Rethinking Trauma

How to Use Brain Science to Help Patients Accelerate Healing after Trauma

the Main Session with

Daniel Siegel, MD and Ruth Buczynski, PhD

National Institute for the Clinical Application of Behavioral Medicine

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How to Use Brain Science to Help Patients Accelerate Healing after Trauma

Dr. Buczynski: Hello everyone and welcome. I am Dr. Ruth Buczynski, a licensed psychologist in the State of Connecticut and the President of the *National Institute for the Clinical Application of Behavioral Medicine*.

I want to say hello and welcome to my guest, Dr. Dan Siegel. He is a psychiatrist and a Harvard-trained clinical professor of psychiatry at the UCLA School of Medicine. He is Executive Director of the Mindsight Institute, as well as the author of many, many books and exciting works that we have had the privilege to talk about many times.

In this webinar we are going to get into some new ideas, and as we dig deep into the treatment of trauma, you will see what I mean as we go along.

So, Dan, welcome. I'm glad you're here. I'm excited and looking forward to this.

Dr. Siegel: Thanks, Ruth. It's a pleasure to be here with you once again, and it is always great to talk about new ideas.

How To Define What Happens in the Brain During Trauma

Dr. Buczynski: Let's start by talking about what is going on in the brain when a person experiences trauma.

Dr. Siegel: *Trauma* as a term is often used to mean an experience that is overwhelming for a person, and clinicians use *trauma* in different ways.

> "When we use the word *trauma*, we have to force that apart and say, 'What do we mean by *trauma*?'"

Of course, an emergency-room physician might talk about trauma as physically what happens to the body; a psychologist or social worker or psychiatrist in the emergency room might see it as an acute event that overwhelmed the person's ability to cope as a result of being in an accident or being sexually assaulted.

People use the word *trauma* in different ways.

When we use the word *trauma*, and you asked me what is going on in the brain, we have to force that apart and say, "What do we mean by *trauma*?"

Attachment researchers like me, look at how trauma happens developmentally. If there are overwhelming events that happen early in life, repeatedly and in an intense way – for example, neglect – then that would be considered a trauma to the developing brain.

So my question back to you, Ruth, would be, "What do *you* mean when you are asking me what goes on in the brain with trauma?"

We want to know which kind of trauma *you* mean – that's true for any clinician, whatever field they work in.

Think about, for yourself, what does the word *trauma* really mean?

What do you mean when you are asking the question, "What's going on with my patient, my client, the person in front of me who's been traumatized – what does that really mean? Why am I using that term?"

The Optimally Functioning vs. Traumatized Brain as Defined by FACES

Dr. Buczynski: Let's narrow it down to people who are experiencing an emotional trauma – or perhaps a physical trauma, as in abuse. Let's narrow it down in that way, as opposed to a trauma related to surgery.

Dr. Siegel: As we have talked about before, first of all, the brain is complex.

There are so many different parts to it as a complex system: there are a hundred billion neurons, there are trillions of supportive glial cells, and the overall system works by energy information flowing through its many differentiated parts.

When the brain is functioning well, those differentiated parts become linked, and in the linkage of differentiated parts, you create what is called integration. When the brain is integrated, it is optimally functioning.

> "When the brain is integrated, it is optimally functioning."

That is a summary of the entire idea of what it means when you are *not* traumatized.

When you are *not* traumatized, you are differentiating and linking your brain in the present moment – it **is**

"When you are not traumatized, your brain integrated in creating a flexible, adaptive and coherent flow that is energized and stable."

integrated in creating a flexible, adaptive and coherent flow that is energized and stable over time.

That process spells the acronym *FACES: Flexible, Adaptive, Coherent, Energized and Stable.*

Dr. Buczynski: Let's go over what that means. It starts with *Flexible, Adaptive . . .*

Dr. Siegel: *Coherent* is a mathematical term for something that holds together under dynamic circumstances over time – that means *coherent.*

Energized means the system has vitality to it.

Stable means it has an equanimity or equilibrium that it is able to bring to itself.

These are all related terms: *Flexible, Adaptive, Coherent, Energized* and *Stable.* They make up the acronym I made up – *FACES* – to help describe a complex system in its integrated state.

For me, FACES is what well-being is.

Before we get to the details of how old a person is or what kind of trauma it is or if the trauma is acute, one time only, or repeated or what adaptive mechanisms were in place before the traumatic event happened – and these are all absolutely crucial elements to answer your question, "What is happening in the brain?" – there's a more global statement to make.

And that global statement, as far as my reading of the research literature on trauma and the brain, is that trauma impairs integrative functioning in the brain.

With trauma in the well-developed brain, differentiated areas will not be able to link well.

Brain functioning will stop being flexible – it will become inflexible.

The brain will stop being adaptive – it will become maladaptive.

"Trauma impairs integrative functioning in the brain."

Instead of being coherent, it will be incoherent.

Instead of being energized, it could be depleted or excessively aroused – not functioning with an optimal amount of energy.

In terms of stability, it can have a strange instability – either repeating patterns that are recurrently dysfunctional, which from the outside looks stable, but the "stability" is recurrent dysfunction. We use the word *stability* to describe the healthy way in which this system has equilibrium.

"Re-integration is what repairs the brain."

All of that is the most global thing we can say about trauma, but there's also this: re-integration is what repairs the brain.

So, we really need to ask specific questions: what was the context in which the trauma happened, at what time did it happen – what was the developmental framework – and what was this person like before the event?

Trauma will affect the specifics of the brain depending on all of those factors.

"What time did it happen, what was the developmental framework, and what was this person like before the event?"

Dr. Buczynski: I appreciate you giving us the *FACES* acronym, and I want to say to practitioners, particularly those of you who are physicians or nurses, or occupational therapists, or physical therapists, if you have been working with someone and you find any of these traits different than what that patient has been like – *flexible, adaptive, coherent, energized and stable* – you could certainly look to see if there was some recent trauma.

