

# **A HABIT CALLED ADDICTION**

Cardwell C. Nuckols, PhD

[cnuckols@elitecorp1.com](mailto:cnuckols@elitecorp1.com)

[www.cnuckols.com](http://www.cnuckols.com)

# **ADDICTION**

- **Recent theories of addiction have postulated that these behaviors are the product of an imbalance between three separate, but interacting, neural systems:**
  - **1. An impulsive, largely amygdala-striatum dependent: a neural system that promotes automatic, habitual and salient behaviors**
  - **2. A reflective, mainly prefrontal cortex dependent: a neural system for decision-making, forecasting the future consequences of a behavior, and inhibitory control**
  - **3. And the insula that integrates interoceptive states into conscious feelings and into decision-making processes that are involved in uncertain risk and reward.**

# HABIT

**The chains of habit are too weak to be felt until they are too strong to be broken. ----- *Samuel Johnson***

# HABIT

***YOU CANNOT EXTINGUISH  
A BAD HABIT; YOU CAN  
ONLY CHANGE IT***

# **HABIT**

**About 40 percent of people's daily activities are performed each day in almost the same situations. Habits emerge through associative learning. We find patterns of behavior that allow us to reach goals. We repeat what works, and when actions are repeated in a stable context, we form associations between cues and response.**

# **HABIT**

- **MCDONALDS**

- **Standardized store architecture**
- **Standardized sales pitch from employees**
- **Cues are consistent to trigger eating routines**
- **French fries disintegrate immediately when hit the tongue releasing a hit of salt and grease as fast as possible**

# HABIT

- **PEPSODENT**

- Simple and obvious cue

- “Tooth film” is universal and impossible to ignore

- Company defined the reward

- Beauty- a prettier, sexier smile

- Routine

- In one decade Americans increased daily brushing from 7% to 65%

- And the “tingling” sensation means it is working

# HABIT

- **EXERCISE (RUNNING)**

- **Reward**

- “To feel good” as learn to expect and crave an endorphin surge
    - Accomplishment as expect and crave a regular sense of triumph from tracking performance

- **Simple cues**

- Leave running shoes and clothes by bed
    - Lace up sneakers before breakfast

- ***Only when brain starts expecting reward (CRAVING) will it become automatic to lace up in the morning***

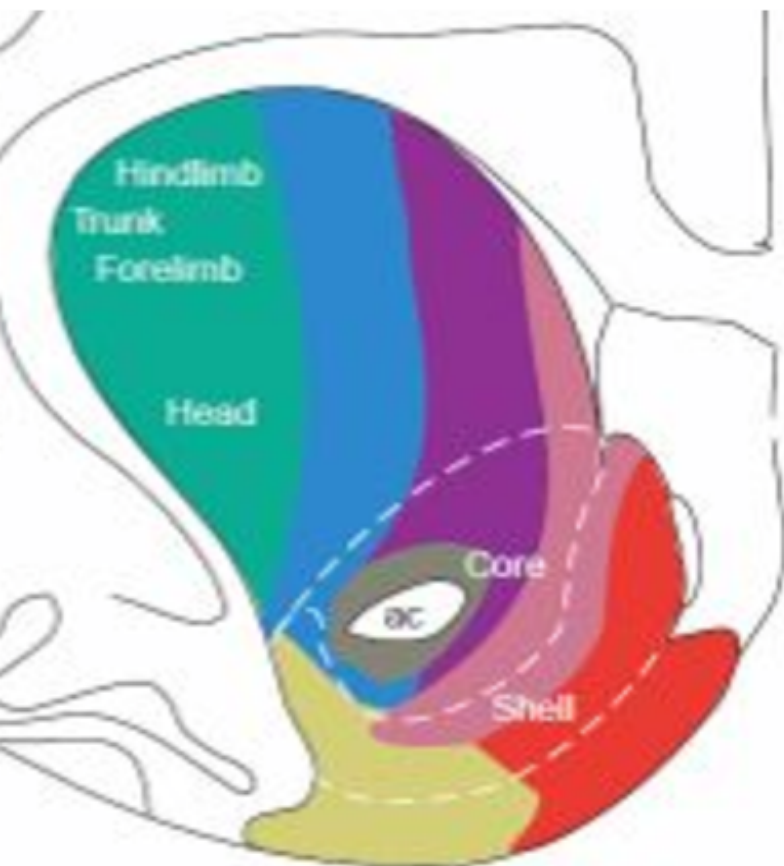
# HABIT

***THE CUE TRIGGERS THE  
ROUTINE AND ALSO  
TRIGGERS THE CRAVING  
FOR THE REWARD TO COME***

# HABIT

- Two types of action
  - Goal-directed or habitual action
- Two neighboring regions of the brain are necessary for these different functions -- *the dorsal medial striatum is necessary for goal-directed actions and the dorsal lateral striatum is necessary for habitual actions.*
- A third region, the orbital frontal cortex (OFC), is critical for shifting between these two types of actions.

# Hierarchy in Cortico-Striatal Network



(Voorn et al., 2004)

