WHAT THE ADHD BRAIN WANTS – AND WHY

Dr. Ellen Littman

Advances in technology are offering us an increasingly bigger window into the neurological bases of ADHD. We now know that differences in structure, functionality, activation, and connectivity all come into play. The key to understanding your behaviors—why you act the way you do in the world—is understanding the needs and wants of your unique brain. If friends and family can't always make sense of your actions, and you can't either, learning about how your brain works at any moment in time will give you an explanation.

Brains regulate our responses to stimulation, and need to be engaged in order to function well. Optimal arousal enables brains to be alert, receptive and hence, ready to attend and learn. Well-choreographed executive functions cue the skills necessary for effective response selection. Goal-directed behaviors can be fine-tuned without the distractions of emotions or sensations. Generally, non-ADHD brains are adequately aroused by the shifting internal and external stimulation of daily life. Regardless of fluctuations in stimulation, those brains can power through with reasonably sustained focus, fueled by the dependable coordination of neurotransmitters. They can self-regulate with relative confidence and feel an adequate amount of control over their behavior.

ADHD brains do not adapt as easily; they have their own rules of engagement. They are motivated by their search for optimal stimulation, rather than by what others label as important. Their degree of arousal differs based on whether the request for attention comes from an internal desire or an external demand. The owners of these brains are not making conscious choices to ignore external demands, although it often appears that way. Instead, internal motivations are intrinsically more meaningful to their brains and, as a result, more dopamine becomes available. Concerns about time or consequences are dwarfed by the

pursuit of such pleasurable reinforcement. Whether through sensation or hyperactivity, ADHD brains compel their owners to scan the environment for engaging stimulation. When mundane tasks can't be avoided, ADHD brains may be compromised in their ability to proactively choose goal-oriented responses.

Learning from experience is the basis for sound decision-making, and the motivation to learn is modulated by the promise of reward. The current Incentive Salience Model describes a dopamine reward system that is responsible for motivation, positive reinforcement, and pleasure for all brains. However, dopamine-increasing behaviors are even more gratifying to ADHD brains. Key aspects of the reward system are underactive in ADHD brains, making it difficult to derive reward from ordinary activities. These dopamine-deficient brains experience a surge of motivation after a high stimulation behavior triggers a release of dopamine. But in the aftermath of that surge and reward, the return to baseline levels results in an immediate drop in motivation.

One of the many consequences of reduced dopamine in the synapses is that the significance of tasks is decreased. If most stimuli appear equally compelling, it's difficult to selectively attend to the most important task. As a result, stimuli need greater personal relevance—larger, more immediate, or repeated rewards—to be attractive incentives for ADHD brains. Reward Deficiency Syndrome (RDS) has been proposed to explain why ADHD brains need these stronger incentives. Deficits in the reward pathway, including decreased availability of dopamine receptors, decrease motivation. Indeed, ADHD brains struggle to sustain motivation when rewards are mild or linked to long-term gratification. As a result, ADHD brains are constantly searching for stimulation that can increase dopamine more quickly and intensely. Ultimately, the pursuit of pleasurable rewards may become a potent form of self-medication. In fact, addicted brains exhibit similar dysregulation of the dopamine reward system.

Every behavioral reward that has been studied has been shown to amplify dopamine production, including food, sex, exercise, competition, and music. High-risk activities like driving fast, motorcycle riding, and waterskiing motivate ADHD brains to focus. Some extreme activities like daring ski jumps, sky diving, or taking fast-acting street drugs can elicit a dopamine spike, the brain's most intense reward. Some ADHD brains have benefited from the greater dopamine involvement that is intrinsic to high intensity, high-risk careers, like emergency medical technicians, firemen, and ER doctors. However, nicotine, caffeine, alcohol, opiates, risky sex, pornography, gambling, physical risk-taking, reckless driving, and compulsive buying increase dopamine even more. In fact, all substances or behaviors that can ultimately result in dependencies have the ability to increase the release of impulse-reinforcing dopamine and reduce the impulse-inhibiting effects of serotonin.

So ADHD brains *are* highly motivated--to find their unique balance of stimulation that enables optimal functioning. Whether ADHD brains err by over-reacting or under-reacting to the stimuli at hand, they rarely engage with moderate stimulation that falls somewhere "in the gray area". ADHD brains tend to respond at one end of the continuum in most but not all areas of functioning. These opposite routes to the same goal explain how high energy, outgoing, talkative, over-subscribed individuals and shy, low-energy, passive, and withdrawn individuals can both be regulated by ADHD brains.

For some ADHD brains, optimal functioning involves augmenting the existing stimulation—seeking louder, faster, bigger, funnier, riskier—the more intense, the better. Boredom is a common complaint for the owners of these brains: it is a physiologically uncomfortable state in which their under-aroused brains struggle to engage with their environment. In fact, in mundane, low-stimulation situations, these restless brains may compel their owners to increase the intensity level with fidgeting, noise, laughter, or conflict, if there is no other route to high stimulation available. These more impulsive ADHD brains have their

own logic: if some stimulation is good, more will be better. This is the signature short-sighted philosophy of brains compelled to choose immediate rewards over long-term gratification.

