Gray Matters: Alcohol, Drugs and the Brain
1997

The following program, "Gray Matters: Alcohol, Drugs and the Brain," was produced in association with the Dana Alliance for Brain Initiatives.

ANNOUNCER PAT SOMERALL: Back at the Super Dome in New Orleans, the Packers will take over. ... Antonio Freeman, you're not going to catch him. Touchdown Green Bay, as the Packers recapture the lead!

SOMERALL: That's me, Pat Somerall, covering the Super Bowl with my longtime partner John Madden. I've spent most of my life around football. I've been a sports broadcaster since 1962 and before that I played pro football for 10 years as a tight end and a place kicker. So the regular rhythms of the NFL seem very natural to me.

ANNOUNCER PAT SOMERALL: The longest touchdown pass in Super Bowl history, 81 yards!

SOMERALL: Players watch game films on Monday, practice Tuesday through Friday, relax on Saturday and play the games on Sunday afternoon. But at night there's no structure in football, and that's how I got into trouble. For more than 40 years I spent most of my nights at the bar. I was usually the last guy there telling the longest stories and drinking everybody under the table. I wouldn't admit it then, but I had become an alcoholic. Since getting sober five years ago, I've learned more about the impact of alcohol and drug abuse. The most common drugs are the legal ones, alcohol and tobacco. Eleven million Americans say that during the last month they have had five or more drinks on at least five occasions. One in four Americans smokes cigarettes every day. But that's just part of a bigger drug story.

DR. LESHNER: Seventy million adult Americans used an illegal drug at some time during their life.

SOMERALL: Dr. Alan Leshner is the Director of the National Institute on Drug Abuse.

DR. LESHNER: People take drugs because they make them feel good. They like what drugs do to them. Well they like what drugs do because they're modifying their brain. People know, and it's true, initial drug use is a voluntary behavior and it's a preventable voluntary behavior. But once an individual is addicted their brain is actually changed, and they no longer are engaging in a voluntary behavior.

MAN: First it was in the evening, it was one drink at home and then it was two and then it got to three. But I didn't want to count. I knew it was too much.

MAN: There are rituals that you get into related to smoking. Smoking is a constant process of deprivation and reward. Getting through a task, getting through a day, getting through whatever and then you smoke.

SOMERALL: Dr. Steven Hyman.

DR. HYMAN: Addictive drugs really commandeer a human being. Any of us who have had experience with a severe alcoholic or someone addicted to opiates or cocaine recognize that in many cases all rationality seems to be overthrown even if people are no longer denying and are aware of the ravages of these drugs. At times they seem absolutely powerless.

SOMERALL: In the next hour we'll talk with brain scientists who are exploring why people use drugs and how they manage to stop. We'll show how prolonged drug use can fundamentally change your brain, and we'll hear from some other experts too: people who abused drugs in the past and who are struggling to stay clean.

MAN: You don't decide to become an addict. It just slowly dawns on you that you are. You can't just wake up and change your life automatically one day. It's not like you're in a car and you can just put on the breaks.

[MUSIC]

SOMERALL: "The urge to escape," said Aldous Huxley, "to transcend [ourselves] if only for a few minutes is and always has been one of the principle appetites of the soul." From the dreamy lotus-eaters in Homer's *Odyssey* to the carousers in *The Canterbury Tales* to the many drunken revelers in Shakespeare, people have always sought the pleasure of getting high. Every culture has a drug of choice and its own rituals for taking the drug. South American Indians chew coca leaves together. South Sea Islanders drink kava. Americans have a long history of using illegal drugs from bathtub gin during Prohibition to cocaine in the 1980s to heroin, which has had a recent resurgence. Fashions in drug use come and go but one fact remains, the most widely used drugs closely mimic the natural processes of our brain. Dr. Steven Hyman, director of the National Institute of Mental Health spent many years studying drug abuse.

DR. HYMAN: Human beings throughout their history have exposed themselves to hundreds of thousands, perhaps millions of different natural plants. And they found a small number of them—opiates from the opium poppy, coca from coca leaves, alcohol from the fermentation products of grain and nicotine from the tobacco leaf—which people, to put it mildly, really like but which also are able to capture us. And what modern neuroscience has recognized is that each of these substances is a molecular mimic. There are molecules that masquerade as neurotransmitters in some way. And it turns out that the drugs which I've just described to you, all, in some way mimic or facilitate the action of neurotransmitters in a system in the brain called the mesoaccumbens dopamine system.

SOMERALL: That's the part of the brain that helps us learn about sexual stimulation, tasty foods and other intense pleasures. Drugs are rewarding because they directly or indirectly stimulate the brains natural reward system and cause dopamine to be released.

DR. HYMAN: Drugs are much more reliable and potent than normal stimuli. Instead of running that marathon or for a scientist working for months and months and writing a good paper and getting it accepted, a lot of work maybe for a little dopamine in the brain, people who use drugs find that they can literally short circuit all of these natural processes.

SOMERALL: Nicotine also stimulates the brain's reward circuits. Dr. Alan Leshner.

