Issue IV

Yellow Brick℠ journal

of Emerging Adulthood

Letter from the Editors

How Neuroscience Informs Treatment
Jesse Viner, MD

Neurobiological Assessment of Emerging Adults: *Are we ready for a paradigm shift?*
Lukasz M. Konopka, AM, PhD

Sharp Waves in Emerging Adults: Implications for Symptoms and Recovery
Elizabeth Zimmerman, PsyD

Mind, Body, Brain, and Art: A Rationale for the Therapeutic Use of the Arts
Christopher M. Belkofer, PhD, ATR, LPC

Literature Review
Jennifer L. Tanner, PhD

Author Bios

Mission

Yellowbrick Journal is the official publication of Yellowbrick Foundation, a not-for-profit organization, whose mission is to support research, training and community education regarding the emotional, psychological, and developmental challenges of emerging adults, ages 18 to 29. ***Yellowbrick Journal*** is dedicated to the dissemination of work that informs the Yellowbrick model—a research-based treatment model that combines the most current contributions of developmental psychology, neuroscience, innovative psychotherapies, strength-based strategies and wellness medicine. ***Yellowbrick Journal*** highlights cutting-edge research that informs our understanding of emerging adults from a holistic perspective. ***Yellowbrick Journal*** publishes articles on applied work that has demonstrated effectiveness and is particularly dedicated to work that emphasizes multi-specialty evaluation, therapeutic residences, research-based strategies, and life-skills interventions. ***Yellowbrick Journal*** represents the voices and perspectives of those who serve as the catalysts for the evolution of Yellowbrick—emerging adults and all who are dedicated to the optimization of their potentials.

Letter From The Editors

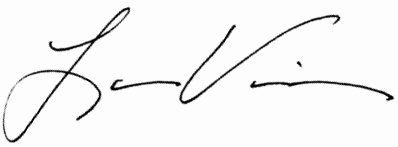
Editorial Introduction to Issue IV

With this fourth issue of *Yellowbrick Journal* we continue to move toward our objectives: (1) to bring together and disseminate scholarship specifically about assessment, diagnosis, and treatment of mental health problems in emerging adulthood, ages 18 to 29, and (2) to identify best practices that effectively support healthy, successful transitions to adulthood. Via shared knowledge, *Yellowbrick Journal* unites researchers, practitioners, and policy-makers working together to 'close the gap.' That is, to respond to need for developmentally-informed conceptual and intervention models designed specifically for young people in their late teens and twenties. Although we are now four issues into the *Yellowbrick Journal*, we keep in mind the significance of responding to the needs of emerging adults, particularly because their unmet need has been there, but has gone "unseen." Historically, these transition years—in-between adolescence ands adulthood—haven't received the same attention that childhood and adolescence, or adulthood has with respect to mental health.

Now, in the 21st century, the transition to adulthood is more circuitous and less linear. One effect of the dramatic shift in the way young people become adult is that we now "see" young people in their late teens and twenties as developing individuals, whereas in prior decades, individual development was at least partially occluded by adult roles, relationships, and responsibilities to others. *Yellowbrick Journal* recognizes the value in paying attention, specifically, to the late teens and twenties. With an equal emphasis on generating a deeper understanding the developmental distinctiveness of the age period and thinking about novel approaches to working with this age group, selecting articles for this issue of *Yellowbrick Journal* we were inspired by a simple question: *what works?*

The theme of this issue of *Yellowbrick Journal* is *Using Neuroscience to Inform Treatment*. The first article, *How Neuroscience Informs Treatment*, is a transcription of an interview with Dr. Jesse Viner. The novel format of this article gives readers an opportunity to hear Dr. Viner's voice come through in his analysis of emerging adult mental health issues through a neuroscience lens. Continuing in the direction of translating neuroscience into practice, the second and third articles introduce neurodiagnostic techniques that are particularly promising for work with emerging adults. *Neurobiological Assessment of Emerging Adults* by Dr. Lukasz Konopka and *Assessing and Interpreting Sharp Waves in Emerging Adults* by Elizabeth Zimmerman discuss novel uses of qEEG and EEG, respectively, to identify atypical neurofunctioning in emerging adults. The fourth article in this issue, *Mind, Body, Brain, and Art: A Rationale for Therapeutic Use of The Arts* by Dr. Christopher Belkofer reframes art therapy using neuroscience to explain why art therapies are effective, why they are particularly promising for work with emerging adults, and even more so, why art therapies are valuable for working with emerging adults with trauma histories. Closing the issue, the LITERATURE REVIEW, *Using Neuroscience to Inform Emerging Adult Treatment* by Dr. Jennifer Tanner, swings back to a wide lens, leaving readers with 10 recommended readings for those inspired to use neuroscience to inform their work with emerging adults.

Jennifer Tanner



Laura Viner

Jesse Viner

How Neuroscience Informs Treatment

Jesse Viner, MD

Jesse Viner, MD, Founder & Executive Medical Director of Yellowbrick, was interviewed by Barbara Alexander, LCSW, BCD of *On Good Authority*, an organization which produces professional educational materials for the mental health professions.

In his article, "Minding the Brain," Dr. Viner (Yellowbrick Journal of Emerging Adulthood III, 2012) writes, "Emerging adulthood is a transforming neurobiological and developmental maturational window during which individuals are challenged to negotiate new social prescriptions affecting the personal foundation for separateness, identity and self-integration, and attachment patterns. This is occurring at a time when brain maturation and its neurobiological underpinnings may be in consonance with or at odds with such growth. Neuroscience research has shown that normal brain maturation in emerging adults parallels the increasing complexity of these developmental and psychosocial demands."

Daniel Siegel, MD has written that "the ultimate, organizing purpose of the brain's formation and growth throughout the lifespan is to evolve an ever more complex, integrated and higher-order representation of the self." Dr. Viner continues that "emerging adulthood is an active and essential window of time in the maturational unfolding of identity, during which a second-wave of psychological separation-individuation occurs with a corresponding profusion of brain cell pruning, re-networking, and the establishment of neural patterns that correspond to enduring patterns of experience and behavior."

It shouldn't surprise us then, with all that is going on in the brain and emotions, to learn that about 75% of those who are to become psychiatrically ill will do so by the mid-20s. According to a survey by the Substance Abuse and Mental Health Services Administration , thirty percent of people ages 18 to 25 reported having a mental disorder in 2010, the highest of any age group. Other estimates show that 2.6 million are functionally impaired as they transition into adulthood, a developmental epoch during which a complex combination of psychiatric illnesses such as depression or anxiety, learning or processing difficulties interfere with skill development and emotional struggles can distort personal growth. Attempts at coping often include behavior patterns such as substance abuse or eating disorders which further compromise brain functioning. Plus, suicide is the second leading cause of death in emerging adults, outpaced by accidents, which most often include alcohol. Tragically, three times as many youth die of accidental overdose than by intentional suicide. The stakes are quite high for advancing our understanding of brain maturation and mind development in emerging adulthood.

ALEXANDER: Thank you so much for agreeing to talk with us today, Dr. Viner. I'd like to speak with you about the neurological developments that occur during the age period of 18 to 29, which is roughly what is being termed as the age, or the stage of emerging adulthood. So, I'll just turn it over to you and you can start to explain some of it to us.

VINER: The phase of emerging adulthood was first defined as a distinct phase of psychological development, going back about 15 years by two developmental psychology researchers, Jeffrey Arnett and Jennifer Tanner. What they did was they looked at the psychological characteristics of those young people who are in the age range of 18 to the late 20s, and then those that are in their 30s and beyond, and they found that there were distinct psychological characteristics.

What is interesting about that finding is that as neuroscience imaging techniques are evolving, there is a parallel database of information demonstrating that in this age group, there is quite a maturational timetable that is unfolding and flowering regarding the brain's development. That development occurs in a number of different forms within the brain and it has, as best we understand these things, a number of different implications for what is—I think at this point the language is clumsy "mind-brain functioning."

So what is happening is that there's a sprouting of new types of connections between different kinds of nerve pathways and networks within the brain. This is a lot like a spring effect on a single tree in one neighborhood which gets closer to the other trees in the neighborhood, but they are also sending out branches to different neighborhoods. So, there is a kind of budding and sprouting of new nerve pathways, both at a local and then inter-regional level.

To facilitate that, another process that is happening in the brain is that there is an increase in what we call "myelinization." Myelin is the covering around the actual nerves in the brain. When you add myelin, you increase conductivity. It's kind of similar to going through a process of going from a dial-up connection for your computer to a T4 line, so the speed of information processing in the brain begins to accelerate at a logarithmic level during emerging adulthood.

Then, finally, there are multiple new pathways that are initiated and established, and sustained during emerging adulthood that make novel connections between the amygdala, the limbic system, the emotional right brain and the left prefrontal cortex of the brain, which is that part of the brain which makes us most distinctly human. This is a connection that, from an evolutionary perspective, if you want to speak of it that way, allows for emotions to not just be in a reactive kind of function or process to the person, but that emotions then become a very sophisticated information system. This is because the left brain is better able to process what various kinds of emotions—subtle and extreme—actually mean and how might one best respond to them in a survival adaptive process, remembering that human survival is so very dependent on the ability to be socially effective.

So these three kinds of processes are happening in the brain: sprouting, myelinization, and interconnectivity between the old, emotional right brain and higher cortical functions of the left brain.

What this means in terms of how this then interfaces with the maturation of the mind is that the areas of the brain that we see coming on line in more of a full-force kind of way, in a flowering way during

emerging adulthood, have to do with first, the regulation of emotion and its relationship to behavior. Second, changes in the emerging adult mind are reflected in what we call, "executive functioning" which is a set of cognitive capacities that allow us to frame problems, problem solve, and implement solutions. Executive functions allow us to think both in a conceptual, as well as, practical way. The third area of mind maturation in emerging adulthood that is awakened by these brain changes has to do with integration of identity, which involves a lot of processing of current experience in relationship to old memory.

So, these three brain processes that I spoke of are connected with these three mind processes: self-regulation of emotion and behavior, executive functioning, and identity integration. So that's what's happening in the brain and the mind in a way that is unique to emerging adulthood, though it has some parallels with two previous times in life: in-utero; and in the first three years, developmental epochs when there's also a major transformation of brain pathways and connectivity.

ALEXANDER: Piaget spoke of this, but not exactly… didn't he? He said that something kicks in, in terms of abstract thought. In your opinion, is this pretty much what he was talking about?

VINER: A very interesting question. There are certain "correlations," I will call them, in that Piaget takes what we call kind of an epigenetic perspective, which means that he's watching, he's observing and thinking about the maturational unfolding of different capacities. Certainly in emerging adulthood, it is not a linear expression of what went on before, in the same way that walking is not a new form of crawling. Early changes in the brain, in the first 3 years, are not 1:1 correspondent with brain maturation in emerging adulthood; the changes are similar in the extent of the transformation that occurs.

Piaget was specifically focused on cognitive capacity, which is *one* dimension of brain-mind maturation in emerging adulthood. The broader literature on brain-mind maturation through the developmental transition to adulthood I think the literature and people working clinically certainly are focused in a much broader way than just the cognitive capacity, but it certainly helps when the cognitive capacity is there as a strength.

ALEXANDER: This is a bit of an off-beat question: *where is the mind?*

VINER: I like to approach very complicated matters by looking for the simple truths. And the simple truth is that it seems to me that rather than search for the Holy Grail, I think we can understand the brain as the organ of the mind.

There's a wonderful book by Dan Siegal, called *The Developing Mind—there's a new 2012 edition*. This book really helps integrate research on the developing brain with research on the developing mind. The book also makes connections between cutting-edge research and thinking of depth psychologists about the nature of the mind. Siegel's view is—and I think most people working clinically from an integrated, holistic lens would affirm this view—the brain is the organ of the mind in that the purpose of the brain is survival of the organism, in the most universal sense.