This is especially true if you are a family physician or nurse practitioner who's been seeing a patient over the last twenty years, and something seems to be different, you might want to consider a single-incident, recent kind of trauma.

What Dan just gave us is useful for looking at someone who may be affected by early childhood trauma, or *any* past trauma. Would you agree, Dan?

Dr. Siegel: Yes. This would be applied to any kind of trauma, but when we get into the details of which areas of the brain and what is exactly happening, we do want to know more specifically what the person was like before the event and the meaning of the event to their life.

How Age Affects the Impact of Trauma on the Brain

Dr. Buczynski: To what extent does the age of a person affect how their brain is affected by the traumatic event?

"Age affects the impact of trauma on the brain in a huge way."

Dr. Siegel: Age affects the impact of trauma on the brain in a *huge* way. For example, if an individual is one year of age and certain structures in the brain are beginning to develop for the first time, the general developmental neuroscience rule is those regions that are developing have the most vulnerability if there is a trauma at the time of the window of development.

Neglect and/or abuse are the two forms of trauma that are called developmental trauma, with neglect being the absence of the nurturing that you need. Both neglect and abuse have huge impact.

Dr. Buczynski: Or you mother is hospitalized . . .

Dr. Siegel: Yes – and no one else takes care of you and you are put in a closet – I mean something severe like that.

If your mother is hospitalized, that is more like loss, which wouldn't be called neglect, but would be a kind of trauma. That is important – and we can talk about that, too – but neglect would be a severe lack of connection with *anybody*.

Neglect and abuse often include forms of physical abuse – being hit, sexual abuse, being sexually invaded and mistreated – and emotional abuse – being actively and emotionally torn apart, which sometimes overlaps with the term *verbal abuse*.

These active forms of neglect and abuse are events of overwhelming trauma, and they form the whole range of developmental traumas.

"The timing of developmental trauma is crucial because windows of growth are different during those different lifespan periods."

If a child is one and this happens, it can have one impact; if a child is four or seven and trauma happens, there is a different impact.

The timing of developmental trauma is crucial because windows of growth are different during those different lifespan periods.

If a teenager is traumatized, it will affect the brain in different sorts of

ways than if the same trauma happened to a forty or a sixty-year-old.

Trauma Leads to the Chemical Release of Cortisol and Adrenaline

Dr. Siegel: We want to know what areas of the brain are developing at the time of the trauma because those will be most vulnerable.

Why are they vulnerable? Because trauma, in general terms, leads to two huge chemical reactions.

One is the acute secretion of cortisol, the stress hormone; the other is the acute release of high levels of adrenaline, which, essentially, increases the encoding of what is called implicit memory.

> "Trauma, in general terms, leads to two huge chemical reactions."

Cortisol, in the acute phase, can lead to a blockage of the activity of the part of the brain called the hippocampus, which is very integrative of memory – and we can talk about that later on.

Cortisol, with extended periods of release, is neurotoxic. Neurotoxicity, in the developing brain, means that the regions trying to grow and establish synaptic connections may be inhibited in their growth – that would be one impact.

Cortisol secreted for long periods of time can not only be growth-inhibitory, but also neurotoxic, which means that it can destroy synapses that have already been established and kill existing neurons.

> "Cortisol secreted for long periods of time can not only be growth-inhibitory, but also neurotoxic."

That can happen especially during the developmental period, but it can also happen in the brains of combat soldiers. The hippocampus becomes smaller because, we think, the cortisol effects of chronic stress are neurotoxic.

Neurotoxicity, even in an adult, or at least in an older adolescent, can lead to damage to this brain region.

There's more that I could say about this, but I will just leave it at that for now.

Dr. Buczynski: So, trauma leads to two huge chemical reactions. One is an increase in cortisol, and we know how that affects – lowers or shrinks – the hippocampus, especially if it is continuous cortisol, over-stimulation of cortisol.

The other is an increase in adrenaline – and you said how that affects, I believe, implicit memory.

Dr. Siegel: Yes, adrenaline increases the encoding of implicit memory, which includes emotional memory – the fear of a dog that is attacking me, perceptual memory – the imprinting of the perception of the dog that is attacking me, and procedural memory – the memory for action, trying or wanting to run but not being able to take that action.

"Adrenaline increases the encoding of implicit memory."

These memories are all deeply encoded – they're standard, implicit forms of memory.

A fourth, that isn't studied so much but clinically is probably in the same category of implicit memory, is bodily sensation: the feeling – in my body – of the bite, of the teeth sinking into my muscles.

Bodily sensation is different from perception – it is a whole different circuitry.

"Bodily sensation, motor memory, perceptual memory, and emotional memory are the four basic building blocks of implicit memory."

Bodily sensation, procedural or behavioral memory**,** motor memory, perceptual memory – what I can see with my eyes or hear with my ears – and emotional memory are the four basic building blocks of implicit memory.

Adrenaline secretion during a trauma seems to increase the encoding, meaning the synaptic connections that are made at that time at this deep layer of implicit memory are stronger because of the presence of high levels of adrenaline.

In contrast, cortisol is blocking the hippocampus, which usually performs an integrative role after the age of about eighteen months, where, in my view, it takes the building blocks of implicit memory and assembles them into the explicit memory forms of factual memory – *I know the fact that the dog bit me*.

Then, this gets put into what is called episodic memory, which means putting *myself* in time – in an episode of an experience.

Clusters of episodic memory are called autobiographical memory, and that is another form of explicit memory, where, for example: *I feel a sense of the past. I am reminded of it, and there I was being bitten by a dog when I was three years of age.*

Explicit, autobiographical or episodic memory and explicit factual memory are created by the integrative hippocampus.

How Trauma Impairs the Brain's Memory Systems

Dr. Siegel: One idea I have been writing about for decades is that trauma impairs the brain's memory systems by blocking the integrative role of the hippocampus to take implicit puzzle pieces and weave them together into an assembled puzzle-piece picture of facts and lived experiences called explicit memory**.**

This proposal can explain virtually all the symptoms of posttraumatic stress disorder as well as explaining flashback phenomenon, which for me was so puzzling back in the eighties.