DR. LESHNER: There's no question in the scientific community about whether or not nicotine is addicting. Nicotine is among the most addictive substances we know about. Look what happened when we tried to take nicotine out of cigarettes, people didn't like low nicotine cigarettes. That wasn't an accident. Nicotine acts on the brain in ways very similar to every other addicting substance. That is, it causes a spike in the chemical dopamine in the brain, which is one of the things which keeps people taking abusable substances. They like that dopamine spike.

SOMERALL: Alcohol too has a profound impact on the brain. Long-term alcoholics can experience memory loss and dementia. Thanks to modern brain imaging techniques we can actually see the effects of chronic alcohol use on the brain. Dr. Enoch Gordis is director of the National Institute of Alcohol Abuse and Alcoholism.

DR. GORDIS: With heavy drinking over many years there can be serious brain toxicology for toxic effects of alcohol. And that's true of the finest beverage alcohol. If it's consumed in adequate amounts over many years you're going to have brain toxicology.

[MUSIC]

MAN: I couldn't stop it. Drinking seven days a week, not being able to stop the drinking was a major problem. I knew that it was too much.

WOMAN: I wanted what I wanted and that was that drug, PCP. It wasn't nothing was going to stand in my way. You can have a bulldozer, I wouldn't care. I would try to knock that down.

WOMAN: My mother, she was an alcoholic my mother. My father was a dope addict. And I was an addict on that day, the first day I was born.

SOMERALL: So why do we have such varied reactions to alcohol or drugs. Why do some people collapse from just a couple of beers while others can drink all night? Why do some people fall quickly into addiction while others can experiment and then walk away? Dr. Hyman.

DR. HYMAN: You know for most of us it's hardly heroic that we use alcohol. Well, I know personally that after having two glasses of even wonderful red wine or two beers, I

simply don't want any more and there's no special act of will. And this gets back to the issue of vulnerability. That is, people who will take drugs enough to potentially get addicted seem to seek them out and enjoy them. They seem to have fewer warning signs.

SOMERALL: Dr. Leshner.

DR. LESHNER: It's not true that you take a drug once and you become addicted for the rest of your life. Some people do. Most people don't. However, most people ultimately will become addicted to an addicting substance. The question is what determines how readily and what determines how intensively a single individual will respond to the drug and become addicted to the drug.

SOMERALL: We now know that some people are genetically more likely to become addicted than others.

DR. LESHNER: There seems to be a large genetic loading, a large genetic component to the vulnerability to becoming addicted. Of course you have no way to know what your genes look like, and therefore you have no way to know how susceptible you might be as an individual to becoming addicted.

SOMERALL: But the search for genetic markers is just beginning as Dr. Gordis explains.

DR. GORDIS: Alcoholism is a polygenic disorder almost certainly. That is, it's not one gene causing a disease, say like Huntington's disease or cystic fibrosis or sickle cell disease. Almost all the complex disorders, especially those involving behavior are probably polygenic, and that means the task is harder because no single gene is responsible for the whole condition. These are genes for vulnerability or risk, not destiny as we say. And that's a very important distinction.

SOMERALL: We haven't yet isolated the genes that make people more vulnerable to alcoholism. But we have noticed some personality patterns.

DR. LESHNER: The people with the highest genetic vulnerability were the ones who had a kind of adventuresome, novelty-seeking, impulsive kind of temperament, which was blind to the potential consequences of behavior. And whether that will turn out to be part of the genetic picture here, I don't know.

[MUSIC]

SOMERALL: We've also learned that the ability to hold your liquor is actually a warning sign, not an advantage. Over the years I saw other drinkers loose control or wake up with terrible hangovers. I had no trouble holding my liquor and I could always get up the next morning and go to work. I used to think I was lucky. Now I know that having a hollow leg like I did is hardly an asset. Dr. Gordis describes a long-term study that psychiatrist Marc Schuckit began with some college students.

DR. GORDIS: He tested their reaction to alcohol on several scales: how much they became wobbly in standing, how much they actually had a subjective feeling of being high, also certain hormonal measurements, which he did at the time. And he found two things. First of all, early on he found that those with a family history tended to be less sensitive to the effect of alcohol—less sensitive. But what was an even more striking finding was that whether or not you had this family history, lack of sensitivity or reduced sensitivity to alcohol on his testing at the age of 20 was predictive of an increased risk of alcoholism at the age of 30.

SOMERALL: It turns out that people like me who hold liquor well are more prone to becoming alcoholics. Most people get signals from their bodies that drinking is bad for them. People with a high capacity for alcohol sometimes don't get those signals. And that makes us more likely to become habitual drinkers. But biology is only part of the story. At the University of Pennsylvania Treatment Research Center in West Philadelphia, Julie is being admitted for the first time. She's only 33 but she looks much older and very tired.

JULIE: Some time I be depressed and I go and get high and that helps. I mean it will help for the moment anyway. Then that's five minutes and I'm still ... I'm depressed again. You get high one second, the next second it's gone.

