

# Picking, pulling and pinching

## The role of habit and harm in TS

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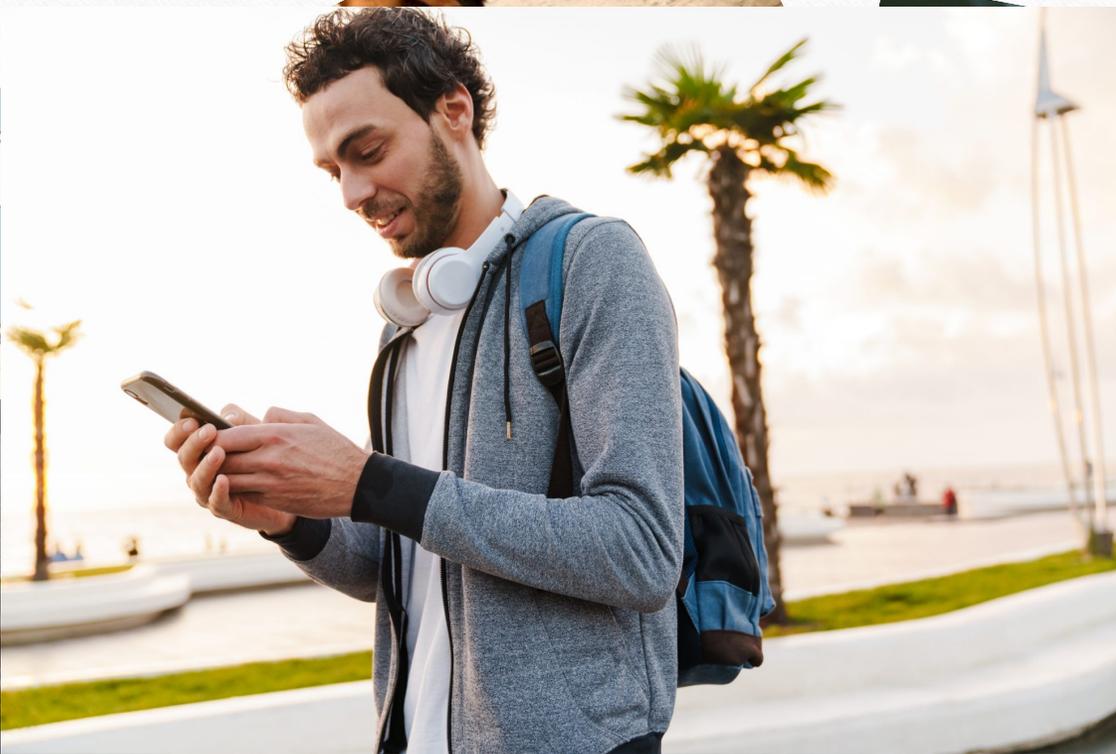
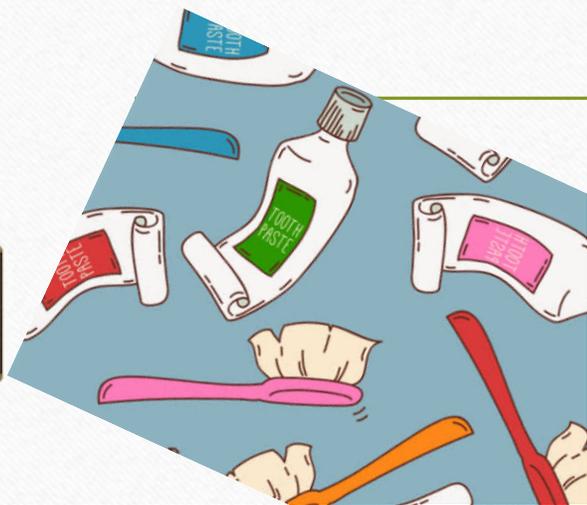
**COARD**  
Center for OCD, Anxiety  
& Related Disorders

# What is a habit?

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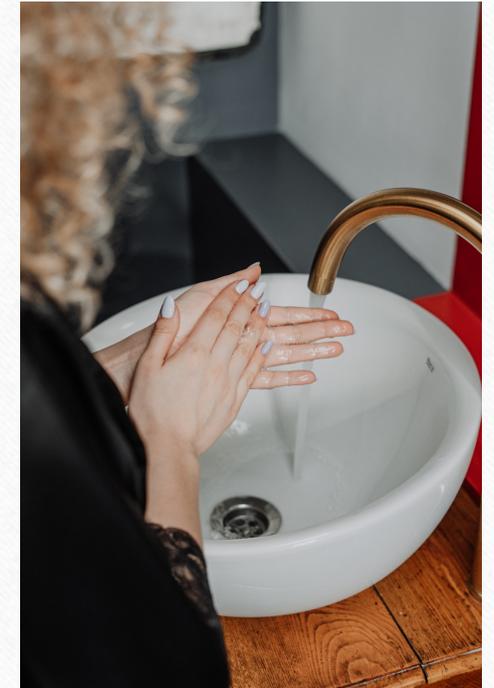
- Routine of behavior that is repeated regularly and tends to occur subconsciously
- Repeated behavioral pattern that is imprinted in neural pathways (habit formation)
- When behaviors are repeated in a consistent context, there is an increase in the automaticity of the behavior in that context (conditioning)
- Automatic behaviors: lack of awareness, unintentionality, efficiency, uncontrollability

# Habits are not inherently good or bad



# How do habits manifest in TS?

- Tics\*
- Compulsions\*
  - Neither tics nor compulsions are technically habits, but, they subsume the same motor systems
  - Like habits, both can be highly conditioned to occur more frequently in a given context, and can become routine/habituated in that context
  - CBIT/HRT/ERP use this principle as the basis for treatment
- Body focused repetitive behaviors



# What is a tic?

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- Sudden, rapid recurrent, non-rhythmic abrupt motor movement or sound (vocalization)
- Irresistible but suppressible
  - “Unvoluntary” as opposed to involuntary
  - Gray area with respect to compulsions
  - “compulsive tics”
- Wax and wane over time, come in bouts
- “Jump” –change location, number, frequency, type, complexity, severity
- Simple or complex
  - Complex behaviors may have strong similarities to OC traits

# Tics – What are they?

- Often preceded by a premonitory urge

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  - Sensory component
  - Cognitive component
  - Temporarily relieved by performing the tic
- Premonitory urges
  - Somatic—itch, tension, physical feeling that precedes tics
  - Cognitive-feeling of not just right or incompleteness
  - Rebound phenomenon?
- Can be highly conditioned

# What is a compulsion?

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- Repetitive behaviors or mental acts that the individual feels driven to perform –voluntary and goal directed
  - in response to an obsession or
  - according to rules that must be applied rigidly
- Aimed at preventing or reducing anxiety or distress or preventing some dreaded event or situation
- Behaviors/mental acts not connected in a realistic way with what they are designed to prevent or are clearly excessive

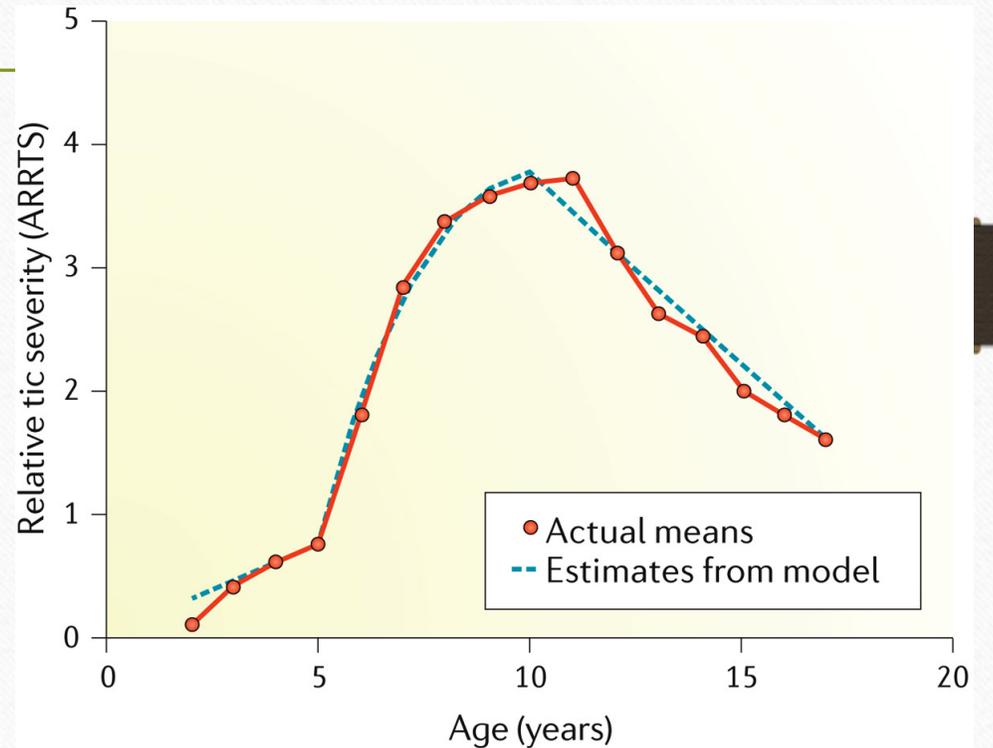
# Compulsions – What are they?

