

Joseph LeDoux, the split brain and a traveling magic show

The director of the Emotional Brain Institute discusses the Cajun music scene in Louisiana and how memories change with time.

1 January 2024 | by Brady Huggett

This transcript has been lightly edited for clarity; it may contain errors due to the transcription process.

[opening theme music]

Brady Huggett

Welcome to Episode 9 of “Synaptic.” This is our podcast that investigates the people, the research and the challenges of the neuroscience field. My name is Brady Huggett, and I’m the host of this show. Welcome aboard. You are listening to this on January 1st or later, so happy 2024. I hope your New Year’s Eve was festive or wild or peaceful or whatever you wanted it to be. For today’s show, let’s go back to 1911, and let’s go to Eunice, Louisiana. Now that year, an aging, faded high school in Eunice was bought by the Congregation of the Roman Catholics of St. Anthony of Padua Church, with the idea of turning it into a Catholic school.

The old school was physically moved to a plot of land behind the local Catholic church, and the congregation also bought a nearby two-story building, which it hoped would eventually house six nuns to help oversee the school. In fact, in late August of that year, a small group of Maronite nuns got off the train in Eunice and were ushered to their new residence close to the school and the church. In September of that year, the school, under the name of St. Paul’s, opened its doors to 112 students. The school name was changed to St. Edmund by 1921, and over the coming decades, it provided hundreds of students with both an education and heavy doses of Catholicism under the watchful eyes of the nuns.

Now, among those students was Joseph LeDoux, who began his schooling there around 1955, I’d guess. That’s today’s guest, by the way, Joe LeDoux. Joe was a nice boy, polite and quiet, and the nuns loved him, and partially because of that, he thought he might one day want to become a priest. When Joe was in the seventh grade, a traveling magic show arrived in Eunice. Of course, this got the attention of the kids, Joe included. The nuns told the students they were forbidden from attending the show, because that kind of thing, they said, was the devil’s work.

Joe went anyway. He was punished by the nuns for this, along with any classmates who admitted to visiting the magic show. That, he says, is when he took a hard look at these nuns and what they were selling, because he was old enough to know by then that there was no devil’s work in a magic show. It was just fun. He’d had fun there. At that point, he stopped thinking he might one day become a priest, and he decided he wanted to go to a public high school, which he did. That led him eventually to college, where he brushed up against psychology, and his life was changed forever.

We talked about that on this podcast. We talked about how after undergrad, he got into Stony Brook for graduate school and was turned down everywhere else he applied. We talked about how he sometimes felt like an imposter in the neuroscience field, studying the brain. All of that coming up in the next hour. I met with Joe on November 2nd, 2023, at his apartment in the Williamsburg neighborhood of Brooklyn, here in New York City. A sunny but chilly day, the temperature in the high 40s, very easy interview for me to get to, just a subway ride over the East River.

He lives in an apartment near the riverfront. In his apartment, he has outfitted a small workspace. The room is filled with books, and guitars, and recording equipment, and his computer. Everything that he needs to fill

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a day. That made it a little cramped for us. There was no common table we could use, but we used an overturned cardboard box for my recorder and mic. Joe hung his mic from a mic stand, angled down toward his mouth, and we got underway. It was a nice talk, I thought. He had a lot to say about Louisiana, and a lot to say about how the brain works, too. Let's pick it up here, where we're just finishing up chatting about Williamsburg and the massive gentrification it has undergone in the past 15 years. This is Episode 9 of "Synaptic," with guest Joseph LeDoux, starting right now.

Brady Huggett

Let's get down to it. You've been in New York state a long time, I know that.

Joseph LeDoux

1974.

Brady Huggett

Before that, though, I think you're from Louisiana.

Joseph LeDoux

Correct.

Brady Huggett

Where did you grow up?

Joseph LeDoux

Eunice, Louisiana, the heart of Cajun country, one of the focal points of Cajun music.

Brady Huggett

How is it that your family was there? Was there family history that had you, your family in Louisiana?

Joseph LeDoux

There was, of course, the migration from Nova Scotia. A lot of French-speaking people moved there, moved to Louisiana, when the British took over Nova Scotia from France. Then there were a bunch of immigrants from France and from other European countries. For example, my father's parents were both French, probably either directly from Canada or from probably Brittany in France. My mother's family was, her father's side was German, and her mother's side was Sicilian. They had been in Louisiana for several generations, so they spoke French.

Brady Huggett

Oh, they did?

Joseph LeDoux

Yes, once you're there, you're enculturated, built into the culture. You just learn to speak the language, and you're just another Cajun.

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Brady Huggett

Did you speak French growing up?

Joseph LeDoux

No, my generation was the last generation to not really learn French. I was born in 1949, post-World War II. Everybody was, rah, rah America, solve the problems of the world. They wanted us to be Americans, not Cajun French people.

Brady Huggett

There was almost, like, let's not speak French anymore.

Joseph LeDoux

Until, maybe when I was 10 or 12, they tried to get me to start speaking it, and it was impossible.

Brady Huggett

Too late?

Joseph LeDoux

Yes.

Brady Huggett

Do you know how your parents met?

Joseph LeDoux

Yes, I do. My father, he had a, what do you call it, a deferment from World War II because he had a daughter, and he was married to a woman. They lived in southwest Louisiana near Lake Charles, down by the Gulf of Mexico. They got divorced at some point. Well, it's a longer story. Let me back up a bit. In the Depression, my father was a young man, teenager, and he took off with the rodeo because there was nothing else to do.

Brady Huggett

The traveling rodeo?

Joseph LeDoux

Yes. He rode bulls in Madison Square Garden, Boston Garden, 17 different states, I think. I have a little book here.

Brady Huggett

Yes.

Joseph LeDoux

Oops. No, it is. It's right up there called "Cowboy Tales" that he narrated, and we turned it into a little pamphlet. My wife sort of —

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Brady Huggett

Stories of his life.

Joseph LeDoux

Yes. It's interesting. Anyway, so he was in the rodeo, fell off a bull and hurt his back at some point, so he came back to Eunice and took over his father's meat market. On Saturday nights, he would go to the, I forget what the club was called, but it was a nightclub out in the countryside where they had big bands playing and so forth, or at least big band music. Sometimes they had Harry James or someone like that that would come in touring. He saw this lady, young lady from Elton, Louisiana, who'd go there to dance, because everybody wanted to hook up because the war was over, and they were trying to mate up and get going. Even though he'd been married before, he was divorced and he was dancing with my mother, my to-be mother, and after the dance he asked her to get married.

Brady Huggett

After the dance?

Joseph LeDoux

Yes.

