

Brainchild

Stress, Learning and the Human Brain

By John Medina
Founding Director of Talaris Research Institute

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The disciplines of brain science and education haven't had a lot to say to each other – mostly because they live in isolation. I think this estrangement is puzzling, because the two are naturally aligned. A simple but crude experiment can prove the point of intersection: Cut off someone's head, and try to teach what's left.

If brain scientists and educators were allowed to work together, they would probably turn both disciplines upside down. But because at this point they don't even have a common vocabulary, the best we can do is come up with ideas for research projects that would get them acquainted. At the Talaris Research Institute, we've identified nine separate areas of potential collaboration – nine brain rules, if you will – that may one day rescind the apparent no-contact order between the two disciplines:

1. Repetition is critical for memory.
2. Sleep is important to the learning process.
3. Every brain is different from every other brain.
4. We process meaning before details.
5. People are natural explorers.
6. We are visual learners.
7. Exercise aids learning.
8. Focused attentional states facilitate learning.
9. Stressed brains don't learn the same way as non-stressed brains.

These facts about human learning are well established and could serve as organizing nuclei for a dialogue between brain scientists and educators – with the goal of optimizing classroom learning.

For starters, let's consider Brain Rule No. 9. What can research on stressed brains teach us about education?

The Depressing Work of Megan Gunnar

It's clear from everything we know about how the brain works that stress can seriously inhibit the ability to learn. The type of stress I'm talking about is long-term and chronic. It's the stress a little boy or a little girl might encounter living in a sustained emotionally unstable or abusive home environment. It's the stress that can sometimes turn into the toxic condition "learned helplessness."

There are a number of cognitive processing features that begin to collapse under the pressure of relentless stress, features that are absolutely critical to success in the classroom. First, stress affects the ability to process new or nearly new input, to perform higher-order thinking, to remember and to problem solve. Second, stress can change the ability to sleep, and that inhibits memory and information processing. Third, stress can cause chronic illness, decreasing the number of circulating immune cells and impairing the body's ability to fight off viral and bacterial infections.

Megan Gunnar is a scientist who is interested in the development of something called "the HPA (Hypothalamus Pituitary Adrenals) axis." You would know it as those areas and organs in your body that mediate the "fight-or-flight" response in moments of stress or danger. Gunnar has known for a long time that newborn babies don't regulate their fight-or-flight responses like you and I do. So her question was this: At what point does that regulation begin to occur?

Here's what she did. She visited what rightfully could be called "pediatric concentration camps." I'm talking about the 1,000-bed Romanian orphanages that became familiar on the news after Romania's communist government fell. You could go into these orphanages and not hear a sound, even though they contained children from ages 0 to 12 months. The reason it was so quiet was that the children weren't fed regularly, and they were given water only infrequently. Their pathogen loads were unbelievably high, and their ability to respond to caregivers was heartbreakingly silent.

Gunnar followed 150 of these severely traumatized babies as they were adopted by 150 Canadian couples with normal marriages. She wanted to know: How would the babies do? After five or six years, what would their grades look like? What would their social skills be like? What about their incident of psychiatric disorders? Her study made her extraordinarily famous – and here's the reason why:

Gunnar found that as these kids began to grow up (the study is now in its ninth year), she could put them in one of two groups. The first group looked absolutely normal. They had normal grades; they had normal social interactions; they had normal serum cortisol (a stress hormone) regulation. They looked perfectly fine. They looked just like Canadians. You couldn't tell them from the controls.

Then there was a second group you could call "the Titanic group," because it looked like they hit something. These kids exhibited antisocial behavior, poor self-calming and deregulated serum cortisol. Their grades were in the toilet, and they were always in detention. They were damaged.

And what separates these two groups of kids? What is the dependent variable? It's the age of adoption. If a couple adopted a child from a Romanian orphanage before the fourth month of life, he or she was just fine. If a couple adopted a child between the ages of eight and

12 months of age, he or she was in the Titanic group. And these kids are now 10 years old. They're still fighting the effects of their stress.

