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ONE MIND AT A TIME:
TAKING NEUROSCIENCE FROM THE LAB TO THE CLASSROOM

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ONE MIND AT A TIME: TAKING NEUROSCIENCE FROM THE LAB TO
THE CLASSROOM

MS. JOHNSON: Good afternoon everyone. We'd like to get started. There are several seats over here if you're still looking for somewhere to sit. I'm Tricia Johnson with the Aspen Institute, and I want to welcome you this afternoon to this session "One mind at a time: taking neuroscience from the lab to the classroom" with Pamela Cantor and Todd Rose; and moderated by Joe Nocera.

Joe is an Op-Ed columnist at *The New York Times* and writes frequently about business, guns, and college sports. So before we got started, I said, Joe, what brings you here to talk about neuroscience. And he said that he's written about Turnaround for Children before which is Pamela's -- the organization that she founded. And he finds it to be very relevant and important, so when he found out she was speaking and this opportunity was available he kindly raised his hand and said pick me.

So I'm going to turn it over to Joe, he's going to introduce Pamela and Todd more thoroughly, but just a quick bit of housekeeping; there's a copy of this *New York Times* story that was on some of the chairs, and we're trying to get a sense of who didn't get it so we can make more copies. Okay, we'll handle that during the session, and then on your way out, it will be by the door, okay? Thank you for joining us today.

MR. NOCERA: Thanks for all being -- thank you all for being here. We're -- this is going to be a very interesting panel. I -- one says at Aspen you always say there are interesting panels, but this one is really an unusual panel I think and has a much higher than average learning ratio, so high in fact that we're even going to have slides, something to look forward to.

MS. CANTOR: And a test.

MR. ROSE: And a test.

MR. NOCERA: No test, thank goodness. I'm punching a little over my weight here, so bear with me.

There have been great advances in neuroscience in recent decades and they allow scientists to learn a lot more about kind of what's going on inside the brain, how it works, what are the differences in different people's brains. And the science applies to everybody. And -- but in this particular session and one way to think about it and one way to really use this science is to adapt it in schools, and in particular in schools where there's a lot of, you know, disadvantaged kids, traumatized kids and so on.

And so, you know, Pam's expertise is as a psychiatrist who has run Turnaround for Kids (phonetic) for the last 14 years. And Turnaround has done precisely that. It goes into schools that -- into problem schools, and it has a set way of trying to transform those schools that not only deal with, you know, teaching better and so on, but also deal with the individual stresses of the children in those schools and helping the schools themselves understand how to deal with those stresses and in some ways how to alleviate them. That's -- that would be my explanation.

MS. CANTOR: Really good.

MR. NOCERA: Now, Todd, who I didn't really know until we started to do this is actually a big shot in South it turns out.

(Laughter)

MR. ROSE: I wrote this for him, so it's --

(Laughter)

MR. NOCERA: Director of the mind, brain, and education program at Harvard's Graduate School of Education, and also the author of the forthcoming book, *The End of Average, How we Succeed in a World That Values Sameness*. And that's really where this starts because what Todd's going to begin with is by sort of explaining why average is bullshit --

(Laughter)

MR. NOCERA: Is that the right way to say it?

MR. ROSE: It's a technical term.

(Laughter)

MR. NOCERA: Yeah. And how -- rather than average how we should think about individual brains and about the way people learn. Take it away.

MR. ROSE: Great. Well, so thanks for coming during lunch. Wonderful. So yeah, just to start the conversation, you know, I've been fascinated with how we actually understand real human beings, like actual individuals in order to both, again, understand them, but how we might be able to create environments that nurture instead of just sort of batch-process and sort, right? And the sort of thunderclap moment for me that changed the sort of direction of my own scientific work and what I care about is, you know, I was trained in brain imaging at Mass General Hospital and while I was being trained, this paper came out. And it is -- has to be quite truthfully one of the most boring topics.

It was just simply by one of my colleagues named Mike Miller, and all he was doing was looking at how brains retrieve memory. And I say it's boring because literally it's been done like a hundred times. Like I don't know how he got funding to do it. Like if you would have asked me 10 years ago what's one thing we know for sure in neuroscience, I would say we know the areas of the brain that are involved in retrieving memory. It's -- it turns out on average we absolutely know.