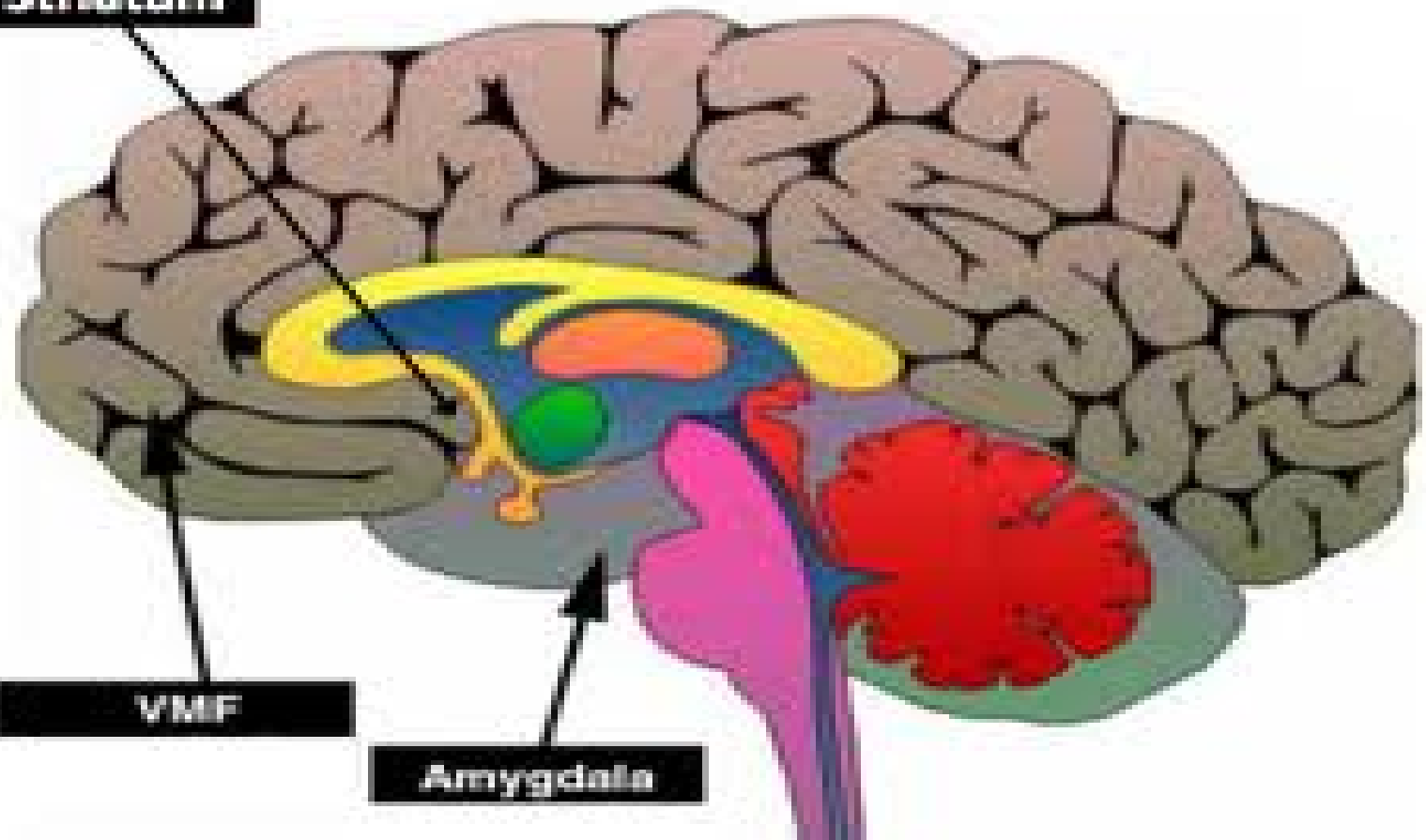
- Dorsolateral striatum – motor
  - early action coding
  - what action to take?
- Dorsomedial striatum - frontal
  - action value
  - in what context?
- Ventral striatum - limbic
  - state value
  - whether worth doing?