Siegel's approach assumes that mind-brain functions activities are organized around survival in two ways: (1) recognizing threat and generating effective threat responses, and (2) figuring-out how to acquire basic kinds of nurturance.

Smiling is an infant survival strategy that reflects the mind-brain capacities of the developing infant. As the human brain grows and matures, the mind grows and matures and the developing young person gains more sophisticated strategies for surviving. They take steps toward using all of their brain as part of their mind.

Not too long ago, we all understood brain functioning in a very different way than we understand it now. We believed that functions were boundaried, that specific brain regions were responsible for specific actions. For example, we would say, 'this XYZ function occurs here, and that XYZ function occurs there.' Now what we know is that there are network centers and at the hub of network centers certain functions may get integrated, but integration requires the participation of the entire brain for mind-body functions to work effectively.

In the Emerging Adult Assessment Center at Yellowbrick, we include neuroimaging studies in all of our initial evaluations of emerging adult patients. Findings from these assessments can show us—objectively, by eliminating the influence of a person's will—that certain parts of the brain in relation to others, are not optimally functioning. We are able to locate networks that are dysregulated and therefore are not contributing to specific mind functions in ways we know are necessary and essential for a young person to experience mental health and to behave in age-appropriate ways. Such findings have very robust correlations with the specific clinical problems emerging adults are dealing with and trying to overcome.

ALEXANDER: You talk about how vulnerable the maturing brain is in emerging adulthood. What makes it more vulnerable during these years, during this life stage compared to others?

VINER: That's a very interesting question, a very complicated question, and I don't pretend to know all of the answers. Not only with respect to the brain, but in terms of all functional systems—periods of transition always set the stage for vulnerability. When a great deal of change is going-on, depending on the nature of the influences at the time, developmental outcomes might be adaptive, call it "healthy change," or distorting.

Two basic principles are important to understand. First, the brain operates on a principle of, "use it or lose it." Think about the "sprouting" we know occurs during emerging adulthood. If a young person sits in his room and all he does is play video games all day, he is not going to be making use of all the opportunities that are present developmentally. So "use it or lose it" is one principle. This principle of development holds true across all organ systems. The upside of that is that if a young person exercises the brain in a variety of ways and he is also feeding it appropriately, if he is getting enough blood supply to it because he does aerobic exercise, and all of those things that we know are part of wellness, then he can optimize the potential for brain development... So "use it or lose it."

The second principle that is important to take into consideration when thinking about the various ways the brain might change during the developmental transition from adolescence into adulthood, is: "what fires together, wires together." Throughout the lifespan, the brain organizes itself structurally around the nature of different kinds of experiences. To give you an example, one of my first professional positions was to run Northwestern Medical School's drug clinic. I remember talking to heroin addicts and pretty much all of them would say the same thing about the first shot of heroin – there's nothing in this world that feels as good as that first time. This primed their brain's reward center. Then they end up chasing that experience until hopefully, they recover.

What those individuals are describing is the way the reward and motivation systems of the brain, which are very much in play during mid-adolescence and emerging adulthood, come online together. To the extent that drug use, just as one example, kidnaps the motivation and reward system. The brain will actually wire around that and some of the more quiet or ordinary satisfactions of doing one's homework, doing a good job, or singing in a play, or whatever those more ordinary satisfactions are, they don't light up the reward and motivation centers. So, the brain's development can get derailed depending on the nature of the experiences that people are exposing themselves to.

ALEXANDER: Also, I think I saw in this article something about the impact of anorexia on the brain. You spoke about volume of the brain and I wanted to ask you about that, because that is very worrisome.

VINER: Sure. The brain needs food. The brain is our most active, high sugar, high food nutrient consuming organ. I think that speaks to its primacy in terms of survival.

So in anorexia nervosa, where people are restricting nutrition, starvation puts the brain into a mode which has very powerful consequences. We know that individuals who have driven their body weight down to a BMI of under 17 can experience a shrinkage in brain volume, witnessed under MRI, anywhere between 25 and 40%.

ALEXANDER: Wow!

VINER: Cognitive problems, identity problems, and obsessional thinking—these are all brain correlates that are the downstream, downline consequences of there not being enough nutrients to the brain.

Brain functioning is also involved in the development of a set of secondary problems in young people with anorexia. Young patients troubled with anorexia do not necessarily complain of hunger or weakness until collapse or near collapse. In fact, they can go a long time without eating. This is not because they are burning fat stores, per se. What happens when a person doesn't eat is that her body will activate emergency systems that release adrenaline and cortisol. Increases in these stress hormones results in elevated blood sugar, a result of the body breaking down tissue. Because cortisol and adrenaline keep us pumped up when we sense threat—the key function of the body's fight and flight system—not all patients dealing with anorexia feel like they're at risk. In essence, our brain's own risk-reward center may interfere with our ability to take action to protect ourselves.

ALEXANDER: So that's why common sense vanishes in anorexia?

VINER: Yes. That's correct. In fact, distorted convictions arise and become a powerful part of identity.

ALEXANDER: Can these things be recovered? Can a heroin addict, a young person who goes into recovery and successfully stays sober for a couple of years—can he restore that brain function? And can the anorexic who starts eating again – can healthy brain functions be restored? Or are they lost forever?

VINER: These are really important questions. These are the questions patients and their families have. There is good news about the brain's capacity for resilience in emerging adulthood. In response to these questions, we can turn to the concept of "neuroplasticity" which is the characteristic of the brain that allows the brain to change from experience. There is evidence of neuroplasticity at all stages of the lifespan; at the same time, we also know there is stronger potential for neuroplasticity in emerging adulthood compared to later adulthood.

In essence, neuroplasticity means that the brain is open for change. The brain's default position is to do what is familiar, do what is habitual. While our brains are open to change, change requires work.

You asked a couple of questions combined; let me parse them out. First, the question: in cases of anorexia, will the brain restore itself both in terms of size and function if nutrition is restored? The answer is 'yes,' very clearly, volume will be restored. Although there is still some research to be done here, of course, at the macrolevel, the vast majority of cognitive performance functions will be restored. A young person may continue to have a distorted experience of her body. For example, a young woman who no longer weighs 82 pounds and now weighs 112 pounds—a weight which may put that person in the "lean category" for her body architecture— she may still feel obese. She may have specific cognitive distortions and impairments, but such complications would be more at a more nuanced, less global level. And, of course, each case is different.

Second, the question about the heroin addict, in contrast to anorexia, with heroin addiction there is a little bit of a different picture and this might apply to other addictions as well. For example, the brain dysfunctioning associated with substance addiction might apply to certain kinds of behavioral patterns such as gambling or compulsive sex addiction. In these cases, neuroplasticity will allow the brain to re-network new neural systems based on healthy motivation-initiative and satisfaction-reward systems. These changes will be real and they will be deep. However, the person may still feel a sense of loss and grief from gaining an understanding that "nothing ever felt so good." This is sometimes true about one's first girlfriend or boyfriend, too. Though this is a part of life in a way, substance use can sometimes provide that experience in a way that does leave some dissonance with other life experiences.

Again, over time and with working the brain in terms of different kinds of satisfactions, particularly as the brain matures, the reward system moves away from rewarding with dopamine to rewarding with oxytocin. While dopamine is the neurotransmitter that mediates that sense of kick, the high, the brief and ultimate experience; oxytocin is the attachment hormone. That's what is being released when mom is nursing and

mom and baby kind of fall asleep with each other in this woozy, "this is great" state. Oxytocin high is much more low key that dopamine high; it doesn't have that sense of excitement and acceleration to it. Oxytocin is associated with feeling deep satisfaction and security, whereas dopamine highs feel more like, "this is great but I may spiral out of control." Again, there may be a sense of loss about some of the ways in which reward systems have been derailed, but they certainly can be significantly reworked in ways that people find satisfying.

A lot of what treatment is about is helping young people—and this is not a treatment of substance abuse per se, but it's also true in a broader sense—gain distance from and control over early experiences that interfere with their current willingness and capacity to engage in secure attachments and meaningful intimate relationships. I use the word "intimate" not necessarily in a romantic sense, though it would include that.

Part of what the research shows is that attachments—secure attachments—are certainly powerful in facilitating brain maturation and functional capacities and to some extent they may be required for some aspects of it. In other words, an emerging adult can't do the "rewiring" himself. Rewiring requires a young person to be in relationship with others to activate brain processes so that they can be rewired in ways that are less dependent on unhealthy stimulus-reward associations. So, a lot of the focus that psychotherapies have on enhancing effective interpersonal relationship functioning really has a very solid brain basis to it. Secure attachment facilitates healthy brain development.

ALEXANDER: At this point let's turn to Yellowbrick and to how you integrate neuroscience research into the work that is done at Yellowbrick.

VINER: Sure. Well, the first way in which neuroscience is prominent within Yellowbrick's services is at the Assessment Phase. One of the first things we do when a patient agrees to an assessment here is we take a swab from the inside of your cheek and take your DNA. We send it to the Mayo Clinic. We partner with them. This gives us information about certain aspects of the emerging adult's DNA makeup. We run labs that provide us with information that has implications for mental health—implications, for example, in terms of how your liver works and what the impact of that will be on your ability to make use of certain medications and what side effects—adverse effects—are likely to be. These findings often help explain why an emerging adult may not have been able to tolerate certain medications in the past.

We use pharmaco-genomic typing analysis as part of our initial assessment to get "genetic hints" as to why an emerging adult may be experiencing symptoms or is behaving in a certain way. Analysis of an emerging adult's DNA also gives us some indication about certain kinds of brain receptor systems that have implications for mental health. Sometimes those implications have to do with the ability an emerging adult has to make best use of certain medications without experiencing adverse effects. Using the latest research, we can also look to genetic reports to see if an emerging adult has any elevated risk for a specific disease or disorder. For example, specific genetic markers are associated with a 50% increase in the predisposition to alcoholism or to developing post-traumatic syndromes in the face of certain types of life events.

We also do neuroimaging. Specifically, everybody in their assessment gets a quantitative EEG (qEEG), which gives us a three dimensional picture of the electrical networking within the brain and how different parts of the brain relate to each other under different kinds of circumstances. This can help us understand certain kinds of impairments that, as I was saying, often have very robust clinical correlations and it also gives us an indication about certain types of approaches that may be more helpful than others. For example, if the qEEG helps us see that somebody's auditory processing is much more impaired than their visual processing, then we might be more inclined to use art therapies or things of that nature that don't rely as heavily on auditory interaction. Those might be people where, after their sessions, we send them a copy of a summary of the session so they can read it, because they take things in better when they see.

We also do neurocognitive testing with a variety of validated, standardized computer assessments. Findings from these tests help to sort out the different kinds of problems known to affect attention. All attention problems are not ADHD. There are certain kinds of patterns that are more consistent with trauma, with dissociation, with anxiety, with depression. We also focus on the cognitive capacity for what's called "working memory," which is the ability to take in some type of information and hold it for future use. If you think about it, that's such an important adaptive function and it's a crucial function for being able to make use of psychotherapies. There are a variety of computer-based cognitive exercises that might be prescribed to help a person build working-memory, although we might prescribe an activity, for example: people to be in a play—having to learn your lines and all that – and that was something that exercises working memory.

We use the assessment findings to guide interventions that map directly on to specific impairments. At Yellowbrick, the neuro-assessments and tailored interventions take place within a context that is thoughtfully constructed in a way that respects emerging adult development. The context is designed to support emerging adult development, including: brain maturation, identity integration, emotional and behavioral regulation, executive functioning, secure attachments, transitions from relating to one's family as a "dependent" toward relating in a mode we call "connected autonomy." Treatment as a whole is directed towards those developmental goals and neuro-psychiatric assessments provide us with information that guide interventions to support important brain functions necessary to approach those developmental challenges.