But one thing that's kind of funny about neuroscience is we collect data on individual brains and then we often just smush it together and create an average brain and then we publish that. And the assumption obviously is that that average has to represent something about the individuals or else it would be kind of a silly thing to use.

So my friend Mike Miller was one of the first to

really ask, well, how many of the brains in my simple study of memory retrieval actually look like the average pattern that I'm publishing? So he starts to look and he thought it would be the vast majority of them, maybe a few outliers. Turned out zero. It's shocking. Not a single brain looked anything like the average. And we think -- now maybe you think these people were not good at the task and that's why they look different. They were all high performers. They looked fine, but their brain patterns looked incredibly unique. So he gets really worried that he's done something wrong, right?

And so he decides before he's going to publish the study, he's going to wait for about 6 months, and bring back the exact same people and put them in the exact same scanner and give them the exact same task. Got the exact same results. The individual brain pattern was very stable. It turns out the way your brain is going to retrieve memory is very similar to how it will retrieve memory a year from now. But it still didn't -- the average represented nobody. So that threw everyone for a loop. Okay, well, if we've been relying on this idea that average tells us at least something about individuals, what else do we do, right?

And so I've been fortunate to be a part of an emerging field that's called the "science of the individual, and it's cross-disciplinary. Almost every single advancement in cancer research has come from this approach where we're going to study individuals and then group them as appropriate rather than just lump everyone together. And it turns out when you do that you actually -- what feels like could be chaos turns out to be anything but, that you end up revealing really important patterns that light, understand and predict individual's behavior and actually be able to do something about it. So I just want to end my little piece there to say if it's my average and sort of your deviation from average, then what patterns do we look for?

So in our science there's really three big patterns that we're looking at. Two you probably are familiar with, and one maybe you're not. And the one you may be not is what we'll focus on today, but the first two

-- the first is we call jaggedness. It's just a clever term for saying instead of thinking of kids in one-dimensional terms which is exactly what we do in schools, right, we give them a GPA, we give them a SAT score, we give them this, and we think that tells you what you need to know. We know that kids are -- have multiple dimensions and that those things matter, but when you look at the whole kid instead of one dimension at a time, you've realized those dimensions aren't really as correlated as you think they are.

And what it means is it guarantees everyone is going to have what we call jagged profile, strengths and weaknesses, but it's a deep scientific principle. And I'll circle back a little later and tell you why that actually matters to know kids that way.

The second one, so you have jaggedness, and then we call the pathways principle. So because we've used averages in thinking about the way brains develop, the way kids learn, averages always converge on one pathway to an outcome, right? The average pathway. And so we've made these assumptions and baked them into the heart of education that there's a basic pace of learning and there's an optimal sequence for getting to an outcome. And that almost feels right, except for it's completely wrong. When you look at individual kids, kids differ in their pacing and learning, which by the way turns out -- we tend to think fast means smart, slow means not so smart, absolutely not true. If anything it's probably the other way around, kids that take a little longer remember more, but that's a different talk.

Most importantly, when you look at individual kids in their sequencing and how they're going to accomplish a goal, instead of one pathway, we always find multiple pathways to success. And give you one quick example of why this matters; in how kids -- young, young kids learn to read single words, really basic. For 30 years we've had the assumption that there is one sequence. You learn visual stuff, you learn auditory stuff, you can -- they converge and integrate into being able to read words. This is pretty simple. My mentor Kurt Fischer at Harvard decided to stop averaging and actually look at

individual kids found there's actually three pathways. One always leads to a reading disability. The other two always lead to good reading outcomes, but they're very different.

So now we realized, we may have created reading problems for some kids because we forced them into the same pathway. So jaggedness, pathways. The final one is -- we call the context principle, and it's actually I think a little harder to accept for some people, but we're still used to thinking that people's brains, their minds, their behavior, their performance, somehow is a part of who they are and that's it, right? It's a trait, it's something that -- but in fact I'd go so far as to say there's no such thing as behavior independent of the immediate context in which you're performing. And this seems pretty obvious to any teacher, right? But we've built whole systems that assume that context doesn't actually matter.