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- Often preceded by an obsession
  - Cognitive component
  - Anxiety driven
  - Temporarily relieved by performing the compulsion
  - Cognitive-feeling of not just right or incompleteness
  - Rebound phenomenon?
- Are highly conditioned to situation
- Can become “habituated” even in the absence of an obsession

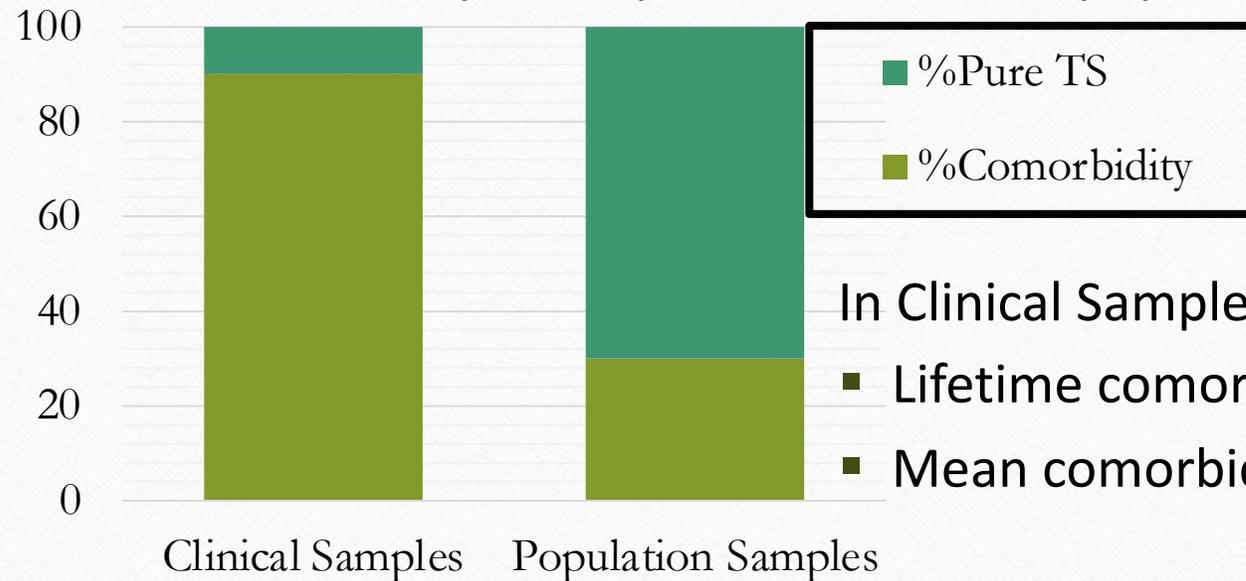
# Tourette Epidemiology

- Maximum severity typically in early adolescence
- Many improve in late adolescence/early adulthood
  - Rule of Thirds: 1/3 “resolve,” 1/3 improve, 1/3 stay the same
  - ~10% of patients have persistent, disabling symptoms as adults
- High rates of co-occurring conditions



# Comorbidity: Prevalence in TS

- Prevalence rates are wildly discrepant based on the population studied:



In Clinical Samples:

- Lifetime comorbidities  $\geq 2$  = 58%
- Mean comorbidities = 2.1

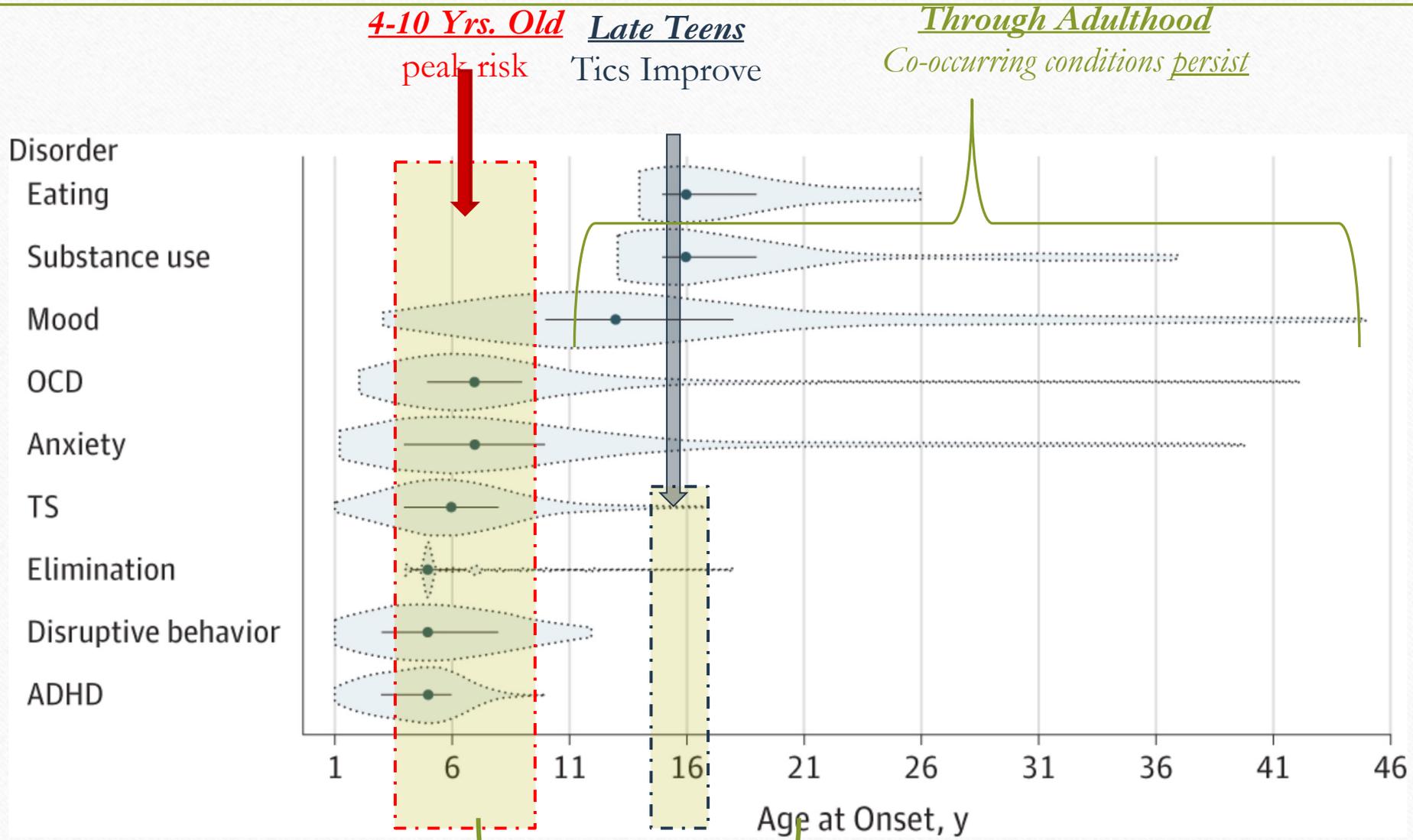
*(Scharf, 2015; Hirschtritt, 2015; Scharf, 2012)*

# Lifetime Prevalence of Other Psychiatric Disorders in TS

- OCD: 50-60%
- ADHD: 54%
- Mood: 30%
- Anxiety: 30%
- Disruptive Behavior: 30%
- Autism spectrum disorders: 10-23%
- Body-focused repetitive behavior disorders
  - TTM: ~4% SPD: ~14%
- Psychotic, substance, elimination disorders
  - No different from general population



Hirschtritt et al 2015  
Ganos and Martinos 2015  
Greenberg et al 2017  
Darrow et al 2017