The point? In the first year of life, the environment plays an extraordinarily powerful role in shaping a brain's capacity, so powerful that in the 10th year of life, children are still not over getting over it. The perceived emotional landscape of a baby's environment is probably a brain development issue; and Gunnar may have stumbled onto a critical period of development for the HPA axis. And if it's a brain development issue, then if you recall the decapitation experiment, it's actually an education issue.

The Hopeful Work of John Gottman

I don't want to leave us depressed; in fact, I think there's a great deal of reason for hope. The hope comes, in part, from attempting to be a careful scientist. Gunnar's work, for example, only applies to severely traumatized babies. Another thing to remember is that only in the last resort is anything considered conclusive. In fact, we usually award Nobel prizes on collective failed efforts to prove somebody wrong.

With that caution in mind, I'd like to focus on some hopeful news, beginning with something that even in research circles is usually referred to as "the love lab." You've probably heard of it. It's one of the reasons why University of Washington psychologist John Gottman is so famous.

Through a series of psychological and physiological tests, Gottman can now predict if a couple is going to get a divorce. At the end of his testing in the so-called love lab, he gives the couple a score, and the score is so powerful and so robust that it's proven to be actually predictive of what's going to happen to them within a few years after the test. Amazingly, he is 96 percent accurate.

So what is the dependent variable here? It's very simple and, strangely, it goes along gender lines. If the woman feels like she is being heard by the man — by that, I mean if he chooses to be emotionally intelligent enough to find something reasonable in a partner's complaint, even to the point of becoming willing to accept her influence, especially in a conflict — the marriage makes it. That's it. It's not intellectual disparity. It's not active listening. It's not financial disposition. All the usual suspects don't work. Humility and a teachable spirit on the part of a guy does.

I am greatly simplifying this data, but I am not simplifying the result, or even what came later. Based on this predictability, Gottman decided he didn't just want to be a good diagnostician; he'd like to be a good physician. He began to design intervention protocols he thought might really succeed, especially in high-risk couples. His design was as rigorous as the diagnosis. Rather than going through the entire marital relationship and the usual active communication issues that are often taught, he simply concentrated his intervention on the dependent variable he saw coming out of the love lab. The results were nothing short of extraordinary. Nine months after intervention, those couples predicted to divorce had a near-0 percent risk of going their separate ways.

It's an extraordinary finding. If you think about it for a second, what he's actually come up with is a tested method to create emotional stability inside somebody's house. Put another

way, he's found a way to remove the toxic relational effects of stress. Now, what does all this have to do with learning and the human brain? To help make the connection, let's talk about mom, dad and baby.

Of Mom, Dad and Baby

The problem with an idealized picture of having children — though I personally experience the great riches of being the father of two children under six — is that there's a flip side to having kids in American culture these days.

With the introduction of the first baby into a family, within six months there is a nine-fold increase in toxic marital conflict. Within the first year after birth, there is a 70 percent drop in marital satisfaction on the part of the female and a 0 percent drop on the part of the male — and that disparity is a killer. The couple gets less sleep and is more prone to viral and bacterial infections, depression and anxiety disorders. In fact, having a baby is a risk factor for behaviors that eventually end in divorce.

Talaris has a strong interest in this, particularly as it relates to brain development in kids. It turns out that Gottman has also been interested in the subject. Here are the questions he wanted to ask: What if the intervention strategies so successful in stabilizing the emotional landscape of a marriage were given to couples before they had babies? Or while they were pregnant? Or just after pregnancy? Would that change the emotional environment in such a way that they would stop fighting? That they would report a change in the increase in the level of their satisfaction? What would happen to the brains of the kids under certain situations, and how would they perform in school later?

Talaris has funded an experiment to answer these questions. Gottman found couples who were about to have babies and provided the intervention that has been shown to help "divorce-proof" marriages. Then we began tracking the infants, and the answers are coming in. He already has much of the marriage data and is waiting on some of the infant data.