Many of the patients we see present with both a clinical picture that suggests—and their assessment findings also suggest—that their emotional brain is overactive, it's basically "on fire." Almost 80% of our patients have some type of traumatic experience in their history. These experiences range from bullying to sexual assault to violence in the home and more. These types of experiences kindle the emotional brain, making it overactive in a way. When the emotional brain is and has been on fire; thinking parts of the brain have not had an opportunity to really catch up.

We use neuroscience to inform our therapeutic approach which is aimed at quieting the limbic system—the emotional part of the brain. In essence, the neuroscience perspective says, "Gee, people have to feel safe to be able to be vulnerable enough to engage and grow." And the next logical question is, *how do we quiet the limbic system*? We can quiet the limbic system with everything from medications to certain kinds of neural feedback. There are interventions we can use to help "neuromodulate" brain activity; that is, they can put a patient in an alpha state

using certain techniques, including meditation, yoga, exercise. Also, working on secure attachment is a way for young people to use relationships to help calm and soothe themselves.

We also use neuroscience to inform a second, overarching treatment goal: to promote new network connections, particularly connections that might help us metabolize emotion rather than be threatened or overrun by them. The goal is for emerging adult patients learn to become informed by them. To do this, we use a variety of what I call "skill-based treatment models." We look to best practices such as Dialectical Behavioral Therapy or Acceptance and Commitment Therapy. We look to the 12-step model. Each of these was developed for a distinct clinical purpose. To us, the skills taught in these specific therapies are all ways to exercise the brain and to help the brain develop skills to manage and learn from emotions. These skills often have to do with being centered as a person, they have to do with building with self-regulation capacity, involve gaining experiences in interpersonal effectiveness, and involve developing a kind of mindful state where you understand yourself and other people.

So, in sum, the basic principles of the neuroscience inform to broad treatment goals: quieting the limbic system and exercising the brain in its skill-based way.

A third way you can see how neuroscience informs the work we do at Yellowbrick is in our use of "Coherence Therapy." We see a fair number of patients whose left brain and right brain are not speaking to each other. These cases, I think, present a current challenge. We don't currently have a best practice treatment strategy to follow know that we are promoting new connections between the right and left brain? What we do know comes from clinical experiences when we have seen progress in right and left brain integration after a patient participates in art therapy, yoga and other body-oriented. In my opinion, the reason a clinical lore shines over these arts-based therapies is because these therapies don't involve the prefrontal cortex, which primarily involve words and conscious ideas—rather the impact of these interventions takes place outside of awareness. As a result, neither the patient nor therapist can necessarily answer our questions: *"How did that help? Why did that help?* But, they can say, thank God—it helped!"

We call them Coherence Therapies because they focus on non-verbal experiences and the body in particular. These therapies make sense when history suggests less than optimal conditions or experiences during the developmental years. Early emotional experiences—those occurring in infancy and childhood, before individuals' emotional processing capacities are fully mature—can be stored in the body if the experience overrides a young child's ability to organize the experience. These experiences are often those that get stored because the mind keeps them out of conscious awareness to protect the child's sense that he is safe and belongs in his environment. If not processed, what often happens is that those emotions take representation in the body. Later, these emotions often present clinically as patients who have all kinds of physical symptoms.

Somatic symptoms take place in a realm that's beyond words, and so the challenge is to develop techniques that help to engage that in some aspect of experience. To be clear—their problems are not "all in their head," it's about the mind-body relationship. In essence, the brain's emotion-processing network was over-run or circumnavigated. People with trauma, particularly violent or sexual assault trauma—some aspect of that moment got metabolized into their body self and so interventions that are in a communication not involving words are often necessary and helpful to help that person engage that part of their experience and their self.

ALEXANDER: Dr. Viner, there are those who say that whatever these neurological findings tell you as a clinician—they are just an excuse for parents not to do their job of instilling a sense of responsibility in their children. What do you say to those who are of the opinion that troubled emerging adults are not being held accountable for helping themselves? For example, how to you respond to someone who says, "well, he's just doing this or not doing that because it's part of his hormones or part of his neurobiological development; that's why he hasn't developed that way and so that's why he's the way he is?"

VINER: Well, there are certain parts of that that I agree with and certain parts I believe are misrepresentations. It would be a misuse of neurobiology research to say that personhood has not been involved and that people don't have choices and that people aren't responsible and accountable for the choices they make.

From my perspective clinically, what I have witnessed is that when people come to Yellowbrick it is often after years of the emerging adult and the family's life being a nightmare. When we can demonstrate to them that there are objective findings suggesting brain abnormalities, this is helpful to people because it de-stigmatizes what's actually happening in reality. It takes the blame out of it, but still keeps responsibility intact. For example, if we think of these brain-based problems in the same way we think of diabetes, yes, it may be difficult to learn that your son or daughter has diabetes, say, at 9-years-old. The reality is unfortunate. Life becomes harder. But he is still responsible for good nutrition and for telling the school nurse he is feeling dizzy and for, in general, managing this health condition.

It takes it out of the realm of moral failure and moral defect and puts the "issue" into the realm of, "people have certain problems that are rooted in the brain and in brain development." That doesn't excuse anything. But an explanation of the way brain dysfunction is contributing to the presenting problems lends a new framework for understanding the patient's contribution to the problem. Emerging adults benefit from this reframe because the focus turns from emerging adult as the cause of the problem to emerging adult as responsible agent in the treatment and management of the health problem. These young people need support to help them develop effective and satisfying lives. They have genuine issues that we can objectively identify So, I think stigma against people with mental health difficulties is a bigger problem than them "getting off the hook."

Of course, there are families that, for a variety of reasons—everything from parents who have needs of their own that are not growth-promoting for the children to parents who have gotten overinvolved in taking responsibility for their emerging adult's life—set the stage for an eruption of problems when their children begin to make the transition to adulthood. In such family systems, responsibility and accountability get confused and get turned upside-down. But, I don't think that in any way invalidates the findings of the neuroscience or its validity and utility clinically.

Neurobiological Assessment of Emerging Adults:

Are we ready for a paradigm shift?

Lukasz M. Konopka, AM, PhD

In their late teens and twenties, young patients often present with complicated clinical profiles and developmental diagnoses, only some of which make sense in the context of the patient's current presentation. A complex emerging adult patient (typically between the ages of 18 and 29) is vulnerable because a complex presentation makes accurate diagnosis more challenging and reduces the likelihood of designing an effective, well-fitting treatment plan. Clinicians want to know how to meet the specific challenge of diagnosing complex patients who are in the midst of transitioning from adolescence to adulthood. In clinical practice, we ask ourselves, *"How can we use objective, reproducible, and quantifiable measures to assess symptoms and treatment progress, and how do we design personalized treatment plans for emerging adult patients based on a patient's unique profile of strengths and weaknesses?"*

Young patients, particularly those who are no longer adolescents but not yet adults, may present unique diagnostic challenges due to both age and developmental stage. These patients may want to play a role in the diagnostic process, but they frequently have very little experience communicating with clinicians and describing their symptoms and problems. Moreover, because the majority of psychiatric episodes in emerging adulthood are preceded by at least one prior episode of the same or a different psychiatric disorder, it is likely that an accurate diagnosis will require a mental health professional to consider manifest symptoms, but also requires a clinician to think about what may lie beneath. One promising approach, with respect to its potential to increase diagnostic accuracy in complex patients, is neurobiological assessments. Neurobiological assessments (e.g., pharmacogenomics, single-photon emission computed tomography(SPECT), positron emission tomography(PET), and magnetic resonance imaging, (MRI), evoked potentials) are not common practice for diagnosing psychiatric disorders, but are considered cutting-edge tools for understanding the biological makers of different psychiatric conditions (Tregellas, 2014). This paper describes how new quantitative methods for neurobiological assessment, specifically quantitative electroencephalography (qEEG), can be used in a clinical setting for the accurate diagnosis of emerging adult clients with complex symptom profiles.

The "emerging adult" patient

In the past several decades, young people spend more years between adolescence and adulthood. Recent developmental theory suggests that 'emerging adulthood,' roughly spanning ages 18 to 25, is a new, 21st-century developmental stage when young people feel that they are no longer adolescents, but not fully adult because they have not yet taken on adult roles and responsibilities (Arnett, 2000). During these years, emerging adults are more likely to make changes in their living situations, relationships, and educational and career plans. During these years, they spend time focusing on figuring-out their identity and see many possibilities for their future selves (Arnett, 2004). Emerging adulthood is a critical juncture in the human lifespan (Tanner, 2006). During these years, emerging adults face significant, major, immediate decisions that have the potential to tremendously impact their future, adult lives. For some, the life choices and decisions they face may be particularly daunting. Emerging adults may feel overwhelmed by the transitional nature of these years and the lack of certainty about their future. This may be particularly true when family and society have high expectations for achievement, when perceived potential is high, and when a great deal of resources have been invested in the accomplishments of the emerging adult. That is to say, the emerging adult may fear failing himself and may also fear failing others who care.

Experiencing psychiatric disorder during this critical life stage is not uncommon, but can be particularly undermining during this transitional life stage. Emerging adults may interpret their mental health problems and related impairments as indicators that they are failing at becoming adult and may anticipate futures filled with insurmountable obstacles. For individuals entering adulthood with significant handicaps, such as unresolved early childhood trauma, sexual abuse, mild traumatic brain injury (often sports related), bullying, and parental neglect, the pressure of the transition to adulthood can be particularly onerous.

The emerging adult as a "complex" patient

Treating emerging adult patients may be particularly challenging for mental health professionals. It may be particularly challenging to form a therapeutic relationship with emerging adult patients with poorly developed attachment strategies accompanied by aberrant coping responses that emerged early in development and became magnified throughout the years. Treatment may also be challenging due to increased risk for suicide and self-injurious behavior that present in a variety of behaviors including eating disorders, internet and/or pornography addictions, sexual misconduct, chronic anxiety, depression, successive life failures, inability to form interpersonal connections, helplessness, and hopelessness.

Designing and delivering effective treatments that reduce symptoms and support healthier functioning in emerging adult patients requires accurate and comprehensive diagnosis to guide treatment planning. Clinical diagnostic evaluation practices vary widely. Most often, a diagnostic consultation includes a clinical interview and, less frequently, standardized assessments. Rarely do clinicians seek specific information about a patient's neurological functioning. In cases that do prompt the clinician to request neurological testing, most frequently this is because the clinician wants to rule-out an underlying neurological condition as a potential source of abnormality observed during evaluation.

Various methods are used to collect information about a patient's neurological functioning. The specific information the clinician is looking for determine which tests are most appropriate and useful. Specific tests range from a basic neurological exam (e.g., assessment of motor and sensory skills), to laboratory and genetic screening tests, to brain and

body scans (e.g., PET and CAT scans), to more invasive biological tests including tissue biopsy and cerebrospinal fluid analysis.

Advances in neurodiagnostics: qEEG

Relatively recently, with advances in electronics and computer technology, researchers have developed new ways to utilize data from electroencephalography (EEG) and link EEG data with observable activity (e.g., cognitions, emotions, and behaviors) (Konopka & Poprawski, 2008). One such method, quantitative encephalography (qEEG) relies on the well-established practice of measuring neuronal communication recorded from the surface of the skull via EEG (electroencephalography). In qEEG, a patient's unique electrical activity patterns (EEG) is compared to expected, normal patterns found in active and resting states. The result of this analysis is a "brain map" that provides detailed information about the client's brain functioning.

