

TABLE 12.2 Processes Associated With the Prefrontal Cortex That Are Disrupted in Addiction

PROCESS	POSSIBLE DISRUPTION IN ADDICTION	PROBABLE PFC REGION
Self-control and behavioral monitoring: response inhibition, behavioral coordination, conflict and error prediction, detection, and resolution	Impulsivity, compulsivity, risk taking and impaired self-monitoring (habitual, automatic, stimulus-driven, and inflexible behavioral patterns)	DLPFC, dACC, IFG, and vIPFC
Emotion regulation: cognitive and affective suppression of emotion	Enhanced stress reactivity and inability to suppress emotional intensity (for example, anxiety and negative affect)	mOFC, vmPFC, and subgenual ACC
Motivation: drive, initiative, persistence, and effort toward the pursuit of goals	Enhanced motivation to procure drugs but decreased motivation for other goals, and compromised purposefulness and effort	OFC, ACC, vmPFC, and DLPFC
Awareness and interoception: feeling one’s own bodily and subjective state, insight	Reduced satiety, “denial” of illness or need for treatment, and externally oriented thinking	rACC and dACC, mPFC, OFC, and vIPFC
Attention and flexibility: set formation and maintenance versus set-shifting, and task switching	Attention bias toward drug-related stimuli and away from other stimuli and reinforcers, and inflexibility in goals to procure the drug	DLPFC, ACC, IFC, and vIPFC
Working memory: short-term memory enabling the construction of representations and guidance of action	Formation of memory that is biased toward drug-related stimuli and away from alternatives	DLPFC
Learning and memory: stimulus–response associative learning, reversal learning, extinction, reward devaluation, latent inhibition (suppression of information), and long-term memory	Drug conditioning and disrupted ability to update the reward value of non-drug reinforcers	DLPFC, OFC, and ACC
Decision making: valuation (coding reinforcers) versus choice, expected outcome, probability estimation, planning and goal formation	Drug-related anticipation, choice of immediate reward over delayed gratification, discounting of future consequences, and inaccurate predictions or action planning	IOFC, mOFC, vmPFC, and DLPFC
Salience attribution: affective value appraisal, incentive salience, and subjective utility (alternative outcomes)	Drugs and drug cues have a sensitized value, non-drug reinforcers are devalued and gradients are not perceived, and negative prediction error (actual experience worse than expected)	mOFC and vmPFC

Note: Brain areas are prefrontal cortex (PFC), anterior cingulate cortex (ACC), orbitofrontal cortex (OFC), and interior orbitofrontal cortex (IOFC). These various processes and regions participate to a different degree in craving, intoxication, bingeing, and withdrawal.

Source: Goldstein & Volkow (2011, p. 654).