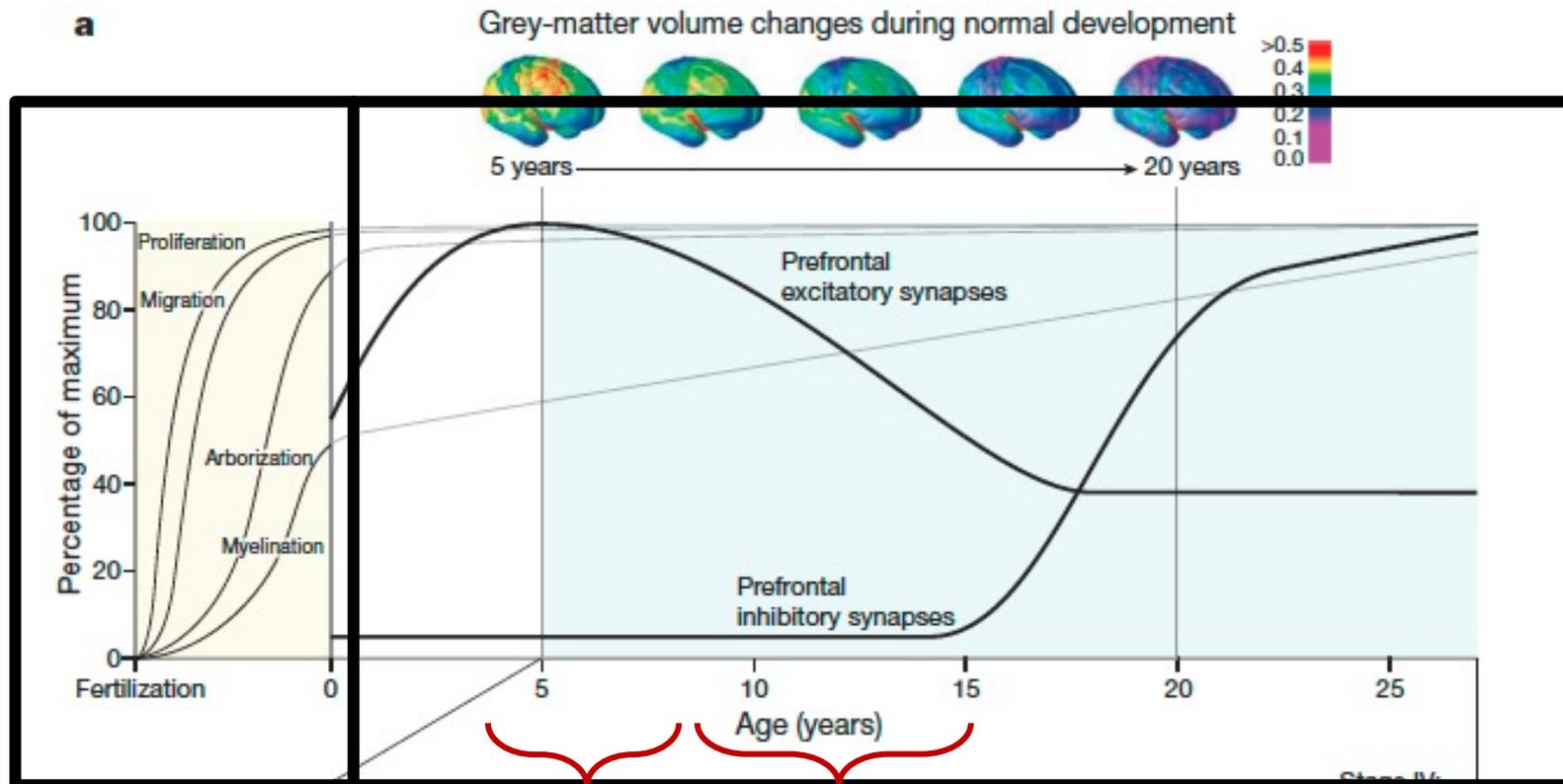


(Hirschtritt et al. 2015; *JAMA Psychiatry*)

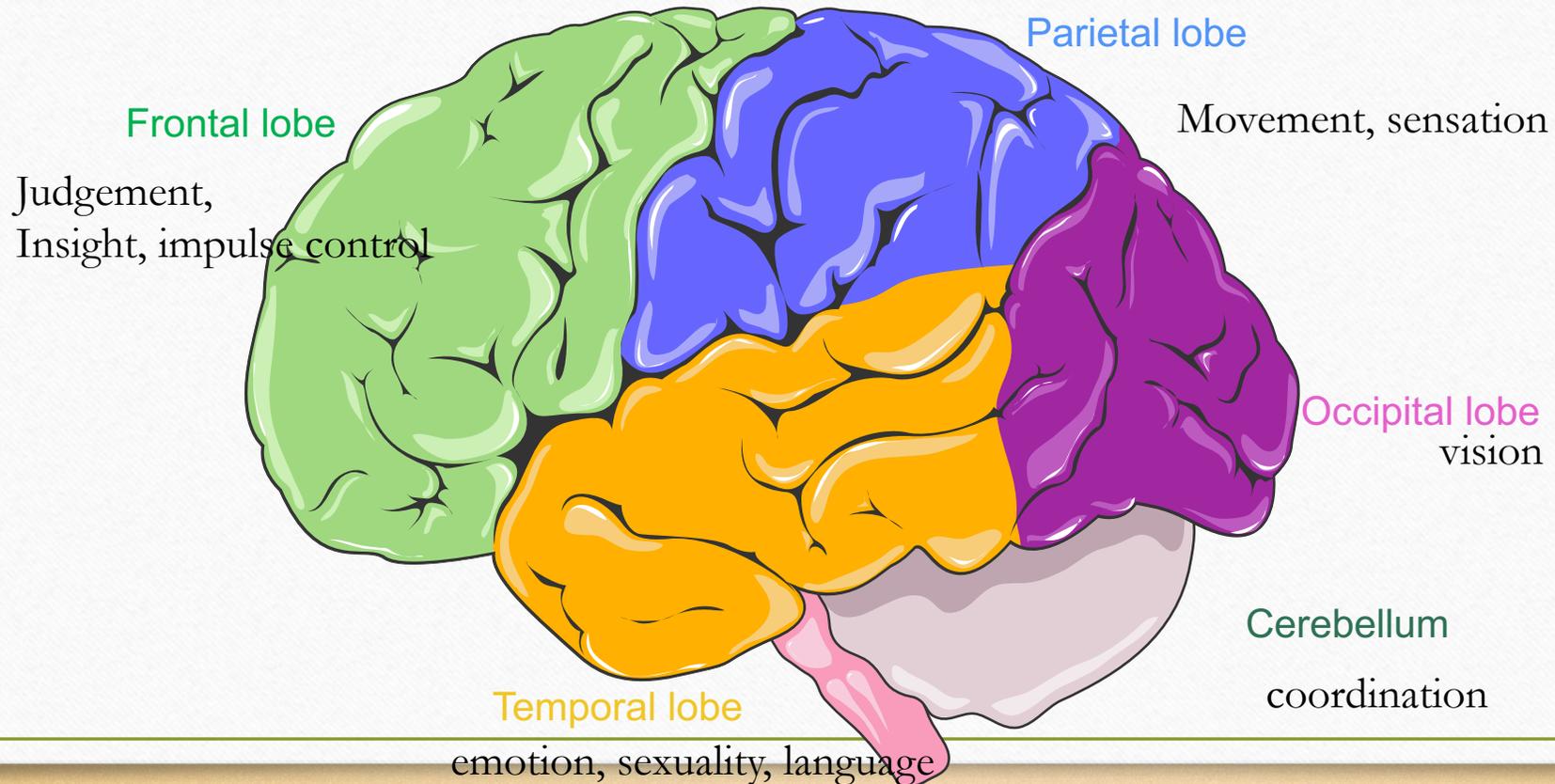
Adolescence is a time  
of extensive neural  
reorganization