Quantitative EEG is flexible and based on digital data acquisition; the data can be used to describe absolute power, relative power, coherence, symmetry, and source localization (Konopka & Poprawski, 2008). The process of electrical source localization is achieved by low resolution brain electromagnetic tomography (LORETA). This technique can aid the location of surface EEG to the anatomical structure of the patient's brain by co-registering EEG electrode location and activity to an individual patient's MRI or to an available, standard MRI atlas (Pascual-Marqui, 1994). Moreover, we can use these methods of mapping electrical activity to identify cortical structures and the connecting networks that generate specific patterns of electrical activity (Greicius, Krasnow, Reiss, & Menon, 2003). We may also compare underlying frequencies and electrical fields with other functional imaging techniques such as positron emission tomography (PET) (Larson et al., 1998). With PET, we can correlate glucose metabolism with electrical fields; for example, we find increased metabolic activity coincides with theta frequencies in the anterior cingulate gyrus (Pizzagalli, Oakes, & Davidson, 2003). Cordance, another recent method developed by Leuchter et al., 1994, takes EEG measures and directly correlates them with brain perfusion measures.

qEEG not only improves our ability to make more accurate clinical diagnoses but also has resulted in general advances in our ability to identify the normal limits of healthy brain functioning (Boutros, Thatcher, Galderisi, Yudofsky, & Hales, 2008). Comparing digitized EEG patient data against database reference ranges in the context of additional patient information (e.g., clinical histories, imaging data (e.g., MRI)) has helped researchers develop guidelines for discriminating normal from abnormal qEEG results with their respective, specific clinical conditions. For example, a discriminant function for mild traumatic brain injury (mTBI) from qEEG data has been coined the "Thatcher's function"(Thatcher, Walker, Gerson, & Geisler, 1989). This method of identifying mTBI via qEEG is particularly promising given patients with mTBI often have normal findings on standard imaging (e.g., CT or MRI; Andreasen, 1989; (Hollister & Boutros, 1991).

In practice, discriminant functions on qEEG provide clinicians with a tool to evaluate brain activity in the context of the patient's cognitive deficits with no known cause. For example, patients may experience cognitive problems (e.g., difficulty controlling attention or recalling events) or mood disruption following a head trauma but may present with normal findings on standard structural brain imaging. In some cases, patients will show no mTBI findings on EEG despite a clear, verifiable history of mTBI. Discriminant functions on qEEG can overcome this limitation of standard EEG and can help clinicians discriminate between potential malingering and true complaints.

In even more complex cases, qEEG practices may be combined with data from various imaging techniques. One such technique involves recording EEG simultaneously with the distribution of imaging ligand throughout the brain (Goforth et al., 2004). This technique allows one to evaluate brain function using independent qEEG techniques and nuclear medicine tools such as PET or SPECT and, thus, enhance the reliability of the results (Gordon & Konopka, 2005; Poprawski et al., 2007; Zimmerman et al., 2011). qEEG data alone may provide insufficient sensitivity for detecting subcortical tissue involvement, but when we combine imaging approaches, the clinician may gain new insights into the current clinical presentation. For instance, if one uses standard qEEG analysis, thalamic hypoactivity may go undetected; however, if one uses qEEG in conjunction with PET, thalamic abnormalities may be more readily identified providing additional information for issues directly related to the reported clinical presentation, such as chronic, localized pain (Iadarola et al., 1995) or potential genetic vulnerability (Zimmerman, Konopka, Epstein, & Konopka, 2013).

At Yellowbrick: qEEG in clinical practice

During Yellowbrick's comprehensive assessment, we use qEEG on each and every patient. By correlating the qEEG data with the more standard neurobehavioral evaluation, we have identified patients, who had brain abnormalities later discovered on imaging studies such as PET-MRI. In the past two years, Yellowbrick has scanned approximately 10% of their patients, and from that population, approximately 25% have shown significant structural findings; three patients had subarachnoid cysts located in the posterior fosse. When assessing and diagnosing emerging adult patients with complex symptom profiles, the qEEG can identify brain activity areas that may contribute to the presenting clinical problems. Just as lab test reports (e.g., blood and urine) include information about whether a patient results are "in" or "out" of range to identify abnormalities, individual qEEG results also are compared to reference ranges. A number of "normative" databases are available for such use (Zimmerman, Golla, Paciora, Epstein, & Konopka, 2011).

When an emerging adult patient's assessment includes qEEG, we use the "Lifespan Database" (Thatcher, Walker, Biver, North, & Curtin, 2003). This commercially available database contains the normal EEG data used as a standard for comparing patient data. This database is well-defined and scientifically reviewed (Gordon & Konopka, 2005). Using a qEEG database and other imaging analysis, a clinician can compare individual patient data to reference norms derived from control samples of subjects matched for age, gender, and handedness. Comparative analyses yield statistical distribution maps that identify brain activity that statistically deviates by two standard deviations or more from reference norms. The clinical reports of qEEG abnormalities involves interpreting how dysfunctions in specific brain networks may present as clinical symptoms (Chennamchetty, Poprawski, Crayton, Hamilton, & Konopka, 2009; Poprawski et al., 2007).

Early stages of a paradigm shift

Using qEEG in the assessment of complex patients represents divergence from traditional clinical standards for assessment and diagnosis and forward thinking with respect to using biological data to more ac-

curately diagnose and treat psychiatric disorders. Currently, standard assessment and diagnostic practices in psychiatry and psychology involve matching a patient's self-reported, subjective symptoms with DSM or ICD diagnostic criteria. This is an imperfect approach to clinical diagnosis. Even within well-defined DSM or ICD diagnostic categories, there may be at least two identifiable subpopulations (Gunnarsdattir et al., 2000; John et al., 1994; Poprawski et al., 2009). For example, some individuals with schizophrenia have enlarged ventricles and others do not (Kasparek et al., 2007). Despite their symptom similarity, we use the same diagnostic category to classify patients with schizophrenia despite different biological abnormalities. The question is, should we distinguish the two groups and treat them independently? Data indicate that separate treatment for distinct subgroups would lead to more effective treatments (Kasparek et al., 2007).

Toward biologically-based diagnostic criteria

Although we should question our assumption that symptom clusters characterize distinct biologically-based mental illnesses, the practice of diagnosing and treating patients based on these diagnoses is unlikely to be replaced by a different approach in the near future. Progressive changes in the way we assess and diagnose psychiatric disorders are unlikely to be seen in the near future due to systemic reliance on diagnostic codes to provide us with a universal language used by medical and health professionals and management systems (i.e., medical education and training, scientific inquiries and insurance reimbursement procedures,). Yet, there is some reason to believe that there will be a paradigm shift toward biologically-based assessment and diagnosis for a number of reasons. Thomas Insel (2013), Director of The National Institutes for Mental Health, launched the Research Domain Criteria (RDoC) project in an effort to "develop, for research purposes, new ways of classifying mental disorders based on dimensions of observable behavior and neurobiological measures."

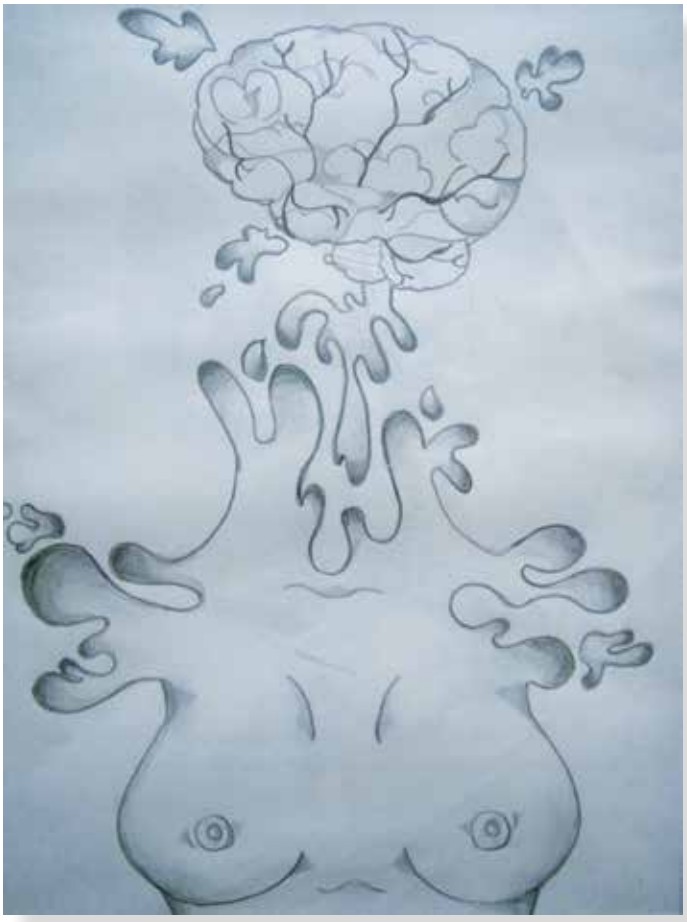
Toward personalized medicine

Developing research-based criteria for use in clinical practice is a natural next step, one that will inform movement toward the goal of personalizing and practicing "precision medicine"— diagnosis that is person-centered and multifaceted (Insel, 2011). Likewise, under the auspices of the College for Person Centered Medicine, the movement for an individualized approach is gaining worldwide momentum, and funding agencies are supporting advancement toward personalized medicine (Hamburg & Collins, 2010). Using objective data, the "Brain to Behavior Approach" to diagnose psychiatric disorders in individual patients (Zimmerman, Golla, Paciora, Epstein, & Konopka, 2012) is an approach that mental health professionals can begin to implement and practice in advance of system-wide, universal implementation.

When we shift our thinking from diagnostic labeling to data-based analysis of observable biological and behavioral characteristics symptoms, we are moving in the direction of delivering personalized medicine. Using multimodal imaging in parallel with a detailed clinical history and objective and subjective neurobehavioral assessment, we can define the patient's unique strengths and weaknesses and gain greater understanding of the person: this is the person-centered diagnostic approach. Through the person-centered diagnostic approach, we seek to develop more precise and effective treatments.

Moving forward: A person-centered approach to diagnosis of emerging adult patients

Neurodiagnostics in general and qEEG specifically can be used to improve our ability to accurately diagnose and effectively treatment of emerging adult patients with complex psychiatric profiles. Since Yellowbrick invests significant time and resources and heavily relies on neurobiology, qEEG affords a noninvasive, relatively inexpensive method to objectively evaluate the brain functions of complex patients. qEEG results are based on a well-characterized, scientifically validated, commercially available, database of normals the qEEG results can be universally replicated. qEEG analysis defines the impairment of an individual's brain networks and provides a precise understanding of neurocognitive processes and limbic influences. In turn, this information results in clinical understanding of each individual patient's unique presentation. Then supported by both electrophysiological and behavioral data, Yellowbrick can rank order and target symptoms that lead to individualized treatment approaches. With these data, Yellowbrick can objectively evaluate treatments and treatment effects. To our knowledge, this objective, multimodality, data-driven, cutting-edge approach is unique only to Yellowbrick.



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Sharp Waves in Emerging Adults: Implications for Symptoms and Recovery

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Vulnerability in Emerging Adulthood

Emerging adulthood is a unique stage of human development characterized by a formative set of social, psychological and physiological changes. Today's emerging adults face several challenging demands including the need to decrease dependency on family, to narrow career options, and to leave behind behaviors or beliefs by which they do not want to be defined. The way they meet those demands will determine future pathways across personal identity, relationships, professional choices, values and lifestyle (Tanner, 2009). Also during this developmental stage, the brain is similarly establishing pathways across cortical networks. Dendritic and axonal arborization and myelination continue to build upon and consolidate neuronal networks, particularly in the frontal lobes (Lenroot & Giedd, 2006). Meanwhile, the brain is selectively trimming or pruning excess neurons that are not involved in final cortical pathways (Giedd, 2008). These maturational changes have the potential to significantly influence an individual's health and well-being throughout adulthood.