In their impulsive hunger for greater stimulation, these ADHD brains can suddenly find themselves in a state of over-arousal. Egged on by their brains, most are unable to modulate their responses and can't anticipate an impending "crash". The fun suddenly becomes out-of-control, the laughter takes on a hint of hysteria, sights and sounds bombard them until they are overwhelmed. Ambushed by physiological overload and depleted of psychic energy, they may become irritable, tearful, restless, or aggressive. Their brains abruptly demand respite from the commotion so that they can regroup with negligible stimulation. Their sudden and total withdrawal is often a source of confusion and consternation to those who know only the spirited stimulation-seeker.

At the other end of the continuum, there are ADHD brains that can barely tolerate existing levels of stimulation. These brains teeter on the brink of sensory overload, and seek every opportunity to escape from the bombardment. Unexpected or novel stimulation is experienced as an ambush, evoking discomfort, frustration, and irritation. Owners of hypersensitive brains tend to reduce stimulation by tuning out of conversations, avoiding group activities, and isolating themselves. They shun busy department stores, loud concerts, big parties, and prefer to stay where they can control the amount of stimulation they experience. These brains find comfort in the self-contained world of video games: with an internal structure that offers complete control over the kind and amount of stimulation, they can select games with rewards that are strongly reinforcing to their brains. These rewards offer pleasure within a cocoon, shielding them from the unpredictable minefield of personal interaction. As a result, these games have incredible addictive potential for the more inattentive ADHD brain.

Food is a ubiquitous substance that activates the dopamine reward center in all brains. However, especially for the more impulsive ADHD brain, it can be a torturous daily self-regulation challenge. The low levels of dopamine interfere with focused self-regulation, increasing the likelihood that ADHD brains will be inattentive to the many factors that can modulate eating behaviors. ADHD brains exhibit decreased glucose metabolism compared to non-ADHD brains, resulting in less energy available to the attentional center in the prefrontal cortex. As a result, ADHD brains send out distress messages demanding more glucose and, suddenly, the owners of those brains crave sugary foods and carbohydrates, which can be quickly converted into glucose. Glucose increases dopamine and serotonin, so brains experience pleasure and greater calm. Many chide themselves for indulging in pasta, bread, and cookies, when their brains are actually demanding those foods instead of a salad. Chocolate is especially appealing to ADHD brains because it increases glucose and has the added stimulation from caffeine. It is no wonder that those with ADHD struggle with eating disorders; each time they self-medicate with food, their brains enjoy a surge of dopamine, an increase in glucose-based energy that improves attention, and a serotonin-based calming of restlessness. Particularly for the impulsive ADHD brains, this perfect storm of rewards increases the likelihood of binge-eating and bulimia compared to non-ADHD brains.

The Reticular Activating System (RAS) in the brainstem is responsible for regulating arousal and the sleep/wake cycle. In ADHD brains, the RAS is dysregulated; circadian cycles tend to skew towards higher activity levels in the evening, resulting in later bedtimes and waking times. In fact, many individuals with ADHD celebrate when they finally have time to themselves late at night. This is when they feel entitled to internally driven activities like watching random TV, engaging with social media, looking at porn, or playing computer games. With their greater arousal, which is often experienced as ‘a second wind’, these brain-pleasing behaviors are quite reinforcing. Studies show that the blue LED light from screens further increases alertness while suppressing the normal elevation of melatonin. With delayed melatonin production, ADHD brains

are often flooded with both internal and external stimulation into the early morning, delaying sleep and making it difficult to be an early riser.

Understanding what ADHD brains want makes it clear that the struggle for self-regulation is neurological and not characterological. For example, it would be easy to misinterpret the following scenario as a standoff between two partners: imagine that your partner asks you to pay the electric bill and you say to yourself, "OK—I have time to do that today". But when you sit down to do it, you keep getting distracted. The ADHD brain needs higher stimulation in order to engage with this rote task with minimal payoff. Your ADHD brain says "That task is way too boring and I refuse to focus on it. Find something that interests me more, which offers me a bigger dopamine reward, and then I'll work with you." It doesn't matter how much you think you should pay the bill as promised; if your brain won't engage, it's an ugly standoff. Perhaps, after a day of procrastination, when your partner will be home in 20 minutes and the bill is still unpaid, there may be enough of an adrenalin rush from a sense of crisis that your brain will engage and, in the eleventh hour, the bill is paid. It's really the ADHD brain and it's owner that are at odds with one another. Intellect vs impulses: it's difficult to compel a disengaged brain to engage by force of will. In fact, much of the treatment for ADHD involves learning to psyche out the brain so it will attend to necessary, low stimulation tasks.

Appreciating the tug-of-war within that pits intellect against neurobiology can increase compassion and acceptance for one's hidden struggle. ADHD behaviors are frequently mislabeled and misjudged by society, and there is some comfort in knowing that there are neurological explanations for seemingly incomprehensible judgment. When the workings of ADHD brains are better understood, the behavior of their owners becomes more predictable; in addition, others can stop taking it personally. Understanding how ADHD brains work and why shows us that increasing saliency and manipulating rewards can improve motivation and performance. And appreciating the complex dance between owners and their brains may help to remind everyone that they too are struggling to

navigate a confusing world and still fight the good fight.