SOMERALL: Julie says she's been drinking beer and smoking crack cocaine for almost 10 years. She quit several times while she was pregnant with her five kids. Today she's arrived with her baby girl ready to try again.

WOMAN: What happened this week or this time that made you come back again to seek help?

JULIE: I'm having a lot of physical problems right now and I think this has a lot to do with the drug. Pressure in the chest and sharp pains, numbness, dizziness.

SOMERALL: Like most patients here, Julie learned about the clinic from ads on city busses and in the newspaper. The clinic does research on nicotine, alcohol, heroin and cocaine. Patients get free treatment in exchange for participating in the studies.

WOMAN: How'd you sleep last night?

JULIE: [UNINTELLIGIBLE].

WOMAN: Really? OK. This is just a breathalyzer, just checks for alcohol in the last couple of hours. Just need you to wrap your lips around here and blow straight through this straw there.

SOMERALL: Dr. Charles O'Brien, a professor of psychiatry at the University of Pennsylvania runs this center.

DR. O'BRIEN: We started the program over 25 years ago as a treatment program for veterans returning from the Vietnam War with substance abuse problems. And we decided at that time that relatively little was known about the nature of addiction and certainly very little about how to best treat it. Basically our patients have been our research subjects and our research volunteers over the years, so they've been our partners in the research.

JULIE: You know I used to have long, pretty hair and used to go out and do things and have friends and go to movies and stuff. I don't do anything like that. The only thing I think about is getting high.

MAN: Maybe now is a good time to try and put this behind you and concentrate on this and make it a lifelong obligation, really.

JULIE: I'm going to try.

[MUSIC]

SOMERALL: Poverty, sexual abuse, depression, boredom, parents or friends on drugs, these are all risk factors for substance abuse. Many people use drugs to block out the pain in their lives at least for a few minutes. It's not that anyone is destined to use drugs or that anyone is immune. It's just that your environment can place you more or less at risk.

[MUSIC]

SOMERALL: In a landmark study begun in 1971 Dr. Lee Robins surveyed a group of 600 enlisted men who were returning from Vietnam. He results were startling. Dr. Robins found that 11 percent of the soldiers were using heroin regularly. That seemed to threaten not only our military effort but also our communities back home as thousands of veterans returned to the United States addicted to heroin. Dr. Robins is a university professor of social science at Washington University in St. Louis.

DR. ROBINS: What we found to the army's delight and the VA's relief was that most of them did not continue to use heroin when they came back. And even those who did mostly used it only occasionally, did not get re-addicted. And the few who did get re-addicted were re-addicted only very temporarily. So that by the time we interviewed them, which was eight to 12 months after their return, only 1 percent of the men we talked to—and we asked them for urine samples at the end—had positive urines. So the story was not nearly as frightening as the government had expected.

SOMERALL: When the veterans came home their environment changed dramatically and so did their craving for drugs. Again, Dr. Alan Leshner.

DR. LESHNER: The heroin addicts in Vietnam developed their heroin addiction in a certain environmental context, Vietnam. When they came back to the United States they were never exposed to that context again. So all of the cues associated with their initial

drug use, being in Vietnam, were not present and, therefore, weren't a problem. But the street addict in the United States, even though that individual may have gone through a treatment program, goes home, goes back to their home community. It could be as little as a lamp post where they used to buy their drugs, but all those stimuli around drug use become conditioned to drugs and, therefore, they illicit tremendous craving. And that learned aspect is actually a part of the addiction per se.

[MUSIC]

SOMERALL: I started drinking back in the late '40s. When I finished college and joined the Chicago Cardinals I used my entire signing bonus to pay off a bar tab. The bonus, by the way, was $250. A little bit less than players get now. I drank almost every day for 40 years. But I was a pretty quiet drinker. I didn't get into trouble, I didn't get in fights and I worked as hard as anyone. But I didn't feel good either unless I had a vodka after a game or a Jack Daniel's on the plane or a few beers with friends during all those nights on the road. I also took painkillers every day for the knees I banged up playing football. The combination of painkillers and booze were slowly ripping a hole in my stomach and one day I almost died.

ANNOUNCER PAT SOMERALL: Second down and about, well about 14. Sanders is the man in motions, ripping back to throw it—and does, has a man open ... incomplete. A little behind, him he would have had a first down.

SOMERALL: It was December 10, 1990, the Monday morning after a game between the Chicago Bears and the Washington Redskins. I had stayed up late drinking the night before. On the flight home from Washington to Jacksonville I became violently ill with what turned out to be a bleeding ulcer. When the plane finally landed I was rushed to the hospital in Jacksonville. The doctors gave me five pints of blood and three pints of plasma. They said if I'd gotten there 15 minutes later I would have died. I promised myself then I would never drink again.

DR. HYMAN: When do you cross the line from being a heavy social drinker to an alcoholic.

SOMERALL: Dr. Steven Hyman.