Brady Huggett

You mean-

Joseph LeDoux

After the first dance.

Brady Huggett

-after the first dance.

Joseph LeDoux

He was this rugged character.

Brady Huggett

Bull rider, yes.

Joseph LeDoux

Bull rider, not the kind of guy she was really looking for. She was looking for some ex-marine that would go into business or something. She said no, but every week he would show up again until finally he got her to say yes. Then they got married. I don't know exactly what year that was. I think probably 1948, and I was born in 1949.

Brady Huggett

Have you ever asked him about that? Just the concept of one dance and you're like, I want to marry you.

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Joseph LeDoux

That's just how he was. He was a real character.

Brady Huggett

He was like straight ahead, this is what I want, I'm going to do it.

Joseph LeDoux

He probably did it as a joke at first, but then he began to believe the joke.

Brady Huggett

He was serious. He convinces her. They got married. How much longer after that?

Joseph LeDoux

Again, I don't know the gory details, but I guess it's possible that she was pregnant with me, because it wasn't a lot of years involved, but maybe not. Maybe they just got married and got pregnant, but hard to know. Then she took over being the face of the meat market, took over the books, and would smile to the customers and stuff. My father would be cutting the meat and there would be a staff in the back, three or four guys. They'd always come in the next day drunk after having too much fun the night before. Often you'd have to go drive through the neighborhood, find them, get them out of bed, shake the woman away that they'd picked up, and drag him into the meat market to work.

Brady Huggett

That was his job to do that?

Joseph LeDoux

Yes, but he also cut meat. He was a skilled butcher. Those guys were interesting to me. I'd hang out with them in the back and I had to learn how to do things. My job as a kid was, I've told the story a million times, but it was to pull the bullets out of the brain because they were selling the brains as a delicacy. People would eat brains back then. I had to reach in and find where — you could see that there was a wound where the bullet had gone in, kind of a blood clot. You could separate that and dig the bullet out and throw it away, and then they would use the brains for selling.

Brady Huggett

Who was doing the slaughtering?

Joseph LeDoux

We had a farm three miles out in the country. My father's name was Boo LeDoux. He would go to the cattle auction in Opelousas, which is about 20 miles east, and buy a few calves and bring them back in the truck. They would stay at the slaughterhouse. Then their day would come when they were put down.

Brady Huggett

He'd buy the calves. They would be raised at the slaughterhouse and then —

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Joseph LeDoux

They would be ready to slaughter.

Brady Huggett

Oh, they would?

Joseph LeDoux

Pretty much. They were not baby calves. I guess they called them calves, but they were adolescents, I guess you would say. Then at the slaughterhouse, they would of course kill the animals. There was a bullet that was used, but that was a stun gun, basically. That's a 22 rifle. That would go in the head and knock the animal out. I don't know how gory you'd want to get into all the details, but the death came by releasing the blood.

Brady Huggett

This is still the way they do it. They stun the animal first and then slit the throat. Then that meat would come to you, but the bullet was still in the brain?

Joseph LeDoux

Right.

Brady Huggett

It would come to the meat shop, and your job was to get the bullet out?

Joseph LeDoux

Yes. They would skin the cow as well, cut it in half so you have two halves hanging on a rack that could move around. Then they would throw those in the back of the pickup truck and drive it in. That's an interesting thing that I've actually written about. I wrote a blog about this, I think for *Huffington Post*, years ago, about how you've got a couple of cows that have been skinned, cleaned, cut in half, thrown in the back of a pickup truck, driven into town with a tarp on top of it, flies everywhere, but nobody got sick. Why?

This was a very well-contained community. There weren't a lot of people coming in and out from the outside. The microbiota of the community was, I think, stable enough that whatever the common bacteria were, whether it was going to get into the cow or into the person, was familiar enough to the immune system to detect all that and not cause big problems. That's just my theory, but I don't know if it's true.

Brady Huggett

That would never pass muster today. Do you have any siblings? You have one [crosstalk].

Joseph LeDoux

She was a half-sister. We never lived together, but we were pretty close over the years.

Brady Huggett

Your mother and father only had one child; that was you?

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Joseph LeDoux

Yes.

Brady Huggett

As you're growing up, it sounds like, number one, there was always an interest in music in your family.

Joseph LeDoux

The family was not- My mother could keep a beat; my father couldn't. My beat is somewhere between there. [laughs]

Brady Huggett

Skip a little bit of a beat.

Joseph LeDoux

There wasn't a lot of music in my family but everywhere in town. If you were an old man, you probably played in some kind of Cajun band because it just was so popular there.

Brady Huggett

As you're growing up though, did you have any interest in science at all?

Joseph LeDoux

None.

Brady Huggett

None at all?

Joseph LeDoux

Every now and then I'd say I'm going to build a little radio or something but never got anywhere with it, no. There weren't role models to —

Brady Huggett

It wasn't around you.

Joseph LeDoux

— no one to help me do that kind of thing. I just really wasn't that interested in it. I wasn't that interested in school either. I was a shy kid. My first day in kindergarten, I was the youngest kid in the class, too, because it was December birthday. My first day, I was whipped with an electrical wire in the playground. From that point on, I just was silent. I was like, yes.

Brady Huggett

Who whipped you?

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Joseph LeDoux

I know his name. I'm not going to say it. [laughs]

Brady Huggett

Was it a teacher or a kid?

Joseph LeDoux

No, a kid.

Brady Huggett

It was a kid?

Joseph LeDoux

Yes.

Brady Huggett

He was carrying around an electrical cord?

Joseph LeDoux

No, it just was lying around in the weeds. It really inhibited me. I was nervous enough about — I didn't know these kids. When I grew up, I was playing with Black kids all the time because the meat market was on the edge of the "colored" part of town. Those were my friends. They called me White Joe because there was another guy who was Joe. He wasn't Black Joe, but I was White Joe. They would treat me as the boss of the gang because I had the toys and stuff. When I went to school, all of a sudden I was totally the lowest man on the totem pole because I got whipped that way.

There were years where I would — I think the way kids knew me was I was the quiet one that would never talk when the teacher would leave the room or anything like that. I started making rosaries with the nuns after school. It was their favorite little thing. They thought I was perfect because I never cut up or anything. I was really into Catholicism. They were pushing me to become a priest and to get set up because as a young boy, you can be moved into that track.

Brady Huggett

There might be a career for you to be a priest.

Joseph LeDoux

I was really into it for a while. I didn't know anything better, so that seemed like fun. After school, I'd go put on my mother's negligee and stuff and dress up like a priest. [laughs] The whole mass in their bedroom, but I freaked out. Oh, I guess one thing, one crucial thing that happened was there was a horror show thing, a traveling magic show that went through town. I was getting a little older now, maybe sixth or seventh grade, maybe seventh grade. The nuns forbade us from going to this magic show because it was the devil's work.

