

# Methamphetamine: Neurochemistry & Recovery

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At the beginning of the twenty-first century, drug treatment facilities began to see an increase in the number of people seeking recovery from methamphetamine dependence. One of the primary reasons for this increase is the fact that dependent methamphetamine users have found the drug to be more difficult to quit than most other addictive substances.

*Michelle:*

*"Usually when I come to jail I plan to do good when I get out and I try to do good but it's like running into the old people and going back out there to the same places. It is so hard to quit. It is so hard to quit. I know that I have been wanting to quit for a long time."*

*Dr. Rawson:*

*"People who take methamphetamine experience this very large reinforcement effect, this very large pharmacologic blast of euphoria. And when they stop taking methamphetamine and they no longer have access to feeling that way and that's a difficult for them to cope with."*

*Patrick:*

*"For me, I feel like I was beaten pretty senseless by this thing. I took a ruthless beating by it and it wasn't like I had this stash of virtues somewhere or this stash of conviction that I could just change my mind and change direction in my life."*

This video will examine the ways Methamphetamine changes the brain, both chemically and structurally, how these changes interfere with the recovery process, and what a person seeking recovery can do to improve their situation.

*Pat:*

*"If you are into taking speed and it still works, man, the day will come when it doesn't. I'm telling you right now, you're not going to want to quit if it is still working. But if it is not working you are definitely going to want to be where I'm right now... which is a good place."*

## BASIC NEUROCHEMISTRY

Methamphetamine is a central nervous system stimulant. The method of use determines the speed at which the drug reaches the brain.

*Crystal:*

*"I started out shooting it. I like to smoke it. I like the process and I like to eat it but I have bleeding ulcers so when I eat it. I puke blood for like 2 weeks."*

Regardless of how the drug enters the body, eventually it reaches the brain by penetrating the barriers the body has developed to protect itself from danger.

Externally, the skull protects the brain; internally it is protected by a filter called the blood-brain barrier that keeps harmful substances out. Because methamphetamine so closely resembles the brain's own neurochemicals, the methamphetamine molecules can pass through this filter, causing an immediate impact on the brain.

*Bonnie:*

*"The drug starts working on your brain. Pretty soon your brain is telling you, you want that drug, you like that drug, you like what you're doing. You don't like what you're doing."*

Methamphetamine's impact on the brain is the result of its ability to alter certain brain chemicals, called neurotransmitters. These neurotransmitters relay messages from one nerve cell to another. By increasing or decreasing the activity and availability of these neurochemicals, the messages to and from various parts of the nervous system are altered.

There are dozens of different neurotransmitters but only a few that respond to methamphetamine, specifically norepinephrine, epinephrine, dopamine, and serotonin. Epinephrine regulates the amount of physical energy available to the body.

*Mike:*

*"When I get high I like to tweak or go dancing or I'll go dumpster diving. That's a favorite tweaker thing."*

Norepinephrine boosts confidence and feelings of well being.

*Patrice:*

*"I was super outgoing and really didn't care what was going on."*

Serotonin helps regulate mood, appetite, sleep, and self-esteem.

*Charlotte:*

*"With me, physical, I wouldn't sleep. I wanted to stay awake and do a lot of stuff. You know, my mind just going, you know clean a lot. It was also a sexual drug."*

And finally, dopamine, which activates the reward/reinforcement pathway - signaling pleasure, alleviating pain, and most importantly, encouraging the repetition of actions that produce dopamine.

*Darren:*

*“Like my first time I did it, I went on like a 7-day binge and ever since then I’ve been smoking meth.”*

Methamphetamine works by increasing the release of the neurotransmitters through three mechanisms.

First, it enters the terminal, the end of the sending nerve cell, and forces the release of neurotransmitters.

Then, tiny pumps called transporters propel the neurotransmitters toward the receiving neurons, creating an excess.

Finally, the drug blocks the enzymes that break up and eliminate the excess neurotransmitters, allowing continued overstimulation.

*Patrice:*

*“My heart would start beating really hard and really fast. and like my necklaces, you could see them beating on my chest. And my vision would go black, I’d get dizzy.”*

The body can recover from the occasional use of methamphetamine, but sustained use causes the body’s chemistry to become unbalanced and ultimately damaged.