DR. HYMAN: I think the real issue is when there is loss of control and compulsive use. And often people don't share this. But many people who might claim, for example, to be just heavy social drinkers—actually might choose which party they go to according to where there's going to be more alcohol, plan to get drunk, do spend a lot of times recovering from their alcohol misuse—may tell themselves they're going to cut down. In short, they're struggling with, they're involved in compulsive use and at the border of out-of-control use.

SOMERALL: When you use drugs again and again and again, they actually start changing your brain. Dr. Hyman likens the impact to a sledgehammer to the brain.

DR. HYMAN: Without showing you frying pans and eggs, the brain after chronic drugs really is different.

SOMERALL: Dr. Hyman says that regular drug use leads to three kinds of changes in the brain.

DR. HYMAN: The first kind of adaptation is caused only by alcohol and by opiates, not by nicotine particularly and not by cocaine or amphetamine. And these are adaptations that lead to what has been called physical dependence. So we know that if somebody who has been drinking alcohol excessively stops drinking alcohol, they will develop tremors and agitation and an inability to sleep and even sometimes grand mal seizures. With opiates there's also a well-known physical withdrawal syndrome. Not so for the other drugs of abuse.

SOMERALL: Drugs can also effect the brain reward pathway itself. Drug users start loosing the ability to experience normal pleasure. They feel depressed and they crave drugs. The third change from chronic drug use involves what Dr. Hyman calls your emotional memory.

DR. HYMAN: This is a system that's there to say that was good, let's do it again and let's remember exactly how we did it. So memories that are associated with the drug-taking become nearly indelible and we know, for example, that people who are fully detoxified from drugs remain at really high risk of relapse for a very long time, maybe for the rest of their lives. Alcoholics Anonymous says that people are only recovering and not recovered and a great deal of this I think has to do with these, let's call them emotional memories. And these can be triggered by even trivial reminders of drug use in the environment. A smoker might have a festive meal, Thanksgiving dinner, and intensely crave a cigarette. Someone who had used opiates or cocaine might meet friends that they used to use drugs with or see some drug paraphernalia and get intense waves of craving.

SOMERALL: Dr. Bertha Madras, associate professor of psychobiology at Harvard Medical School says that the brain works furiously to respond to the drug's assault.

DR. MADRAS: When we go outside in the wintertime we put a coat on, and as soon as we enter back into our warm, cozy houses we take the coat off. In the same way when the brain receives these abnormal signals from drugs, the brain begins to adapt to the abnormal signals. And at this stage the brains of certain people have changed. They are no longer in control.

SOMERALL: Someone once asked comedian Richard Pryor how cocaine makes you feel. It makes you feel, he said, like having more cocaine. For many substance abusers, including me, it's hard to stay clean without some outside help. During the next half-hour, getting off drugs and staying off. I'm Pat Somerall. You're listening to "Gray Matters, Alcohol, Drugs and the Brain."

[MUSIC]

SOMERALL: For the longtime substance abuser, staying sober means making a radical, wrenching change in who you see, where you go and what you do. The biggest challenge is turning away from the people, places and things you associated with getting high: an old drinking buddy, a favorite bar or the friends who want to party every night. Dr. Alan Leshner, director of the National Institute on Drug Abuse.

DR. LESHNER: Alcoholics Anonymous was probably the first group to really understand this phenomenon, and they didn't understand it in technical terms but they understood it at its core. So we either mean, as a part of a treatment program, to either teach people coping mechanisms, or another approach that's been used is based on classical learning principles. That is, we extinguish the response. That is, you expose the individual in a controlled setting to those kinds of cues over and over and over again. They don't get the drugs and eventually they stop responding. That is, it's a learned phenomenon. You should be able to unlearn the phenomenon and approaches have been tried in a variety of places to extinguish that learned response to the cues.

[BACKGROUND VOICES]

SOMERALL: This is a classic cue. A drug dealer bragging about his heroin supply.

MAN: Watch how, you watch how it falls out the bag. It come out like one big flake. When they [UNINTELLIGIBLE] ain't nothing laying in the [UNINTELLIGIBLE] it goes right up.

SOMERALL: At the Penn Treatment Research Center recovering heroin addicts listen to this tape of a drug deal in progress.

MAN: I know all about it. I've had that before but ... coming on me slow man ...

SOMERALL: They're also asked to handle drug paraphernalia, a syringe, some matches, a rubber belt. As they hold the syringe their heart rate and skin temperature are monitored to gauge their response to these familiar cues. Because the cues are so powerful, patients spend time with a therapist immediately after each session to make sure any craving has subsided before they leave the center. Doctors hope that during the course of treatment they can slowly extinguish the effect of these cues by separating them from the memory of drug use. In effect, they are trying to rewire the addict's brain. But not all the patients at Penn are in recovery. Some programs are designed to help patients break their long-term drug habit. In one study smokers gradually reduced their exposure to tar and nicotine by applying first one, then two, then three drops of a sweet-tasting solution to the filter of their cigarettes. The drops make it much harder to inhale the smoke and unlike the nicotine patch they get patients actively involved in their own treatment. Other studies involve harder drugs.