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I just didn't see it — I said, "They wouldn't stop me from going. I'm their little pet." The next day, they called out all those that went to the show and went to stand out. We got all suspended.

Brady Huggett

How did they know?

Joseph LeDoux

I guess it was the honor system or maybe somebody was telling who went.

Brady Huggett

Oh, they said who went to the show and you said I did?

Joseph LeDoux

Yes. It just turned my head a little bit about the nuns and what they were after. It was ridiculous. There was no devil worship in that thing. It was just fun. Then the other thing that happened is, of course, hormones kicked in. I figured out that those girls were real. There was something to that. [laughs] I had a girlfriend or something at some point and decided that the priest thing was no more for me.

Brady Huggett

That was not the life for you.

Joseph LeDoux

At that point, I decided I wanted to go to high school at the public school rather than the Catholic school. Then they freaked out about that. They wanted me to stay at the Catholic school.

Brady Huggett

Your parents or the nuns?

Joseph LeDoux

My parents.

Brady Huggett

Your parents are Catholic too?

Joseph LeDoux

Yes. At first, they were pushing me to go to high school to get me out of the priest thing. Once I did it, they wanted me to stay back. It was a complicated time. Anyway, I discovered girls, and folk music came at some point. Everybody got a folk guitar. I remember at a party at a very rich family's outdoor kitchen — everybody in the South has an outdoor kitchen. The older fella in this family took his acoustic guitar. Everybody had a gun too. Someone took his acoustic guitar and shot holes through it.

Brady Huggett

As part of his performance?

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Joseph LeDoux

Just for fun. Drinking too much and shooting guitars. [laughs] Anyway, I had an acoustic guitar. I tried to play “Sounds of Silence” and other things like that. Then when I would play, the girls would come. I said, “Oh, OK.” I tried to learn how to play. Then of course, The Beatles came on to Ed Sullivan. That changed everything; we threw the acoustic guitars away, bought electric guitars. This amp here, I bought it in 1963.

Brady Huggett

Oh, really? Oh my God.

Joseph LeDoux

Fender Deluxe. That’s the guitar I had, my first guitar.

Brady Huggett

This one right here?

Joseph LeDoux

Yes. From Sears and Roebuck.

Brady Huggett

Wow, man. You were in some bands in high school, too, yes?

Joseph LeDoux

Yes. We had a couple of bands. I can’t remember the first one, but the second was called The Countdowns.

Brady Huggett

The Dead Beats.

Joseph LeDoux

Oh, The Dead Beats, I think.

Brady Huggett

Right? Those sound like punk bands to me.

Joseph LeDoux

All we knew it was like how to — We weren’t good enough to play like The Beatles. There was another man that could, but we could do The Stones; we could do simple blues things.

Brady Huggett

You were actually, were you playing shows around town? It could be, in a bar, I get it.

Joseph LeDoux

Yes, we played a couple of things here and there. Probably, we were together for two years, we probably had two shows. All right. We practiced a lot.

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Brady Huggett

Yes, you practiced a lot. You thought about the shows. I feel like there's probably some expectation that you might take over your father's business or your family's business. Was that the idea?

Joseph LeDoux

That was the idea at some point. In high school, in addition to, I'll get to the other part, but in addition to having a band, I was a disc jockey on the local radio station in my senior year. One of my highlight moments of life was, radio stations would arrange for bands or groups to come through town and play at the National Guard Armory. One of the performers was Percy Sledge. His big hit was, "When a Man Loves a Woman." I was backstage with Percy; it was really cool. He's about to walk out, and he hands me his pint of whiskey out of his back pocket. He says, "Have a sip." I got to drink out of Percy Sledge's bottle just as he went and played —

Brady Huggett

That's pretty amazing.

Joseph LeDoux

Yes, that's right. Louisiana is a wild place. You could drive up to liquor store windows, drive-in windows, as a 15-year-old in a car because you had a driver's license at 15, and like a high ball whisky on the rocks or something, and drive off with that. Adults would do that too. That was how —

Brady Huggett

It's funny, were you allowed in a bar at 15? No.

Joseph LeDoux

Yes.

Brady Huggett

Oh, you were?

Joseph LeDoux

You weren't supposed to be allowed, but there were bars who could do it.

Brady Huggett

Obviously, you can drive up to a package store and then buy booze itself, but —

Joseph LeDoux

Yes, but —

Brady Huggett

— not handing you in a glass to drive away, yes.

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Joseph LeDoux

Louisiana is so lawless. There were no counties. There were just parishes, right?

Brady Huggett

Yes.

Joseph LeDoux

Each parish had a sheriff to keep things under control. The sheriff of St. Lambert Parish was named Cat Doucet because he ran the cat houses.

Brady Huggett

That's a great name.

Joseph LeDoux

Anyway, so yes, I went to college. The year I was supposed to go to college, LSUE Junior College opened up in Eunice. My mother was begging me to go there because it was cheaper.

Brady Huggett

And closer, yes.

Joseph LeDoux

And closer. She just didn't want me to go to LSU because she saw where I was headed as a teenager. I was getting a little wilder and just doing things she wasn't happy about. She really wanted me to stay there. I said, no, I have to go to Baton Rouge. It's just —

Brady Huggett

From what you've told me, the wilder Joe LeDoux is just maybe getting a cocktail and playing in bands. You weren't like a — well, I don't know.

Joseph LeDoux

Yes, no, I wasn't doing anything.

Brady Huggett

Lifting cars or —

Joseph LeDoux

No, nothing like that, but compared to where I started.

Brady Huggett

Back when you were going to be a priest, this is a big change.

Joseph LeDoux

Yes. There was one incident that there was some event near Lake Charles, Louisiana, a football game or

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something. Everybody went on the bus, but I drove my car. My parents didn't know that I was doing that. Somebody saw me in the car and told my parents and so they were pissed off about that. That's about as wild as it gets.

Brady Huggett

She wanted you a little closer.

Joseph LeDoux

She wanted me closer.

Brady Huggett

You wanted to go to LSU.

Joseph LeDoux

We came up with an agreement that I would come back to Eunice and be a banker and go study business at LSU and be a banker and come back to Eunice.

Brady Huggett

Did you like that plan?

Joseph LeDoux

I knew it was never going to come to pass.

Brady Huggett

But you agreed to it?

Joseph LeDoux

I agreed to it.

Brady Huggett

All right. When you did go to LSU, what were you thinking about? If you knew you weren't coming back to be a banker, what were you planning on getting out of education?

