Neuroscience of Addiction 101

This lecture was developed for audiences of all backgrounds to absorb. From patients to nonspecialist docs. The intent was to move people past the preconceived notion that addiction is a moral failing or choice, to the reality that it is a chronic brain disease that creates maladaptive connections in large swaths of the brain. Over the hundreds of lectures, I have given in my career, I have come to realize that running through 30+ articles in a 70 slide PPT does not move people emotionally. But a good story will. The lecture has coalesced into a story form that is much more compelling than digging through the dense science of voxel dysmorphology, BOLD fMRI technology, and all of the structures postulated to drive craving. If I need a custody officer to "get it" or an administrator to understand the concept, I cannot give them the same lecture I would give a psychiatrist, addiction psychologist, addiction doc, or a neurologist.

More specifically, when I first started building this lecture, the average person did not understand mM as a tangible unit (they still don't). So using some poster studies from a NIDA conference that obtained core NAc dopamine concentrations from micro-pipetting analyses, I took the molecular weight for dopamine (153.9 g/mol), converted the concentration to micromoles per liter, then changed to nanograms per deciliter (because it sounded better). From this number, I used the fMRI studies that showed a % increase in activity/dopamine release in the NAc and VTA for different substances to obtain the relative amounts of dopamine for a given substance. I concede that at actual numbers could be debated for accuracy, but they are, at a minimum, directionally correct and in the ballpark. It can be confusing because most studies look at synaptic concentrations at either stasis, stimulation, or both and vary widely.

For the craving calculations, I used the fMRI studies (voxel morphologies and densities) for dehydration, starvation, and visual drug stimuli to calculate the relative signal intensities (baseball, basketball, baseball field).

Altogether, it created a story that helps people better understand the concept of addiction through the lens of dopamine and craving. I still feel comfortable with the numbers, as I have not found any literature to dispute the idea or blow the actual number apart. [1–55]

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