SUSAN: First time I actually didn't like it. I mean it wasn't bad, it just wasn't as fabulous as everyone had told me. Everyone said yeah, you do it once and you'll never stop and the next couple of times were really nice.

SOMERALL: Like most addicts, Susan started taking drugs as a teenager. She's only 24 but she's been using drugs for 10 years. Susan started with speed and pot and the moved on to cocaine. She began taking heroin two years ago and now she can't get off.

SUSAN: It's like the feeling you get when you're coming down from an orgasm where everything is just warm, comfortable and feels good and you get that, you know, like a huge endorphin rush. It's just, everything is perfect. But after a while you don't feel that. Initially it would last all night but now, if anything a couple of seconds. You consider yourself lucky if you get like five seconds of a rush if you feel it at all.

SOMERALL: Susan came to the Penn clinic after trying to quit more than a dozen times. Now she's part of a research project testing a new medication designed to suppress the craving for heroin. But she's still shooting up.

SUSAN: I mean this isn't a question of will power or morality or weakness or anything like that. I mean it's ... I can't tell you how badly I want to be clean and how badly everybody I know wants to be clean. But it's not that simple.

SOMERALL: How do we get people to give up drugs or alcohol? That's one of the most important questions in dealing with drug dependence. Some people manage to quit on their own says Dr. Hyman.

DR. HYMAN: It's important to recognize many people recover from this spontaneously. Job gets less stressful, they have some personal epiphany and they stop, and they're not part of medical statistics. We just don't know how they recover.

SOMERALL: Dr. Alan Leshner.

DR. LESHNER: Some people spontaneously remit and that, by the way, is a big difficulty for getting people into treatment, because many people say, oh, I knew Harry. Harry was a crack addict and Harry, he just decided he was never going to do it again. Well lucky Harry. Harry's an exception. Harry is not the norm. The norm is that people can't break their addiction by themselves. They have to have treatment. They have to have an intervention.

SOMERALL: We've all heard about the physical symptoms of getting off drugs. Alcoholics often feel sweaty and shaky for a few days and many heroin users can't eat, can't sleep and feel like they've had a bad case of the flu. But other drugs like amphetamines and crack cocaine cause almost no physical withdrawal symptoms. Dr. Leshner says that physical addition plays a surprisingly small role in drug addiction.

DR. LESHNER: What does matter in addiction is what people used to call psychological addition, but which I prefer to think of as the essence of addiction and that's uncontrollable, compulsive drug use. Sometimes that's a hard concept for people to think about, but think about the crack addict who has sold her children in order to get drugs. Nobody wants to sell their children. But the drug becomes such a consuming part of the individual's core personality at that point in time that there is nothing else but drug and the craving for the drug. That's what addiction is. Addiction is not about does it or doesn't it give you the chills when you stop taking it? We can manage the chills. We can't seem so easily to manage the behavioral elements of it and those are the things that matter clinically.

SOMERALL: Developing effective treatment remains the greatest challenge in dealing with drug abuse. Because addiction is such a complex disorder no single treatment works for everyone. Alcoholics Anonymous, group counseling, hospitalization, psychotherapy, all these approaches have had some record of success. Dr. Steven Hyman.

DR. HYMAN: I think all successful treatments these days have an important behavioral component, which teaches the person and often their family about the disease and which importantly gives them something back. I mean you're taking away something which has been at the core of somebody's life. And whether it's the fellowship of Alcoholics Anonymous or mediation or exercise or something, I think you have to give something back to people who are addicted.

[BACKGROUND VOICES]

SOMERALL: At the Center for Mental Health Clinic in Washington, D.C., many of the patients are the mothers of young children. The center offers childcare and family therapy as part of its treatment program.

WOMAN: It's not only us in recovery, it's our children in recovery. Your children were suffering right along with you. My oldest says my mommy don't smoke weed no more. My mommy don't smoke drugs no more. My mommy don't sell drugs. And it makes me feel good. I cried to hear my daughter actually say thank you God for giving me my mother back.

DR. HACKNEY: We really have a family health approach. Before you would use and stay away from your children and try to get your good feelings through the marijuana or the alcohol. Now it's just the opposite. Your children are your good feelings. It's them that you go to in order to feel loved and sustained and positive and so forth.

SOMERALL: Dr. David Hackney is director of Adult Recovery Services at the Center for Mental Health.

DR. HACKNEY: Our patients are often using with family members or with the next-door neighbor and as you can imagine these aren't people that you can just ignore and avoid

and run away from. But we try to help them come up with creative ways of changing the interaction with these people.

SOMERALL: The Center for Mental Health is on Martin Luther King Avenue in Washington's Anacostia section, just two miles from the capitol dome. Dr. Hackney says that a big part of his job is helping patients deal with an environment that makes drugs readily available.

DR. HACKNEY: And that can be as simple as instead of going down one street in order to get to the local grocery store where you know there's a drug dealer, you know, on the corner, you may have to circle around and, you know, it may take you an extra 10 or 15 minutes to get there. But if you can avoid seeing and walking by, you know, the drug dealer, you're of course more likely to have a shot at not spending your money on drugs than picking up the bread or the milk that you're supposed to get that day.