Ventral  
Striatum

VMF

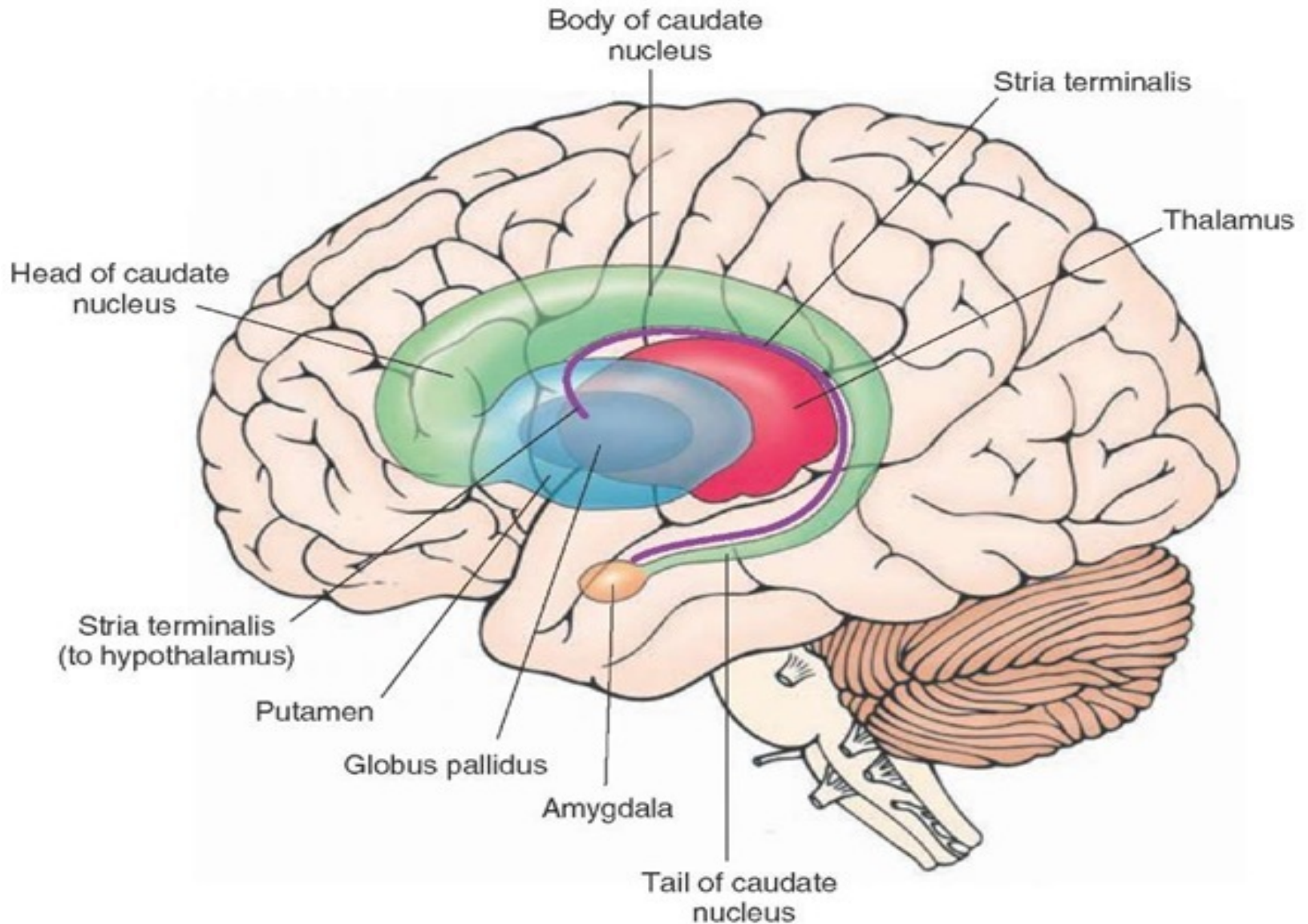
Amygdala



# THE STRIATUM

- The basal ganglia is nestled inside the cortex, surrounding the thalamus. *The striatum (part of the basal ganglia circuitry) is composed of the putamen, caudate, and nucleus accumbens.* Other important parts of the basal ganglia are the globus pallidus and the subthalamic nucleus (STN).

# BASAL GANGLIA



# THE STRIATUM

- The brain processes external input such as touch, vision or sound from different sources and sides of the body, in order to select and generate adequate movements.
- *The striatum is the main input structure in the basal ganglia, and is typically associated with motor function*

# THE STRIATUM

- The striatum is the largest structure in a collection of brain nuclei called the basal ganglia, which are located at the base of the forebrain. *It is involved in motor learning, planning and execution as well as selecting our actions out of all possible choices, based on the expected reward by the dopamine system.*

# THE STRIATUM

- *In order to select the correct actions, and generate proper motor activity it is essential to continuously process sensory information, often arriving from different sources, different sides of the body and from different sensory modalities, such as tactile (touch), visual, auditory, and olfactory. This integration of sensory information is in fact a fundamental function of our nervous system.*

# CORTICOSTRIATAL CIRCUITRY

- Corticostriatal projections are responsible not only for generating learnt, well-established behaviors such as in drug taking, but also for changing behaviors in response to a variable environment, and thereby generating new adaptive behaviors
- *Addicts have difficulty modulating drug-seeking behaviors with information that should suppress the behavior*