*Giselle:*

*“There’s definitely damage that occurs. You cannot allow your neurons and your synapses to rapid fire that quickly for a lengthy amount of time without long-term damage. It has affected my memory.”*

Striving to be “up” most of the time, actually results in a slowly diminished high because too many neurotransmitters are being depleted. In an attempt to avoid the crash, the user increases the dose and frequency, causing the body to shut down to recover its balance.

*Cynthia:*

*“I had an unending supply but there is only so much you can do and after a while you don’t get high anymore, and no matter how much more you do and you just need to crash.”*

*Darryl:*

*“The receptor sites on the dendrite is getting overstimulated, overactivated and in order to deal with that, the actual receptor site in the molecules that make up that receptor site sort of shrink or shrink back into the membrane of the dendrite and therefore they are not available to be activated by neurotransmitters.”*

When there are fewer receptor sites to react to neurotransmitters, the drug has less of an impact. This causes a person to use more in an attempt to feel the effects; this phenomenon is called tolerance.

*Giselle:*

*"Your addiction can go from, you know, a 50 sack a week to an eight ball a day in two weeks. Your tolerance level increases that rapidly."*

There are other reasons for the development of tolerance.

*Dr. Rawson-*

*"Methamphetamine actually enters the terminals and destroys the terminals of the presynaptic neuron. Over time, when you have neurons that come together like this, pretty soon you have neurons without axons and without terminals. So, over time you end up with the inability to experience any dopamine effect because you simply don't have the tissue to produce that effect. Now the good news is they regrow, but the less good news is that it takes 6 to 12 months to regrow and that's what we've been able to see with PET scans."*

As tolerance builds so does dependence. Eventually something will happen to interrupt a meth user's habit. Lack of supply, arrest, or major life changes can result in the abrupt cessation of use and present an invitation to the recovery process.

*Jerry Clarke, Genesis:*

*"That is the toughest time that the addict might experience because the brain chemistry is still craving the drug and not free from the addiction."*

There are six factors that can sabotage the recovery process which would lead to a relapse. They are:

Depression,

Unclear thinking,

Intense craving,

Deficit of self-control,

Preexisting or drug induced mental problems

And using to mask negative emotional states.

## **DEPRESSION**

*Dr. London:*

*"When people stop taking methamphetamine they feel just awful. They have trouble thinking, they have depressive symptoms, they have anxiety. We've had the opportunity to study the brains in action of methamphetamine users when they've come off the drug."*

Using functional magnetic resonance imaging scans of the brain Dr. Edythe London of the UCLA Neuropsychiatric Institute compares the brains of methamphetamine users versus non users.

*Dr. London:*

*"These are composite pictures so that colors represent differences between two groups of people with blue representing areas where the meth users have abnormally low activity, considerably lower activity than the healthy comparison subjects. Red represents areas where the meth users have hyperactivity."*

Because meth depletes energy chemicals at an excessive rate, abstinence can result in depression.

*Dr. London:*

*"This area of the brain is called the cingulate cortex. It's a very important part of the brain for thinking, for inhibiting certain responses, but it's a part of the brain that we know is very much affected in depression."*

*Cynthia:*

*"Oh yeh, the depression is terrible when you are coming down and just the fatigue, you know, not even being able to walk, not being able to get out of bed. And not being able to sleep. Just being desperate to sleep."*

*Rick Rawson:*

*"Our best information and the clinical studies of 1000's of meth users is there is a period of about 4 months, 4-6 months where you experience this pretty substantial anhedonia, difficulty concentrating, life just doesn't feel exciting or interesting."*

In fact, anhedonia, the inability to experience any positive feelings whatsoever, is overwhelming.

*Sara:*

*"I got so depressed that I've, you know, tried to kill myself several times. You know I was a prostitute on the street and stuff and I just . . . it's not an option for me anymore. You know, I would lose it, lose everything. It would be devastating for me to go back out."*

*Dr. Rawson:*

*"So, the good news is that it does get better. The brain does heal. You do regain the ability to feel good. The bad news is, it takes a while."*

## **UNCLEAR THINKING**

In early recovery, the ability to think clearly is impaired by changes in a number of brain structures. In particular, meth abuse shrinks the limbic system's mass by 11.3%. Most of the loss is in the hippocampus.