WOMAN: The first two years I used to have dreams. I would be sleeping. I used to have dreams I was sitting there smoking a big pipe with weed in it, and I would actually feel myself getting high. And I would get up sweating and I would say, damn, the center. I'm not going to lie. What used to keep me clean was the hot chair. I don’t know if you still have it. That's what kept me clean.

SOMERALL: Many patients at the center say the hot chair kept them clean. The center forbids drugs and it enforces the rule with random drug testing. The first time patients relapse the counselors talk with them privately. But the second time they have to sit in a lone chair in the middle of a group meeting while fellow patients confront them about the relapse and urge them to stay clean.

MAN: What we've instilled here is an actual therapeutic community, which is a bunch of individuals who have a common experience, namely substance abuse, who have decided to achieve abstinence and who kind of support each other and form really a surrogate family, which can be seen as a healthy alternative to the kind of dysfunctional families that they've often grown up in.

SOMERALL: Experts say that dealing with relapse is the biggest hurdle in treating substance abuse. It can be relatively easy to get off alcohol or drugs but much harder to stay off when you're faced with the same problems that may have led you to drink or take drugs in the first place. Think of how difficult it can be just to say on a diet for a few months. We ask addicts to give up their alluring habits for a lifetime. I know what relapse is like. After I almost died in that Jacksonville hospital in December of 1990, I quit drinking and I promised myself I would never drink again. But seven months later I started drinking again. At first I drank secretly, just a vodka or two in my hotel room to let off stress after a bad day. When people asked me if I was drinking I denied it.

ANNOUNCER PATSOMERALL: LA back to throw. That has every chance of being intercepted. It is—by the Redskins.

SOMERALL: By January of 1992 when the Redskins beat the Bills in the Super Bowl, I was drinking just as much as I ever had. For me, hitting bottom once was not enough. I had to do it for a second time.

ANNOUNCER PAT SOMERALL: Edwards is down and about the Buffalo 34. That's the fifth turnover.

SOMERALL: Three months later I was covering the Masters Golf Tournament for CBS. I was so sick from drinking that I barely finished the tournament. Even then I didn't want to get help. A few days later my wife and some close friends joined forces and confronted me in a hotel room near Philadelphia. They urged me to get treatment. My first instinct was to argue, to insist that I could handle it myself. And then when my only daughter wrote me a letter—and I still remember her exact words—she said, "I'd always been proud that we had the same last name, but now I can't say that." A few days later I checked into the Betty Ford Clinic. I spent 33 days there attending lectures, going to counseling and trying to find the tools that would let me stop drinking at last. Drug treatment centers have helped millions of people, but for many it's only a short-term cure. Only about half of the patients who go into treatment programs are still off or mostly off drugs a year later. Brain scientists like Dr. Leshner are continuing the search for better treatments.

DR. LESHNER: We're in a very difficult position having learned all that we've learned about the brain and drugs and the importance of the brain. In that, if you understand addiction as the quintessential bio-behavioral disorder that it is, that is if it really involves the brain, the environment and behavior, then the best treatments are going to require the combination of all those elements. We're going to have to address, the biological aspect, the social aspect and the behavioral aspect. Well we actually do fairly well at the behavioral and the social side. But we have very little in the toolbox to help us deal with the biological side.

SOMERALL: We have developed medicines to deal with some addictive substances. For nicotine there is the patch, and for heroin methadone.

DR. LESHNER: A maintenance drug like methadone, we call it an agonist compound, actually binds to and occupies the receptors in the brain where the drug of abuse acts. So that methadone works primarily by occupying the opiate, the new opiate receptors in the brain and therefore the individual doesn't feel the need to occupy his or her own new opiate receptors. What's interesting about that is that's lead to a lot of ideological problems. It's a substitute. Methadone is literally substituting for heroin on the receptor in the brain and, therefore, people keep saying wait a minute, you're giving a drug abuser a drug. How come people don't say that about diabetes and insulin? People who are diabetics don't make or don't have insulin. We give them insulin. They're just as dependent on the insulin as the heroin addict is on the methadone. The difference between heroin is that methadone doesn't interfere with functioning and heroin does. Methadone gives some people a little bit of a buzz. But it does not produce a high. It

doesn't produce the dysfunction that heroin produces. And therefore there are people who have been on methadone for 10 or 15 years and lead totally functional lives.

SOMERALL: But there are no medications to help addicts to deal with cocaine overdose. Nothing to do with long-term cocaine addiction or the craving for cocaine. Brain science is now engaged in the search for new medicines to deal with the biological aspects of cocaine and other drugs.

DR. LESHNER: What the basic science has now given us is a series of molecular, biological targets at which we can direct our medication development efforts. So that we are actually taking synthetic chemistry, medicinal chemistry, and using it to develop compounds that are directed specifically at each of the mechanisms of action of drugs of abuse in the brain. So that we are strategically searching for that cocaine medication, and I can tell you that we're making some headway. We don't have the medication yet and I can't tell you exactly when I'm going to have it for you. But we have 26 compounds in clinical trials at the moment, each of which is targeted at one of the mechanisms of action that cocaine has on the brain.

