- ▶ Results: Compared to the other 2 conditions, the prayer condition was characterized by less self-reported craving; increased activation in left-anterior middle frontal gyrus, left superior parietal lobule, bilateral precuneus, and bilateral posterior middle temporal gyrus.
- ▶ Conclusion: AA member's prayer was associated with a relative reduction in self reported craving and with concomitant engagement of neural mechanisms that reflect control of attention and emotion. These finding suggest neural processes underlying the apparent effectiveness of AA prayer



# Neurobiology of successful abstinence

- ▶ Significant recovery in gray matter volume out to at least 9 months with most rapid recovery in first 30 days
- ▶ Recovery of PET measures of brain metabolism within 30 days
- ▶ Elevated frontal lobe blood flow persists into abstinence and can take approximately 4 years to return to normal
- ▶ Reflects more than just recovery but the increased cognitive control needed to maintain sobriety
- ▶ Near infrared spectroscopy demonstrates improving cortical function with cue based triggers with longer abstinence

# Higher Power and resolution of cognitive dissonance

- ▶ The concept of turning over one's will and life to a higher power can be understood neurologically. Those struggling with addiction have conflicting views of themselves as both able and unable to control actions. The result is cognitive dissonance. Accepting powerlessness and calling on a higher power to guide and govern relieves the that dissonance...a process played out in the anterior cingulate .

# The “fellowship” and mirror neurons

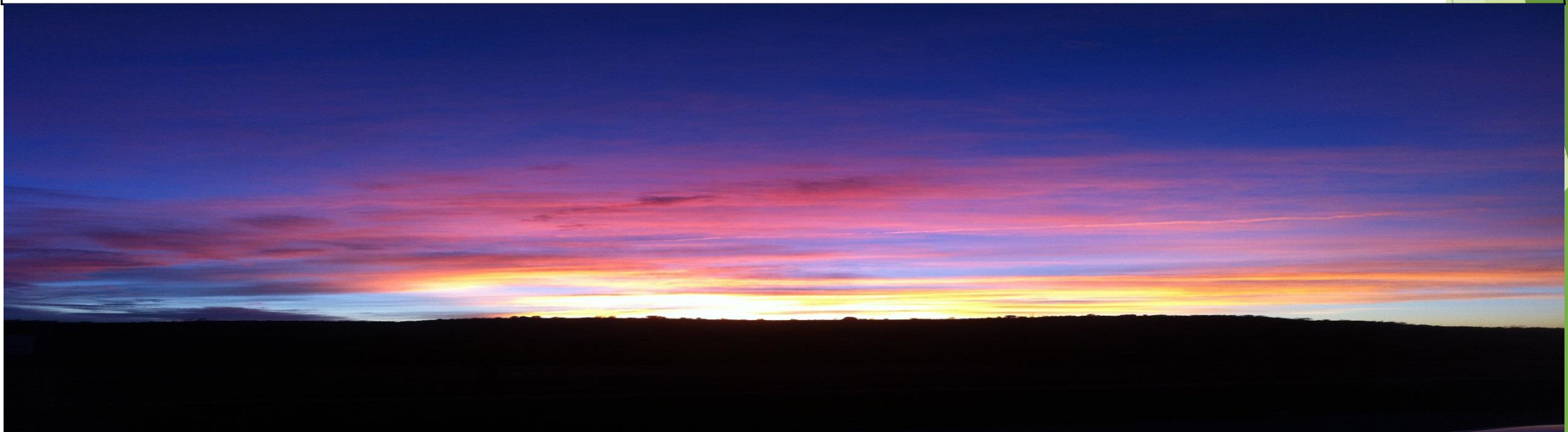
- ▶ Brain process called mirroring which relates to empathy and self awareness. Humans tend to copy the behavior of individuals with whom we are in close contact. You’ll find yourself unconsciously mimicking your friends facial expressions or hand gestures. This activates a specific area in the inferior frontal cortex. This is conceptually similar to AA’s emphasis on mutuality over self-help and identification and alignment with a sponsor
- ▶ Mentalizing is the ability to understand one’s own mental state and its relation to another person’s mental states and to see them separate from their behaviors
- ▶ This leads to improved empathy and responsivity and therefore less selfish behaviors



- ▶ Stories of self disclosure are strongly associated with increased activation in the mesolimbic dopaminergic systems and are actually felt as an alternative reward.
- ▶ Narratives of self redemption (shared strength and hope) are predictive of behavioral change and improved health. Dunlop published 2 studies revealing a common difference in the narratives of long-term sobriety compared with short term and 83% compared to 44% success with redemptive vs non-redemptive self narrative and the redemptive group had higher general health scores

- ▶ Speaking out loud one to another helps to clarify thoughts and also broadens accountability and opens up the avenues for help. The spoken word reaches our memory through a different pathway and helps to recreate new memories via the amygdala and the hippocampus
- ▶ Step 4 followed by step 5 does not simply focus on the chemical because the phenotype is the reward deficiency syndrome and therefore helps to identify problems and issues
- ▶ Making amends and helping others as a form of altruism improves the synthesis and release of oxytocin which is the human bonding neuropeptide further improving selflessness and strengthening the bond within families and the fellowship.