Response to Stress

Such dramatic shifts during this stage of life are often accompanied by significant stress. Acute or intermittent stress can be a natural process of development to which the brain responds adaptively. Repeated or chronic stress, however, can have significant consequences on physical and emotional wellness (see McEwen, 2007 for review). Although many healthy young adults may be armed to tolerate and adapt to the stress associated with this normative developmental transition, there are factors that leave other individuals vulnerable for psychiatric disorders. Such factors may include exposure to early and chronic adversity. Emerging adults with histories of trauma, abuse, socioeconomic disadvantage, and early onset of mental illness are at greater risk for developing depression, anxiety, substance abuse, and various psychiatric disorders (Heim & Nemeroff, 2001; Fergusson, Woodward, & Horwood, 2000; Jaffee et al., 2002).

Changes in the Brain

Early or repeated exposure to stress may impact healthy brain development by increasing neurophysiological vulnerability and reducing tolerance for additional stressors. Several studies have demonstrated functional and structural cortical abnormalities associated with childhood trauma. Psychological, physical, or sexual abuse has been correlated with greater prevalence of left hemisphere EEG abnormalities (Ito et al., 1993), diminished cortical development in the left hemisphere and left hippocampus (Bremner et al., 1997; Ito, Teicher, Glod, & Ackerman, 1998; Stein, Koverola, Hanna, Torchia, & McClarty, 1997), and damage to white matter tracts in different regions of the left hemisphere (Choi, Jeong, Rohan, Polcari, & Teicher, 2009). Many abnormalities associated with early abuse or neglect involve impairment of cross-hemisphere communication, including reduced density of the corpus callosum (Teicher et al., 2003) and impaired hemispheric integration (Teicher, Ito, Glod, Schiffer, & Gelbard, 1994).

Changes to the Stress Response System

Under conditions that support normal development of a healthy stress response system, exposure to an acute stressful event is likely to trigger a short-term biological stress response. This adaptive, hard-wired function involves the release of powerfully stimulating hormones such as corticotropin-releasing factor (CRF) and glucocorticoids. Activation of these hormones protects the individual in the short-term by preparing the person for optimal physical performance. In addition, activation of the stress response protects the individual in the long-term by stimulating the formation of emotional memories that warn the individual of similar threats in the future (McGaugh & Roozendaal, 2002). Normal function of these biological mechanisms in response to acute stress resolves with psychological recovery and return to physiological homeostasis (Yehuda & LeDoux, 2007).

Exposure to chronic stress in early childhood, however, results in repeated release of these stimulating hormones with lasting consequences on the body and brain. With repeated exposure, the stress response system becomes increasingly dysregulated, reducing an individual's ability to efficiently and effectively respond to negative events. It becomes increasingly more difficult for the system to return to psychological and physiological homeostasis with each subsequent event. Chronic stress results in repeated acute CRF release, which has excitatory effects on neurons in key brain structures such as the amygdala (Rosenkranz, Venheim, & Padival, 2010). Elevated glucocorticoids also facilitate excitation in vulnerable brain structures such as the hippocampus by influencing glucose uptake as well as increasing susceptibility to excitatory neurotransmitters such as glutamate. These processes have neurotoxic effects that cause cell damage, exacerbation of previous injury, or cell death (McEwen & Magariños, 1997; McEwen, 2007; Duman, Malberg, & Thome, 1999). Evidence of such damage is seen in patients with depression and PTSD by decreases in hippocampal volume (Caetano et al., 2004; Apfel et al., 2011; see Bremner, 2006 for review). Chronic stress also effects down-regulation of protective factors such as brain-derived neurotropic factor (BDNF), which serves a role in neuronal survival and function (Duman et. al., 1999).

Impact of Harmful Substances

Another factor increasing vulnerability to stress involves insult to the developing brain as a result of substance use. While many types of substances are common and socially normative in emerging adulthood, substance use is associated with risk for psychiatric disorder and impaired functioning in emerging adulthood. Use of substances impairs the functional capacity of the stress response system through the disruption of balance between excitation and inhibition.

Specifically, for example, cocaine has an excitatory effect on neurons. Chronic use of cocaine has been shown to facilitate "kindling" processes that can eventually develop into seizures. Individuals who chronically and habitually abuse cocaine demonstrate increased sensitivity to cocaine's epileptic effects (Post, Weiss, & Pert, 1988; Dhuna, Pascual-Leone, Langendorf, & Anderson, 1991). Alcohol, on the other hand, facilitates inhibitory processes in the brain as it attenuates excitatory glutamate and enhances inhibitory GABA neurotransmission (see Julien, Advokat, & Comaty, 2011 for review). Upon withdrawal, the brain has an increased vulnerability to a rebound excitatory response that can result in alcohol withdrawal seizures. Therefore, emerging adults who engage in use or abuse of substances increase network susceptibility to excitation, which can exacerbate underlying psychiatric symptoms.

In difficult-to-treat individuals with complex case histories, clinicians are challenged to understand all of the driving factors that underlie behaviors and emotions. In addition to presenting problems, many emerging adult patients will have a history of psychiatric disorder(s). Clinicians may not have access to past clinical information essential for understanding the context of current psychopathology. Due to limitations of early childhood memory, some individuals have difficulty recalling or describing their history so portions of the clinical picture can be incomplete, especially in regards to preverbal trauma. It is also imperative to consider how life events are understood in light of each individual's unique understanding of the world, which includes distinct preferences for processing information and how this information is communicated to others. Yet it may be challenging to gather this data. Thus, in addition to subjective descriptions of current symptoms and previous life events, objective measures can become increasingly important to provide insight into the clinical picture and offer supportive evidence for experiences of early adversity (Zimmerman, Golla, Paciora, Epstein, & Konopka, 2011).

EEG Sharp Wave Assessment

Electroencephalography (EEG) is one objective measure clinicians can use to assess the brain's potential vulnerability to pathology. This method is useful in clinical settings because it is a relatively non-invasive and inexpensive neuroimaging tool that can be used to identify brain patterns associated with a wide variety of psychiatric disorders (Coburn et al., 2006). EEG records electrical activity of the brain at the scalp, capturing the firing of large groups of synchronized neurons. One EEG pattern associated with psychopathology and potential neuronal vulnerability is a brief event called the sharp wave. A sharp wave is a time-limited (70-200ms) electrical event that appears on the EEG as a sharply pointed spike clearly standing apart from normal EEG background rhythms (Figure 1).

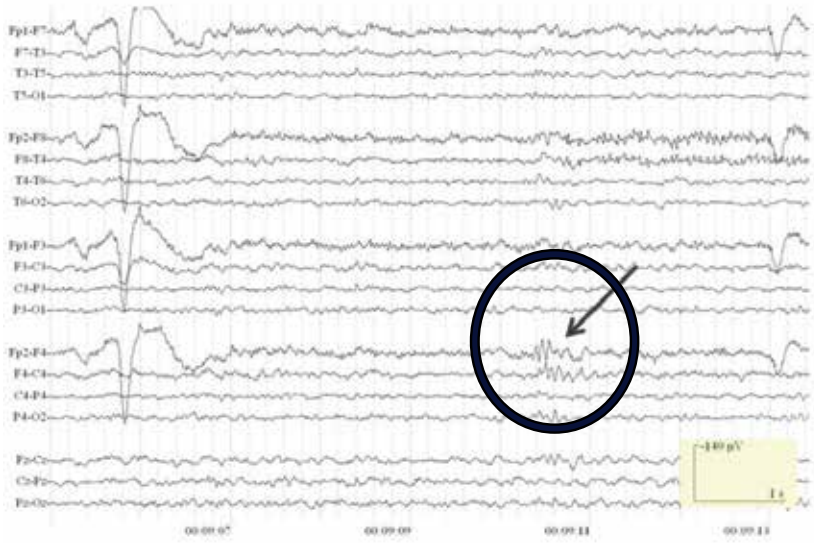

Figure 1. Twenty-five year old male referred for depression and anxiety. Bipolar montage displaying sharp wave in right frontal lobe (F4 electrode) detected during sleep.

Sharp waves are present at a very low rate, less than 1% (Shelley, Trimble, & Boutros, 2008), in normal, healthy populations. Sharp waves also occur as a normal feature of brain activity during transitional states, for example, from wake to sleep (Hughes, 1994). In children, sharp waves and certain types of seizure-related activities are often considered benign and resolve or disappear with age (Hughes, 1994.) Although normal features of transitional and developmental states, sharp waves are more prevalent in psychiatric populations and may be a feature of both symptomatology and recovery processes.

Sharp Waves Correlated to Pathology

On EEG, sharp wave activity reflects chronic excitation (i.e., electrical or chemical), indicating stimulated regions that have been repeatedly simultaneously activated. Neurons in a particular region then "learn" to fire together in an increasingly synchronous fashion. Over time, the threshold for excitation of focal neuronal aggregates is lowered, and these groups of neurons decrease their ability to maintain normal inhibition. Underlying this transformation in neural wiring are changes in neurotransmitter functioning including dysregulation of inhibitory neurotransmitters (i.e., GABA) and excitatory neurotransmitters (i.e., glutamate) (Morimoto, Fahnestock, & Racine, 2004). As a result of enhanced excitatory tone, regions of the brain chronically exposed to CRF and elevated glucocorticoids repeatedly fire and can eventually develop into a self-sustained focus of neuronal excitation.

These focal areas of excitation become less and less dependent on external stimulation to activate firing (Morimoto et al., 2004). This process is called "kindling" (Goddard, McIntyre, & Leech, 1969), and is a critical feature in the development of sharp waves. Much like kindled wood acts as easily ignitable material to start a fire, kindled neurons after repeated stimulation are easily "ignited" at low threshold and eventually develop self-sustained electrical bursts—sharp waves on EEG (Figure 2).

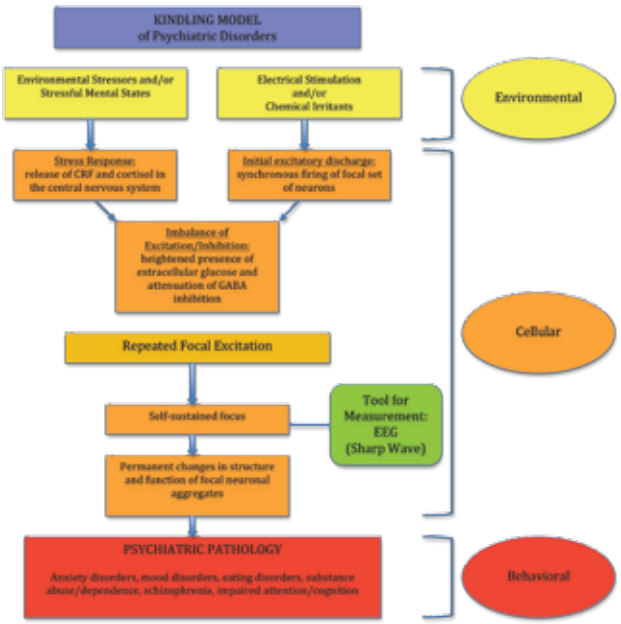

Figure 2. Kindling model of psychopathology

In psychiatry, the kindling hypothesis is a useful framework for understanding why some individuals develop a heightened psychological and physiological response to stress (Post & Weiss, 1998). For example, in unipolar and bipolar depression, environmental stressors may play a significant role in the initial onset of depressive episodes, but over time, subsequent episodes of depression may emerge spontaneously independent of significant environmental triggers (Post, 2010). Another example lies in kindling of withdrawal seizures reported in alcohol dependent individuals. These individuals have an increased likelihood of developing seizures with every alcohol detoxification because with each withdrawal, normal inhibition is weakened and the threshold for excitation is lowered (Brown, Anton, Malcolm, & Ballenger, 1988).