# Brain growth starts before birth and continues into early adulthood

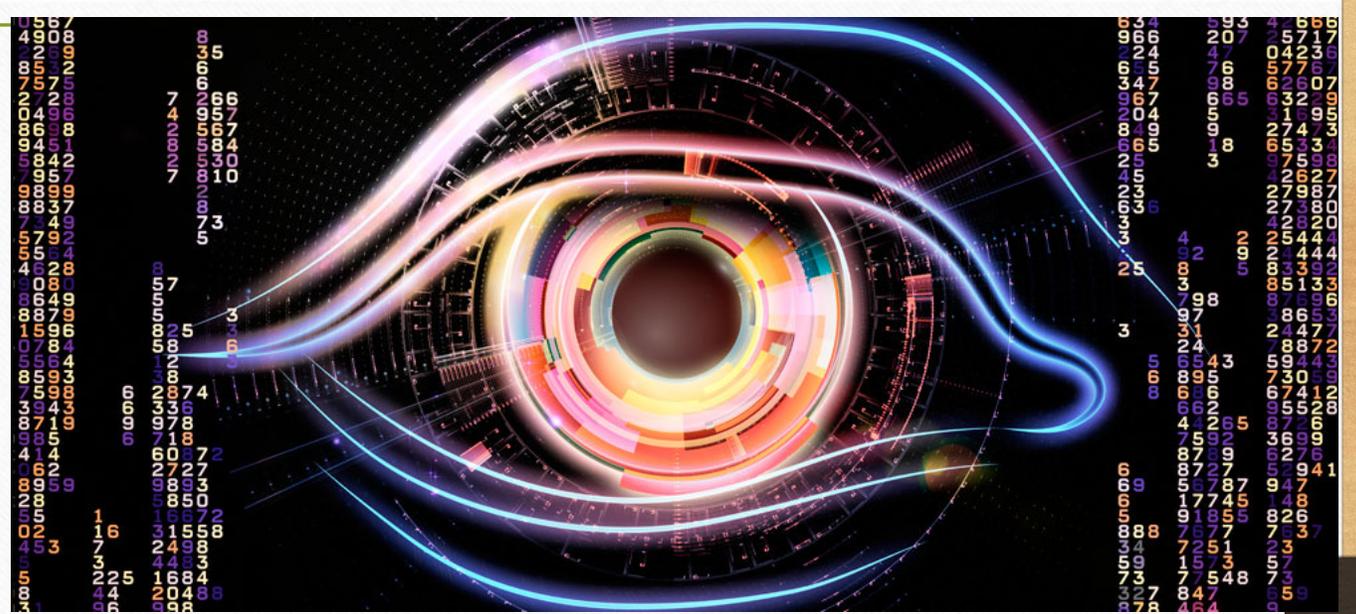


# Brain growth takes place from back to front



First few years of life

Visual and auditory cortex develop



Early to middle childhood

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Motor and sensory cortex  
develops



## Then comes adolescence

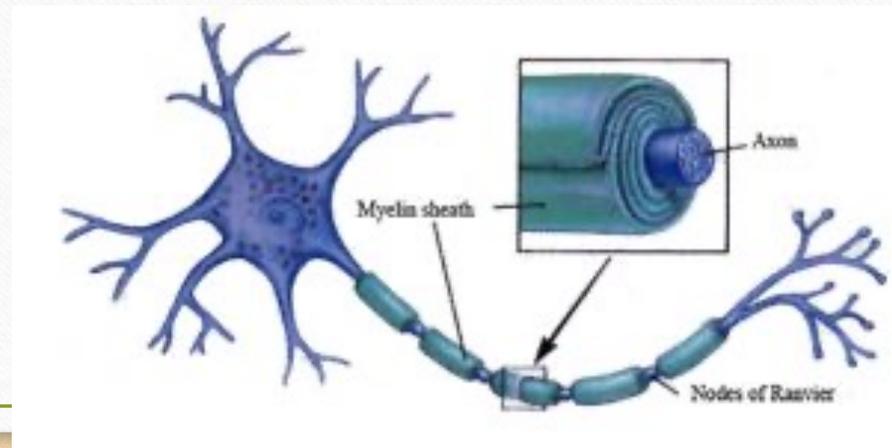
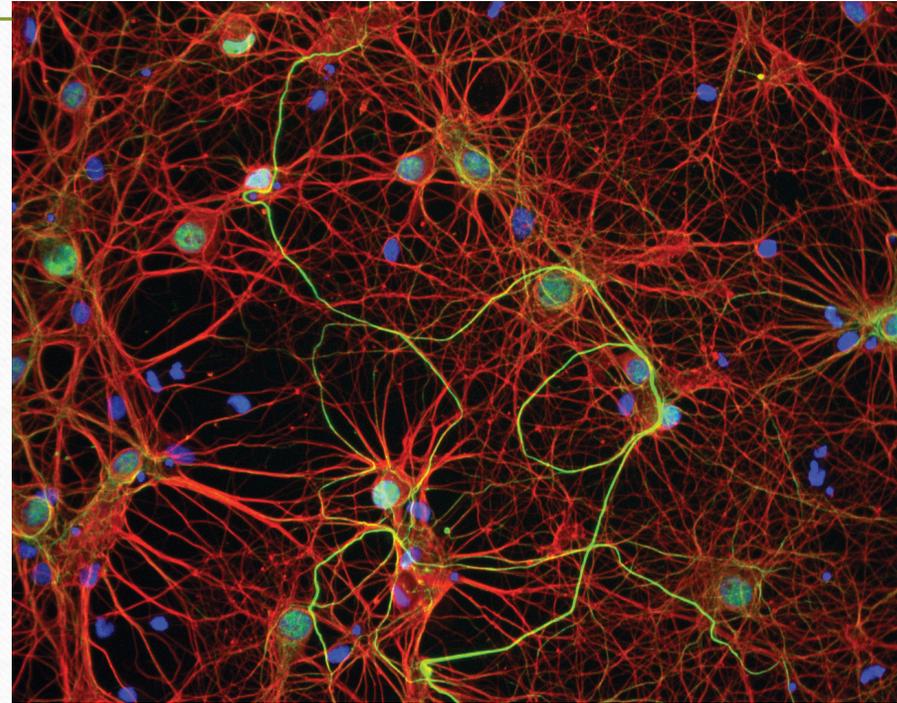
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Adolescence is a long developmental phase, beginning around age 10 and continuing into the mid 20's

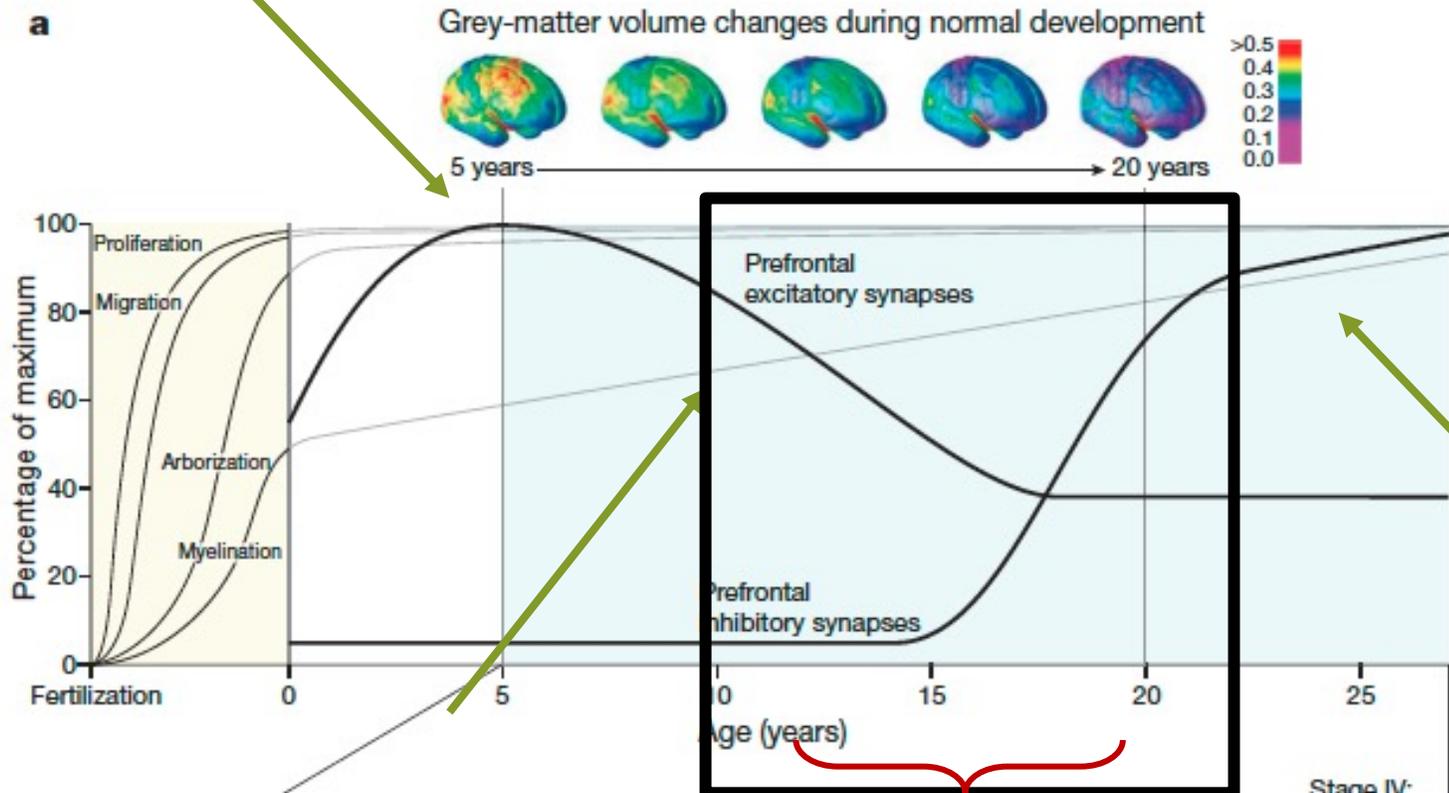
Although myelination is continuing to occur, the primary “growth” activity is actually pruning and wiring (and re-wiring) of neural connections rather than growth of neurons