When I first made this proposal, I was a young trainee asking my supervisors to explain the flashbacks that my soldier patients, former soldiers in the VA, were having, and my supervisors just said, "Well that's interesting – we have no idea what memory is."

"Trauma impairs the brain's memory systems by blocking the integrative role of the hippocampus to take implicit puzzle pieces and weave them together into explicit memory."

Back in the late eighties I went to the brain literature and started not only reading it, but meeting with brain researchers like Larry Squire, for example, and made a proposal back then that somehow – we didn't know how – but trauma is likely blocking the hippocampal functioning, and that would then allow implicit memory – when it is laid down, untagged with a sense of the past.

If you could keep implicit memory in a pure, unintegrated form – that is if the hippocampus didn't link all of implicit memory together – you could explain not only flashback phenomena, but you could explain all the avoidance behaviors (implicit-procedural memories), the intrusive emotions, implicit emotional memory, intrusive bodily sensation, (if we put bodily sensation in that category), and the perceptions that flood people.

"If you could keep implicit memory in a pure, unintegrated form the whole syndrome of PTSD could be explained."

Basically, the whole syndrome of PTSD could be explained by the hypothesis, which when I made it, people thought was kind of nutty to even look to the brain to explain psychiatric conditions, but to me it made sense.

That was back in the eighties, and now we know. In the nineties, we found out that yes, the hippocampus is damaged in trauma.

After that, we found out that the integrative areas – the hippocampus, the corpus callosum, and the

prefrontal cortex – are the three integrative regions of the brain – circuits that link widely separate areas.

This finding supported the hypothesis from decades earlier that basically trauma impairs integrative growth and/or functioning in the brain, depending on its developmental period. Martin Teicher at Harvard University just recently established how that is true.

"Trauma impairs integrative growth and/or functioning in the brain, depending on its developmental period."

Why the Brain's Developmental Period Is Crucial to Working with Trauma

Dr. Buczynski: How did the research support the hypothesis that trauma impairs integrative growth depending on the brain's developmental period?

Dr. Siegel: He took people with documented developmental trauma – neglect or abuse – and did structural scans of their brains, and showed that, depending on the timing of the neglect or abuse – both neglect and abuse are under the general category of developmental trauma – neglect was just as, if not more negatively impactful, as overt abuse.

So we need to realize that the brain needs connection to other people, and severe lack of that – and I don't mean just, "Oh, let's not talk about your feelings," but I mean neglect – has the same impact, and depending on the timing or when that occurred, you would get corpus callosal damage, hippocampal damage, or prefrontal damage.

"The brain needs connection to other people."

It wasn't across the board – all of them, but those areas were particularly vulnerable because they were growing at the time.

If the trauma happened during the development of any one of the integrative areas, then that would be the integrative area that was either blocked in its growth or have cortisol damage to the neurons that were there.

Dr. Buczynski: Because it was being flooded?

Dr. Siegel: Yes, it would be flooding it – that is a good way to begin that statement.

Cortisol, especially to the hippocampus, hits certain receptors and then leads to apoptosis, which is literally

the destruction of neurons.

When I was in medical school – David Hubel taught me neuroscience, and during the time I was there, he won the Nobel Prize for showing what happened if you kept certain stimuli away from the brain – he was experimenting with kittens.

> "If the trauma happened during the development of any one of the integrative areas, then that would be the integrative area that was either blocked in its growth or have cortisol damage to the neurons."

He showed that the brain needed to have certain stimuli to grow well, and there were certain vulnerable periods.

The important thing, at least that I learned as a young student with him as my teacher, was the brain is not just driven by genetics – genes are really important in setting up the basic foundation, but experience then fills in the foundation.

If you deprive a brain of what it needs, that is a form of trauma.

> "If you deprive a brain of what it needs, that is a form of trauma."

I was very struck by that idea as a young student, and everything I did in pediatrics and psychiatry – child and adolescent psychiatry – and as a researcher in psychiatry was with that kind of lesson in mind.

In the eighties, I know that approach was weird, but because of my training, it was very natural to always turn to the brain as part of the story.

So for trauma and doing therapy with people who have PTSD, I was deeply, deeply committed to trying to use my training as a scientist to understand with an instrument I am trained in – the adult attachment interview – why unresolved trauma and resolved trauma were so profoundly different.

For example, two people who have both experienced "similar trauma" – if we can say that – one person did not resolve it and the other one did – their outcomes were profoundly different for experiencing the "same trauma."

As a therapist, I just became deeply committed to understanding what nature was trying to tell us about resolving trauma: what is needed to do it, what happens in the brain, and what happens in a relationship – all of these questions.

That is just a little background to where this kind of thinking went. Back in the day, this kind of thinking was

quite bizarre.

I guess I had some of my own trauma – it was very traumatizing, as a young student, to think in a certain way with everyone else thinking that I'm weird, and then it turns out – and maybe I *am* weird – but those ways of thinking deeply about science can actually contribute something to our knowledge base.

> "I just became deeply committed to understanding what nature was trying to tell us about resolving trauma: what is needed to do it, what happens in the brain, and what happens in a relationship."

Dr. Buczynski: Yes, absolutely. In fact, a lot of what we try to do here is combine the scientist/practitioner model.

It is not enough to have the science because if you don't apply it, it's not going to make a difference with our patients, but it has to be grounded in the science.

There are people on the call who will want to look up the people you reference, check some of the citations and go further with that research.

Dr. Siegel: Yes, and everyone I mention is in my books. If you look in *The Developing Mind,* 2002, the second edition, all of these references are in there.

Dr. Buczynski: Great. I would like to continue, but I would like to get us into memory, and maybe it would help if we contrast what is happening with memory when a person experiences trauma with the "normal" development of memory, and I want to focus on implicit memory.