The presence of sharp waves on EEG can be an indicator of alterations to cellular physiology and may be associated with changes in cognition, emotion, and behavior. Sharp waves appear in 28% of psychiatric patients diagnosed with a wide variety of disorders (Zimmerman & Konopka, 2014). Sharp waves have been correlated to suicidal ideation, suicide attempt, and suicidal-assaultive presentation (Struve, Saraf, Arko, Klein & Becka, 1977). These waveforms also appear on 20-40% of EEGs of patients diagnosed with mood disorders (Shelley et al., 2008) and are also present on EEGs of patients diagnosed with panic disorder (Weilburg et al., 1995; Hughes, 1996), affect-related psychoses (Inui et al., 1998), borderline personality disorder (Archer, Struve, Ball, & Gordon, 1988; Osigo et al., 1993), violent behavior (Wong, Lumsden, Fenton, & Fenwick, 1994), and eating disorders (Wermuth, Davis, Hollister, & Stunkard, 1977; Neil et al., 1980; Rau, Struve, & Green, 1979).

Sharp Waves As Recuperative

At the same time, some evidence suggests that sharp waves may serve a recuperative purpose. As discussed above, exposure to chronic stress can lead to neurotoxic effects that cause cell damage, exacerbation of previous injury, or cell death (McEwen & Magariños, 1997; McEwen, 2007; Duman, Malberg, & Thome, 1999). In recovery processes, however, sharp waves may emerge to counteract processes of cell injury due to stress. Sharp waves are identified as type of a hyper-synchronous EEG activity, as is seizure activity. Hyper-synchronous activity has been implicated in promoting

neuronal growth processes, and evidence suggests that such activity may influence the dynamic balance between neuronal death and proliferation (Madsen et al., 2000). Researchers have shown that seizure activity increases expression of BDNF (Scharfman, Goodman, Sollas, & Croll, 2002; Altar et al., 2004), which directly modulates cell growth and synaptic function with neuroprotective effects (Causing et al., 1997; Schuman, 1999; Tucker, Meyer, & Barde, 2001). Induction of hyper-synchronous EEG activity via electroconvulsive therapy (ECT) in patients with depression has been linked to increased number of hippocampal synapses following treatment (Chen, Madsen, Wegener, & Nyengaard, 2009). Along the same lines, sharp wave activity may serve to reverse the process of stress-induced cell death by promoting the expression of protective neurotrophic factors. From this perspective, the presence of sharp waves could reflect the engagement of an endogenous compensatory recovery mechanism (Post, 1992).

This process may be similar to the activation of other compensatory systems known to be associated with the recovery process. For example, sleep problems are diagnosed in some, but not all patients with affective disorders. Sleep disruption is a commonly reported symptom in depression, and at the same time, depressed patients experience significantly enhanced mood immediately following sleep deprivation (Kuhs & Tölle, 1991). Such an example demonstrates the brain's ability to develop endogenous physiological adaptations related to both problematic symptoms as well as signs of recovery.

Sharp Waves and Symptom Severity

Thus, with respect to psychiatric disorders, sharp waves may serve a dual purpose. They may (1) signal biological burden associated with chronic stress exposure, and (2) protect the brain's compensatory response to chronic stress exposure. Figure 3 illustrates how sharp waves represent a range of underlying processes spanning the pathological to protective.

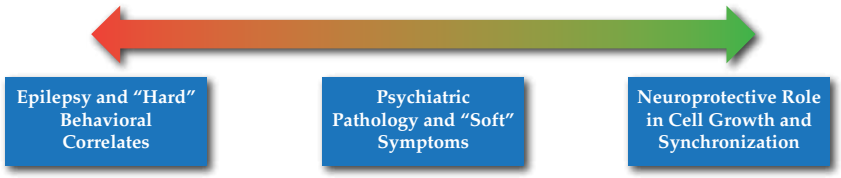

Figure 3. Spectrum of seizure-related activities ranging from pathological to protective

Also, it is worth noting that severity of psychiatric symptoms has been correlated with how sharp waves are distributed in the brain. Specifically, patients with sharp wave activity at a single EEG electrode have been shown to demonstrate significantly greater number of reported symptoms related to emotional dysregulation. On the other hand, patients with sharp waves distributed to homologous regions across hemispheres were significantly less likely to endorse severe clinical symptoms such as self-injurious behavior, suicidal/homicidal ideation, dissociation or psychosis, history of psychiatric hospitalization or prior suicide attempt (Zimmerman & Konopka, 2014).

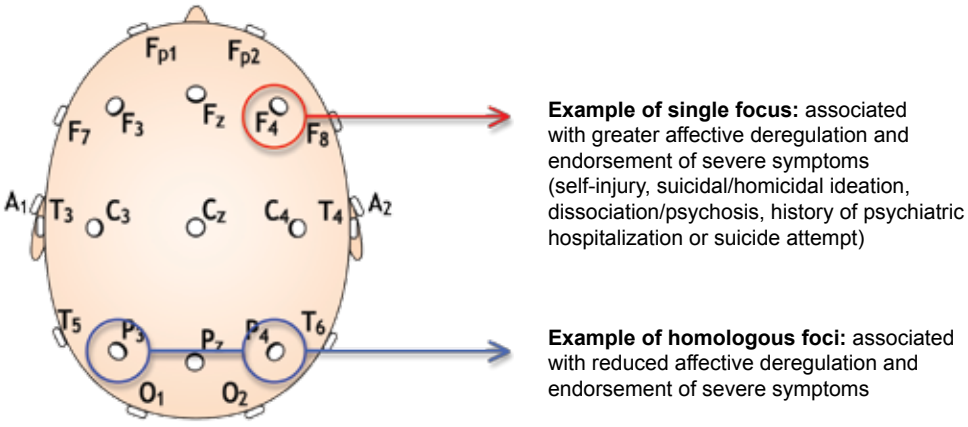

Figure 4. Single v. homologous foci of epileptiform activity may differentiate severity of pathology.

These outcomes suggest that isolated, highly focal epileptiform activity may represent disconnectivity from surrounding cortical networks, while distributed sharp waves across neuronal networks may actually serve as a protective factor, reflecting cross-hemispheric communication and connectivity.

Conclusions

In a time of significant biological, psychological, and social changes, emerging adults are at a unique stage of development characterized by self-establishment, growth, and selective elimination. Stress brought on by the radical change during this period of life may increase vulnerability to psychiatric disorders, particularly for individuals who have already faced adversity and who are sensitive to additional emotional challenges. Sharp waves may serve as a potential marker of electrophysiological vulnerability and provide indications for symptom severity. Sharp waves may also serve a recuperative purpose in enhancing network connectivity, facilitating network establishment and neuronal growth during a critical maturation period.

The use of EEG as a tool to identify patients with sharp wave activity is a growing frontier of clinical neuroscience in psychiatry, and may lead to the design of treatments based on individual brain patterns. Presence of sharp waves provides implications for clinical severity in terms of location and distribution and offers insight into network vulnerability. At the same time, sharp waves as a normal feature of transitional states of brain activity, resolution with maturation in childhood, and presence in some normal individuals suggests they may serve other roles in brain function. Ongoing monitoring of sharp wave activities in conjunction with other EEG abnormalities can provide an objective assessment of brain activity. Objective measures are important in psychiatric assessment of emerging adults dealing with stress or psychiatric symptoms because they can shed light on complex clinical presentations that are often dynamic and multifaceted during this challenging phase of life.

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Mind, Body, Brain, and Art: A Rationale for the Therapeutic Use of the Arts

Christopher M. Belkofer, Ph.D., ATR, LPC

Recent advances in neuroscience provide strong evidence of brain-body connections in a wide variety of mental illnesses. Art therapies have been used for decades based on an implicit understanding that expressive therapies help patients integrate thoughts and feelings. While the clinical benefit of art therapies is widely accepted, a body of literature that empirically validates the effectiveness of art therapies has been slow to accumulate. Now, studies of art therapies that explore the effect of these experiences on brain functioning present an opportunity to reframe art therapies. This framework views creative expression not just an adjunct tool of verbal therapy, but rather an independent and self-sufficient agent of therapeutic change. Theorists and researchers studying developmental trauma were quick to take advantage of the synergy between neuroscience and creative therapies. Neuroscience- informed expressive arts are especially promising techniques for treating patients with histories of trauma.

Trauma: Brain-body connectivity

If past experience is embodied in current physiological states and action tendencies and the trauma is reenacted in breath, gestures, sensory perceptions, movement, emotion and thought, therapy may be most effective if it facilitates self-awareness and self-regulation. Once patients become aware of their sensations and action tendencies they can set about discovering new ways of orienting themselves to their surroundings and exploring novel ways of engaging with potential sources of mastery and pleasure (van der Kolk, 2006, p. 289).

Traumatic experiences stimulate sub-cortical regions of the brain involved in emotional processing, essentially bypassing brain regions that deal with the regulation of emotion (van der Kolk, 2006). We often experience emotions independent of our higher-order, conscious, logical, and analytical brain (Hughes, 1999). Yet, the impact of trauma on the human body and mind can remain. Over time, real or perceived threat, including psychological and physical trauma, can alter one's physical health (Anda et al., 2007) as well as their experience of reality and the autobiographical self. In other words, trauma can alter how one feels in their body (e.g., tense, nauseous, angry, unable to relax) and in the world around them (e.g., safe, stable, consistent, unable to trust). These effects are very real, and they can also be very difficult to talk about.

Traumatic experiences can defy logic and understanding and may be so disorienting that words cannot express the complexities. Therapists working with victims of trauma are faced with the challenge of how to address the trauma in a safe way that gets to the root of the problem. In efforts to separate and protect the self from the physical and emotional effects of their trauma, many survivors develop a negative relationship with their own bodies (van der Kolk, 2006). As noted by van der Kolk, with the therapist's support and guidance clients can practice expressing and regulating their sensations in the present instead of attempting to make meaning of past experiences with narrative descriptions. Experiencing sensations in the present becomes a way of reconnecting to one's own body and the primary goal of therapy.

Feeling the body is knowing the self

" For every person that you know, there is a body" (Damasio, 1999, p. 142).

Traumatic memories, which are often stored as pictures or scenes, are not easily organized into sequential narratives (Klorer, 2005). Rather, clients experience snapshots of the event and flashbulb memories (van der Kolk, 2006). The non-linear and intrusive images associated with trauma may be foggy in their detail but vivid in their emotional content. For example, a client may be able to recall an image of a couch when asked to verbally describe her childhood sexual abuse. While she may be unable to remember sequential details, she knows that something bad happened on this couch. As the image of the couch enters her mind, her body involuntarily remembers and communicates a complex series of responses: her heart rate quickens, her chest tightens, and she shifts tensely in her chair. The trauma is manifested in bodily associations paired with images in the mind.

Figure 1. ***Mind-Body Loop*****, 2008, by Chris Belkofer. Oil on canvas.**

All of the arts involve the body because of their reliance on perception and sensation (Kossak, 2009). The physical action-oriented qualities of the arts may help clients learn to alter their internal loops of self-appraisal and baseline levels of homeostasis.

The role of empathy in aesthetic responses

Trauma survivors often experience "physical immobilization" (van der Kolk, 2006). As a result of the intrusive characteristics of trauma, survivors may shut down and close off from the external world and their own bodies. The hands-on, action-oriented qualities of the expressive arts can help counter these immobilizing states. Expressive arts therapie such as art therapy, dance-movement therapy, music therapy, drama therapy, and poetry therapy allow for traumatic material to be "externalized in the form of images or objects" (Collie, Backos, Malchiodi, & Spiegel, 2006, p. 160). Pushing a brush, marking with a pencil, banging a piano key, or lifting an arm helps clients begin to move. These methods of active engagement, which are kinesthetic and sensory, are often playful and exploratory in nature can be utilized to promote mind-body awareness (Malchiodi, 2006).