Joseph LeDoux

I wasn't thinking about anything. I was thinking about being in a fraternity and going to parties and having a good time. I think I had a D average first semester.

Brady Huggett

Because you were partying and not paying attention.

Joseph LeDoux

I wasn't doing much studying. That didn't go over very well at home. Maybe I got it up to a C the second

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semester. I was not a great student. I was studying business, and it wasn't very hard. You could quickly read the night before, stay up all night.

Brady Huggett

Get a D.

Joseph LeDoux

There was a doctor in the student infirmary that was giving out dexedrine to students that would go in and say they wanted to lose weight. Everybody was using it to stay up all night to study. I was just having a good time.

Brady Huggett

Well, something changed.

Joseph LeDoux

Yes, at some point, I was studying business.

Brady Huggett

You still are, right? You're studying business with this false promise.

Joseph LeDoux

Then I had a girlfriend, Penny Bolins from Opelousas. She was much straighter. I was in love with her. We would probably get married, but I wasn't toeing the line well enough for her. She wanted an upright guy that was really good in business. I tried to clean up. I think I ended up graduating with a B-plus average or something like that. I was on the dean's list.

Brady Huggett

Yes, you've come a long way, then.

Joseph LeDoux

Yes, but then we broke up because she didn't think, she could see that I was trying, but it wasn't going to work, which is OK. That was the summer of, I would say, probably summer of '69, and that was also when all the shoes were taken off, your hair was being grown long, smoking pot, everything was happening. I was no longer worried about Penny Bolins; I had other things on my mind.

Brady Huggett

When you graduated from LSU, what did you do? I actually don't know this.

Joseph LeDoux

I guess it was my junior year at LSU that the first military draft was started, and they put birthdays in a bowl and drew them out, and I was number 12, so I was headed for Vietnam. My father knew someone who knew someone who knew someone, and so I had a meeting with the governor, and he helped me get into the National Guard.

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Brady Huggett

You were in the National Guard?

Joseph LeDoux

In the National Guard.

Brady Huggett

For how many years?

Joseph LeDoux

The National Guard you do six months in the regular Army in basic training, and then every weekend for five years or something.

Brady Huggett

You went to boot camp; you did all that, and then you were in the Guard while you, I don't know, worked?

Joseph LeDoux

After boot camp, I came back and did a master's in marketing.

Brady Huggett

You did? In marketing?

Joseph LeDoux

Yes.

Brady Huggett

Is this, you're working with Rob Thompson, is that right?

Joseph LeDoux

Bob Thompson.

Brady Huggett

Bob Thompson, well, Robert, right?

Joseph LeDoux

Yes.

Brady Huggett

You had taken some sort of class almost by accident, right?

Joseph LeDoux

I took his class by accident, because it was called Learning and Motivation, I thought that was relevant to psychology.

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Brady Huggett

To you and Penny, actually, yes.

Joseph LeDoux

This guy was studying rat brains and memory, and making lesions in the brain, and I didn't know you could do that. I just fell in love with it, and so I said, this is what I want to do, and he wrote letters for me, I got in at Stony Brook and nowhere else. I studied my butt off to get in using the — I said, well, if I can do well on the psychology GRE exam, maybe they'll let me in.

Brady Huggett

At Stony Brook?

Joseph LeDoux

I applied to 12 places, and Stony Brook's the only one that accepted me.

Brady Huggett

When you meet him, and he's doing this work on rats, did you think, all right, the rest of it, forget it, I actually want to do research.

Joseph LeDoux

Yes.

Brady Huggett

Why did that, have you thought about that, like, why that click happen so fast?

Joseph LeDoux

I really didn't like marketing; it was definitely not cool at the time. No hippie wanted to be involved in marketing research. I had written to B.F. Skinner about trying to use some of his ideas in the pursuit of consumer protection, but he misunderstood what I wrote and wrote back a nice letter saying, "Well, I don't feel my work should be used to make people buy stuff," which is not what I wanted, whatever, but I was so happy to get this letter. It was just, I just didn't like what I was doing. We had a friend who was older and the guru of our little hippie group, and he was studying philosophy and had all these wise ideas, and we were smoking pot and really enjoying the wise ideas. I just kept trying to impress him by studying psychology. I think that's what it was all about.

Brady Huggett

That is the wise ideas, the deep thinking, psychology, rat brains, that is all the brain and how it works, and what it's capable of doing. Something about that turned you on?

Joseph LeDoux

Yes, absolutely.

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Brady Huggett

You liked that idea?

Joseph LeDoux

I just love the possibility of being able to actually study the brain. It just was fascinating.

Brady Huggett

You get this masters; I think you published a paper too before you —

Joseph LeDoux

Yes, we published several papers together. I was basically very low-level assistant. He had no real reason to put me on the papers, except kindness.

Brady Huggett

That helped. You apply, I don't know, Joe, were you applying to like, "I'm going to try Harvard and also try SUNY," or no?

Joseph LeDoux

No, it was more realistic, kind of some southern schools and in University of Tennessee, University of Florida, maybe British Columbia because everybody wanted to go to British Columbia at that time anyway, so I applied there. The only place I got in was at Stony Brook because Thompson knew someone there, and so that paved the way.

Brady Huggett

All right, so you also have to tell your parents that you're not going to run the butcher shop and you're not going to [crosstalk] —

Joseph LeDoux

Yes, they saw the writing on the wall.

Brady Huggett

It was fine. Had you ever been to New York state, even?

Joseph LeDoux

No.

Brady Huggett

That's a big change. You didn't mind?

Joseph LeDoux

No, I had this fascination with New York from watching all the old noir crime movies and stuff. Also, I had a cousin that lived either in the Bronx or Brooklyn, I forget where.

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Brady Huggett

Oh, you did?

Joseph LeDoux

I did call him once when I got here, but he was not very — he didn't say, "Oh, great."

Brady Huggett

He wasn't like, "Come on in."

Joseph LeDoux

Said, "OK, yes, good."

Brady Huggett

I'm glad you're here, whatever. You never met him?

Joseph LeDoux

No.

Brady Huggett

The person that Bob Thompson knew at Stony Brook, did you work under that person for your Ph.D.?

Joseph LeDoux

No, that person hooked me up with someone else, and it was not what I wanted to do. I didn't go to New York to study marmoset play behavior. I wanted to study the brain. I had a friend, a graduate school friend that I'd just met the first couple of weeks who was working with a guy named Mike Gazzaniga on split-brain research.

Brady Huggett

For epilepsy?