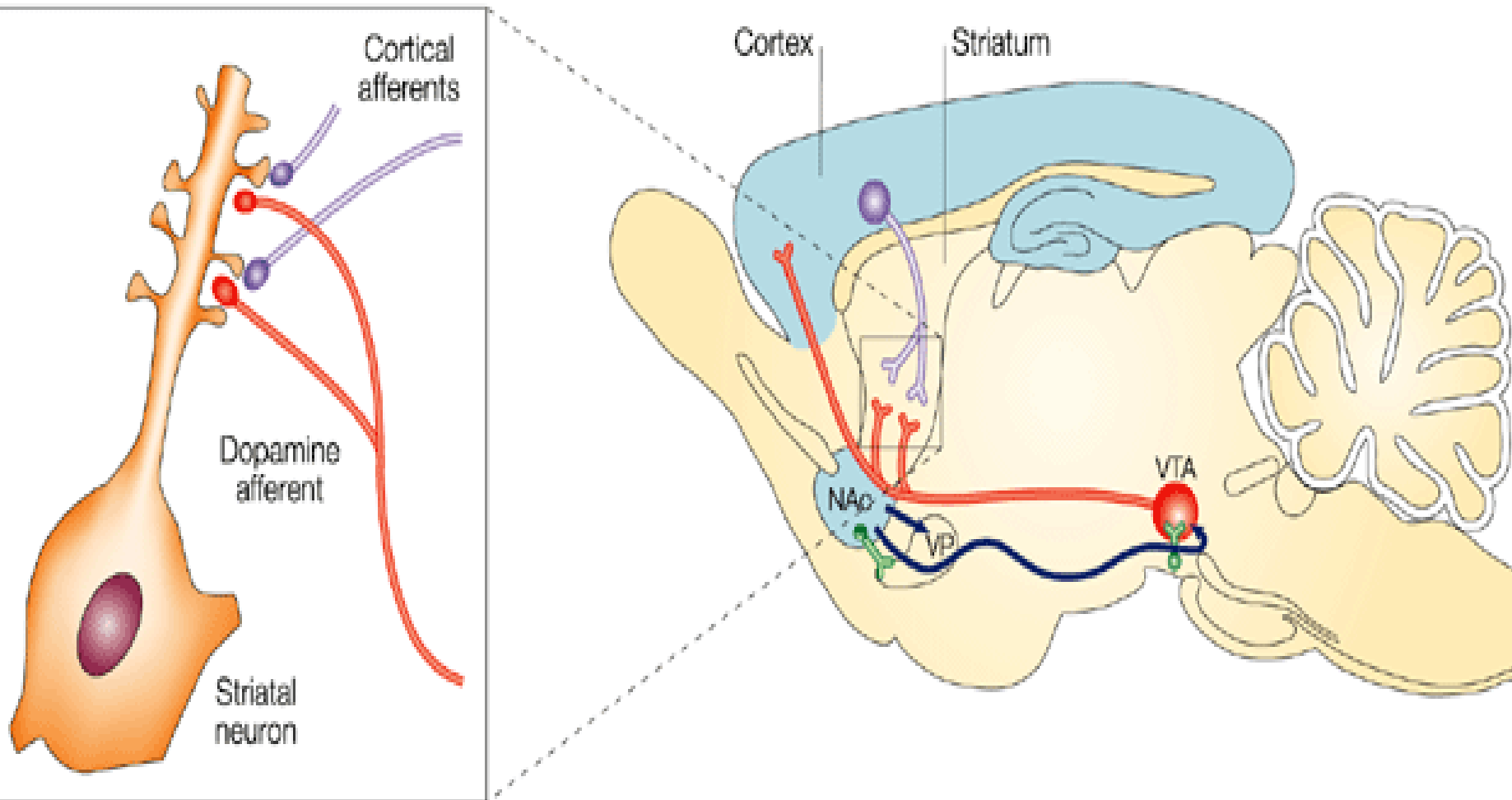
# CORTICOSTRIATAL CIRCUITRY

- The NAc serves as a gateway through which information that has been processed in the limbic subcircuit gains access to the motor subcircuit.
- *Relapse to compulsive drug seeking arises from an impaired ability of the limbic subcircuit to effectively process and/or use the negative environmental contingencies associated with relapse. The result is that behavior is dominated by the previously learnt, well-established drug-seeking strategies.*

# **CORTICOSTRIATAL CIRCUITRY**

- **This impairment could arise from two general pathologies in corticostriatal circuitry: addicts could have pathologically strengthened drug-seeking behaviors, or they could have pathological impairments in the capacity to control drug-seeking behaviors. These two possibilities are not mutually exclusive.**

# CORTICOSTRIATAL CIRCUITRY



# **HABIT**

- **Methamphetamine alters brain structures involved in goal-directed decision-making and impairs the ability to suppress habitual behaviors that have become useless or counterproductive.**
- **The structural change underlies the decline in mental flexibility.**

# HABIT

- **Cognitive deficits in chronic drug abuse**
  - **Withdrawal produces cognitive symptoms**
    - Cocaine-deficits in *cognitive flexibility*
    - Amphetamine-deficits in attention and impulse control
    - Opioids-deficits in *cognitive flexibility*
    - Ethanol-deficits in working memory and attention
    - Cannabis-deficits in *cognitive flexibility* and attention
    - Nicotine-deficits in working memory and declarative learning

# HABIT

- *Addiction as impairment in reversal learning*  
**IN ADDICTION...**

***“WHEN I USE DRUGS I FEEL GOOD”***

***CHANGES TO***

***“WHEN I USE DRUGS BAD THINGS HAPPEN”***

***NEW RULE BUT CANNOT ADAPT***

# HABIT

- **ADDICTS CAN LEARN A NEW RULE BUT RUN INTO PROBLEMS WHEN THE RULES CHANGE**
  - **COCAINE AND ALCOHOL ABUSERS WERE ASKED TO PRESS KEY EACH TIME THEY SAW A GREEN RECTANGLE ON THE SCREEN**
  - **AFTER 500 REPETITIONS TOLD NOT TO PRESS KEY WHEN SAW GREEN RECTANGLE**
  - **CONTROLS EASILY ADAPTED WHILE ADDICTS KEPT PUSHING THE KEY EVEN AFTER GIVEN FEEDBACK**
    - **IMPAIRED *REVERSAL LEARNING* DUE TO DRUG USE AND NOT GENETICS**

# HABIT

- Psychological testing of addicted individuals has linked their difficulty quitting to a weakness in inhibitory control—a reduced ability to stop repeating previously learned habitual behaviors.
- *Brain imaging studies have also shown that, compared to nonusers, chronic users of the drug have, on average, more gray matter in the putamen and less gray matter in the prefrontal cortex (PFC) brain regions.*

# HABIT

- A primary role of the putamen is to initiate established or habitual responses to familiar situations or stimuli. In the normal shaping of behavior, other brain structures, in particular the PFC, functionally inhibit the putamen from initiating those responses in circumstances where they are inappropriate. *However, an enlarged putamen may override this input and trigger habitual responses even when they are useless or harmful.*

# HABIT

- The animals that showed the greatest increases in putamen size were slowest to adjust to the altered reward structure
- *The brain's structural integrity is dysregulated in the striatum [the brain region that contains the putamen], the animal's behavior is unleashed from inhibitory control*

Groman, S.M.; Morales A.M.; Lee, B.; London, E.D.; Jentsch, J.D.  
Methamphetamine-induced increases in putamen gray matter associate with inhibitory control. *Psychopharmacology* 229(3):527-538, 2013.

# HABIT

- ***Discovered why stressed persons are more likely to lapse back into habits than to behave in a goal-directed way***
- **The researchers have now reported in the *Journal of Neuroscience* that the interaction of the stress hormones hydrocortisone and noradrenaline shut down the activity of brain regions for goal-directed behavior. The brain regions responsible for habitual behavior remained unaffected.**

L. Schwabe, M. Tegenthoff, O. Höffken, O. Wolf. **Simultaneous glucocorticoid and Noradrenergic activity disrupts the neural basis of goal-directed action in the human brain.** *Journal of Neuroscience*, 2012

# HABIT

- *Seemingly diverse choices -- drug taking, eating quickly despite weight gain, and compulsive cleaning or checking -- have an underlying common thread: rather than a person making a choice based on what they think will happen, their choice is automatic or habitual.*