The Layers of Memory and Encoding Implicit Memory

Dr. Buczynski: We talked about how trauma sets and encodes a lot of implicit memory. Just so people have a good sense of what that means, could we think of riding a bike and how that experience is encoded in an implicit way? Could you say more about that, Dan?

Dr. Siegel: Sure. If you read the memory-research literature, you will see it described in very different ways with different systems, but as you point out, Ruth, as clinicians, we need to *apply* the science.

In general, it is most useful, clinically, to think of these as layers rather than forms of memory.

You won't see it written that way in the research literature because it's not studied in that way, but for me – and I have been doing this for so many years – thinking about the layers of memory is a very useful way to teach clinicians and patients – it helps them to more fully understand it.

So what do I mean by *layers*? Even when we are in utero, we have implicit memory available to us for encoding.

"As clinicians, we need to apply the science."

In general, memory is the way an event at time one is going to change activity at a later time – the future**.** That is the simplest way of defining memory.

We know that in utero, during the third trimester of life, the brain is encoding experiences into implicit memory, storing them – meaning a change in synaptic strength, and then retrieving them – meaning that you are activating something and brain-firing.

Encoding, storage and retrieval are basically the way we believe memory of all layers happens.

Here is one way to think about the layers of memory.

Up until about eighteen months of post-birth age, you are only able to encode – that's for most human beings. I did have one patient who could encode from in utero in an explicit form, but most of us don't record anything explicitly until around eighteen months of age.

"Memory is the way an event at time one is going to change activity at a later time."

So what does that mean? It means that, when you look at development of the brain, the dentate gyrus, which is one area of the hippocampus, matures enough, probably from genetic encoding and around that age your hippocampus is developed enough to start taking – the four basic building blocks that we mentioned earlier of emotions, perceptions, bodily sensations, and motor movement and summarizing them together in what are call *mental models* or *schema* – that is another form of implicit memory.

The ability, the sixth part, is to prime the brain – get the brain ready to respond, based on these prior experiences.

So, the four building blocks (emotional, perceptual, bodily and motor memory), mental models, and priming are all part of the implicit layer.

"Encoding, storage and retrieval are basically the way we believe memory of all layers happens."

You and I, Ruth, as adults, are constantly encoding implicit memory. It never stops.

The key thing about implicit memory is you don't need to be paying attention, with consciousness, to encode things into implicit memory.

"The four building blocks (emotional, perceptual, bodily and motor memory), mental models, and priming are all part of the implicit layer."

The general public and even clinicians usually don't know this, but it's an incredibly important aspect of implicit memory.

With attention, which is the streaming of energy information flow, you have some attention in consciousness, called *focal attention,* and some attention that isn't in consciousness – like right now we are constantly bringing in energy information flow streams that we are not paying attention to consciously – this is called *nonfocal attention.*

Implicit memory is perfectly fine with nonfocal attention for its encoding.

The Retrieval of Implicit Memory and the Experience of Flashback

Dr. Siegel: Now, when you store implicit memory in these layers of the brain – distributed all around the brain – and then you retrieve an implicit memory – let's say when you are twelve months of age, and here is a second really important fact, the retrieved implicit memory doesn't have the feeling of coming from the past as it comes into awareness.

Implicit memory with feeling is what I call an *ecphoric sensation* – *ecphory* is when you go, "Oh, here's a cue from what is going on now, and here is something being activated so – oh, yes, that's coming from three years ago and I remember when we were at that restaurant.."

That will be the ecphoric sensation. You say, "Yes, you and I were at the restaurant three years ago – remember that?" And I'll say, "Oh, yes – we had those popsicles there." We would have a feeling of remembering the past.

"When you are twelve months of age, the retrieved implicit memory doesn't have the feeling of coming from the past as it comes into awareness."

Implicit memory, when it is in its pure, implicit-only form, has no ecphoric sensation – no feeling that, "This thing I'm experiencing right now is related to the past."

Pure, implicit memory is just in the here and now – so back to your bike analogy.

Every time you get on a bike, you are reactivating implicit encoding for pedaling, balancing, and steering. You're aware of riding the bike, so it's not the same as unconscious memory – you are perfectly conscious of riding a bike.

It is implicit only – you are not feeling: "I remember. I remember. Oh, yes, yes. My mom taught me how to ride a bike." No. You just ride the bike.

Throughout our adult lives, we're always accessing implicit memory.

"Pure, implicit memory is just in the here and now."

Now, when I am talking to you using my hands, or watching your facial expressions, these are implicit procedural memories and implicit emotional memories I have – and life is filled with them.

What often happens is a select amount of implicit encoding, that layer, is selected by the hippocampus because of its salience for our life or its importance to our survival – there are all sorts of reasons – and is integrated into factual memory, especially on the left side of the brain with the left hippocampus or into episodic memory, which gets clustered into groups called autobiographical memories, especially on the right side of the brain – the right hippocampal.

This factual memory and autobiographical memory set up a whole other layer of memory where, number one, you need focal attention – attention with consciousness – to encode it, and number two, when it is encoded, stored – which means those potential firing patterns are altered in their probability of their synaptic associations – and finally retrieved, like retrieved implicit memory, it can be unconsciousness – or not, either way.

So, it's not the same as conscious memory; they are both almost identical in that they are either retrieved in consciousness or retrieved outside of consciousness, but when it is retrieved in consciousness, then you have the ecphoric feeling, "Woah – here is the fact I learned before," or "Here's the fact – President Obama was the president for two terms. That's a fact and I know that, and I know it's a fact that I learned in the past."

Autobiographic would be – let's just say that I had lunch with President Obama – "Oh, yes, I remember he had a hamburger and I had a salad when we had lunch together that cold, January afternoon." That is autobiographical memory because it would be a time in the past of me, and I would have a feeling that I am recalling it now.

Dr. Buczynski: As opposed to the feeling that it is *taking place* now.