*Darryl:*

*"Loss of these areas of the brain, especially the hippocampus, will have an effect on cognition and memory processes. Your memory is impaired, your ability to grasp and*

*understand things will be decreased so that for the length of time afterwards, people will have much more difficult time getting through life, understanding things, and memorizing things.”*

*Bonnie:*

*“My memory, oh my God. I have none, you know. Those things I couldn’t even tell you what I did five years ago. You know, and that’s sad because my kids, my youngest kid’s going to be 15 this year and I can’t tell you anything about his life other than little glimpses, little pieces.”*

*Dr. Rawson:*

*“Short term memory and memory for words appears to be interfered with so your brain isn’t remembering stuff nearly as well.”*

*Tom:*

*”“A lot of times I have trouble with concentration. A lot of times when I read a book sometimes the words on the page look like they’re dancing around like a bunch of ants crawling on it and I know that’s a direct result of the meth use cause it never used to be that before I used. And now, a lot of times I have to read a sentence over and over again before it sticks with me. I know there’s damage there and it’s something that I’m learning to deal with. I don’t know if it will all ever go away but I’m learning to live with it and how to work around it.”*

*Dr. Rawson:*

*“So you have a brain that doesn’t feel good, can’t remember anything and has bad judgment. And we wonder why people have trouble saying sober.”*

*Tara:*

*“And I feel really guilty for choosing the dope over my children.”*

*Eric:*

*“You can want to use and you can want to stay clean at the exact same time. And this is the way it is with methamphetamine. So what we do is work with that part of the person that wants to quit using and we have to do special things like call them and remind them about their appointments, call them the night before, the evening before and say. ‘Hey, you’ve got an appointment tomorrow, just calling to remind you,’ and things along those lines to help that person through their cognitive impairment.”*

## **CRAVING**

*Tom:*

*“When I did come down, I felt really terrified that I didn’t have anymore. Crank was my best friend and I felt terrified, you know. If I didn’t have it, I was going to go to any means to get it.”*

Darryl:

*"There is a process called craving. Craving is a real phenomena. It has real physiological signs and symptoms. It can be predictable. You can also measure things that cause craving."*

London:

*"We know that a very, very important part of the brain in responding to stimuli on the outside is called the amygdala at the seat of a person's emotional system. The amygdala is shown here and it's shown in bright red, showing that in the meth user, the amygdala is very, very active, hyper-responsive to the environment we believe"*

Michelle:

*"I can't go and hang out at old places and get loaded. And I have to go to meetings, get me a sponsor, talk to my PO. if there is a problem. Like I said, if I am feeling like I want to get loaded talk to somebody about it, not hold onto it and get loaded over it."*

Jerry:

*"Being able to talk about the cravings is very important. Don't try to manage this on your own. Talk to other people, get the support from other people who have gone through this process themselves."*

London:

*"We've also found that another area of the brain is hypoactive. In other words it's not working as much as in the comparison participants who don't use drugs. . . . That part of the cortex keeps the amygdala in check, it keeps the amygdala from running wild. Unfortunately in the recently abstinent meth user, that part of the prefrontal cortex isn't working very well. It's not able to do its job of controlling the activity in the amygdala."*

Charlene:

*"Coming down I'm really moody and crying and I'm moody and then I'm happy and crying. I don't think I had one stable emotion as I was coming down, you know."*

London:

*"It really is wonderful for clients to know that the feeling of craving, at least when they're not in the environment and constantly reminded, their spontaneous craving does in fact go down."*

Darryl:

*"Once you are in recovery the greatest cause of it is being triggered or having slippery people, places, and things that remind your brain of its use and activate those brain circuits."*

Deith:

*"I still have friends that do it and they know that that's not my thing anymore and they try and keep it away from it Not keep it away from me but keep it at arms length away from me anyway. They do it around me all the time but it doesn't call me like it used to."*

The chemical craving for dopamine is what most often causes a person struggling with abstinence to resume using.

*Amodia:*

*“Once the old brain which is involved in addiction, becomes so deeply embedded and triggered in primarily obtaining the drug, that’s all an individual wants to do is get that drug because the brain believes that, that’s all they need to survive, so everything else falls to the wayside.”*

*Deith:*

*“You are not worried about rent money, you are not worried about your girl friend, you are not worried about groceries, and stuff like that. You are just fixated on this drug.”*

When dopamine is released by the brain, it stimulates the reward/reinforcement pathway. Unfortunately, psychoactive drugs hijack this pathway so the brain comes to believe that the continued use of the drug is necessary for survival.