Joseph LeDoux

He was actually doing split-brain pigeons, this guy, and so I said, "Wow, that sounds cool. Can you introduce me to him?" He said, "Sure." He introduced me to Mike. Mike was a pretty conservative guy; I had long hair. He said he didn't like the way I looked, but he would let me work at his lab. [chuckles]

Brady Huggett

He had long hair?

Joseph LeDoux

No, I did.

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Brady Huggett

Oh, you had long hair. He took one look at you and said he didn't like it. Yes, but you guys had a long working relationship. You won him over, I guess.

Joseph LeDoux

Yes. No, what happened was he said, "Write me a proposal." I went back to my room, wrote a two-page proposal about what I might do on split-brain monkeys in this case.

Brady Huggett

Which is what?

Joseph LeDoux

I was going to study most of the split-brain research had involved communication of sensory information in the back of the brain, but I was interested in the prefrontal cortex and how higher thoughts might be transmitted between the prefrontal cortex on the two sides. We were going to do that in monkeys. I wrote this two-page proposal and brought it to him, and he said, "Oh, you write pretty well; you want to revise my book? It's due for revision." It's like, I'm two weeks into graduate school, right out of business, and he says, "You want to revise my book?"

His book was called "The Bisected Brain," and it's about the split-brain work he did at Caltech as a grad student. I made some feeble effort to try and start doing that, but right about then Mike said, "Why don't you join me on the human split-brain work, because it's a rare opportunity, and you'd probably get something out of that." That's what we did. He had a new group of patients at Dartmouth that were being operated on and studied up there. What we did is we took a little camper trailer and turned it into a Tesla. We'd drive it up there behind a truck and drive up to people's homes and put them in there, flash some stimuli. If you flash it to the left visual field, we go to the right hemisphere, so the left hemisphere can't talk about it, but normally the left hemisphere is where all the talking gets done.

Brady Huggett

Right, that's where language lives.

Joseph LeDoux

We did a bunch of experiments, one of which ended up being one of the things that Mike always talked about after I left, and it was beginning of a new approach where, in the past, people were asking basically what happens when you split the brain, but here we were asking a different kind of question: What does it mean for us? Instead of rewriting the bisected brain, we ended up writing a book called "The Integrated Mind," based on my dissertation work and the other studies that we were doing at the time. The basic idea was that the split-brain is interesting in and of itself, but it can tell us stuff about how our minds work as well.

Brady Huggett

Exactly, right. I don't know where this happened, where this came in your timeline, but you did this rat study and you're going to have to explain to me, you had conditioned these rats to, I think you'd play them a sound and then they'd get a shock.

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Joseph LeDoux

Yes.

Brady Huggett

They'd been fear-conditioned in this way. You then, I think maybe split their brain, played the sound, but they'd been rendered functionally deaf, so they couldn't hear the sound, but they still had a fear response.

Joseph LeDoux

Not quite right.

Brady Huggett

Take me through that.

Joseph LeDoux

Let me wrap up the human split-brain because then it'll make the rat thing make sense. We had this one experiment where we presented two stimulus simultaneously. The left side stimulus, in other words, left side of space, goes to the right hemisphere, right side of space, goes to the left hemisphere. As long as you're staring at a dot. The right side picture going to the left hemisphere was a chicken claw. The left side picture going to the right hemisphere was a snow scene. The two hands go out, the left hand points to a shovel, the right hand points to a chicken. You say, why'd you do that?

The left hemisphere says, "Well, I saw a chicken claw, so I pointed to a chicken, and you need a shovel to clean up the chicken shed." The shovel was pointed to by the left hand, right hemisphere, because the right hemisphere saw a snow scene, but the person that's talking to you, the left hemisphere, made a story up to make the chicken and the shovel go together. What we would do is we'd do all these studies quickly during the day, because these guys were living in Vermont or wherever, and we'd have the camper trailer there. Then we'd go back to the bar at night and have a few whiskeys and discuss events of the day.

Brady Huggett

Talk about the events, yes.

Joseph LeDoux

We had this discussion about what this meant. I was very naive and all in all of this at that time, and Mike really probably had most of the ideas, although he credits me for some of the big ones, [chuckles] but that's very generous of him because I didn't know what I was doing most of the time. The idea in our conversation that emerged was that this is something we do all the time that we behave, and then we interpret and build that into the scheme of psychology that's going on in your head at the moment. The basic point was that if you see yourself behaving in a way that you didn't control, then that is a source of discordance or cognitive dissonance, and you need to correct that in some way, and the way you correct it is by re-narrating why you did what you did.

If you're in a tense moment with your partner and you say something, and as soon as it comes out of your mouth, you didn't mean to say that but you said it. You either rewrite that as a narrative by saying, "I

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apologize,” or you dig in, depending on your mood, and make it go on and pretend that it was real. Basically, the idea was that emotion systems might be the systems in the brain that most need these kinds of narrative explanations, working unconsciously generating behaviors. I decided I wanted to study emotion systems and that it would be perfectly fine to do that in rats because the rat and the human brain subcortically is pretty much the same.

I started using the old Pavlovian fear conditioning paradigm, tone plus shock. The rats then freeze; their blood pressure and heart rate go up, and the stimulus is very precise. The responses are very precise as well, so you’ve got a good stimulus, a good response. Then it’s just a matter of connecting the dots in the brain. Eric Kandel had tried to study memory in the hippocampus in mammals in the late 1950s after Brenda Milner discovered patient H.M., but he felt that the circuitry was too complicated so he went to aplysia, invertebrate animals where there were fewer neurons and you could learn a lot more from those few neurons. I felt with this simple procedure, it might be possible to do what he did in the aplysia in a mammal, which is to trace the sensory information all the way through to the motor response.

Brady Huggett

Right.

Joseph LeDoux

Fortunately, there were new techniques coming along at that point, techniques for tracing pathways in the brain. You inject a chemical into one area of the brain, and it’s picked up and transported down the axons to the other area, so you could figure out the whole mapping of circuitry that way. Within, I would say, four or five years, we had some of the basic information down about how information comes into the sensory system, gets to the amygdala, and then goes out. We didn’t have it all down, but pieces were falling together like that. Within seven or eight years, the whole picture was pretty well known. The question you were asking about didn’t involve split-brain rats, but what we did was we found that if we lesion the auditory cortex then —

Brady Huggett

That’s right.

Joseph LeDoux

Here we’re about to start doing the tracing, following the stimulus all the way through the brain. Do we start at the ear and make the animals deaf? That seemed ridiculous because deaf animal’s not going to respond. We start at the auditory cortex, the endpoint of the pathway.

Brady Huggett

Now this makes more sense.