Dr. Siegel: That's right. If I had trauma around having lunch with him, I would just see the hamburger and I would see his face and I would think he was right there with me, and you would say, either I am in a flashback, or I have become psychotic – because President Obama is not here with me.

The activation of implicit-only memory can explain flashback phenomena, maybe even hallucinations – I don't want to go that far because I don't know the research on that – but certainly implicit memory and trauma is a way of explaining the profile of an unresolved, posttraumatic condition.

Dr. Buczynski: What you just explained is the experience of flashback: when a person is in a flashback, they don't know they are in a flashback.

Dr. Siegel: Yes, exactly. It is rich and full**,** and it is implicit-only memory just consuming you in the present moment.

"The activation of implicit-only memory can explain flashback phenomena."

Putting the Science into Clinical Practice

Dr. Siegel: I just have to say that what was so powerfully emotional for me in learning this – and there are all sorts of studies I cite in *The Developing Mind* about this – was to realize that science has so much to offer us as clinicians.

Back in the eighties, I'd say, "Wow!" I wanted to go to my supervisors as a young kid and say, "Hey, let's read the scientific literature and translate it for clinical application," but for some reason my supervisors weren't trained to do it or they didn't like to do it, or they didn't feel comfortable, but for me, as a scientist becoming a clinician, I really wanted to bring those two worlds together – and it was useful.

People often say, "Oh, you want us to learn about the brain. It's useless." I have had so many senior clinicians say that to me, and I say, "Why do you think it's useless?"

They say, "Everything you could do that you are saying to do, in psychotherapy, you could do without knowing *anything* about the brain."

And I'll say, "Well, here is one example" – and this is the example of implicit versus explicit memory.

I remember in 1991 when I first gave a talk on this at the American College of Psychiatrists. Eric Kandel was on the stage with my research mentor, Bob Bjork, and a person who I had been consulting with, Larry Squire.

The three of them were on the stage, and a person in the audience raised their hand and said, "Can you please explain posttraumatic states and flashbacks?" None of the three could. Only Eric Kandel was a clinician, but they said they couldn't.

The moderator who was running the meeting knew I was giving a talk on that, so she asked me to stand up and answer the question.

Responding to her request, as a young person, I stood up and I said, "Here's a hypothesis…" I gave them the hypothesis I just gave you.

I must have had a hundred people come up and surround me after that talk. I wasn't even on the stage talking – I just answered her question. Everyone was so excited that finally we had an explanation for flashback phenomena.

And what was really exciting about it was that Larry Squire was supportive. Eric Kandel and others standing for the APA were supportive, and my research mentor, Bob Bjork, was incredibly supportive.

I like to think of the idea like this: Let's take the hard-earned work of scientists and build a framework for clinical practice that is consistent with science but not constrained by science**.**

> "Finally we had an explanation for flashback phenomena."

So, yes, when a patient or client walks in and you say, "Hello," there is no research that says you should say "Hello" but it's human to do that – that is what I mean by not being constrained by science – you want to build everything you do so it is consistent with science.

What Happens in the Brain during Dissociation?

Dr. Buczynski: This might be too much of a stretch, but since we are on a roll here and we have just talked about what is going on during flashbacks, can we try to talk about what is going on in the brain when someone dissociates?

Dr. Siegel: Sure. Part of what happened with me, just so you and everyone knows the background, is that as a first-year resident, one of my first long-term patients was a young woman who had a dissociative disorder – then it was called multiple-personality disorder. During the ensuing years, the name changed to dissociative-identity disorder.

From the very beginning, I was immersed in caring for her, and, again, what was so striking was at my institution, UCLA, the main faculty didn't believe that dissociation existed. They didn't believe multiple personality was real; they thought it was a distortion of clinicians.

When I had to hospitalize her and many other patients with dissociation, I became the dissociation expert at UCLA for many decades.

One time a senior faculty member said to me after I had just hospitalized a patient, "Dan, why are you putting the diagnosis of *dissociative disorder* when you know that doesn't exist?"

"Let's take the hard-earned work of scientists and build a framework for clinical practice that is consistent with but not constrained by science."

I looked at him and said, "Aren't you an examiner for the board exams?" He said, "Yes," and he was very proud.

I said, "Haven't you read the *DSM III* to see that dissociation *is* a recognized disorder? *This patient* is an example of dissociation." He was not happy . . .

Dissociation is defined very simply as *dis-association* – and that means associated things are now literally not linked anymore.

In the model of integration, this is a great match: dissociation means that which used to be linked is no longer linked and that translates to that which used to be integrated is no longer integrated.

You can imagine, Ruth, what I am going to say. Fundamentally, what happens in dissociation . . . and this goes way back to the time of Pierre Janet, who was talking about dissociation without knowing about the brain.

But now looking at some of the studies of the brain in dissociation, we can see that the brain literally becomes fragmented – it is no longer linking its differentiated parts.

As an attachment researcher, I will just say that when we study a form of attachment called *disorganized attachment,* longitudinal studies done by Alan Sroufe and colleagues at the University of Minnesota have

"Dissociation means that which used to be linked is no longer linked and that translates to that which used to be integrated is no longer integrated."

demonstrated that at least one source of dissociation is disorganized attachment.

There may be other sources, and I want to say that clearly. Those other sources of dissociation may have genetic components and vulnerabilities – that very well could be. I have never seen a study that clearly demonstrates that, but there absolutely could be.

But, again, one source of dissociation is disorganized attachment, and this is our understanding of it.

"In dissociation, we can see that the brain literally becomes fragmented – it is no longer linking its differentiated parts."

If someone has the experience as an infant or very early on of their caregiver, the attachment figure, being the source of terror – and this can include severe neglect – then we see disorganized attachment.

If you look at the incredibly powerful work of Karlen Lyons-Ruth, and we combine her work with the work of Alan Sroufe, basically what we know is that disorganized attachment is associated, in its developmental pathway, with dissociation.