SOMERALL: Dr. Bertha Madras says that a group of drugs called dopamine transport blockers are showing some promise in dealing with cocaine addiction. These drugs would prevent cocaine from binding to the brain's dopamine transporters.

DR. MADRAS: One of the approaches that we've taken is to try to find drugs that lodge on this dopamine transport system like cocaine, that are much longer-acting but also enter the brain very slowly unlike cocaine. Because there is accumulating evidence that the speed at which cocaine enters the brain, which is seconds, and the speed at which it comes off it targets, which is minutes, is part of the process of producing the euphoria as well as the potential addictive properties. So we are trying to develop compounds, medications, replacements for cocaine that are analogous to methadone that would have different profiles of time on and time off.

[MUSIC]

SOMERALL: Alcohol is one area where there recently has been a breakthrough. For more than 40 years Antabuse was the only drug that had been approved for treating alcoholism. But Antabuse can make you very sick if you take even one drink so many alcoholics simply refuse to take it. Now there is an alternative, a medication called naltrexone. Naltrexone is a drug that blocks the opiate receptors in your brain. Naltrexone was being used with heroin addicts but it wasn't working very well because most addicts didn't want to take it.

DR. O'BRIEN: First of all when you take it you feel nothing.

SOMERALL: Dr. Charles O'Brien is professor of psychiatry and director of the University of Pennsylvania Treatment Center and a leading researcher on naltrexone.

DR. O'BRIEN: If you take methadone you feel a little bit better. But if you take naltrexone it's pretty much a blank. Also if you're a heroin addict and you've had years of being able to get high any time you wanted to and then suddenly you're on naltrexone, Your opiate receptors are blocked. Suddenly you're deprived of the possibility of getting high and that's very upsetting.

SOMERALL: But animal studies had shown some interesting results.

DR. O'BRIEN: In the 1970s a number of laboratories were doing studies in animals, looking at the role of opiate receptors. And in these studies it was discovered that rats and monkeys who were found to like alcohol and to actually become alcohol dependent, that these animals would have their alcohol drinking decreased by giving them a drug that blocked opiate receptors. So we were impressed by these animal lab findings and we decided that we ought to try it in human beings.

SOMERALL: Clinical trials at the University of Pennsylvania and at Yale showed that naltrexone could make a difference. Again, Dr. Enoch Gordis, director of the National Institute of Alcohol Abuse and Alcoholism.

DR. GORDIS: All this research was together with effective counseling of various sorts. But it did two things. It diminished the time to the first drink and in addition, if a slip occurred, that is the person did start experimenting with alcohol again, it reduced the odds of this developing into a full-blown binge. Now these are two separate phenomena, possibly, because the first has to do with the craving issue—how much you miss it when you don't have it—and the second may have to do with how much of a reward or a kick or reverse of effects you're getting from it once you do start drinking.

SOMERALL: Naltrexone was approved by the FDA in December of 1994. And the research on naltrexone has deepened our understanding of alcohol by showing that alcohol effects specific receptors in the brain.

DR. GORDIS: I think naltrexone represents not only an advance in itself, but is the opening up of a new era in which potent pharmacotherapy, that is drug therapy, would be added to counseling to improve the odds of not relapsing.

SOMERALL: For Eric, a 33-year-old patient at Penn's treatment center, naltrexone has been the key to staying off alcohol and cocaine.

ERIC: Putting yourself on some kind of drug that will alleviate the craving is the main thing, I guess. The thing I worry about is my ... some day I'm going to have to go off of it and that will be the real test—how strong my will will be at that point. But it really works is the most amazing thing. I don't even smoke cigarettes anymore. It just seems to block any and all cravings for any kind of stimulants.

SOMERALL: Researchers are now conducing large-scale studies of naltrexone to determine how to use it most effectively. Other medications for alcoholism are also being studied at research labs around the country. Again, Dr. Gordis.

DR. GORDIS: Well I think we've learned more about alcoholism in the last 20 years than we have in probably most of the history of this before. It's only in the last few years that treatment has been subjected to the same rigorous scientific inquiry and analysis that every other branch of medicine is customarily used for new treatments for many, many years. You see alcoholism treatment developed outside the mainstream of medicine. And obviously the dedication and the genius of people like Bill Wilson, the founder of AA, are remarkable. So those who are doing well with contemporary treatment, especially the traditional ones, should consider themselves blessed and continue doing so. At the same time, these people and their families should be the most forceful spokesman for the need to research so other people who are not doing well, which unfortunately is still the majority, can benefit from the fruits of science.

SOMERALL: The struggle to control substance abuse has been waged for as long as people have been experimenting with drugs and alcohol. "Happy day," said Abraham Lincoln in 1842, "when all appetites controlled, all poisons subdued ... there shall be neither a slave nor a drunkard on the earth." That day of course is a long way off. Relapses happen all the time and it's easy to be discouraged when you see a drug user get in trouble again. But Dr. O'Brien says we may be expecting too much.