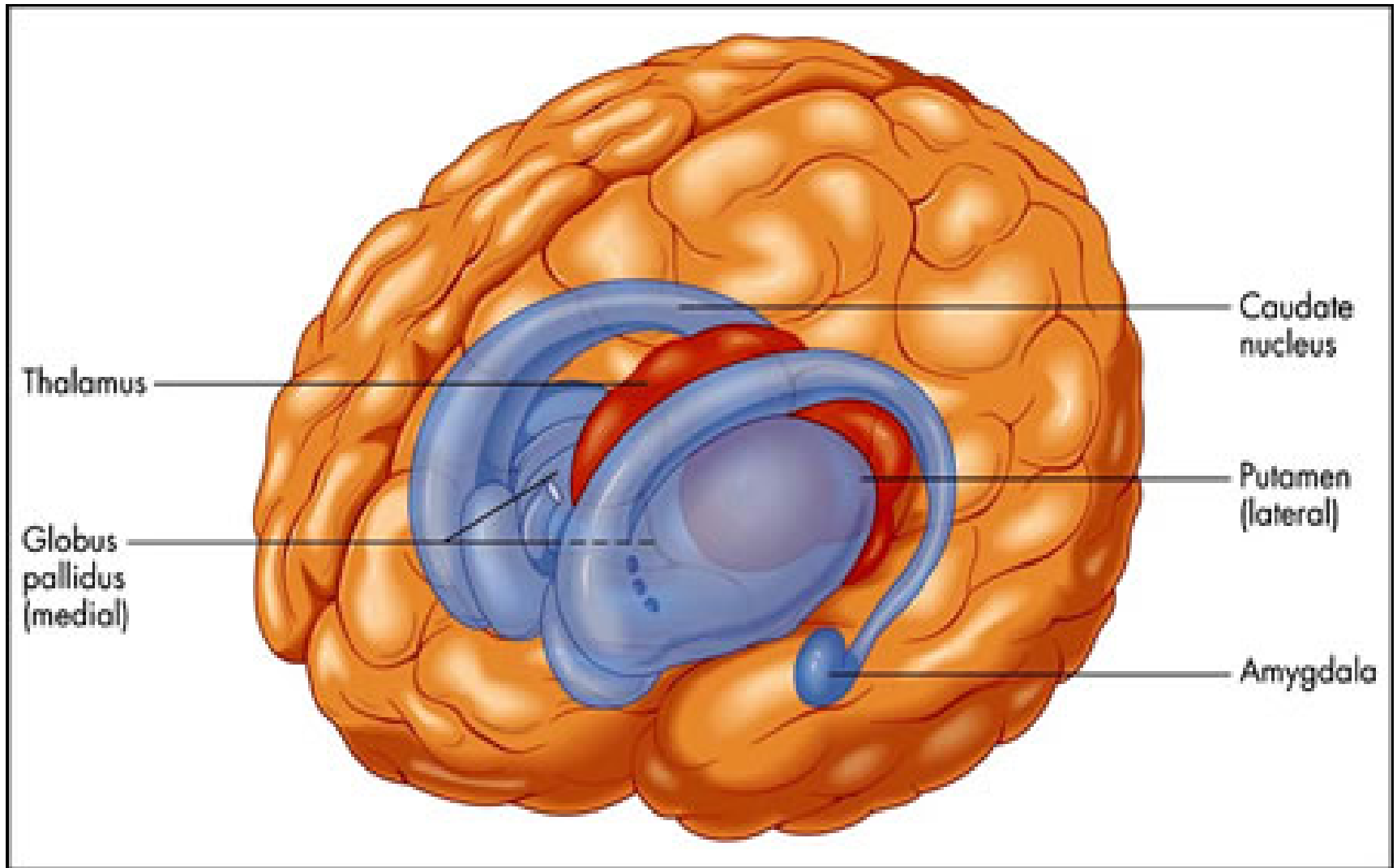
# THE HABIT LOOP



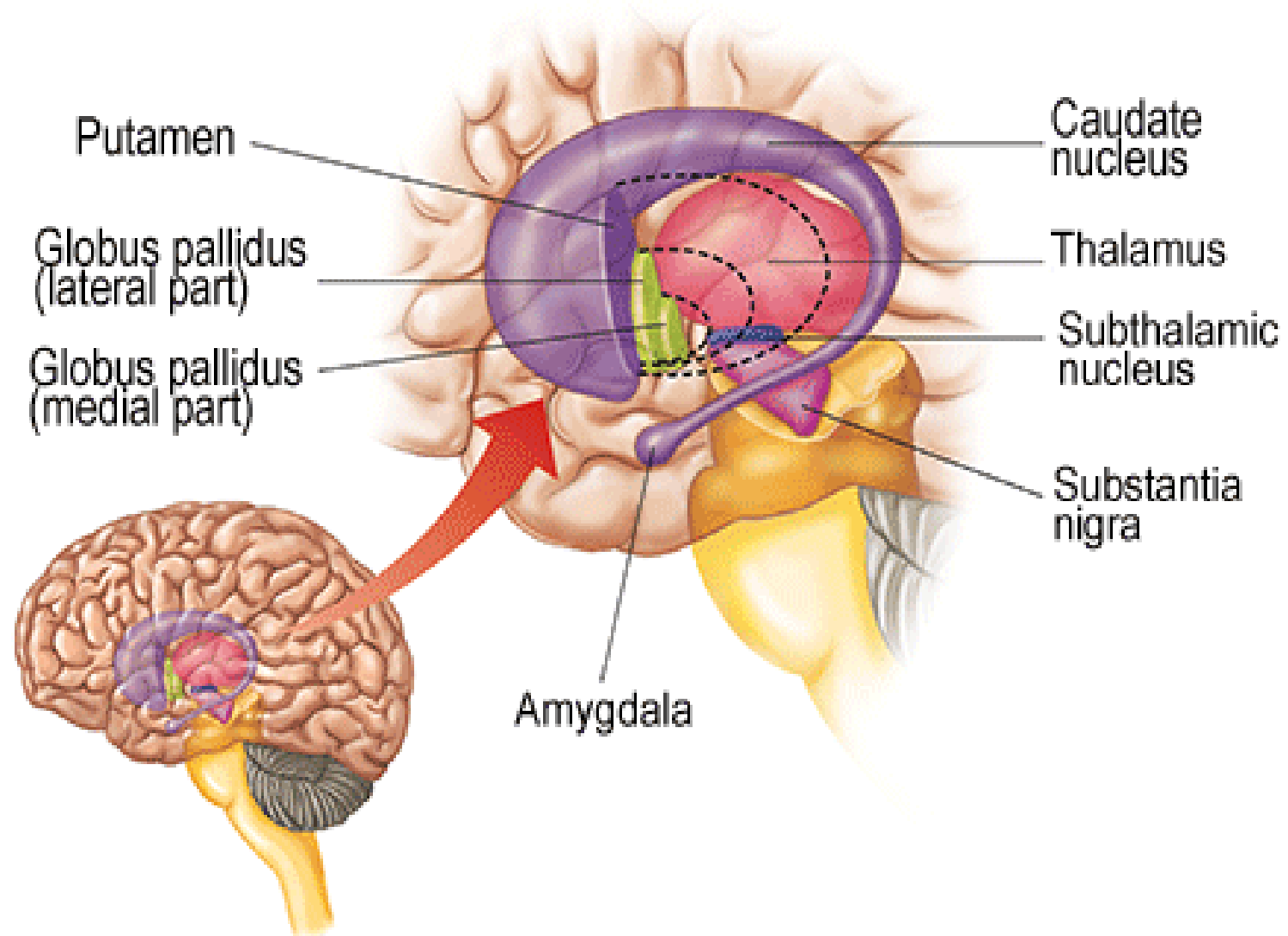
# HABIT

- When a habit begins the whole brain is activated as it actively processes all of the stimuli
- After this phase the higher brain begins to reduce level of activation
- Then even the memory centers reduce activity
- *BASAL GANGLIA has now taken control of recalling the patterns and acting on them*