Joseph LeDoux

We lesion that bilaterally and the rats still learn. That was mind-blowing to a lot of people in the field, because everyone thought you needed to process information in the cortex for it to be meaningful, but here we were just sending it directly. We were showing that it would go directly. It could be done without the

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cortex. Where was it being done? Well, we injected the tracer into the auditory thalamus, which is the way station to the cortex. Of course, the tracer went to the auditory cortex, but it also went to the amygdala and to some areas of the hypothalamus and other areas and the caudate nucleus. We lesioned all the areas that we found connections to, and the only one that had an effect was the amygdala.

Now we had a sensory input to the amygdala, and that got the attention of a lot of people. The psychoanalyst loved it because it meant having an unconscious kind of control of behavior. Dan Goleman, who famously wrote “Emotional Intelligence,” based on the work I was doing, basically, but really based on the article he wrote in 1989 for the *New York Times*, beginning of the *Science Times*. He wrote an article called “Brain’s design emerges as key to understanding emotion.”

It was all about the subcortical pathway to the amygdala. That became his whole amygdala-hijacked model in emotional intelligence. I like to say that I think that if he hadn’t written about my work, I wouldn’t have gotten as far as I did, and he wouldn’t have gotten as far as he did with that. It was a good kind of — Some people said, oh, he ripped you off in the book? No, he didn’t rip me off.

It was all published information, but he really, really helped. I wrote my book, “The Emotional Brain,” in 1996, and that put me on a different scale because it wasn’t that cool to be writing books for laypeople at that time. You had people like Steven Pinker that were getting away with it, Daniel Dennett, Mike Gazzaniga, but I was still relatively young. I was a full professor then at NYU.

Brady Huggett

Right. By then you had gone from SUNY Stony Brook, you had followed Gazzaniga to Cornell, yes?

Joseph LeDoux

That’s right. Actually, I was hired at Cornell before Mike-

Brady Huggett

Oh, I didn’t know that. OK.

Joseph LeDoux

-by Fred Plum, who was the most famous neurologist in the world at that point. He was neurologist to the Shah of Iran. Maybe that makes him the most infamous neurologist, but anyway, he was a very scary guy. Every morning you’d have to go to morning report, where the residents would show up, and I was his postdoc, so I had to show up. There was not a day that would go by where the resident who spoke at that meeting, left in tears. The guy was really tough.

Brady Huggett

Every day he’d shout at someone until they cried.

Joseph LeDoux

Yes, just tear them apart with their presentations, trying to toughen them up.

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Brady Huggett

That's fun.

Joseph LeDoux

At the same time, roughly the same time, right after I had received the offer from Fred Plum and written an NIH postdoc grant, Plum decided to hire Mike.

Brady Huggett

Oh, OK. You're an associate professor at Cornell?

Joseph LeDoux

At that point, I was a postdoc.

Brady Huggett

A postdoc, OK.

Joseph LeDoux

Then I stayed there for 10 years, went through the whole rigamarole. My first grant was in 1985 when I was still maybe a postdoc or something like that.

Brady Huggett

You just said an interesting thing that Pinker was getting away with writing books back then for the laypeople. What did you mean by that? Meaning that no one read science books back then or?

Joseph LeDoux

It wasn't that scientists — Your colleagues didn't like it that you were writing. It was viewed as cheesy or sleazy or something.

Brady Huggett

Below an academic almost.

Joseph LeDoux

Right. It was not worthy of an academic to do that kind of thing. I'm exaggerating a little bit because there just weren't many people doing it.

Brady Huggett

This is your fourth book that's out now or your fifth book?

Joseph LeDoux

Fifth.

Brady Huggett

I want to ask this because you just were talking about the amygdala and I heard you on something else and

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you were saying you had shown that fear is processed through the amygdala, right? The media seemed to take it as fear was created in the amygdala.

Joseph LeDoux

Well, fear the experience, yes.

Brady Huggett

It's almost like you've been trying to reset that narrative ever since.

Joseph LeDoux

Yes, again, I felt kind of imposterish through a lot of this work because I had no scientific background. Even in graduate school there were no courses. It was just on-the-job training stuff. Then when I went to Cornell in the neurology lab run by Don Reese, they had all these tools. I spent a year learning anatomy, a year learning physiology, a year learning molecular biology. I learned everything in the process of doing an experiment.

That gave me an edge, but I didn't have all the background that other people did. No math training at all. Everybody says they feel somewhat of an imposter in their field, but I really do feel I had a reason to feel that. I didn't want to rock the boat too much, but I just felt I had to do what I had to do. I also needed to get out the message from the split-brain work that consciousness is an interpretation of a situation, a way to make you feel like you are a unitary entity that you're not like a bunch of things happening all the time, but that you are in charge of what you do.

That was the thing I wanted to get across. The whole idea of the amygdala being a fear center, I talked about it as an implicit unconscious fear processor but everybody thought of it as just fear. It didn't take hold the way it did in memory where you have implicit and explicit memory. I tried the implicit-explicit distinction, but nobody wanted to bother with that. It just became fear. That was true of scientists as well as the press. It wasn't one side of it.

Brady Huggett

What can you do about that, once the work is out there?

Joseph LeDoux

Once the cat is out of the bag, you can't get it back in, the same with the meme. I've been really, really working hard since 2012. I wrote a paper called Rethinking the Emotional Brain, saying the amygdala is not a fear center. It's a place in circuits in the brain that detect and respond to danger. These are survival circuits. They are in every animal with some kind of circuitry. Invertebrates don't have an amygdala, but they have their own survival circuits for detecting and responding to danger, acquiring nutrients, balancing fluids and ions, thermo regulation, and reproduction. Those are essential survival circuits. If you look at it, you can trace that all the way back to the beginning of life.

Brady Huggett

There's two things that I wanted to ask about from your work that I — Well, I think I understand them. I think I know what you're going to say, but I want to ask. The first one is, you had a quote some place that your

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memory is only as good as your last memory. My understanding of that was that because of the narrative thing that you're just talking about. If I see something and I recall it five years later, I'll have applied a narrative to it, and it may or may not be actually accurate.

Joseph LeDoux

That's a very good interpretation, but that's not what the —

Brady Huggett

OK. Take me through it.

Joseph LeDoux

We were doing some work in my lab starting in 2000 on something called reconsolidation of memory. Karim Nader was a very bright postdoc who discovered that in — or rediscovered it in — my lab, and it became a big deal in the field because the conventional view was that when you form a memory, you always go back to that memory. You retrieve the same memory every time. The reconsolidation idea was that every time you take a memory out, you have to restore it in order for it to persist. When you restore it, you have the opportunity to verify it or to change it. Sometimes it changes in a way that is consistent with the original, but other times it can diverge from the original memory.