The main site in the brain where this is taking place is the prefrontal cortex,

mediates planning, impulse control, judgement, organization, risk/reward, delayed gratification

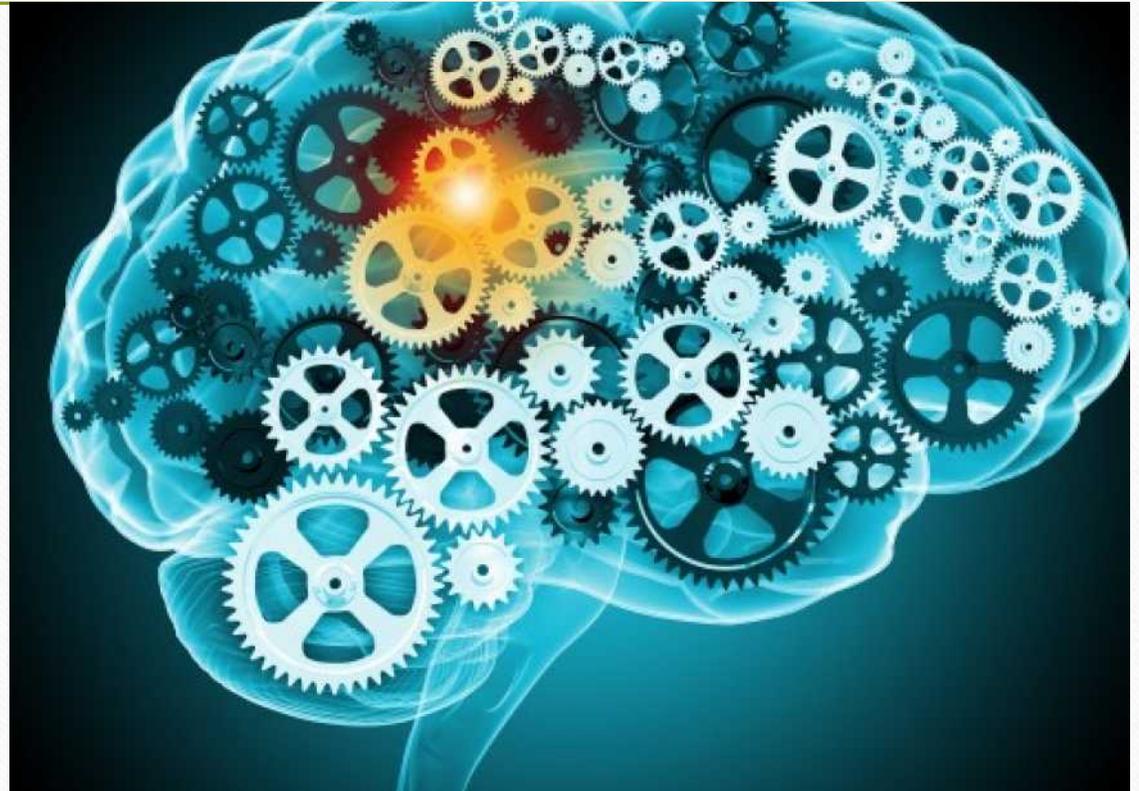


# Synaptic pruning and myelination



These changes are reflected in cognitive functioning and affect regulation

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# Children vs teens

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- Less developed limbic system
- Less developed prefrontal cortex



Emotionally immature, but more consistent

- More developed limbic system
- Less developed prefrontal cortex

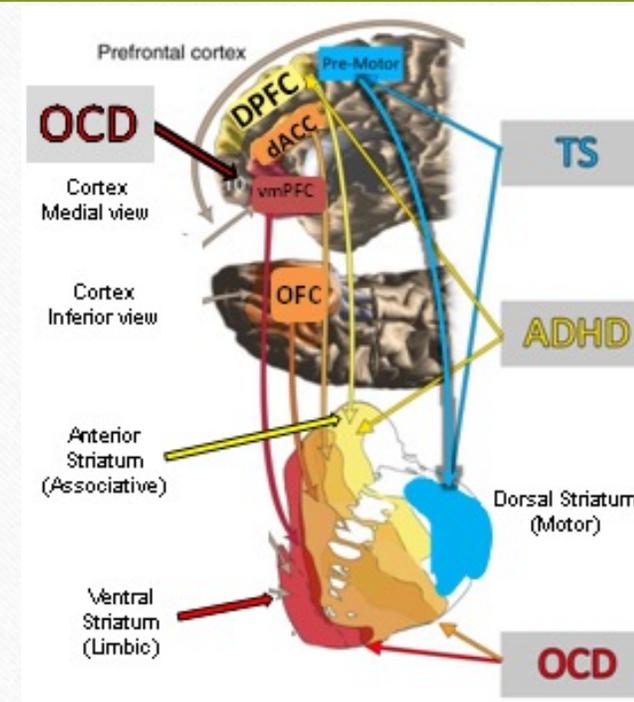


Emotionally intense, sometimes unpredictable, novelty seeking and risk taking



# TS, OCD, and ADHD arise from dysregulated development/maintenance of cognitive and motor control circuitry

- Cortico-striatal-thalamo-cortical (CSTC) circuitry
- Underlies planning, selection and regulation of:
- Movements/actions=dorsal striatum/putamen
- Cognition=caudate, DLPFC
- Behavior=nucleus accumbens, OFC
- Emotion=amygdala



Modified from Haber & Knutson, *Neuropsychopharmacology*, 2010  
Alexander et al *Ann Rev Neurosci* 1986  
Alexander et al *Prog Brain Res* 1992

# Brain Biology Models of TS

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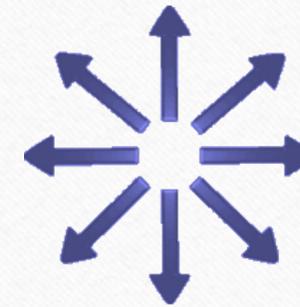
- **Habit/Compulsive Disorder**

- Obsessive-Compulsive Disorder (OCD)
- Body-Focused Repetitive Behaviors (BFRBs)
- Anxiety/Depression



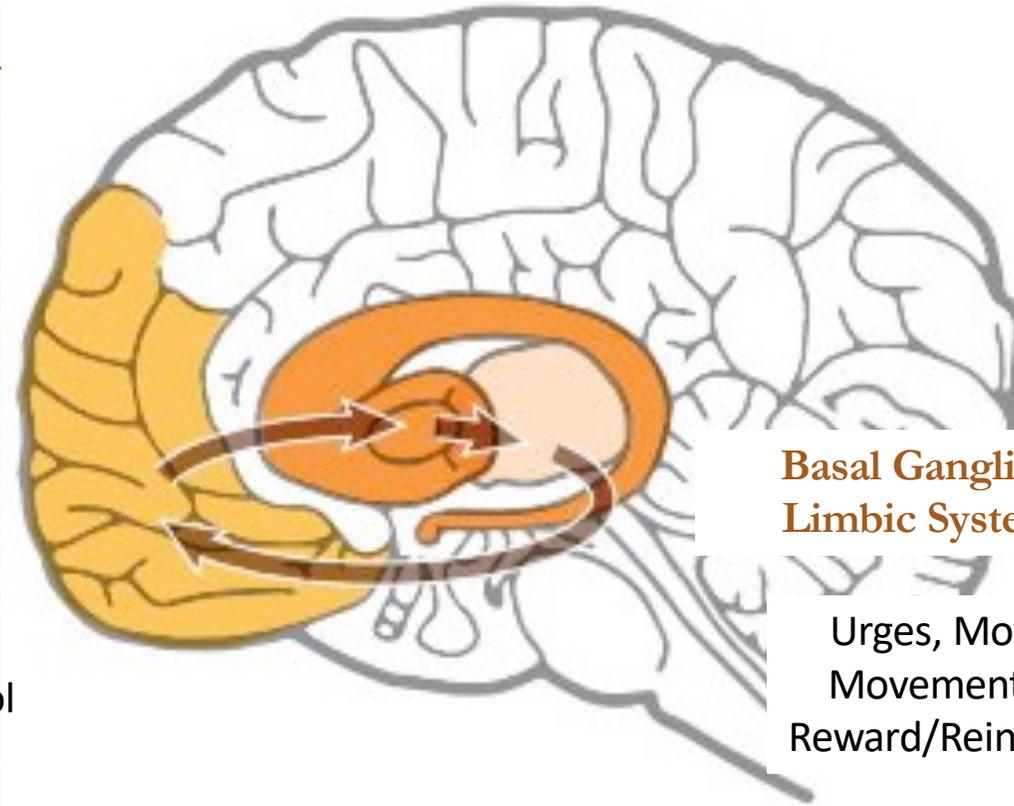
- **Disorder of Disinhibition**

- Attention-Deficit/Hyperactivity Disorder (ADHD)
- Rage/Disruptive Behavior
- Learning Disability