# BASAL GANGLIA



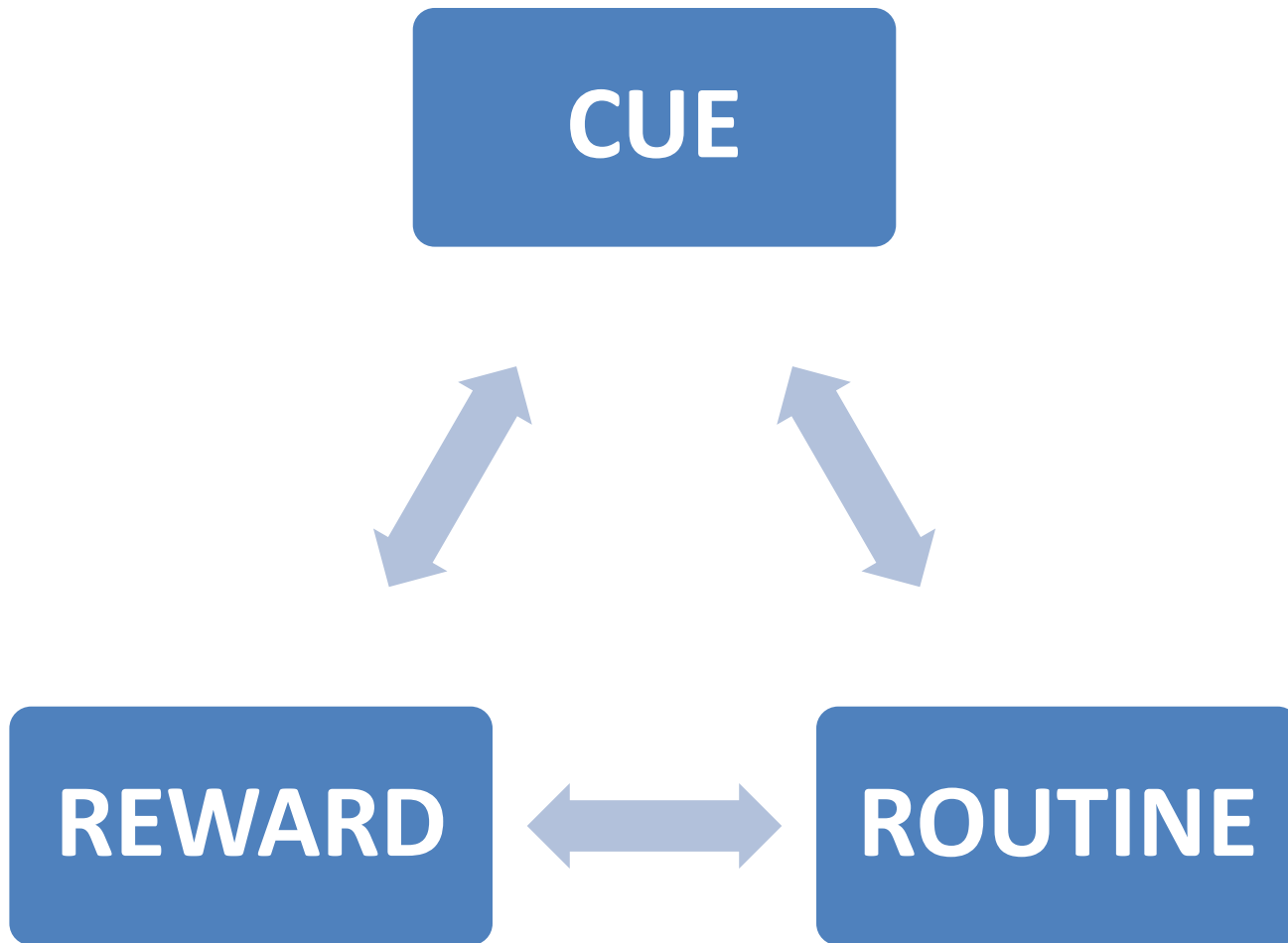
# BASAL GANGLIA



# **HABIT**

- **BASAL GANGLIA controls the sequencing of behaviors involved in the habit**
  - **“CHUNKING”**
    - A sequence of actions that make up a habit
    - This is a way of reducing effort
- **CUE (AUTOMATIC MODES, WHICH HABIT TO USE)**
- **ROUTINE (PHYSICAL, EMOTIONAL, MENTAL)**
- **REWARD (IS HABIT WORTH REMEMBERING)**