*Dr. Rawson:*

*“And we now show patients these PET scans and we say ‘When you take methamphetamine it pretty much shuts off the dopamine to this part of your brain. When people don’t have dopamine this is how they feel. And if you don’t use more methamphetamine your brain will start to recover and you can see it with these PET scans’”*

## **IMPULSE CONTROL**

*Pat:*

*“I’ll tell you, as soon as I stick a needle in my arm I might as well take all my guitars and amps down to the pawn shop and just hand them over that day.”*

As the craving for methamphetamine increases, the ability of the user to say “NO” decreases.

*Dr. London:*

*“Part of addiction is a deficit in self control so what we’ve started doing is testing self-control in the laboratory. One of the tests that we use is called ‘the stop-signal task.’ It tests the ability to stop a response that’s already underway. What we’ve observed is that meth users have a much longer stop signal reaction time than healthy individuals. We’ve also shown that the stop-signal reaction time is directly related to how much methamphetamine people take. The more methamphetamine they take, the more difficult it is for them to stop.”*

Once a person is addicted to meth they can never go back to casual use.



*Bonnie:*

*“Eventually it always happens, I end up using the dope. I end up wanting to do it more and more. I don’t stop at just that one time because it never is going to happen like that.”*

Because the prefrontal cortex, the thinking area of the reward circuit is impaired by meth the brain continues to seek the drug with no inhibitory thoughts to stop using To break this cycle and move toward feeling normal, individuals in recovery must deal with some immediate issues.

*Lt. Michael Schults:*

*“Their health problems using methamphetamine when they come in; typically they are weak, they’ve got sores on their bodies, and their immune system is just shot so that when they come into a group of people they get sick very quickly so it takes a while for them to start repairing their own body.”*

*Jerry:*

*“Having plenty of sleep, eating properly, nutritional needs are very important as well as exercise, getting the endorphins going, that helps with the mood. Surrounding yourself with clean and sober people, making sure that you have the support, talking about those cravings.”.*

*Brian:*

*“You know, I haven’t felt like drinking and using in about the last month. But when I don’t get enough rest, that’s when I want to use speed.”*

Many drug counselors encourage those in recovery to develop a series of automatic responses when an impulse to use comes up. These suggestions include:  
Calling another recovering user or friend;

*Giselle:*

*“I’m really anxious right now. All I can think about is using. Ad I’m just wondering if you have some time to talk?”*

Engaging in a physical activity or doing chores around the home;  
Refraining from acting on the impulse by focusing on the consequences of using including loss of trust, losing your housing, and your family, and dirty UAs;  
and finding ways to nurture your creativity.

*Brian:*

*“My therapist told me to, you know, get back into that because I really missed it and it was tearing me up inside by not playing it. I feel grateful for it. It’s saved me a lot of times too, you know when I am lonely or depressed. You know, I play to let me feel a lot better.”*

## MENTAL PROBLEMS

Darryl:

*“A person who takes methamphetamine for a long time is imbalancing the same brain neurotransmitters or chemicals that are involved in major psychiatric disorders; in depression, thought disorders or schizophrenia and bipolar disease.”*

Giselle:

*“I am diagnosed bipolar and if you were to actually look it up in a medical journal and some of the symptoms in bipolar and the symptoms of meth use are exactly the same..”*

For this reason, it is difficult for treatment providers to know with certainty if mental problems are preexisting or drug induced. Depression, paranoia, hallucinations, and manic states can all be caused by methamphetamine abuse.

Pat:

*“The delusional thinking, the paranoid schizophrenic type of behavior, severe mood swings. But you know, the thing is I don’t know anybody that has abused speed that doesn’t have those hallucinations. I mean, they have them. They are a part of that drug.”*

Brian:

*“I wouldn’t take a shower because I couldn’t hear anybody coming and you know being scared of that and just not taking a shower, not brushing my teeth for however long I was on it.”*

Sara:

*“I swore there was government agents across the street in the park, in the trees with these new high-tech high tech rifles that shot like electric rays, like a stun gun ,and I was actually getting physically shocked.”*

Darryl:

*“If these symptoms persist after a person has remained abstinent for a period of time then you are looking at some underlying co-occurring psychiatric disorder along with their methamphetamine abuse.”*

Sara:

*“I’m on a lot of medication. I’m on medication for paranoia, you know because it was still going on after I stopped the speed.”*

Recent statistics show that twenty to thirty percent of meth users have a preexisting mental health diagnosis.