# Compulsivity Model

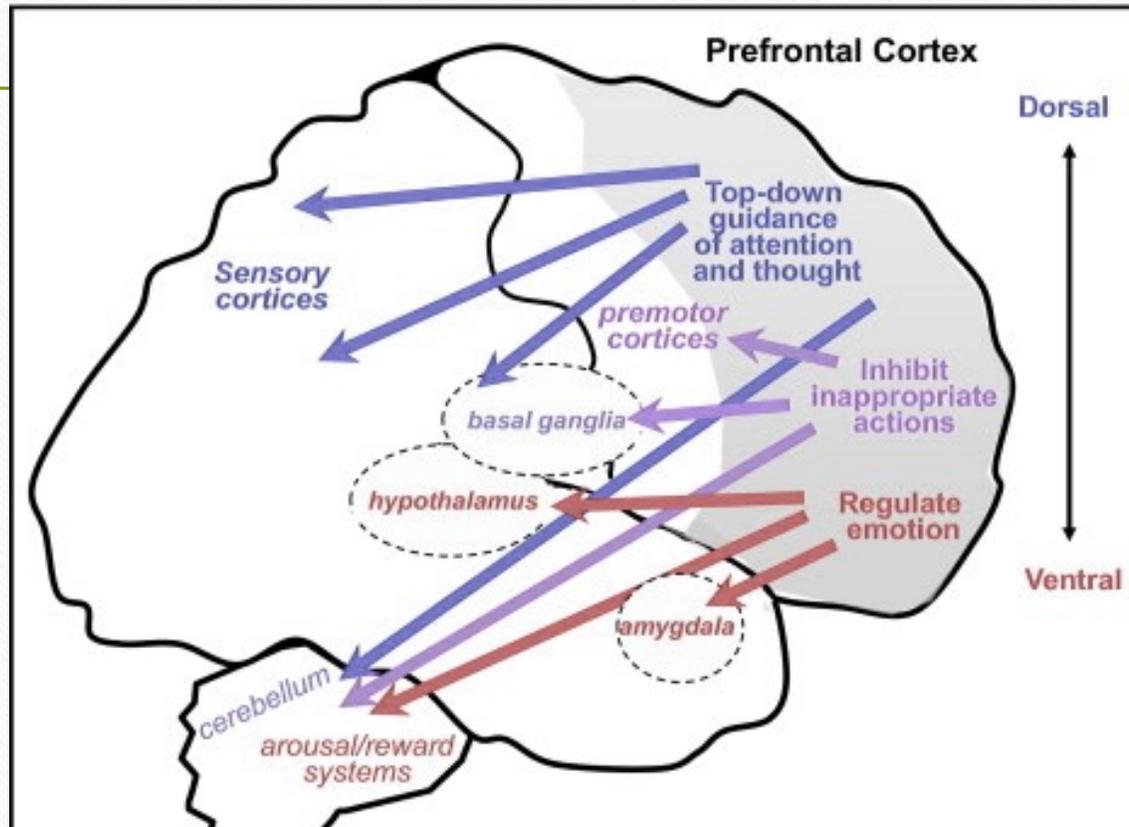
**Prefrontal/  
Anterior Cingulate  
Cortex**  
Urge/Impulse Control



**Basal Ganglia/  
Limbic System**

Urges, Motivation,  
Movement, Habit,  
Reward/Reinforcement

# Frontal Disinhibition Model



ADHD

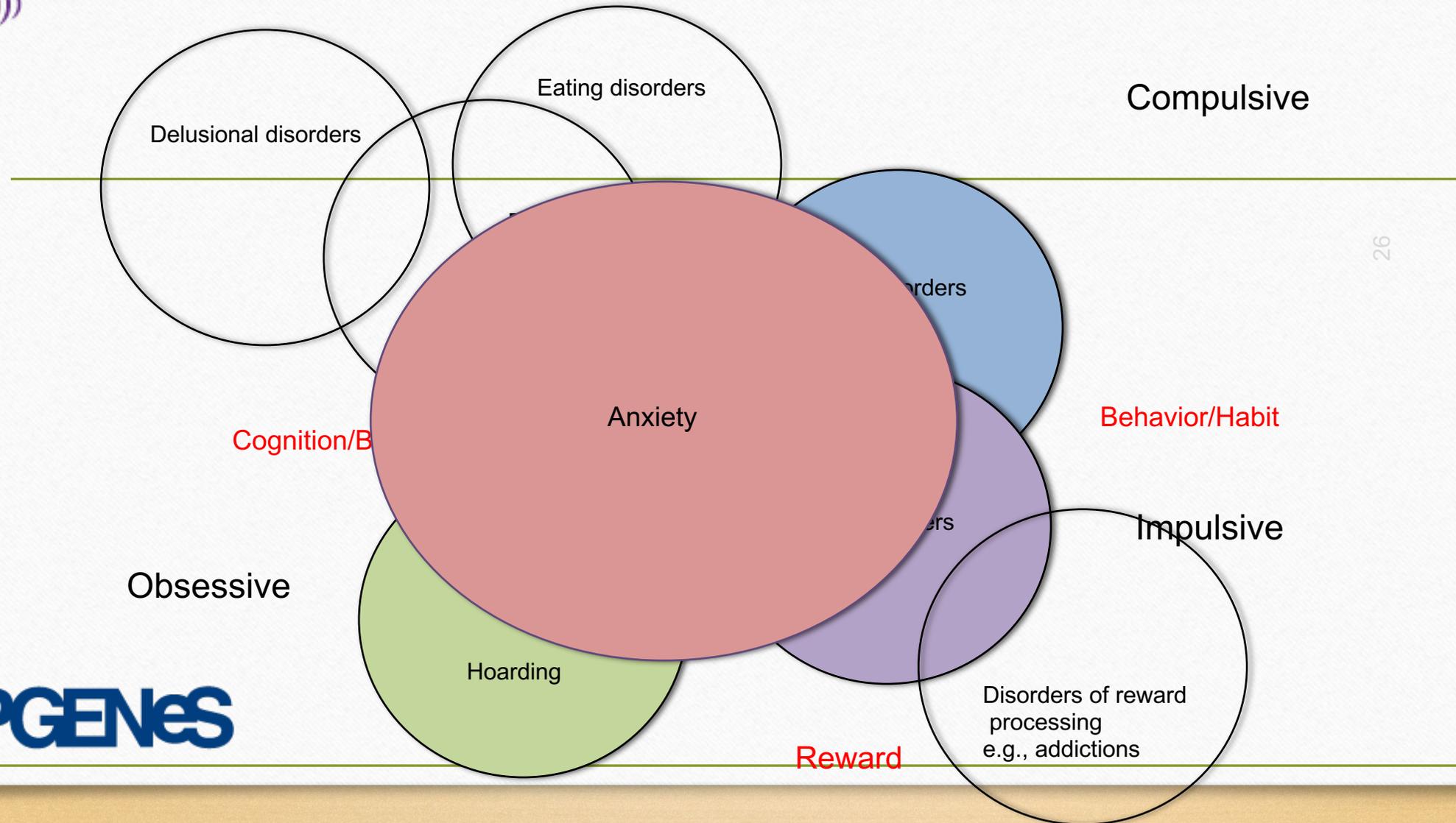
TS

Rage

(Amsten, JAACAP, 2012)