So now in this new science, we're not looking for somebody's trait or context-independent performance, we're measuring how kids change across different contexts, and finding those kind of what we call "if then statements." And it's quite cool, you can really predict a lot about kids. But this context principle isn't just about learning, it's not just about, you know, brains, it goes really deep, it goes all the way down to even like cancer cells and microenvironments it turns out really matter. But I want to -- because this context principle, when you situate a brain in the context and you take that seriously, it -- I think it changes fundamentally how you're going to think about the developing brain, the developing mind, because for a really, really long time, people like me have thought of the brain as an independent variable, right?

So whenever you look at studies we always say, okay, here's differences in the brain and it predicts something, right, as if it's just this perfect thing in a brain in a bucket that just doesn't -- but it turns out it's way better to think of it as a dependent variable, that the environment is actually sculpting and shaping the brain just as the brain is then having an effect on your

environment. And that subtle shift I think matters in a great deal. And so I want to pivot because Pam can take us deeper on that.

MR. NOCERA: Well --

MR. ROSE: Or Joe can take us deeper.

(Laughter)

MR. NOCERA: Well, so you know, much of what you're saying -- all of what you're saying applies to everybody, it's not just traumatized kids, but this is where you can kind of very easily think about, you know, here are kids that need a lot of help, how do you get -- how does -- how do you get them that help, and how does the brain -- how does this knowledge about the brain kind of start you on this path?

MS. CANTOR: So I want to pick up on the notion of dependent variable and talk a little bit more about what that means. So first of all, all of us are mammals, and as mammals, one of the things that is really key to understand is that all of our brains very significantly develop after we're born, and they develop because of the environments and the relationships that they're subjected to. So you have to take in this idea that we aren't born with the brain that we have. It was shaped.

And one of the big shapers of a developing brain is the context of adversity because one in five children right now in this country are growing up in the context of adversity. So when we think about what does adversity do to the developing brain, so adversity is like homelessness, exposure to violence. We can think about them as things that happen to children, but actually adversity doesn't just happen to children. It happens inside their brains and bodies through the biologic mechanism of stress. It gets right under their skin. So one of the most powerful thunderclap moments for me was seeing a visual of this because when stress happens to kids a hormonal cascade goes off in their brains starting with the release of cortisol, and then cortisol produces this other chemical called the cytokine. Well, there it

is.

MR. NOCERA: See, I told you, slides.

MS. CANTOR: Okay. So this is a giant important thing because this cytokine affects two major systems in kids. It affects their immune systems and it affects their learning brain. So by immune system I mean their rate of getting infections, asthma, obesity, cardiac, pulmonary diseases. So we have children exposed to adversity who become like little old people by the time they are 10 years old and they present an enormous looming public health crisis. But the other side of this, the one that I want to dig into is what adversity, what the cytokine does to the developing brain of kids.

MR. NOCERA: And so how does this connect to learning?

MS. CANTOR: Okay. So we have -- we have a learning center in our brain, and it's called the limbic system. And it consists of three structures, the prefrontal cortex, which is responsible for attention and executive function, the hippocampus which has many roles in learning but let's just say memory is one of the big ones. And then the amygdale which is the brain's emotional smoke detector. This is the part of the brain that remembers stress even long after the stressful event happens. And these structures are cross-wired. So they talk to each other and influence each other.

So the limbic system is the system in the brain that's responsible for all meaningful learning. And it is also the system that is exquisitely sensitive to stress. So kids who have an impact from stress have issues with attention, concentration, they get easily triggered, they have trouble organizing themselves. So by definition all the things that make kids into ready and engaged learners are ways in which an individual child is going to struggle in a leaning environment.

Now imagine 30 kids in a learning environment with these issues, it's enough to shut the entire learning environment down. And now imagine 47,000 schools in America located in high-poverty communities and having lots and lots of kids that struggle with these issues in a public education system that hasn't yet factored in the impact of stress on the learning brain of kids.

