

## A Mindful Vixen: Degradation Due to Methamphetamine

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Life was good. I was the most popular neuron of the mesocorticolimbic-dopamine system in the small town of Ventral Tegmentum, Midbrain USA; home of the famous reward circuit of Stewart Evans. Stewart Evans exists because I allow him to think and function and he loves activating his reward circuit and every neuron knows it. This is why me and my connections, Barger, Ewens, and Arvid, were so well known; and being a part of the mesocortical pathway, we were about to be even more famous.

Although I am fully matured at this point in my life, let me explain why I must recall some highlights of my youth. I am expanding my connections as much as possible, but at one point I had no connections. I came from the neural tube of the neural plate and migrated to the ventral tegmental area with the help of radial glia. Once I arrived in my hometown I began to differentiate and officially could be identified as a neuron, leaving me to develop synapses, myelinate, and grow my dendrites.

Now, I am very developed and specialized. I am a dopaminergic neuron. I produce dopamine, created by L-Phenylalanine, L-Tyrosine, or L-Dopa. Dopamine is a classical, small molecule neurotransmitter of the Amine group. It is present in my synapses and when I communicate with my connections, I release dopamine with an action potential, where dopamine goes from the presynaptic terminal, released from its vesicle by exocytosis, and into the synaptic cleft. Once dopamine reaches this point, it crosses the cleft and binds to one of my friends, let's say Arvid, receptors. Arvid gets very elated and will transmit my chemical message to his own to send out while my re-uptake mechanism, VMAT2, sends dopamine back to me to recycle or removes it entirely. I always loved this, it's always satisfying for me to communicate with my friends, that is, until one day something strange happened that I still do not understand nor do I know if I like.

It was a Tuesday when the foreign invader came rolling through my little town. She was the most deceptive creature a neuron could ever meet; she looked like dopamine, felt like dopamine, spoke like dopamine, however, she was everything but what I expected. When she came my way, she lingered around my dendritic spines, waiting for me to accept her chemical message. I wish I did not respond to her, because when I did, she took complete control. She invaded my synapses, expelling dopamine with wild abandon. Her only intention was to have a good time. She purged out more dopamine from me than I should be allowed to give out, and she blocked VMAT2, my reuptake mechanism, from picking up the straggler neurotransmitters, so they lingered there for hours. Ewens, Barger, and Arvid were also invaded and we all were flooded with chemicals and high with signals, none of us knew what to do. In frenzy, we were all out of control, allowing dopamine to float in the cytosol and turn our town into a toxin. She went on for hours, teasing neurons all over Ventral Tegmentum and other parts of the brain. For over 13 hours, Arvid, Barger, Ewens, and I were suspended in a neurotoxic bliss. I did not think it would ever end and I even thought I was going to fall in love with this foreigner. I found out her name, Methamphetamine, or Meth for short, and I could not wait to see her again.

Because of Meth, the connections and I enjoyed our time. We were loaded with rewarded rushes and none of us could deny that it felt great working at such high levels of dopamine. Meth hung around to chat while we enjoyed her ways of communication. When Meth decided to leave our town, she took all of her fun with her and I crashed harder than anything I had ever experienced. Meth's way of activating my dopamine signals were a thousand times greater than when Stewart has sex, and the crash was intense. I could not sense more than a few neurotransmitter particles and I felt like I had lost some of my dendritic spines from Meth's encounter.

Normal levels of dopamine were no longer satisfactory for me. I could not send out signals to Arvid or Barger or Ewens like I did before. I sensed that my cell body was the same as it always was, but my dendrites were no longer functioning the right way. I was surviving the roller coaster of Meth coming and going, but Ewens could not. He was so torn apart that I could not send or receive dopamine from him anymore. I began to stop sensing him entirely after Meth left the fifth or sixth time. It was difficult to get adjusted to, having Meth flood me with dopamine and then feel nothing, but she always came back and eventually I would feel something again.

This went on for what felt like years and I aged rapidly from these chemical changes. My dendritic spines were so brittle and small that I virtually stopped all communication with Barger and Arvid. I grew depressed from a lack of social interaction and that my dendrites were virtually gone. My receptors did not want to accept any neurotransmitters and I knew I was not normal anymore. Every time Meth came through town, I aged more rapidly while she looked better than ever. I could not handle it anymore and I think Stewart felt the same way because Meth stopped coming to see me. I hoped I would recover and sense my connections again. I knew I could not regenerate but I could not get any worse. Right?

Wrong. Stewart quit cold turkey, the wrong decision, and a life threatening decision. I continued to degrade without Meth coming and going. I continued to die faster and faster and I watched my town die along with me. There was darkness in the horizon; a bulging blood vessel crept up in Ventral Tegmentum. It seemed to bulge more, very quickly, after Stewart quit Meth. I do not know when it happened, but now in my life, I sense that that bulging vessel is going to burst. My life seems wasted and I am not feeling right. I decided to think it all over while I sit here trapped in my cell body with no way to communicate. I feel like the entire brain knows something is wrong and is trying to give Stewart a warning, but I am not sure. I cannot feel much anymore. Everything is flooded, not with dopamine, but with lifeless waste.

I am flooded and fading away. Something happened, maybe that vessel ruptured. I can sort of sense microglia in the area, but I cannot signal to them that I am here. I know I am a problem in this brain and do not deserve the choice to recover. I see the clean up crew of microglia picking up the devastated town I live in, the town I trashed because of a woman named Meth. Its growing dark, I feel a presence all around me. Microglia? Are they coming to eliminate me? I need to be eliminated, as I have no use in the brain anymore. I hope it doesn't hurt.

List of Neurological Concepts:

Midbrain, neural tube formation, cell types, neuronal development, structure of synapse, stages of neurotransmitter function, action potential, types of

neurotransmitters, structure of a neuron, brain parts, altered structure of neuron, drug use affects on neuron

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