Brady Huggett

OK. That's almost like the more often I tell a memory, it changes over time. I pull it out, I add an element, I put it back. I pull it out —

Joseph LeDoux

When we were doing this, I found this story, and I lost where it came from, but there was a story of this war hero that had 100 city tour, and the first city, it's rather blase, but by the 100th city, he's this gigantic hero. He has done all these amazing things that he wasn't doing on day one. It got embellished, it got improved every time he said it. It just changed. There are famous examples where people will go to court to testify about something they witnessed in a crime, and instead, they talk about what they read in the newspaper because that got reconsolidated into the actual memory. That's why they have to be very careful in sequestering witnesses.

Brady Huggett

Yes, exactly. This other thing that I think you've talked about it, and I have this feeling that you get a lot of pushback on this, it deals with consciousness and animals. I think particularly people probably push back on — you have said that we know that we're conscious for all these reasons, and animals might have consciousness, but we cannot prove that they do. They don't have language, so we don't know, their brain is not the same as ours, etc. I think people probably feed you anecdotes all the time. "My dog did this. I saw my cat did this. This is how I know that they have consciousness." Is that accurate? Your new book, you have a chapter called something like, "What Conscience Might Look Like in Animals."

Joseph LeDoux

Here's the deal. When we started doing the split-brain work in the '70s, I was thinking of consciousness in

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terms of working memory because that was the mega concept of cognition at the time. Working memory was a place where you could hold information in mind while making these interpretations, and so forth, that we were talking about. A lot of human experience, because we can talk about it, we can share it socially. It's a big part of human experience.

I got a little too stuck, I think, on the language component at the very beginning, and on the working memory component because working memory involves areas of the prefrontal cortex that only primates have, like dorsal lateral prefrontal cortex. It narrowed my vision about how other animals might be conscious. I'd say maybe five or six years ago, I began to see things slightly different. I started using a partition of consciousness that Endel Tulving had offered, which was that you have auto-noetic consciousness, which is consciousness of yourself, being self-aware, noetic consciousness, which is awareness of factual and conceptual knowledge, and anoetic, which is a little harder to explain, so I'm just going to hold that on the table for a moment and come back to it.

What he did was he proposed that one of the virtues of his model is that each is associated with a kind of memory. Auto-noetic is associated with episodic memory, your memories of your personal past. That's why you can use episodic memory to construct an immediate self-aware situation, because you're drawing upon what you are and what you know about yourself to generate that conscious experience.

Noetic consciousness, on the other hand, is about factual and conceptual information, so it's based on semantic memory. Because semantic memory depends on areas — because this working-memory version of semantic memory being integrated into a concept and used in decision-making behavior depends on working memory and does a lot on the prefrontal cortex, I couldn't see how other animals could have that kind of awareness.

Now, the episodic memory prefrontal connection is that the — Tulving and others have talked about the importance of episodic memory as a way of having these auto-noetic experiences because you can travel mentally to the past and future. That's a very special kind of experience that probably only exist in humans, maybe in great apes. Then we get to the question of how do we know, but certainly in humans. All of these things exist, certainly in humans.

Let's go now to the anoetic because that was the hardest to understand. Anoetic is based on procedural memory. Procedural memory is traditionally thought of as unconscious memory. How can you have a kind of consciousness based on unconscious memory? That bugged me for the longest time. Then I began to understand that what he was talking about was a fringe consciousness. Over the years, I had a lot of disagreements with the neuroscientist Jaak Panksepp about emotions and so forth, but through his work, I actually came to understand anoetic better.

He thought of anoetic consciousness as this fringe state. For example, the anoetic state of fear would be something that emerges in the amygdala. It's not quite conscious, it's fringe consciousness, so it's hovering there. He described it that way as this practically unconscious conscious state. The way to think about it is you walk into your apartment and you don't have to say, "This is my apartment." It just is. You know it because you've been there so many times.

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It's the same with your body. You don't have to say, "This is my body. It's my body." You know what it feels like because you've lived for however many years you've lived with that body. You've acquired, and to use a contemporary term, deep learning sense. You've learned all that information, and you're constantly learning about its changing and updating. That is who you are.

If all of a sudden when you walk into your apartment, you see books are turned over, chairs are misplaced, things are not right, from there, you go from anoetic all the way up to noetic so that you now have a semantic understanding. It's not just a feeling of wrongness as opposed to rightness, but now you have content about what's wrong, and because that's wrong, that bumps you up to autonoetic. Because it's you and you're worried about why this happened and what it is that's happened and how are you going to fix it, those three kinds of consciousness are really fundamental.

If we could understand more about them in the human brain, I think we could then extrapolate to other mammals because we've inherited all our stuff from them based on which kinds of circuits they have. For example, all mammals have medial prefrontal cortex. This is a granular, sub-granular, however you want to call it. There's no granular layer that typifies the granular prefrontal cortex that's so important for human cognition.

If let's say that the anoetic kind of consciousness, and I believe there's some evidence for this, is dependent upon this medial prefrontal cortex, default mode network, all that kind of stuff in the human brain. We know that all mammals have that kind of cortex. They could have this kind of anoetic consciousness of knowing when things are safe and not safe, in other words, right and not right, who is friendly and who's not friendly, what to eat, what not to eat. If you start to eat something, and you taste it and it's not right, then you stop eating. Not necessarily because you're, "Oh, it's bad." You have this feeling of not rightness, but they don't have anything to bump it up to.

They're stuck in that not rightness and rightness mode of consciousness. Whereas other primates have the conceptual and semantic knowledge and the working memory that allows them to put all that together into content, because there's no content in anoetic. It's just more of a raw feel kind of thing. The noetic is content-rich. Then the autonoetic, of course, is content-rich about yourself, based on episodic memory. If we had a better sense of what each of these things does, we could extrapolate from dorsolateral prefrontal cortex to monkeys for this kind of noetic consciousness. It would also involve interactions with medial temporal lobe memory systems, obviously, because you need that for the memory of the somatic memory and so forth.

Brady Huggett

It's almost like you've changed your thinking. Also, when I read your earlier work, it wasn't that you were saying animals do not have consciousness. You're saying, I just can't prove that. Now what you're saying is, it might be possible to prove that they have some level of consciousness.

Joseph LeDoux

I don't know if you can prove it, but I think it's –

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Brady Huggett

Extrapolate.

Joseph LeDoux

Extrapolate, because a lot of the work in animal consciousness goes from the point of dead certainty. It can't be any other way. It's just so clear from watching the behavior that it has to be. What I'm trying to say is, let's be a little humble and say, maybe, because that's pretty good. It still allows you to treat animals in the proper way and to have animal welfare if we can make those kinds of extrapolations, but at least it's based on something.