As clients become more aware of their body, emotions that were once closed off begin to surface. The client and therapist must then begin the work of encountering these difficult feelings together In the language of movement, line, shape, color, form, and rhythm, therapist and client can reach a place of empathic understanding by engaging the body through expressive arts processes (Pearson & Wilson, 2009).

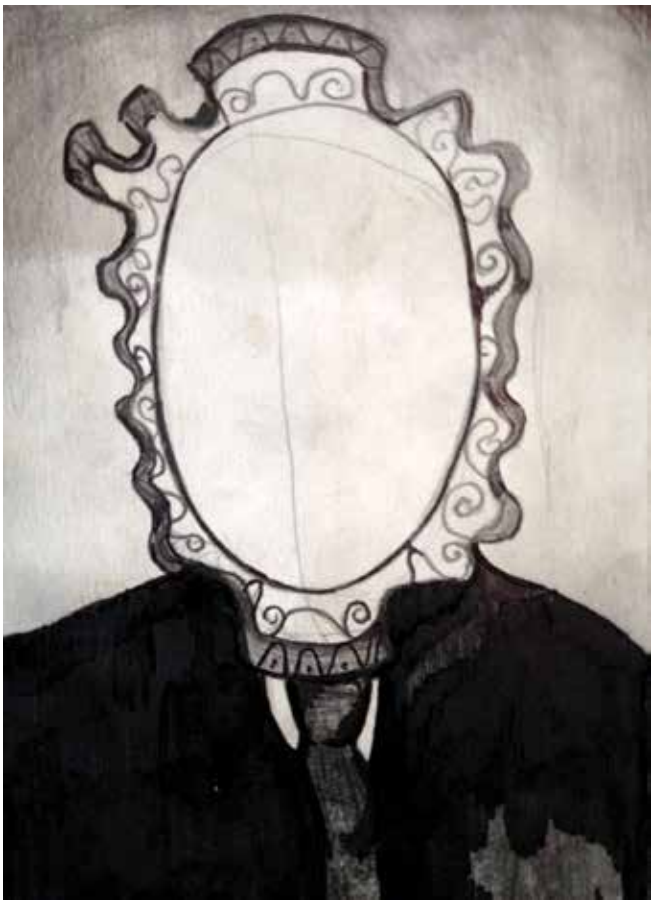

Figure 2. *Mirror Neurons*, 2013, by Chris Belkofer. Pencil and marker on paper.

Research on mirror neurons has widespread implications for the therapeutic use of the arts. Therapeutic attunement and states of empathy may be directly related to functioning of the mirror neuron system. Making art in the presence of others can be a powerful non-verbal way to promote community and positive interpersonal relationships.

Mirror Neurons

How these empathic connections are made may be related to cells in the motor areas of the frontal cortex called mirror neurons (Gallese, Fadiga, Fogassi, & Rizolatti, 1996). In laboratory experiments, researchers found that when monkeys reached for a peanut, certain specific clusters of neurons in their brains fired. When this same monkey watched a different monkey reach for a peanut, similar neuronal paths in their brains were activated. In other words, the brains of the observing monkeys responded to watching the movements of others as if they had actually moved.

A growing amount of literature has found similar engagement of mirror neurons in humans observing other people (Marshall, Bouquet, Shipley, & Young, 2009). These findings have led to clinical implications regarding mechanisms involved in behavior modeling and empathic experience (Siegel, 2010). Since the mirror neurons system may be involved in our capacities for experiencing empathy, this is of particular interest to the expressive therapies (Franklin, 2010). It seems likely that mirror neurons would be involved with the interpersonal connections, intimacy, and vulnerability that clients often feel when making and sharing their art with others. Such connections are related to states of attunement and empathy (Kossak, 2008).

Preliminary findings from research with individuals diagnosed on the autism spectrum provide evidence for these theories. Participants with autism displayed different brain activity than normal controls in response to perceived movement (Oberman et al., 2005). The authors hypothesized that the literal responses and lack of metaphoric expression associated with autism "may arise from a dysfunction in the mirror neuron system" (p. 196). Buk (2009) noted that mirror neurons might be impacted by watching others make art or by being around creative environments. Viewing art and art-making behaviors may be therapeutic in their activation of brain regions that would be stimulated if the viewer were actually making the imagery. Persons with limited motor and cognitive functioning then could potentially benefit from the neural stimulation created by being around creative behaviors even if he or she was unable to move.

Even images that are non-objective (images that do not depict actual objects) can evoke "bodily resonances…in which beholders might find themselves automatically simulating the emotional expression, the movement, or even the implied movement within the representation" (Freedberg & Gallese, 2007, p. 197). The gesture of a mark may make us feel the sensation of a swoosh across a canvas as if we are being swept away. Here we see the communicative power of the gesture and its possible relations to the mirror neuron system. Not only does the content of the art piece evoke responses from the mirror neuron system but the non-objective qualities, such brush strokes or pencil marks on a page, may evoke responses as well.

Art theory in the nineteenth century emphasized the role of physical responses in assessing and observing a work of art, while the arts in the 20th century have focused more on cognitive responses (Freedberg & Gallese, 2007). A parallel can be seen in the historical shifts of psychotherapy toward cognitive and solution focused treatment. In an attempt to gather empirical evidence, current psychological approaches rely heavily on cognition. The result may be a culture that has left the body behind.

Summary

In summary, creative therapeutic applications of neuroscience support movement away from a division between art and science. The brain and the body are connected (Newberg & d'Aquili, 2000). Trauma severs our mind-body connections in a variety of ways: it makes us less present in our bodies and in the world, and it disrupts our ability to experience the feelings of vulnerability needed for empathic connections. Yet, the bodily elements of the arts can guide clients toward new ways of *being* and *understanding* that are *felt* as well as *thought.* Art can facilitate this because it helps clients become present in their body. Growing scientific evidence is showing that empathy is a conduit to implementing the therapeutic process of interpersonal connection (Siegel, 2012). This may be related to mirror neurons. Empathy is the therapeutic bridge, the space where engagement of the senses opens the capacity to have embodied interpersonal connections. The arts help the body speak to the mind, often leading not only to long lasting shifts in how a person feels *about* the world but long lasting shifts about how they feel *in* it.

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LITERATURE REVIEW:

USING NEUROSCIENCE TO INFORM EMERGING ADULT TREATMENT

Jennifer L. Tanner, Ph.D.

Co-editor, *Yellowbrick Journal*

The first step in moving toward a specialized approach to assessment and diagnosis, and tailored treatments for mental health problems in emerging adulthood is recognizing that developmental features of emerging adulthood make this age period a candidate for developmentally-tailored mental health services. A decade ago, developmental psychologist Dr. Jeffrey Arnett introduced a theoretical lens for conceptualizing emerging adulthood as stage of the life course characterized by distinct developmental characteristics This lens is useful for framing a very real practice challenge: *how do we accurately conceptualize and effectively respond to the distinct challenges we face when it comes to providing mental health care to young people ranging in age from 18 to 29?* Recent advances in neuroscience present us with an opportunity to generate specialized emerging adult mental health practices grounded in cutting-edge scientific research.

The theme of this LITERATURE REVIEW is work that considers the intersection of development and psychopathology with a specific emphasis on the contribution that advances in neuroscience offer in terms of both conceptualizing and treating psychiatric disorder in emerging adulthood. Included in this review are conceptual papers that frame emerging adulthood as a distinct stage of development with respect to neurodevelopment and neurological functioning, seminal articles on brain structure and functioning in the late teens and twenties, empirical studies that refine our understanding of associations between neurological functioning and psychiatric syndromes, and conceptual integrations of neuroscience and therapeutic practice.

Tanner, J. L., & Arnett, J. J. (2013). Approaching young adult health and medicine from a developmental perspective. *Adolescent Medicine: State of the Art Reviews (AM:STARs), 24*(3), 485- 506.

This paper provides readers with a broad overview of the challenges associated with carving out a specialization in medical care specifically designed to meet the needs of emerging adults, ages 18 to 29. Although the scope of the paper is broad, focusing on the value of the developmental lens for designing specialized health care practices for emerging adults across health sectors, a special section 'Focusing on Psychiatric Disorder and Mental Health' provides readers with a very brief introduction to the specific health risks and challenges associated with psychiatric disorder in patients ages 18 to 29. This special issue contains a number of other articles that will be of interest to mental health practitioners working with emerging adults: 'Mental health among late adolescents and young adults from a population-level and clinical perspective' (Dopp, Lipson, & Eisenberg), 'Non-medical use of prescription medications in young adults' (Tapscott & Schepis), 'The transition to adulthood from adolescence to adulthood and associated substance use/abuse' (Stoddard, Eisman, Aiyer, & Zimmerman), 'Asperger syndrome in young adulthood: The physician as supportive coach and medical advisor' (Greydanus, Truba, & Pratt), 'ADHD diagnosis and treatment in college students and young adults' (Thomas, Rostain, & Prevatt).

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Giedd, J. N., Laloonde, F. M., Celano, M. J., White, S. L., Wallace, G. L., Lee, N. R., & Lenroot, R. K. (2009). Anatomical brain magnetic brain resonance imaging of typically developing children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*(5), 465-470.

It is currently widely accepted that there is a neurological basis to the majority of if not all psychiatric disorders. Although there has been an increase across the past decade in neuroscience of psychiatric disorders, there remains very little data on neuropsychiatric disorders in emerging adulthood, specifically. With his colleagues, Dr. Jay Giedd, Chief, Section on Brain Imaging, Child Psychiatry Branch at the National Institute of Mental Health, uses cutting-edge technologies to deliver scientific information about both typical and atypical brain development from childhood through adulthood. This classic paper remains the gold-standard publication in basic research science, using MRI to report on normal differences in the brain from ages 12 to 25. One finding from this study that gained significant attention is the conclusion that brain maturation continues past adolescence into emerging adulthood. Giedd et al.'s research has fueled debates across disciplines concerning the question—when does the brain reach full maturation? And, when is an individual a full adult?

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Bennett, C. M., & Baird, A. A. (2006). Anatomical changes in the emerging adult brain: A voxel-based morphometry study. *Human Brain Mapping,* 27(9).

Since the 90s were declared "the decade of the brain," one of the most impactful changes in our understanding of brain development has come about as a result of the discovery that the brain continues to change through adolescence into emerging adulthood in predictable ways. Bennett and Baird's now classic, oft-cited study used MRI to study changes in the brain structures of 19 college students during a 6-month period. Broadly

speaking, the study was designed to explore the question: does the brain change during an ecological transition common to emerging adults—the transition to college? Study findings revealed significant changes in specific structures: the right midcingulate, inferior anterior cingulate gyrus, right caudate head, right posterior insula, and bilateral claustrum. Interpreting these findings compared to control groups, study findings suggest that common environmental transitions should be considered as we further develop our understanding of brain development in emerging adulthood.

Noble, K. G., Korgaonkar, M. S., Grieve, S. M., & Brickman, A. M. (2013). Higher education is an age-independent predictor of white matter integrity and cognitive control in late adolescence. *Developmental Science,* 16(5), 653-664.

Among the contributions Bennett and Baird's study makes is the introduction of the idea that brain development in emerging adulthood is not acontextual; that is, person-context interactions influence brain development. Study findings make significant contributions to our understanding of separate, distinct contributions of age and higher education on brain development through late adolescence. It's not just age that contributes to brain development, higher education makes an independent contribution to brain development in early emerging adulthood. Implications of this study are discussed in terms of socioeconomic disparities and the long-stretch of socioeconomic advantage into emerging adulthood. Thinking about this work with respect to mental health, this paper informs our understanding of neuroplasticity in emerging adulthood.

