

Understanding Addiction

An Interview with Dr. Darryl S. Inaba, PharmD, CADC-V, CADC III

Interview by Ashley Johnson

This article's questions on the nature of substance-related and addictive disorders and the future of the evolving field of addiction medicine were posed by Ms. Ashley Johnson, a journalism major at University of Winchester in England. Submit your questions for Dr. Inaba to igleason@naadac.org.

Ms. Johnson: How is it that one person becomes addicted and another doesn't? Is the brain chemistry different?

DR. INABA: Addiction is due to a combination of genetics, environment and pharmacology. Most researchers feel that genetics contribute about 40% to 60% of the vulnerability to addiction. (Schuckit, Marc M. A., 1986; Goodwin, D. W., 1976; Blum, K. et al., 1990, Goldman, O., 2005; Hiroi, A., 2005.) Some 89 different genes have been linked to addiction vulnerability with 900 other suspected genes. (Li, M. D. &

Burmeister, M., 2009; Agrawal A., et al., 2012.) Some are born prone to be addicted to either a specific drug/behavior or to a multitude of drugs/behaviors while others may not. This and other factors cause anomalies in brain cells, brain chemistry and even communication pathways between brain cells that make certain individuals more vulnerable to addictive disorders. Current U.S. estimates project that about 15% of those who drink alcohol, 17% of cocaine and methamphetamine users, 24% of opiate/opioid users, 9% of marijuana users and 5% of gamblers will develop addiction to that substance or behavior. Note that about 34% of those who try a tobacco product will become addicted to nicotine making it the most addictive substance. (American Psychiatric Association, 2000.)

Ms. Johnson: Are persons with addictive disorders just born that way or can it develop from other causes?

DR. INABA: Even though one might be born with all the genes to develop addictive disorders; they will not manifest that vulnerability unless they are exposed to what they are genetically prone to be addicted to. So if you have all the genes to be, say an alcoholic but never drink alcohol you will not develop alcoholism. On the other hand, if you even just experiment a little with drinking alcohol and have all the genetics for it you will likely manifest that addiction.

In addition to genetics, environment and pharmacology or toxicology also affects the brain's neurons, chemistry and communication networks to make one more or less vulnerable to developing addiction. Environmental influences like stress, trauma, nutrition, injury, illness, toxins, pesticides, et al. all alter brain neurons (cells), neurotransmitters (brain chemicals) and brain communication networks to make one more or less vulnerable to addiction. Drugs and even behaviors like gambling, internet, sex, relationships, eating disorders, arson, et.al. also alter the brain to make one more or less vulnerable to addiction. Each involves the brain's natural balance of chemicals and activity and can be altered by artificial external chemical or inappropriate involvement in addictive behaviors. So, one can be born with a very low genetic vulnerability to addiction but be in a very traumatic and stressful environment, drink excessively to cope with that environment and develop alcoholism. On the other hand, one can be born with a high genetic vulnerability but have a wonderfully supportive environment and drink for social reasons and wind up an addict.

The combination of genetics, environmental influences and pharmacological effects of addictive drugs or behaviors on the development of substance related or addictive disorders is known as the Diathesis-Stress Theory of Addiction (Inaba and Cohen, 2014).

Ms. Johnson: In layman terms, can you describe the process that occurs in the brain when an addict uses and is unable to stop?

DR. INABA: There are specific parts of the brain involved with addiction that I call the brain's addiction pathway. This pathway consists of two main brain circuits: the survival-reinforcement and the control circuits. The survival-reinforcement circuit is also known as the reward circuit in scientific literature. It has a small cluster of cells, the Nucleus Accumbens Septi that I call the "go switch." When activated, the "go switch" results



in a strong need or compulsion to be activated again linking it to our primitive survival instincts. (Inaba and Cohen, 2014; Schmidt, H. D., Vassoler, F. M., and Pierce, R. C., 2011; Olds, J. and Milner, P., 1954.)

The second part of the addiction pathway, the control circuit located in the orbital frontal cortex of the brain acts like a sort of “stop switch” that turns off the “go switch” when it determines that the survival need is satisfied. (Denton, D., Shade, R., Zamarippa, F., et al., 1999.) Persons with addictive disorder have an overactive go and an under-active or disconnected stop switch in response to the drug or behavior that they are vulnerable to. (Hyman, S. E., 1996; Courtney, K. E., Ghahremani, D. G. and Ray, L. A., 2013.) This makes them obsessed with continued drug use or participating in destructive behaviors once addiction has occurred. Then, other parts of the brain also conspire to keep the person with addictive disorder using.

Major decision areas in the thinking part of the brain, the neo-cortex, turn off and make it difficult to enforce any decision not to use. (Paulus, M. P., Tapert, S. F., and Schuckit, M. A., 2005; Bando, K., et al., 2011). The “go switch” becomes dysfunctional with continued use and this creates a strong urge to use drugs. Powerful emotional memories of using that emphasize the benefits of use and downplay the negatives are activated by any stimulus: sight, smell, place, using partner, an emotional event, etc. also activate the addiction pathway to get a person with addictive disorder to start using again. (Kasai, H., Fukuda, M., Watanabe, S., et al., 2010; Luo, A. H., 2011, Inaba and Cohen, 2014.)

Additionally, the human hormonal stress cycle is interrupted by addiction creating uncomfortable feelings from any stress (relationship, money, life problems). The addicted body is unable to regulate stress to turn off the discomfort caused by stress in its normal way with its own regulatory hormone (cortisol) thus keeping the person with addictive disorder in a stressed out state. (Kreek, M. J. and Koob, G. F., 1998; Kreek, M. J., et al., 1984; Heilig, M. and Koob, G. F., 2007; Lowery, E. G., 2008.)

All this makes it difficult to stop using once a person with addictive disorder starts and those in early recovery continue to crave that often results in relapse.

Ms. Johnson: What is your response to people who say that addiction is a choice?

DR. INABA: Addiction is a biologic process that hijacks the ability of an addict to make healthy choices about their life since it disrupts the unconscious survival mechanisms of the brain. The brain’s normal function is to seek out and continue exposure to things that benefit one’s life. Addiction hijacks that process to make one seek out and continue exposure to things that bring catastrophic consequences to their life. (Inaba and Cohen, 2014.) Note that nicotine is the most addictive substance to humans (American Psychiatric Association, 2000) and I don’t know of any nicotine addict who really continues smoking because it provides them with any life or health benefits yet they cannot stop (without help) when they so desperately want to stop. If one cannot stop if they really desire to do so, how can addiction be a choice?

Dr. Gene Heyman has argued that addiction is a disorder of choice. (Heyman, G. M., 2009.) Dr. Kevin McCauley provided the essential components of Dr. Heyman’s concept in his wonderful film, *Pleasure Unwoven: A personal journey about addiction* (McCauley, K., 2009) as consisting of:

1. Genetic Vulnerability (Schuckit, M. A., 2000)
2. Incentive-sensitization of Reward (Robinson, T. E. and Berridge, K. C., 2008)

3. Pathology of Learning & Memory (Hyman, S. E., 2005; Everitt, B. J., Robbins, T. W., 2005)
4. Stress and Allostasis (Koob, G. F. and LeMoal, M., 2001)
5. Pathology of Motivation and Choice (Kalivas, P. and Volkow, N., 2005)

More succinctly, addiction is biological process that impairs a person with that vulnerability from making a choice about using a substance or participating in a behavior that will result in catastrophic health, emotional and spiritual consequences in their lives.



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