Did the intervention stabilize the marital emotional landscape when compared to the controls? Did it work for couples having babies like it works for couples who don't have babies? The answer was yes. The observed hostility rate profoundly decreased in the group that had undergone the intervention. Marital satisfaction actually showed a slight increase with the intervention. Significantly, the amount of diagnosed postpartum depression fell by almost 40 percent in the females compared to the controls.

We now know how to stabilize the emotional environment of a home when a baby is first born. And we know that its environment has measurable affects on a child's nervous system. And with this, I'm ready to tell you why I think all of this is so important anyway.

Why All of This Is Important Anyway

Adult behaviors are bellwethers for the kinds of emotional environments in which kids thrive. Our research shows that babies in stable emotional environments shift attention better than their controls. They become terrific self-soothers. They're quicker at lowering their heart rates and

have faster recovery times from environmental stressors. These features predict better impulse control, which predicts fewer behavioral problems, a drop in pediatric psychiatric disorders and better pair relationships in the future. And here's the kicker: These factors in turn predict greater academic achievement in school. All a sudden, by meddling in a home situation, helping to create an emotionally stable environment, we can change a kid's grade!

Based on all these observations about stress, learning and the human brain, and during SPU's Day of Common Learning, when we celebrate creative thinking, I want to make a very practical three-part proposal that has absolutely no basis in reality. This proposal, which refers explicitly to the education system, actually comes out of a talk I gave to the National Governors' Association a couple of years ago: "Why I Don't Believe In the First Grade."

First, I propose that the inaugural event of the formal education system should not occur in a classroom, but in a maternity ward. Designing an education system with first grade aimed at a 6-year-old is too late. As we see from both Gunnar's and Gottman's work, as well as a whole litany of other research, a great deal of critical brain activity occurs before 6 years of age, activity that has profound influence on a classroom later. First grade should literally start either while the couple is pregnant or shortly after birth.

Second, I propose that the first student in this first grade not be the child; indeed, the child doesn't even have to be born yet. Starting an education system by focusing first on the performance and behavior of the child is the wrong audience. The proper first student in the American education system should be a parent – or whoever is going to be in charge of the emotional climate of the home. Thus I am not only attempting to re-imagine the concept of school, I am re-imagining the concept of student.

Third, I propose that the curriculum for this odd definition of first grade should be rigorously researched interventions proven to show couples how to sustain an emotionally stable atmosphere for their kids. By concentrating first on stabilizing the emotional climate of the home, you can build the rest of the curriculum around a baby's brain, which is more active than it will be at any time during the rest of its life.

I realize I've never taught 30 kids in a classroom, half of whose parents are getting a divorce, 25 percent of whom are on some psychoactive drug. And I understand that I've been in an ivory tower for years and know a lot about brains only from an academic perspective. I realize that my proposals are not how the education system is currently conceptualized. And I realize even more fully what it might take to infuse these ideas into an already existing system. I also have to tell you, I could care less.

It may not be how the system works, but it's how the brain works. You can ignore it or you can accept it, but you're not going to change it. And if educators and brain scientists ever got together to effect best practice, these are the kinds of things they'd probably come up with. And, if that's true, the best design of all is to get out of their way and let them begin the research.

May this spirit of inquisitiveness stay with us throughout the entire day today, this Day of Common Learning. May we, at least for one day, dream of ideas that are creative, difficult, innovative, almost impossible to implement – and life-changing if we did.

CLARIFICATION

In the transcript, the reference to Megan Gunnar's work actually refers to a subset study (1) from a larger investigation conducted by researchers at Simon Fraser University (2). Gunnar et al focused on the stress hormone levels of a total of 70 children (18 adopted after 8 months of institutionalization, 15 adopted after four months and 27 Canadian controls), not 150, as mentioned in the transcript. This lapse of memory in no way reflects on the transcriber. The error was my own.

1) Gunnar, M. et al
Development and Psychopathology 13: 611 – 628 (2001)

2) Ames, E.
The development of Romanian orphanage children adopted to Canada (Final Report to the National Welfare Grants Program; Human Resources Development. Canada) Burnaby, Canada; Simon Fraser University (1997)