Dissociation, for attachment purposes, is one of the most severely disabling conditions – that's number one.

Number two, clinically, what we know – and this is what I have been trying to teach here at the university for so long – dissociation, while it is one of the most disabling conditions, is one of the most treatable – it is completely curable, and that has been shown.

"One source of dissociation is disorganized attachment."

When you add that to your question about the brain, we now know – which we didn't know back in the eighties and nineties but we have learned since then – the brain is incredibly plastic.

The brain changes in response to experience throughout the lifespan, and that means clinical interventions need to be framed in the context of neuroplasticity.

Let me give you an example of a chemical induction of blocking integrative fibers.

In studying the effects on the brain of individuals who dissociate, if you give them chemicals like yohimbine (hydrochloride) – I think that is accurate, but I need to back-check my references – a chemical used in anesthesiology that blocks the natural order of integrative neurons rapid-firing, then if you give a person who

dissociates this chemical, they massively fragment, whereas other people may just get a little anesthetized.

There's supportive evidence for this general proposal: in disorganized-attachment terms, when you are an attachment figure inducing a state of terror in your child, you have an unsolvable paradox.

The child's brainstem circuit says, "I'm being threatened" and wants to get away from the source of being threatened or terrorized, and that source is the caregiver!

But, at the same time, the child's mammalian circuit, the older, limbic circuit, has a drive *toward* the attachment figure – to be protected from the source of terror.

"Dissociation, while it is one of the most disabling conditions, is one of the most treatable."

The problem is: the attachment figure *is* the source of terror.

Physically, you can't go *toward* and *away from* a person, your attachment figure, at the same time, and therefore your brain fragments.

We believe the disintegration *is* the dis-association – leading to dissociation in the brain, which comes from this situation of having unresolved fear.

"The problem is: the attachment figure is the source of terror."

Basically, that then continues on, and when you do the empirical studies, these kids have a hard time regulating their emotions. They have a hard time thinking clearly under stress, they have a difficult time with relationships, and their sense of self is fragmented, and I believe all of this comes from a non-integrated brain.

Unresolved states can be dissociative and the brain fragments under certain situations – and not *always* is a dissociative person *always* dissociative, but they have the vulnerability. The brain, which can work together as a system, is vulnerable to becoming fragmented.

You see that fragmentation in psychic numbing and they feel numb to their body; they can feel unreal; they can have memory lapses.

Clinically, we see all sorts of dissociation, and they all can be understood as examples of impaired integration in the brain that are completely treatable.

This is what people really need to understand. When I was in training at UCLA, everyone was saying, "Oh, the

brain is damaged, so give the patient a pill."

To me, it's the other way around: the brain is not integrated, so give psychotherapy and let the relationship develop the integrative fibers of this patient's brain.

> "Clinically, we see all sorts of dissociation, and they all can be understood as examples of impaired integration in the brain that are completely treatable."

In my experience, people with dissociation can stop dissociating. You can get the brain more integrated.

They can have other issues, of course, like any human being – that is not the end of their work – but they don't need to use dissociation as a fallback for how to deal with stress.

To Talk (or Not to Talk) with Patients about the Brain

Dr. Buczynski: We talked earlier about whether or not it is important for clinicians to know about the brain, and people are starting to more or less agree that knowing about the brain is important. It is certainly not something we thought back in the sixties and seventies, but it is now.

That leads to my next question. How useful is it to talk to a patient about the brain when, let's say, you are in psychotherapy or in any kind of work as a practitioner and you are working with someone who has experienced trauma?

Dr. Siegel: That is a great question, Ruth. I think it is important to say, as we get into this central question, that one of the risks of glorifying knowledge about the brain – some people use the word *reify* to make it sound like the brain has this royal aura – is that people will begin to believe the statement that generally comes from the majority of brain scientists, which is that "the mind is what the brain does."

Now, that statement has huge, negative implications for clinical fields.

I am concerned when people say, "Shouldn't clinicians know about the brain?"

I always say – and this is my view from the field of interpersonal neurobiology that I work in – "You might want *to know* about the mind if that is your job – you're an emergency-room doc or nurse, or you're a social worker who works in a medical setting, or you're working a lot of the time with medical problems, or you're a psychotherapist in various fields of mental health, or you're just interested in the mental life of your patient –

your client." Let's just say that is who you are.

If that's the case, then I want to caution you to consider that reducing the mind to just brain activity will make it less likely you will connect with and understand your client – your patient – in the full, deep way that they deserve.

"Reducing the mind to just brain activity will make it less likely you will connect with and understand your client – your patient – in the full, deep way that they deserve."

Recently, when I have been asked to give addresses about where I went to medical school, the importance of empathy in medicine, or the importance of stories and emotions, I always start with cautioning this love affair people are having with the brain.

So, I would say this: the mind is both a fully embodied and relational process.

The Fully Embodied and Relational Brain

Dr. Siegel: Let's look at what that means, word by word. The "fully embodied" means anyone interested in what goes on in the skull should just as well be interested in what goes on in your heart, lungs, intestines, endocrine and immune systems – your whole body.

The mind is *embodied* – it is not *enskulled.* Now, this gets neuroscientists upset because that is not what they say or believe, but that's the first thing.

Second, I think the mind is a self-organizing, emergent, embodied and relational process that is regulating energy information flow both within the whole body, including the brain, and also between us and the whole world – to all people on the planet. But let's just stay with people here for the moment.

"The mind is both a fully embodied and relational process."

This is what I say when I give this address: the clinical encounter needs to realize that energy information flows – that is what is happening right now between you and me and between us and everyone listening.

The mind is being created *between* us and *within* us.

So, yes, if you want to know fully about the mind – caring for the mind and healing the traumatized mind – you need to know about relationships and relationship science.

So, yes, if you want to know fully about the mind – caring for the mind and healing the traumatized mind – you need to know about relationships and relationship science.