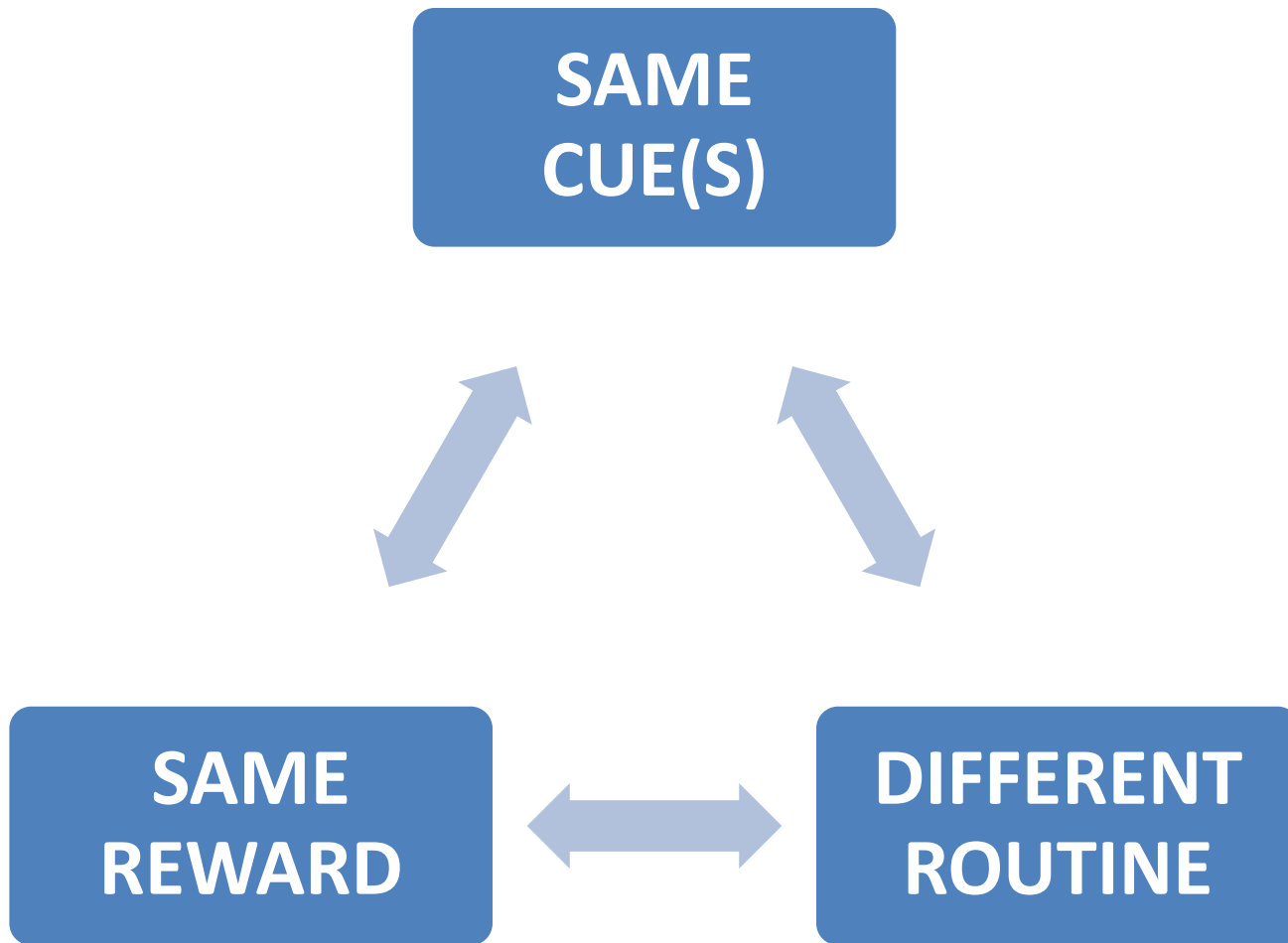
# HABIT LOOP



# **HABIT**

- **CUE AND REWARD BECOME INTERTWINED CREATING A CRAVING (CONDITIONING)**
- **In a habit the brain reduces emphasis on decision making**
- **Pattern unfolds automatically unless you find a new routine**
- **After craving develops, cannot extinguish a bad habit, you can only change it**

# HABIT LOOP



# HABIT

- **ALMOST ANY HABIT CAN CHANGE IF YOU KEEP THE SAME CUE(S) AND SAME REWARD**
- **ALCOHOLICS ANONYMOUS changes the habit loop**
- **ALCOHOLICS ANONYMOUS succeeds because it helps use the same cues and get the same rewards but shifts the routine**

# HABIT

- *To change a habit must address the same cues and rewards as before and feed the craving by inserting a new routine*
- **WHAT DO ALCOHOLICS AND ADDICTS CRAVE?**
  - It isn't a craving to be drunk
  - Physical effects of alcohol are the least rewarding (the same can be said for cocaine, methamphetamine, etc.)
  - Is it connection, reduce anxiety, forget worries?
  - Meetings and companionship-another bar to escape to, catharsis, distraction

# **HABIT**

- **What is the pleasure we seek in the first place?**
  - **Is it...**
    - **COMPLETION**
    - **RELAXATION**
    - **TO FORGET**
    - **TO CONNECT**
    - **TO REWARD MYSELF**
    - **TO GIVE ME COURAGE**
    - **TO FEEL LIKE YOU BELONG AS ONE OF THE GROUP**