# OC Spectrum Disorders



# Body focused repetitive behaviors

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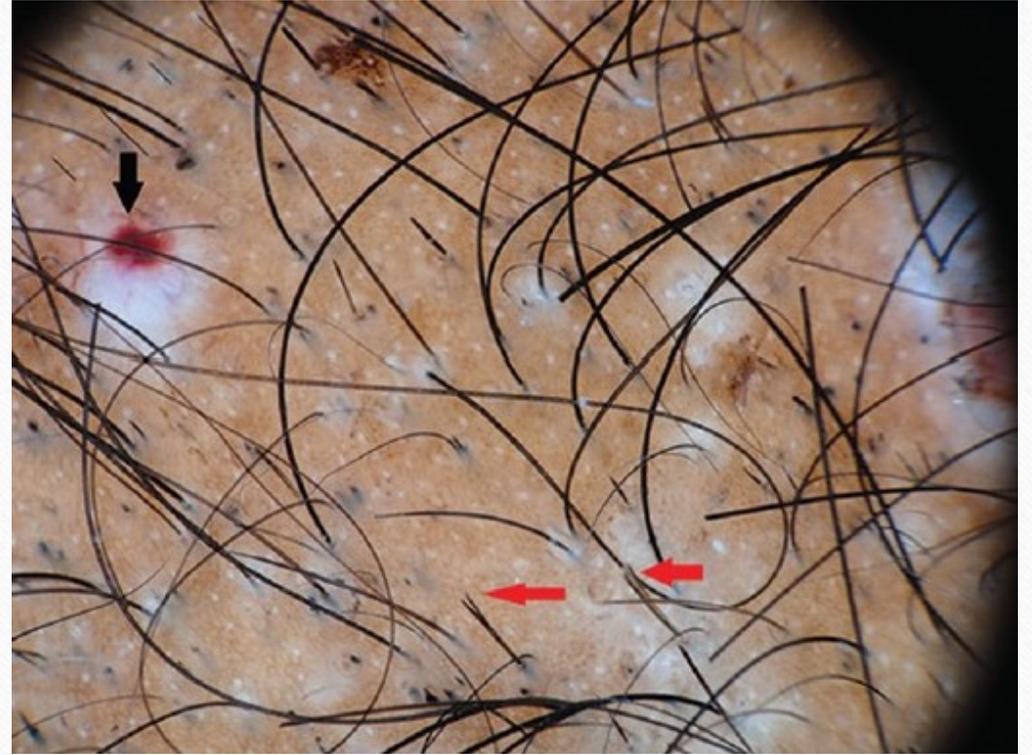
- Repetitive self-grooming behaviors directed towards a part of one's own body
- Occurs at least five times a day over the course of at least four weeks
- Causes physical damage, impairs social or occupational functioning, or would cause damage if ongoing



# Trichotillomania

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- Affects 0.5-2% of children, adolescents and adults
- Males and females equally affected in childhood, females: males = 4:1 in adulthood
- Most common sites are scalp, eyebrows and pubic region
- Triggers can be sensory (physical characteristics of the hair), emotional (bored, anxious), or cognitive (focused on appearance)
- “trolling” for specific types of hair is common
- Ritualistic manner of choosing and pulling the hair out
- Implements such as tweezers often used and can create additional dermatological problems
- Rituals around the hair once pulled (including eating it ~20%)



# Excoriation Disorder

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- Affects 3% of children, adolescents and adults
- Males and females equally affected
- Often begins with picking at blemishes and/or scabs, but progresses to “trolling” for perceived imperfections, very minor skin changes, etc
- As with TTM, instruments are often used to assist in the removal of the perceived imperfection (tweezers, knives, paper clips, other sharp objects)
- Treatment approaches parallel those of TTM
- Ongoing involvement by dermatology also needed to manage any underlying blemishes, acne, primary or secondary rashes, etc



*Compulsivity:*

# BFRBs in TS

TTM



ExD



**Prevalence**

3-4% (2-10X pop)

13% (2-10X pop)

**Course**

Rate increases with age

Rate stable with age

**Sex**

F:M = 2:1

**Onset**

~13 yo

~8 yo

**Predictors**

Sex

female

Comorbidity

OCD, ExD (35%)

OCD, ADHD, TTM (9%)

Severity

TS & OCD severity

Family Hx

TS or OCD

TTM, TS or OCD

*(Greenberg, 2018)*

# Other body focused (harmful) habits

- Scratching
- Nail biting
- Cheek/lip biting
- Teeth grinding



# Treatment of TTM/ExD

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- Bring the behavior into consciousness—can't adequately address a behavior that is unconscious or semi-conscious
- Barrier methods
  - Gloves
  - Band-aids on fingers
  - Hats
  - Braids
- Distraction during automatic behavior times when hands are not needed for something else (watching television)
  - Knitting or finger crocheting

# Treatment of BFRBs

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- Exposure/response prevention (ERP)
  - Identify when pulling/picking
  - Formalize when pulling/picking (e.g., set a specified time and place)
  - Resist the urge to pull/pick for a defined period of time
  - Pull only for a specified period of time or a specified number of hairs
  - Achieve success with this goal and systematically work to decrease time/number of hairs

# Treatment of BFRBs, continued

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- Habit reversal
- Similar to ERP but with a slightly different theoretical frame
  - Awareness training
  - Create a competing response
  - Social support –praise not for success but for completing homework

# Pharmacotherapy

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- None very effective, but many can help some
- Treat underlying OCD and ADHD
- Clomipramine
  - Tend to need OCD doses and timeframes (higher doses, takes longer to take effect)
- Neuroleptics
  - Low doses, low potency work best
- N-acetylcysteine
  - 600 mg BID increasing to 1200 mg BID
  - Helps decrease the urge to pull

Lamothe 2020  
Bloch 2007



# Self injurious behavior

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- Deliberate, non-accidental, repetitive infliction of self harm without suicidal intent
- Tic-related
- Compulsive
- Impulsive
- Other
- Skin picking
- Self hitting
- Self biting
- Teeth grinding
- Head banging
- Poking objects
- Tongue/lip biting
- Body to object banging
- Biting or hitting others
- Pinching
- Cutting

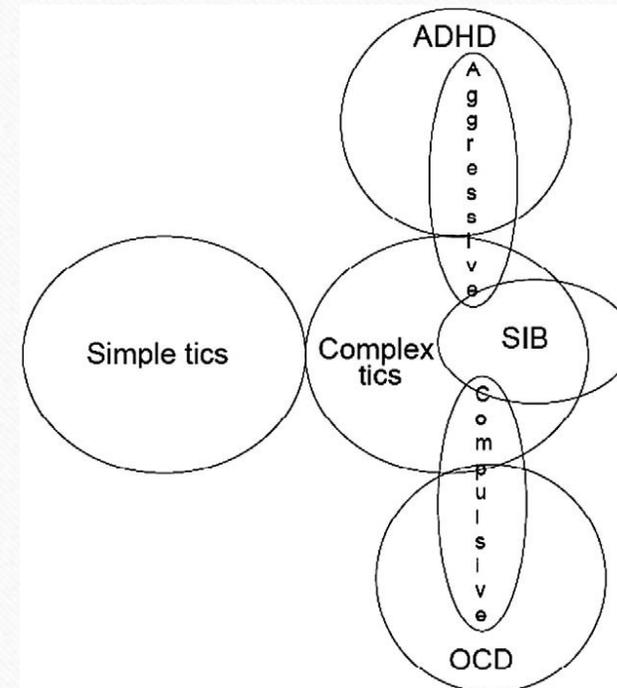
# Prevalence of SIB

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- Prevalence estimates range from 11% to 78%
- Most estimates fall into the 30%-45% range
- Recent systematic review found a pooled prevalence of 35% in 20 cohort studies
- Prevalence of tics or compulsions causing injury (not including behaviors such as scratching, picking) is lower, probably around 15-20%
- Prevalence of severe SIB is  $\leq 5\%$

# Clinical correlates of SIB

- Obsessive compulsive symptoms/OCD\*
- Impulsive symptoms/ADHD\*
- Tic severity\*
- Complex tics\*
- Dystonic tics
- Anxiety disorders (adults)



Mathews et al 2004  
Szejko 2019  
Stafford and Cavanna 2020  
Baizabal-Carvalho 2022

Grados and Mathews 2009

# Treatment of SIB

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- Behavioral treatments
- Neuroleptics
- Naltrexone
  - Not studied in TS specifically
  - 80% improve relative to baseline
  - 47% improve by 50% or greater
  - ASD symptoms did not impact treatment response



# Suicidality



- 75 youth with tics recruited from a clinical setting
- 61% had some symptoms of suicidal ideation
- 8% met the clinical cutoff for concerning SI
- SI was correlated with:
  - Anxiety
  - Depression
  - Externalizing symptoms
  - Affective lability
  - Poor distress tolerance
  - Poorer overall functioning

# Suicidality, continued



- 196 youth with chronic tic disorders from a clinical sample
- 10% with SI vs 3% in a community control sample
- SI usually expressed in the context of anger and frustration
- Clinical correlates:
- Tic severity and related impairment
- OCD, anxiety, depressive, and ADHD symptom severity
- Internalizing, withdrawn, aggressive, anxious/depressed symptoms on the CBCL