You need to know about the body and body science, which includes the brain.

Knowledge about the brain and the body in which the brain lives is incredibly important, and knowledge about relationships is just as important.

> "The mind is being created between us and within us."

Now, here you are asking about the brain, which I am happy to talk about, but I wouldn't feel comfortable talking about it unless we gave the bigger context: the mind is not, in my view, just brain activity – even though that is what ninety-eight percent of the neuroscientists I speak with say – that is what they publish and that is what they talk about over dinner with wine!

They *still* believe it, so it is not as if they are hiding some other belief – they really believe mind is brain activity, and I think it is *not* that simple. But that gets into what I'm working on for my next set of projects.

So, yes, clinicians should know about the brain because impaired integration in the whole body, including the brain, or in our relationships, is a source of *unhealth*.

> "Knowledge about the brain and the body in which the brain lives is incredibly important, and knowledge about relationships is just as important."

We're not healthy when we have impaired integration.

To be an effective clinician, you should be able to detect the chaos and rigidity that emerge, whether that is impaired integration of the brain as in dissociation or impaired integration within relationship as in unfair treatment in domestic abuse or even in society.

Wherever integration is impaired relationally or neurologically, *unhealth* ensues.

As clinicians, it is our job to know about integration, relationally and bodily, and there is no better place to start than in this large frame.

Then we say, "Okay, let's dive into the brain." And when we get to the brain, we say, "I want to at least keep track of these three integrative areas for trauma: the hippocampus, the corpus callosum that connects left and right, and the prefrontal region that essentially connects up and down."

We want to know that the hippocampus is linking all the layers of integrative memory together. It is taking

the differentiated aspects of implicit memory and linking them together – so the brain is integrative.

The corpus callosum connects the left and right side of the brain, which are very, very different from each other, and we need to know those differences and work with them in medical settings and therapy.

> "Wherever integration is impaired relationally or neurologically, *unhealth* ensues."

Then, we have the prefrontal cortex, and while it does some left and right integration, it is primarily up-and-down as well as self-integrating.

The prefrontal cortex does it all – it is the area just behind your forehead, and it links the cortex to the limbic area, the brainstem, the body, and even input from the relational world.

Key Areas of the Brain Impacted by Developmental Trauma

Dr. Siegel: The hippocampus, the corpus callosum, and the prefrontal cortex are the three areas of the brain that Martin Teicher at McLean Hospital at Harvard University has demonstrated as most severely impacted – either not growing well or damaged – depending on the timing of developmental trauma – meaning neglect or abuse.

> "The prefrontal cortex does it all – it links the cortex to the limbic area, the brainstem, the body, and even input from the relational world. "

If you are working clinically with traumatized people who have developmental issues with trauma, and they have experienced a new trauma – they have gone to Afghanistan, or they have been in a terrible car accident or an abusive marriage – there are many kinds of trauma we encounter as adults – you want to ask yourself the question, "What is the developmental history of this person? Did they have a lot of negative experiences that had negative effects on them as children?"

If you look at the studies of the negative impact scales that are done here in California – at Kaiser, we know that this has severe impacts, not only on your mental health but your medical health, too.

What we don't know is this: Can psychotherapy heal a person and prevent those negative impacts from happening?

So, based on all this, I think clinicians should know about the brain because it is what, among the many systems, holds on to the trauma due to impaired integration in these three regions – and we haven't even mentioned epigenetic changes.

> "The hippocampus, the corpus callosum, and the prefrontal cortex are the three areas of the brain most severely impacted depending on the timing of developmental trauma."

Michael Meaney at McGill has shown that epigenetic changes, which exist in people who have had developmental trauma, alter your ability to respond to stress.

And that is a whole other layer to talk about, but you can have neurons, synapses, myelin, and epigenetic control systems in the brain – all affected.

Those are the four ways trauma impacts the brain, and sadly, those synaptic, integrative, or epigenetic changes continue the legacy of trauma into a person's future.

Even more sadly, there is some hint now, in this new field of epigenetics, to suggest that you can inherit the epigenetic adaptations of your grandparents through their sperm and egg that then influence your neural development.

You can show signs of posttraumatic conditions due to their living through a famine or a holocaust at a particular time in their life.

That is the fourth layer that can be impacted.

Epigenetics in Relation to Trauma

Dr. Buczynski: Let's just spend a little bit of time talking about epigenetics in relation to trauma, and specifically in regard to Michael Meaney's work. What is he doing and what is interesting to you in what he is doing?

Dr. Siegel: There are a couple of areas. I'd like to put Michael Meaney's work into the larger context of other researchers' work – let me just sort of paint the whole picture first.

> "Can psychotherapy heal a person and prevent those negative impacts from happening?"

You have a set of DNA (deoxyribonucleic acid) molecules and the sequence of those nucleotides – nucleic acids – form letters that form words that form your genes on your chromosomes.

You inherit from your ancestors this sequence of DNA that encodes how your body will be and even how your brain will develop. So we know genetics is really important.

What scientists have been clarifying is that there are non-nucleic acid molecules that sit on top of genes.

These are called epigenetic regulators, and they include histone and methyl groups that alter the shape of the double-helix DNA so that when it is time for the DNA to be expressed, which means the double-helix DNA unwinds, DNA turns into RNA.

The RNA is a single-stranded, ribonucleic acid; it then goes out of the nucleus of the cell to the cell body, and in the cell body it is going to meet up with a ribosome and be turned into proteins, which will allow body structure to change as well as neural structure.

That is the sequence we know about and that's fine.

> "You inherit from your ancestors this sequence of DNA that encodes how your body will be and even how your brain will develop."

What is *new* is that epigenetic molecules, which alter gene expression, are profoundly important, and two things about them have clinical relevance at this moment.

One is that experiences change epigenetic molecules.

You are not only changing how neurons are firing, you can grow new neurons, or change synaptic strengths, or even lay down myelin to develop a skill with experience.