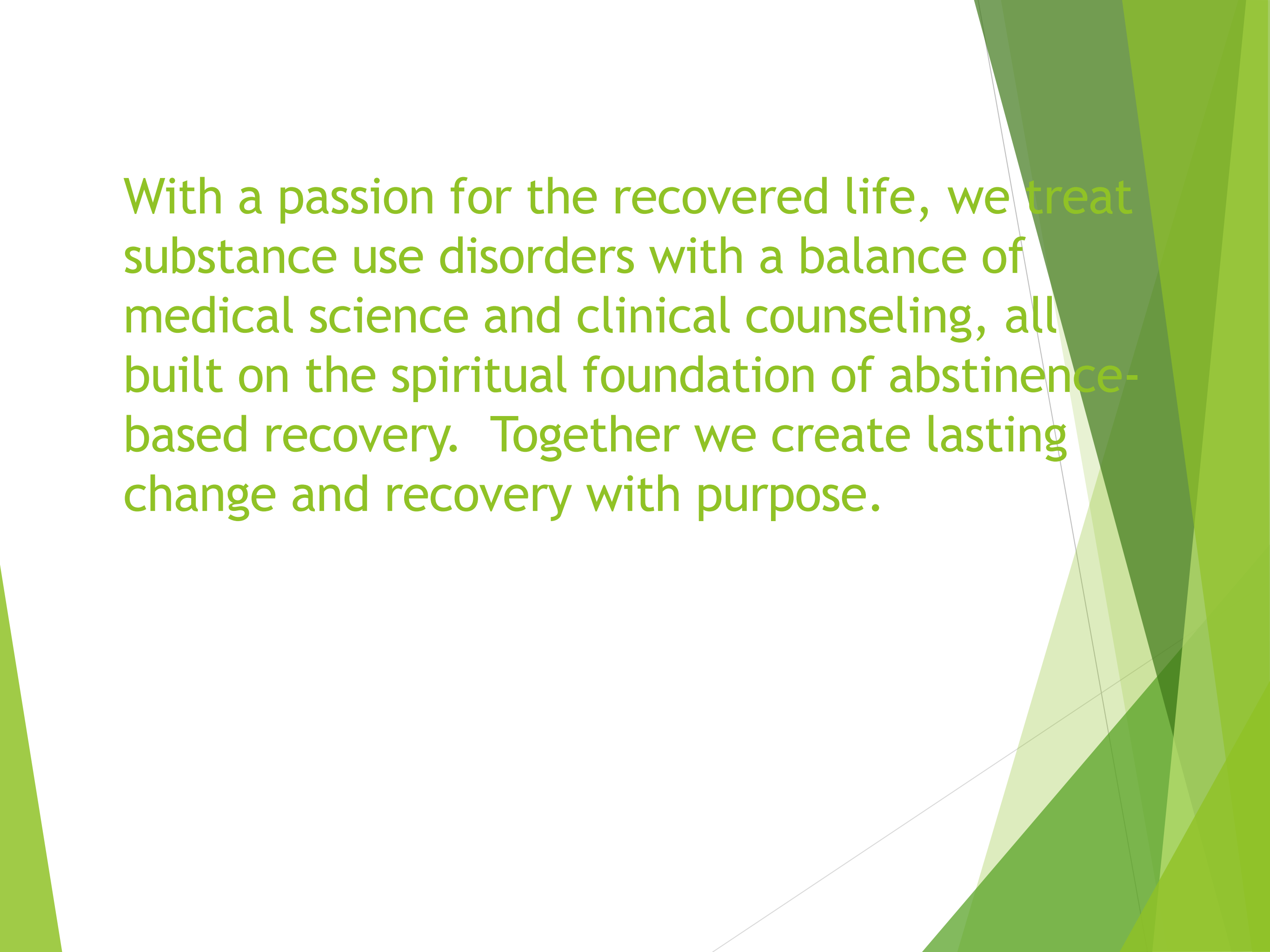
Craving, relapse.....midbrain dopamine levels  
Suppression of craving.....prefrontal cortex  
Mirroring.....inferior frontal cortex  
Mentalizing.....multiple cortical sites  
Memory acquisition, integration....hippocampus, DLPFC, MPFC  
Unconscious learning.....hippocampus  
Incentivizing, story telling.....mesolimbic dopamine system  
Fellow member identification.....anterior insula  
Resolving cognitive dissonance....anterior cingulate



You see, “alcohol” in Latin is “spiritus” and you use the same word for the highest religious experience as well as for the most depraving poison. The helpful formula therefore is: spiritus contra spiritum.

Carl Jung (in his letter to Bill Wilson)



The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect.

With a passion for the recovered life, we treat substance use disorders with a balance of medical science and clinical counseling, all built on the spiritual foundation of abstinence-based recovery. Together we create lasting change and recovery with purpose.