# Population based study



- 7736 TS/CTD cases and 77360 general control subjects over 44 years from Swedish National Health Registry
- 32 individuals with TS/CTD completed suicide (0.41%)
  - 74 in control cohort (0.10%)
- 594 (7.68%) had attempted suicide at least once
  - 1669 in control cohort (2.16%)
- Odds ratios for TS/CTD compared to controls
- Suicide attempts: 3.86
- Completed suicides: 4.39
- ORs were reduced but still significant, after controlling for psychiatric comorbidities (2-4 fold higher)
- Rates of multiple attempts OR 2.01

# Predictors of SI



- 72% of TS/CTD group had at least one comorbid psychiatric disorder
- Compared with 12% of control group
- 2/3 of TS/CTD group had “resolved” tics by age 19 (meaning no continuing diagnoses registered)
- Attempts:
  - all psychiatric disorders (except intellectual disability)
  - Female
  - Tic persistence into adulthood
  - Previous attempt
- Completed suicide:
  - Persistence of tics in adulthood
  - Previous attempt
  - Comorbid personality disorder

# Malignant Tourette

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- Potentially life threatening symptoms
- Defined as  $\geq 2$  emergency department visits or hospitalizations for tic or related symptoms
- Over 3 years, 17/333 (5.1%)
- Tic-related injuries (most common)
- Self-injurious behavior
- Uncontrollable violence (rage)
- Suicidal ideation/attempts

# Malignant Tourette, continued

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- More likely to have complex tics, including coprophenomena
- SIB
- OCD or OC symptoms
- Suicidal ideation
- More likely to be nonresponsive to medications/failed more medication trials

# Sequelae of severe tics

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- Cervical myelopathy/spinal cord compression from neck/head jerks
- Cervical disc herniation
- Retinal detachment
- Concussion/traumatic brain injuries
- Bone fractures
- Stroke/vascular dissection
- Lacerations and bruising from self hitting (including internal damage)
- Damage to teeth from grinding

# Car accidents

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- Increased rates of transport related injuries or death (aHR=1.50)
- Motor vehicle accident related injuries or deaths (aHR =1.58)
- These findings no longer significant after controlling for comorbid ADHD



# Premature death

- Mortality rate ratio for premature death was 2.02
- Not accounted for by co-occurring OCD, ADHD, or SUD
- Substance use related deaths are 2.54 times higher in TS/CTD than in controls
- But, in both studies, death was a rare outcome (e.g, n=46 out of 6781 with a tic disorder)

Meier 2017

Virtanen 2020



# Habits in TS

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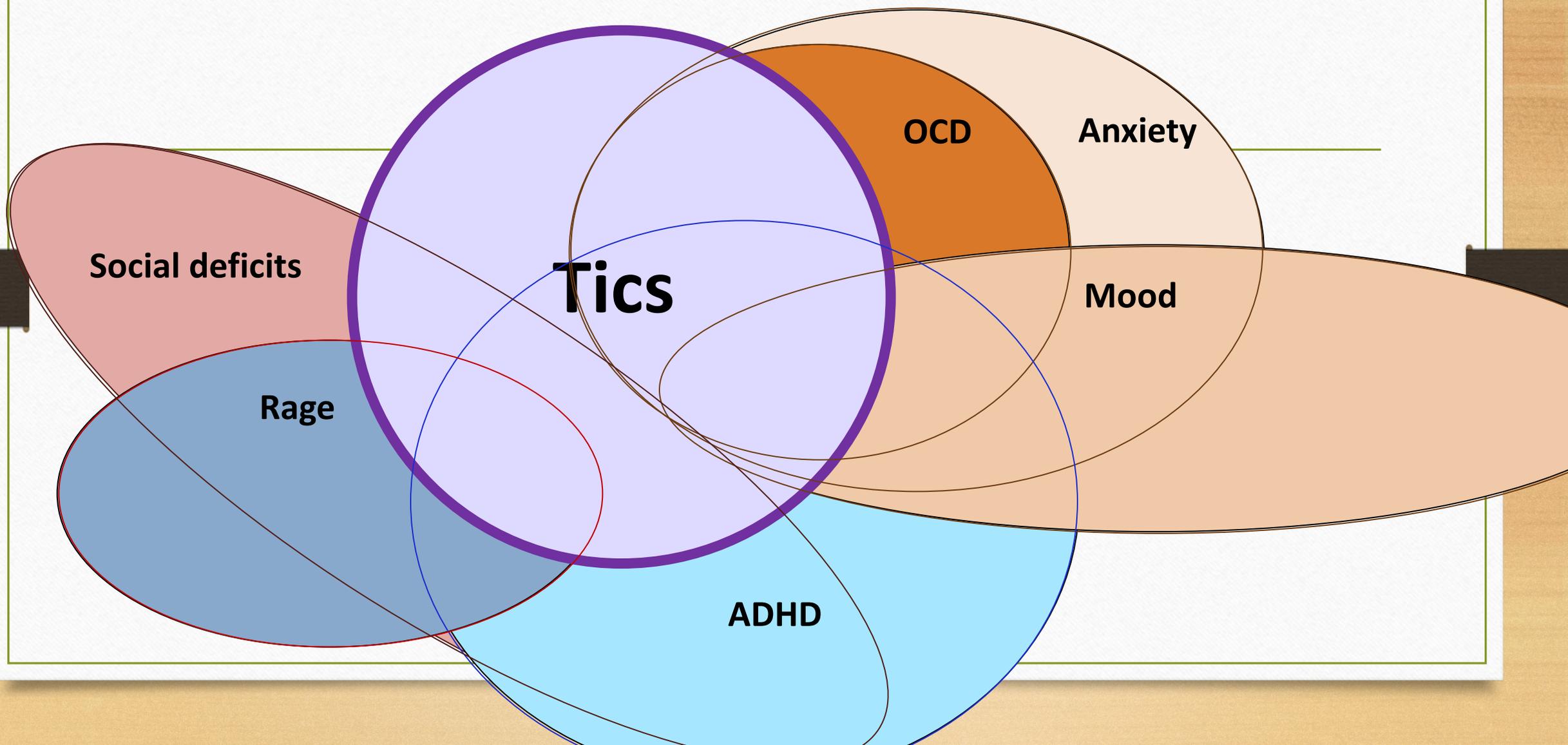
- Habit based disorders are more common in TS than in the general population, but still relatively uncommon (4-12%)
- Typically occur in early adolescence –intersection of impulsivity and compulsivity
- Tend to be more chronic in nature than tics, often with a remitting and relapsing course (worsening in times of stress)
- Socially distressing and impairing, but not life threatening
- Can be treated using similar behavioral approaches that are used to treat tics and compulsions

# Harm in TS

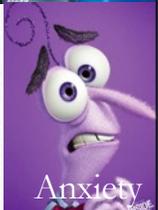
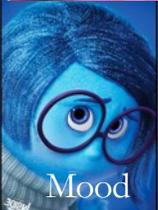
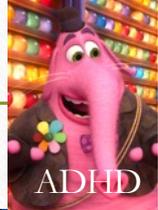
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- Increased rates of harm in TS due to a variety of factors
- SIB is common ~35%, but most is mild or moderate in nature
- Self-injurious tics—can cause significant damage but malignant tics are rare (<5%)
- Suicidality occurs in 7-10% but absolute risk of completed suicide, while elevated, remains fairly low
  - Associated with emotional dysregulation, psychiatric comorbidities, tic severity, low distress tolerance
- Accidents/impulsivity are also higher
  - Associated with ADHD

Risk is substantially increased with comorbid psychiatric disorders



# Comorbidity: Impact on TS



## Main determinant of psychosocial & psychological outcomes

- Patients without comorbidity **do better in early development** and **integrate better into the workplace or higher education** (*Rizzo, 2012*)
- **Number of co-morbidities & presence of coprophenomena** are significant predictors of health-related QoL (*Eapen, 2016*)
- Strong associations between comorbidity & decreased **global QoL**, impaired **emotional & school functioning**, and increased **emotional symptomatology** ( $p < .001$ ) (*O'Hare, 2016*)



# Impact of Comorbidity on Treatment

- Treating comorbidities can greatly improve **outcomes** in TS, for example:

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  - Treating **ADHD** can improve academic and social functioning
  - Treating **depression** and **anxiety** can improve tics
- Comorbidities may suggest **alternative prescribing algorithms**, for example:
  - $\alpha$ 2-agonists (guanfacine, clonidine) may benefit both **ADHD** and tics (esp. in the context of ADHD)
  - Antipsychotics may benefit both tics and **OCD** (esp. in the context of tics)
  - Both may benefit **impulsivity** and **rage**

Assess often and thoroughly for  
presence and severity of comorbid  
psychiatric disorders

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And be assertive about treating  
them



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& Related Disorders

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