So, besides neuron formation, synapse formation and myelin formation that allows neurons to communicate three thousand times faster and makes them more coordinated and balanced and more integrated than the myelin does – is this fourth area of epigenetic control.

Now, Michael Meaney showed that if a rat licks her babies, they will have optimal epigenetic regulation for stress response, and if they are raised by a mother who doesn't lick them very much, they will have suboptimal ability to deal with stress.

> "What is new is that experiences change epigenetic molecules."

I will bet that he is going to win a Nobel Prize for that magnificent work of showing that maternal care not only changes synaptic firings and neuronal, synaptic, and myelin growth, but it also changes the epigenetic regulation of the stress response.

What he has done gave us deep insight into why developmental trauma sets up an individual for more intense stress responses.

Sadly, they have already been stressed-out and now, epigenetically, the way areas of the brain will grow that basically deal with the hypothalamic-pituitary-adrenal axis – the HPA axis – which regulates cortisol response, has changed and they're going to be more stress responsive.

Now, we could say that the positive side of that is: "Well, yes, if you have experienced stress, you ought to be ready to deal with stress more."

But in the long run, this is not very adaptive because you are just stressed-out all the time. So that is Michael Meaney's first contribution, and that was in his study with rats.

His second very important contribution, and this is a very sad study, but we need to talk about it, looked at the brain tissue of those who had committed suicide.

> "Maternal care not only changes synaptic firings and neuronal, synaptic, and myelin growth, but it also changes the epigenetic regulation of the stress response."

He was able to divide them into two groups, matching for age and socioeconomic and educational background, and he was able to show that, by looking at autopsied brain tissue, those with documented abuse had an alteration in the same regions that control the stress response and those who hadn't been abused, epigenetic changes were not there.

That was just confirmation, at least in this one study. We need to do repeat studies but that's hard to do – how are you going to get brain tissue in a living being?

But that study really supported – we can't say it proved – but supported the proposal that negative effects early on have epigenetic changes. In general, this finding goes along with the Kaiser study I mentioned earlier.

Finally, studies that are now being done in Europe are suggesting that how you adapt to famine, for example, in the Northern and Scandinavian countries – I think it is in Sweden – there's a town where they have followed people for five hundred years, and they know who is in a famine and who is in utero during a famine.

Basically, the risk of diabetes and obesity is massively changed. For example, if your grandmother was in the womb and her ovaries were developing and her mother was experiencing a famine, studies show these clear passages of epigenetic modifications of a pregnant mother getting passed on to the ovaries.

These are just preliminary studies – but the same thing is true if a boy is in a famine just before puberty when the basic cells that are going to form the sperm are maturing.

"Negative effects early on have epigenetic changes."

This is a brand-new set of studies, but it just shows that first, these epigenetic modifications are acquired during your lifetime and change gene expression, and second, these modifications are passed on through the egg and the sperm, depending on the timing of those traumatic experiences and whether you are male or female when that happened.

You inherit through a sperm and egg the non-DNA molecular changes of the adaptations to trauma that your grandparents went through.

Dr. Buczynski: Is anyone studying holocaust survivors?

Dr. Siegel: Yes. That is the group that has also been studied besides famine survivors – this exact set of studies with holocaust survivors.

We need to really keep an open mind as clinicians.

First of all, can our clinical work actually support the resolution of trauma to the depth of changing at least epigenetic modifications in the brain?

And then, can we hope to block the passage to the sperm and egg?

Those are very complicated biological questions.

Some of the preliminary data is extremely hopeful, not just about the passage between sperm and egg but just in general.

"First, epigenetic modifications are acquired during your lifetime and change gene expression, and second, these modifications are passed on through the egg and the sperm, depending on the timing of those traumatic experiences."

For example, we know that even after a one-day retreat in mindfulness – and this is a study that came out in December 2013 and another study that came out in July 2013, a different study on eudaimonia by Barbara Fredrickson – that what you do with your mind changes the epigenetic molecules that are sitting on top areas of the genome that help prevent inflammatory diseases like some forms – not all forms – but some forms of diabetes, and some forms – and again not all forms – of cancer.

What you do with your mind, as seen in this December study of the effects of a day-long retreat, optimizes epigenetic control to help prevent certain forms of inflammatory disease.

The powerful thing about that is to say that what you do with your mind appears to go deeply into epigenetic controls that are going to help you bring health into your life.

"What you do when your mind appears to go deeply into epigenetic controls that are going to help you bring health into your life."

Dr. Buczynski: Yes. Thanks, and thank you very much. I appreciate you giving us your time and I appreciate all the studying and thinking that you are doing on this. You have made a *huge* contribution to thousands and thousands of practitioners all over the world.

Dr. Siegel: Thank you, Ruth. It feels so rewarding to connect with you and I'm glad these ideas are helpful. That's great – thanks so much.

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About the Speakers . . .

Daniel J. Siegel, MD received his medical degree from Harvard University and completed his postgraduate medical education at UCLA with training in pediatrics and child, adolescent and adult psychiatry.

Dr. Siegel is currently a clinical professor of psychiatry at the UCLA School of Medicine where he is also on the faculty of the Center for Culture, Brain, and Development and Co-Director of the Mindful Awareness Research Center at UCLA.

Dr. Siegel is also the Executive Director of the Mindsight Institute, an educational organization that focuses on how the development of mindsight in individuals, families and communities can be enhanced by examining the interface of human relationships and basic biological processes.

Ruth Buczynski, PhD has been combining her commitment to mind/body medicine with a savvy business model since 1989. As the founder and president of the *National Institute for the Clinical Application of Behavioral Medicine*, she's been a leader in bringing innovative training and professional development programs to thousands of health and mental health care practitioners throughout the world.

Ruth has successfully sponsored distance-learning programs, teleseminars, and annual conferences for over 20 years. Now she's expanded into the 'cloud,' where she's developed intelligent and thoughtfully researched webinars that continue to grow exponentially.