Brady Huggett

Two quick things, and then I'll let you go. First one. You've closed your lab at NYU. Do you consider yourself in retirement?

Joseph LeDoux

No. I closed my lab because I thought I'd basically done what I — I don't know. I couldn't see what else I could do at this point, because it's such a challenge to raise money, and I thought it was a good time. I still have a couple of grants that I'm just winding down. I thought it was a good time to just say, OK, let's just shut that down, because I'm really — The truth is, over the last few years, I've gotten much more interested in the big-picture, conceptual issues of neuroscience than in the minutiae of data.

That's nothing wrong. We need data in the system; I'm not criticizing that at all. It's just that at some point in your life, you move to a different set of concerns. I've been at this for 50 years, and I think I have a perspective that I can offer. Maybe not everybody will like it, but maybe some people will like it. I think it's useful to have these big-picture things to evaluate. You can reject it if you want, but at least there's some synthesis. That's what my new book, "The Four Realms of Existence," is about. It's really about how there are these four ways that we exist. You can think about it as different kinds of animals being stuffed into the human brain, but I'd like to think about it that way.

It's that we have inherited a biological realm of existence, and the nervous systems evolved by moving forward components of that biological organism, biological kind of organization of cells, into a system that could rapidly and more efficiently respond to the things that the cell needs to stay alive, where the cell are the cells, multicellular organism, to stay alive. For example, cells have visceral and somatic components. The visceral components would be things like metabolism, the somatic would be the cell membrane that is negotiating with the outside environment. Nervous systems came along, and the somatic and visceral partition was carried forward into the nervous system.

There's a guy named Romer who in the 1970s, well actually in the '50s, first proposed this idea that the central and peripheral distinction that we all love so much about the brain, he says it's really secondary. It's not the most fundamental. The most fundamental is visceral and somatic. Within that, you have central and peripheral components. It's the visceral and somatic that connects us to the biology out of which we evolved and allows the nervous system to have components that are visceral and somatic. I had made a diagram in

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my book, my latest book, of the fear conditioning, what I now call threat conditioning circuitry, where you have the amygdala getting inputs.

Then I had a set of pathways going out of the central amygdala to control physiological responses like heart rate, blood pressure and so forth, hormone release. The second set of pathways going to control overt behavior. When I looked at that the other day, I said, well, these are the visceral and somatic pathways. It's so perfectly illustrated by the amygdala outputs like that. You've got the biological level of existence that is completely entwined with the neurobiological because the neurobiological evolves as a variation on the biological. The neurobiological has expanded to allow cognition. That means that we have a bunch of things that happen in the neurobiological that we'll call mirror neurobiological.

That includes reflexes, fixed-action patterns like instincts and so forth, and habitual behaviors. In the cognitive realm, we have those core kinds of behaviors there. We also have, on top of the mirror neurobiological, we have the ability to form internal representations of the world. Some animals do. Those internal representations then allow the animal to hold information in mind and make decisions independent of reflexes that are automatically being generated. One way to think about the difference between mirror neurobiological and cognitive is in terms of what's called model-based and model-free kinds of behavior. Model-free behaviors are stimulus response, stimulus bound.

Model-based behaviors require these mental models. When you have a mental model, that allows a much more efficient use of your energy and resources to solve your problems. The next realm, of course, is the conscious. In the book, what I do is I propose that all of the information in the world that we process, all of that is being packaged in circuits that are processing simultaneously. Those things are the raw materials out of which a complex conscious experience emerges.

You could have a conscious experience about looking at a picture of an apple on a screen that has no emotional content, but you could also have a conscious experience using the same circuitry about looking at a picture of some awful war scene where something really bad has happened. It's the same circuitry, whether it's purely cognitive or an emotional scene, but it involves more inputs when it's an emotional scene that is going to work you up.

Brady Huggett

I also want to ask, are you releasing any music for this book? You did that in the past.

Joseph LeDoux

No, I didn't. I couldn't figure out how to write music for "The Four Realms of Existence." I did for "Anxious." I've got a lot of music coming out.

Brady Huggett

You do? I was going to ask. Your band is still alive and going?

Joseph LeDoux

The Amygdaloids are an idea at this point. The guitar player had some hearing problems, and we hardly ever

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play live. Sometimes I throw together a fake Amygdaloids band for special events. I was in Leuven in Belgium, and they put together an Amygdaloids band for me to play some songs with, and they did that in Germany as well. Mostly what happens is I'll be invited to a lecture, and often this happens in Europe more so than here, and they'll ask me if I can bring the Amygdaloids. I say, no, but I'll bring Colin, and Colin's my duo partner where we play all the Amygdaloids heavy metal songs, but on acoustic guitar. We've been to Rome, Mexico City. We were just in Stockholm at the Karolinska Institute playing in the hallways and in classrooms and in pubs. It's been a great thing to be able to integrate my music with my work or my work with my music.

Brady Huggett

You have one, two, three, four, five, [crosstalk] those cases? Five.

Joseph LeDoux

I think there might be some guitars in some of those cases.

Brady Huggett

You have five, six, seven, eight guitars or something. Do you just get up and play in the morning because you enjoy it?

Joseph LeDoux

I usually write in the morning; then I work on music in the afternoon. You're cutting into my music time.

Brady Huggett

Yes, I better get out of here. Listen, this has been a lot of fun. Thank you very much.

Joseph LeDoux

It's been fun for me too.

[transition music]

Brady Huggett

I've been to Louisiana a handful of times, mostly New Orleans. Somehow that story he told about a musician pulling out a gun and blasting away at his guitar made me want to visit it again. I'm not even sure why it made me feel that way, it just did. Anyway, great interview, thank you Joe for having me into your recording room and for being a guest on "Synaptic." I should say too that a version of the Amygdaloids played at the Society for Neuroscience meeting in Washington, D.C. this year, and they still sounded pretty good to me.

OK, this episode will be archived on thetransmitter.org, where we also have a transcript, and the show can be found wherever you get your podcasts — Apple, YouTube, Spotify and whatever app you can subscribe there. If you enjoyed this and feel inclined to rate our podcast, please do so as it helps others find the show. If you'd like to comment on this show or whatever we do with *The Transmitter*, you can find us on Twitter, where our handle is @_thetransmitter. Some of the history on St. Edmund was taken from the school's website. Our theme song was written and performed by Chris Collingwood. The next "Synaptic" episode will be out on February 1st. That is it. This one is over, and I'll let the music play us out.

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[ending theme music]

[additional music plays]

Brady Huggett

That's a grim ending.