DR. O'BRIEN: I think that too often people think of addiction as kind of a broken arm or a case of pneumonia where you get treatment and then it's cured. And because this is really chronic memory, the brain is changed as a result of using a drug hundreds or thousands of times. Once you get into treatment, you can't expect to wipe all that out. The memories are indelible. They're there and you have to cope with it. And, in fact, we have to aim for improvement and not expect total cure.

SOMERALL: Dr. Hyman compares addiction to other chronic disorders.

DR. HYMAN: For some reason we seem to hold treatment for mental disorders and addictive disorders to a higher standard than we do treatments for other disorders. We don't cure diabetes mellitus with insulin. We don't cure progressive coronary artery disease with coronary artery bypasses, and we certainly have a very poor track record of treating many serious cancers. From that vantage the treatment for substance abuse has certainly a ways to go in terms of broad efficacy. But it's very helpful in getting people drug-free for substantial periods of time. It's clear that we have to do better in treatment. But I don't think that treatments for addiction are so much worse than treatments that we currently possess for many other serious, chronic or relapsing disorders.

SOMERALL: Dr. David Hackney of the Center for Mental Health in Washington works on the front lines of the battle against drug abuse. He spends a lot of time with people in desperate trouble, but he says his work gives him hope.

DR. HACKNEY: What really keeps me going is the tremendous amount of strength that you see in a group of people that have been stigmatized, kind of alienated. And if you just passed them on the street they just look like their life is over. You know, if we looked out the window and looked four blocks down the street, we would see a major drug-dealing area where you can see, you know, burnt-out alcoholics and people addicted to crack who just, they look physically unhealthy, they look depressed. And you drive by and it even hurts to just look at them. You don't want to look at them. You want to hurry up and get out of the area. And what this job does for me, it allows me to work with these people and to see them make the transition from, you know, the burnt-out alcoholic or crack addict on the corner to somebody who's working on a nursing degree and loves dealing with her children. And it's just very inspiring, very gratifying to be part of that, to make a dent in this epidemic.

SOMERALL: Millions of Americans, including me, have managed to break free from their dependence on alcohol or drugs. But on any given day almost 1 million people in this country are getting help for substance abuse. Eric, the alcohol and cocaine user at Penn, says it's not easy.

ERIC: What people don't see about themselves is that they mold their life around the addiction and it's subtle things at first but you begin to realize that almost everything you do molds around the drugs. It's not like you can just say I'm going to quit and then the whole world supports you. It takes years to get there. Takes maybe years to get out of it. It usually takes a lot of help.

SOMERALL: In the NFL they say the hardest shots are the ones you don't see coming. I did my best to avoid those hits and I was able to play for 10 years. But the toughest blows I absorbed came from the drinks I ordered myself. But those days are finally behind me. I'm Pat Somerall.

[MUSIC]

GARRICK UTLEY: And I'm Garrick Utley. It is difficult to get hard numbers on the scope of the addiction problem in the United States. Many addicts simply do not show up in the medical, criminal justice or psychosocial support system. But experts have made some educated guesses. And they say that right now there are about 1 to 3 million Americans who have a serious problem with cocaine. Approximately 76 percent of the population drinks alcohol, and between 5 and 10 percent of them are thought to be addicted. Heroin addiction is rising in this country thanks to the spread of smokeable forms of that drug. As for cigarette smoking, 12.8 percent of middle school students and 34.8 percent of high school students currently use some form of tobacco. A new drug marketed as Zyban has helped some cigarette smokers break their addiction. For heroin addicts there's a longer-acting form of methadone available now that has offered assistance and enabled addicts to avoid the sometimes stigmatizing experience of making daily trips to a clinic to get their dose of medicine. As for cocaine, there are new drugs in clinical trials that use antibodies to fight addiction. The antibodies catch cocaine in the bloodstream and in effect lock it up before it even gets to the brain. This deprives the

addict of a high and hopefully weakens dependence on the drug. Genetic research is likely to tell us more about why people get addicted to certain drugs. Twenty-four genes have been mapped in rodents that are relevant to drug addiction. Addiction genes have not yet been found in humans, but scientists guess it's only a matter of time and technology before the genetic component of human addiction is more fully understood. I'm Garrick Utley and you've been listening to a special addition of "Gray Matters: Alcohol, Drugs and the Brain."

[MUSIC]

WOMAN: "Gray Matters: Alcohol, Drugs and the Brain" is one of a 13-part series. For a cassette, CD or transcript of this show or for any of the "Gray Matters" programs call 1-800-65-BRAIN. At that number you may leave your comments or also request a free pamphlet answering your questions about brain research. That's 1-800-65-BRAIN. This program was produced in association with the Dana Alliance for Brain Initiatives. The Dana Alliance is a nonprofit organization made up of 200 leading neuroscientists including seven Nobel Laureates. The Dana Alliance's commitment is to advance public education about the progress and promise of brain research.

[MUSIC]

MAN: PRI, Public Radio International.