Allott, K., Proffitt, T.-M., McGorry, P. D., Pantelis, C., Wood, S. J., Cumner, M., & Brewer, W. J. (2013). Clinical neuropsychology within adolescent and young adult psychiatry: Conceptualizing theory and practice. *Applied Neuropsychology: Child,* 2(1), 47-63

The recent upsurge in neuroscience research that informs our understanding of the role of brain development in the etiology, onset, course, and functional outcomes associated with psychiatric disorders primarily focuses on the first few years, if not the first decade of, the lifespan. Pushing into new territory, in this paper, Allott and colleagues present a conceptual overview and research summary of neurodevelopment in adolescence and emerging adulthood and discuss the relevance of understanding the role of neurodevelopment through the second and third decades in psychiatric settings that provide care for adolescents and emerging adults. Specifically, the article suggests that there is significant value in integrating clinical neuropsychology in the diagnosis and treatment of adult-type psychiatric disorders (i.e., schizophrenia and other psychotic, mood, anxiety, eating, substance-related, and personality disorders).

Allott, K., Brewer, W., McGorry, P., & Proffitt, T.-M. (2011). Perceived utility and outcomes of clinical neuropsychological assessment in an adolescent and young adult public mental health service. *Australian Psychologist, 46*(1), 15-24

There are no best practice guidelines that dictate the use of neuropsychological assessments in the diagnosis or treatment planning of mental health services for emerging adult patients. To date, very few scientific studies have explored the utility of using neuropsychological assessments to conceptualize cases of emerging adults presenting with mental health problems in either public or private settings. This current study surveyed a relatively small sample of clinicians with respect to their perceptions of the value of including neuropsychological assessments in their evaluations of both adolescent and emerging adult patients. The study reports that clinicians perceive neuropsychological testing to be highly valuable and useful in their clinical practice. Clinician reports indicated that findings from neuropsychological assessments resulted in changes and additions to clinical diagnoses (over 10% of clients referred), changes to approaches in treatment plans (over 50% of clients referred), and increased or appropriate access to services, education, or work (over 30% of clients referred). In addition, in over 60% of referred cases, clinicians forwarded neuropsychological reports to other service providers or clinicians involved in the mental health care of clients. The authors conclude that these results provide evidence that specialist neuropsychological assessments and reports should be routinely included in diagnostic assessment and treatment planning in emerging adult mental health care settings.

Rizzolatti, G., Semi, A. A., & Fabbri-Destro, M. (2014). Linking psychoanalysis with neuroscience: The concept of ego. Neuropsychologia, 55, 143-148.

Rizzolatti & colleagues (2014) offer an expert summary of neuroscience and the psychodynamic principles of ego development and ego functioning. Although this article does not focus on emerging adults, specifically, the article is particularly relevant to emerging adulthood given the significance the ego takes on during this critical life stage. Unlike during any other life stage—in emerging adulthood—for the very first time, individuals are challenged with the task of navigating reality—their own social world. "Ego's role is to coordinate the complexity of the psyche and is conditioned by the request of the id, by external reality, and by the super-ego. Ego's role is to respect the principle of reality instead of the principle of pleasure that unlimitedly governs the id. Ego also controls motor actions, including verbal activity." The reader, keeping in mind the developmental stage, will benefit from this conceptual guide to thinking about the how the maturation of the ego, in interaction with stress on the ego, determines a dimension of vulnerability unique to this age period.

Damasio, A. (2012). Neuroscience and psychoanalysis: A natural alliance. The Psychoanalytic Review, 99, Special Issue: On the frontiers of psychoanalysis and neuroscience: Essays in honor of Eric R. Kandel, 591-594.

Using the developmental lens to read this work, it is easy to link the value of considering and reflecting on the way cutting-edge neuroscience provides a new way of understanding the value of the psychotherapeutic practices we use in everyday clinical practices with emerging adults. Like Rizzolatti and colleagues, Damasio (2012) writes about neuroscience and psychoanalysis in general, not about emerging adulthood specifically. This paper and others in this volume, for example, 'Psychoanalysis, neuroscience, and the unconscious self' (Modell) are valuable reads for the mental health practitioner interested in embracing and integrating neuroscience concepts and research in practice.

Lipton, B., & Fosha, D. (2011). Attachment as a transformative process in AEDP: Operationalizing the intersection of attachment and affective neuroscience. Journal of Psychotherapy Integration, 21(3), 253-279.

From a developmental perspective, emerging adulthood is a stage of the lifespan during which individuals are faced with the tasks of redefining their relationships with their parents, exploring self-in-relation to others, and establishing intimate relationships with others that will, for many, serve as the foundation of family life throughout adulthood. While the role of attachment in successfully managing these tasks in emerging adulthood, until recently we have lacked clinical guidelines for therapeutic treatment of maladaptive attachment in adults. Accelerated Experiential Dynamic Psychotherapy is a clinical practice that integrates attachment theory and affective neuroscience to facilitate emotional development of clients by (i) using the therapeutic relationship to develop a secure attachment framework, and (ii) teaching clients to connect to self and others through the lens of secure attachment, in this way AEDP transforms adult attachment style to allow emerging adults (and older adults) to develop previously undeveloped human potential for connectedness.

Ansari, D., De Smedt, B., & Grabner, R. H. (2012). Neuroeducation—A critical overview of an emerging field. Neuroethics, 5(2), 105-117.

With scientific advances in any field, follows pressure to translate the latest findings into practice. In response to neuroscientific findings about the brain's capacity to mature during emerging adulthood, there has been a surge in private and non-profit health programs designed to 'train the brain,' many of them marketed directly to emerging adults and parents of emerging adults, some with a focus on preparing the brain for college and for supporting college student success. The emerging field of neuroeducation provides leadership in translating neuroscience and informing applications. Translation of research into practice requires thoughtful, ethical consideration of the validity and reliability of research findings. Ansari and colleagues present a critical overview of the field of neuroeducation, or educational neuroscience. This article is useful because it provides a critical overview and analysis of recent neuroscientific findings that suggest that there is future potential in the design and development of educational programs that use neuroscience to 'train brains' to optimally function.

Author Bios

Christopher M. Belkofer, PhD, ATR, LPC

Dr. Chris Belkofer (Ph.D., LPC, ATR) received his doctorate from Lesley University. Dr. Belkofer's dissertation explored how creating a drawing using oil pastels and paper impacted the brain activity of artists and non-artists. Dr. Belkofer worked in collaboration with Dr. Amy Vaughan Van Hecke from Marquette University and Dr. Lukasz Konopka from Yellowbrick treatment center using quantitative electroencephalogram (QEEG) measures. Of particular influence to his research is the study of art making behaviors as self-regulatory processes. This work draws from research and theories related to interpersonal neurobiology, clinical neuroscience, art therapy, psychotherapy, and neuroaesthetics. In addition to his research, national and international lectures, and publications, Dr. Belkofer has extensive clinical experience working with at-risk youth. Currently, he is chair of the art therapy department at Mount Mary University and co-runs a private art therapy clinical practice in the Milwaukee area.

Lukasz M. Konopka, AM, PhD

Dr. Konopka is certified in Quantitative EEG, neuroimaging, and neuro-feedback, and is expert in neuro-behavioral assessment. He was formerly the Director of the Clinical Neuroscience Section at Hines VA and Associate Professor of Psychiatry and Neuroscience at Loyola University Medical Center as well as Professor of Clinical Psychology and Neuroscience at The Chicago School of Professional Psychology. Dr. Konopka has been active within the international scientific community as a clinical researcher and educator for decades. He is Associate Editor of "Activitas Nervosa Superior", Secretary of the American Board of Electroencephalography and Neurophysiology, founding member of the Person Centered Medicine Committee at the University of Zagreb School of Medicine, co-chair of the pharmaco-EEG committee of Electroencephalography and Clinical Neuroscience, co-chair in the World Federation of Biological Psychiatry and an Officer in the World Psychiatry Association. Dr. Konopka has served on expert advisory panels for the American Psychological Association, National Science Foundation, NASA and the Ministry of Health for the Czech Republic.

Jennifer L. Tanner, PhD

Dr. Jennifer Tanner received her doctorate in Human Development and Family Studies from The Pennsylvania State University. Dr. Tanner is an applied developmental psychologist whose work focuses on developmental and clinical issues of emerging adulthood (ages 18 to 29). She is co-chair of the Society for the Study of Emerging Adulthood (www.ssea.org) and has authored numerous publications on emerging adult development and adaptation including the co-edited book, *Emerging Adults in America: Coming of Age in the 21st Century* (APA Books). She serves on executive boards and provides consultations to organizations whose missions are to design and develop programs to benefit emerging adults. She has taught and supervised emerging adults at Boston College, Tufts University, The Pennsylvania State University, Farleigh Dickenson, and Drew University. In addition, Dr. Tanner delivers programs on emerging adulthood and writes a blog on these issues for Psychology Today, Becoming Adult. www.jenniferltanner.com

Jesse Viner, MD

Dr. Jesse Viner created Yellowbrick in recognition of the specialized needs of emerging adults and their families, and the necessity for a treatment system that addressed the unique challenges of the transition into adulthood. A recognized expert in the treatment of eating disorders, difficulties resulting from trauma and bipolar disorder Dr. Viner has three decades of experience applying the knowledge of psychiatry and psychoanalysis to the challenge of creating meaningful and pragmatically effective treatment programs.

Following his education at Yale, The Chicago Medical School, Northwestern University Medical School Psychiatry Residency and The Chicago Institute for Psychoanalysis, Dr. Viner has served as Director of Adult Psychiatry Inpatient Services for Northwestern University Medical School; Medical Director of Four Winds Chicago, a private psychiatric healthcare system; and Director of University Behavioral Health, a group practice on the North Shore of Chicago. He is on the faculty of the Chicago Institute for Psychoanalysis, an Assistant Professor of Psychiatry at Northwestern Feinberg School of Medicine, Rush Medical College, and on faculty at The Family Institute at Northwestern University. Dr. Viner is a Distinguished Fellow of the American Psychiatric Association.

Dr. Viner is parent to six emerging adult and young adult sons (2) and daughters (4).

Laura Viner, PhD

Dr. Laura Viner is a Clinical Psychologist and tenured Associate Professor of Psychiatry and Behavioral Sciences and Northwestern University Medical School. For over 25 years, Dr. Viner has done clinical research, teaching of Psychology and Psychiatry students, assessment and clinical treatment of individuals, families and groups with adults, adolescents, and children. She has published over 50 scholarly articles in scientific journals and books, including her recent popular psychology book on psychoneuroimmunology, *The Joy Formula for Health and Beauty*. Dr. Viner also gives scientific presentations to professional audiences around the country.

Prior to Yellowbrick, Dr. Viner was Senior Staff Psychologist at The Family Institute at Northwestern University where she also developed and directed a program for inner city children and their families to prevent violence and antisocial behavior. Earlier at Northwestern, Dr. Viner was Director of the Outpatient Eating Disorders Program.

Dr. Viner is parent to six emerging adult and young adult sons (2) and daughters (4).

Elizabeth Zimmerman, PsyD

Over the course of her career in clinical psychology, Dr. Elizabeth Zimmerman has presented at local and international conferences and has written journal publications on the use of neuroimaging in psychiatry. In her clinical work she has served a broad spectrum of individuals, those from Cook County jail to the northwest suburbs of Chicago, ranging in age from 4 to 89 years of age. Dr. Zimmerman has dedicated her research and clinical focus to personalized treatment approaches that incorporate brain imaging into a comprehensive clinical picture of an individual's lived experience. Prior to her career in psychology, she began as a history teacher. Her fascination with behavior has evolved from exploration of human connection on a global scale down to the complex networks of the individual brain.

She has a Doctorate in Clinical Psychology from The Chicago School of Professional Psychology. She completed her internship at the Cook County Department of Corrections with Gateway Foundation and her postdoctoral work at Kerns and Associates in Barrington. Dr. Zimmerman is currently a pediatric neuropsychology fellow at Loyola University Medical Center in Maywood, where she evaluates learning, attention, and behavioral difficulties in children and adolescents.

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