Brian:

*“Being bipolar, I didn’t exactly know what was wrong with me back then but I just never felt comfortable in my own skin.”*

If there is a dual diagnosis, it is important to treat both the mental illness and the addiction

## **NEGATIVE EMOTIONAL STATES**

*Sara:*

*"I was trying to hide from my past, you know, trying to run from my past. I didn't want to have to feel anything. I didn't want to have to remember what I had gone through, you know. So being spun would take my mind off of it."*

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*Michelle:*

*"It doesn't really do the job of numbing you anymore unless you do a lot of it but that is the worst part of not having it, then all the feelings come up. The deaths, the loss of kids, people you have harmed and hurt."*

*Jerry Clarke, Genesis:*

*"Often times people use chemicals in order not to feel and not to remember their history so when you take the chemicals away in a clean and sober environment they begin to become flooded with memories of their environment."*

*Sara*

*"It doesn't really even do the job of numbing anymore unless you do a lot of it and the fact that the worst part of not having it or whatever is just all the feelings come up, you start thinking about the deaths and the loss of kids people you harmed and hurt."*

*Dr. Rawson:*

*"One of the key components of treating meth users is focusing them on getting through each day because if they try to take it as a 12-month period of time, they are never going to make it. They have to focus on how to get through each day."*

*Michelle:*

*"My dad was killed by a drunk driver when I was 10 and my step dad shot himself when I was 14. I was molested by a few different people."*

*Sara:*

*"Both my parents were drug addicts, you know. My father would beat and rape my mother as I had to watch, you know. And then he finally kidnapped me from my mom and raped me."*

*Jerry Clarke:*

*"Often times a client doesn't have the coping skills to deal with trauma in early recovery so a stabilization process needs to occur and in many cases we can see somebody go into a therapeutic process of working on post trauma 6 months to a year after they've become stabilized in the recovery process."*

*Michelle:*

*"All that stuff I haven't really dealt with. I haven't really went to counseling about it and I guess when I am out there getting loaded I don't feel it."*

*Sara:*

*"I don't know. I feel like, a lot of times I feel like that I'm stuck at where I started you know. The age that I started using drugs is the age that I am now, you know, in my mind. That is how I feel."*

*Patrice:*

*"It is very scary to be clean after being loaded for so long, very. You have to like, learn how to, everything, you have to learn everything over. How to interact with people and not be high and how to make food for yourself. It's strange. Pay bills, whoa."*

## **RECOVERY**

*Dr. London*

*"What we know is that there are changes that occur over time and it's very important to be patient with yourself and give yourself an opportunity to recover."*

*Brian:*

*"I am powerless. I am discovering a lot of things in this program that are really benefiting me and I'm starting to listen to people, take suggestions."*

*Darryl:*

*"Continued success in recovery, actually the continued growth in life and appreciation for things around them is dependent on your ability to remain totally abstinent from methamphetamine and probably all drugs of addiction."*

*Pat Brown:*

*"What actually finally ended up working was to whole heartedly go through a 12 step program with a sponsor and do all the suggestions as they are suggested as opposed to taking bits and pieces you know the easier softer way through."*

*Tom:*

*"Hope is a fantastic thing. I got here being hopeless and desperate and I didn't know what was going to happen to my life and after I was clean for a few days, hope started happening cause a few days, just a few days for a using addict is quite a miracle and I just put, like a few days turned into a few weeks and then into a few months. Before I knew it the cravings were gone. It took several months for them to be gone."*

*Dr. Amodia:*

*"I have hope for everybody and I have had a number of people really surprise me and do well and continue to visit the program and have been clean for many, many years."*

*Pat:*

*"I'm doing this business with a friend of mine who's like me. He's in recovery and we're kicking ass and having a great time."*

*Patrice:*

*"The easy thing for me is staying clean. Staying clean is not that hard for me cuz I, you know go to meetings and have a lot of friends in recovery and have a daughter, that helps. The hard thing is like all the emotional stuff you need to now deal with that you didn't have to deal with before and there's not only like everyday stuff now what's going on in your life but all the stuff in the past that you've been numbing yourself and that you've been numbing yourself and it all did coming up at 5 years. You gotta get through some of that stuff. So, that's the hard part, staying clean is pretty easy, and exciting."*

END