# HABIT

- **ALMOST ANY HABIT CAN CHANGE IF YOU KEEP THE SAME CUE(S) AND SAME REWARD**
- **ALCOHOLICS ANONYMOUS changes the habit loop**
  - **AA offers...**
    - **Escape**
    - **Catharsis**
    - **Distraction**
    - **Relief via talking**

# HABIT

- **ALCOHOLICS ANONYMOUS** succeeds because it helps use the same cues and get the same rewards but shifts the routine
- **AA** forces new routines for what to do each night as opposed to drinking
- *To change a habit must address the same cues and rewards as before and feed the craving by inserting a new routine*
- **WHAT DO WE CRAVE?**
  - *Is it connection, reduce anxiety, forget worries?*
  - *Meetings and companionship-another bar to escape to, catharsis, distraction*

# HABIT

- **What is the thirst behind the thirst?**
  - “I was thirsty because I was feeling incomplete and alcohol helped me feel more connected, more alive.”
  - Bill Wilson, “Before A.A. we were trying to drink God out of a bottle.”
  - Gerald May- a deep yearning for fulfillment or completion; a longing to love and be loved and a desire for the source of this love-God

# HABIT

- What is the thirst behind the thirst?
  - The great analyst Carl J. Jung put it thus, *“His craving for alcohol was the equivalent, on a low level, of the spiritual thirst of our being for wholeness, expressed in medieval language: the union with God.”*
  - An intense, urgent, or abnormal desire or longing. At the time it seems more painful than any other longing. It subsumes us and we are a slave to it...and it seems it will never end. Although not understood in that moment, it is really a powerful thirst to go “home.”

# HABIT

- **Saul Bellow's *Henderson the Rain Maker*:**
  - *“Now I have already mentioned that there was a disturbance in my heart, a voice that spoke there and said, I want, I want, I want! It happened every afternoon and when I tried to suppress it it got even stronger. It only said one thing, I want, I want, I want. And I would ask, ‘What do you want? But this is all it would ever tell me....Through fights and drunkenness and labor it went right on, in the country, in the city. No purchase, however expensive would lessen it. Then I would say, ‘Come on, tell me. What’s the complaint, is it Lily herself? Do you want nasty whores? It has to be some lust?’ But this was no better a guess than the others. The demand came louder, I want, I want, I want, I want, I want, I want! And I would cry, begging at last, ‘Oh tell me then. Tell me what you want!’”*

# HABIT

- Thomas Wolfe's character in *Look Homeward, Angel*

*“What he had drunk beat pleasantly through his veins in warm pulses, bathing the tips of ragged nerves, giving to him a feeling of power and tranquility (sic) he had never known. Presently, he went to the pantry where the liquor was stored. He took a water tumbler and filled it experimentally with equal portions of whiskey, gin, and rum. Then, seating himself at the Kitchen table, he began to drink the mixture slowly. The terrible draught smote him with the speed and power of a man's fist. He was made instantly drunken, and he knew instantly why men drank. It was, he knew, one of the great moments in his life—he lay, greedily watching the mastery of the grape over his virgin flesh, like a girl for the first time in the embrace of her lover. And suddenly, he knew how completely he was his father's son—how completely, and with what added power and exquisite refinement of sensation, was he Gantian. He exulted in the great length of his limbs and his body, through which the mighty liquor could better work its wizardry. In all the earth there was no other like him, no other fitted to be so sublimely and magnificently drunken. It was greater than all the music he had ever heard; it was as great as the highest poetry. Why had he never been told? Why had no one ever written adequately about it? Why, when it was possible to buy a god in a bottle, and drink him off, and become a god oneself, were men not forever drunken?”*

# HABIT

- Shel Silverstein's character Gimmesome Roy
  - *There is a land beyond the sun that's known as Zaboli.  
A wretched land of stone and sand where snakes and  
buzzards scream,  
And in this devil's garden blooms the mystic Tzu–Tzu tree.  
And every ten years it blooms one flower as white as the  
Key West sky,  
And he who eats of the Tzu–Tzu flower will know the  
perfect high.  
For the rush comes on like a tidal wave and it hits like the  
blazing sun.  
And the high, it lasts a lifetime and the down don't ever  
come.*

# HABIT

- Kris Kristofferson understood the hunger for connection and our restless pursuit of that place called home. *The Pilgrim*
  - *And he keeps right on a'changin' for the better or the worse, Searchin' for a shrine he's never found  
Never knowin' if believin' is a blessin' or a curse,  
Or if the goin' up was worth the comin' down  
Takin' ev'ry wrong direction on his lonely way  
back home.*
  - There's a lotta wrong directions on that lonely  
way back home.*

# HABIT

- Leonard Cohen song *Anthem*
  - *Ring the bells that still can ring*  
*Forget your perfect offering*  
*There is a crack, a crack in everything*  
*That's how the light gets in.*  
*That's how the light gets in.*  
*That's how the light gets in.*

# HABIT

- ***REPLACEMENT ROUTINES ONLY BECOME DURABLE NEW BEHAVIORS WHEN SPIRITUALITY IS ADDED (this is what gets you through the major crises in your life)***
- ***PATTERN:***
  - *Could only stay sober by habit replacement until a major crisis hit*
  - *Add spiritual element and now can get through these tough times*

# HABIT

- **PATTERN:**
  - Maybe it was not God but “the belief” itself
  - “The belief” reworked the habit loop into a permanent behavior
    - Believing I can cope with stress
  - A community creates belief
  - Although one must believe change is possible (helpless)

# HABIT

***THE POWER OF A GROUP TO TEACH INDIVIDUALS HOW TO BELIEVE HAPPENS WHEN PEOPLE COME TOGETHER TO HELP ONE ANOTHER CHANGE. BELIEF IS EASIER WHEN IT OCCURS IN COMMUNITY.***