MR. NOCERA: So that's pretty depressing actually.

MS. CANTOR: But you know why it's not?

MR. NOCERA: Why?

MS. CANTOR: I'll tell you why it's not depressing. Okay. And it's come up here a couple of times it's because brains are malleable. You know, when I was in med school it was the zero to five year, that everything happened zero to five and there was an extraordinary presentation this morning, our board member, colleague, friend, Ellen Galinsky talked about the longitudinal picture of malleability and the opportunities that brains get to develop over time.

But the take-home message here is that because of the plasticity of the brain, because this can change we have to get out of the mindset that we have to fix poverty. It's caused the most unbelievable false choice and false argument in public education. We don't have to fix poverty, what we have to do is fix what stress does to the developing brains of children. And that can be done in schools and it can be done in schools over time.

MR. NOCERA: Okay. So how does that now -- so now we have one person who has talked about the science of individuality, right, and Pam has now talked about the widespread 40,000 schools worth of children under stress whose brains have been affected by that stress, who have, who are, you know, basically potentially disruptive in classrooms. So now what I would like to ask you, Tod, is connect your science to her problem.

MR. ROSE: So I agree, like it paints a sort of bleak picture if you are trapped in this old way of thinking. But from my perspective, well, of course -- if we could solve -- we should certainly keep trying but I agree with this idea that there is something we can do right now that will have a huge effect. So one thing that I find most interesting from my perspective is that when we think about how we deal with stress it is actually the interplay of individuality and relationships in the social aspects. And let me tell you what I mean.

So this triggering of a stress mechanism, right, it's not objective. We tend to think there must be some real threat in the environment that your brain is like we all agree this is a threat. But it doesn't take very long to realize that can't possibly be true, right, because I will have a threat response if there is a lion in the room and the lion tamer will not, right? The difference in knowledge, really. And I'm afraid of a lot of things.

But the -- but here is the thing, when we look at the models of what triggers a kid to have a stress response that's bad, because not all stress is bad, in fact a little bit stress is quite good, you want that, right? We call it challenge. But there is a world of difference between challenge and threat. And threat kicks you into this fight-or-flight and there is no benefit to that at all and it's all downside.

But it turns out that it is your brain making instantaneous evaluations of the environment, is this good for me, is it bad for me, am I in trouble, this. And then it -- you react. And it's just so fascinating, you're not even aware of the choices that are being made here of the evaluation. But we do know pretty -- in a pretty straightforward way what factors go into that evaluation of whether you're going to tip into this toxic kind of stress response or stay in challenge. And it turns out to be -- have a lot to do with the judgment between the demands placed on your right now and your resources or your perceived resources to meet those demands.

Now, what's good about that is that both the kinds of demands that were placed in kids and their interpretation have a lot to do with the environment and not so much about something innate about them. And let me give you an example, so back to these principles of individuality. So part of what is perceived as highly demanding and potentially threatening is not just again somebody, you know, legitimately trying to threaten you right now but uncertainty is a really big trigger. The perception that the demand has placed on you, you simply can't overcome, right.

And it doesn't take very long, like if I asked right now, I teach educational neuroscience and one of my favorite examples, I always have people come up, we do -- I scare them to death, it's fun, you put a microphone on the screen and you say, oh, hey by the way you've been in this class for five weeks, why don't you take a few minutes to write down, you know what -- if you could tell some friends and family what you've learned from the class so far, jot down five things, I'll give you two minutes and I'm randomly going to pick someone to come up.

We go all out, we actually put their names in a bag, we take it all the way to the edge. Some of you right now may already have your palms sweating and you're not even involved in it, right? But what's so interesting about it is using that example, and we never make anyone come up and speak because that would be really mean. But to look at the way that they make the evaluation of whether they are up to the challenge or not, right? So it's things like do I have the background knowledge necessary, you know, is the environment supportive of me.

And so out of these principles of individuality two of them play a pretty big role in not just helping us get to better performance but we can cause more stress. So for example if every kid is jagged, which they are. Right now in schools we actually design everything on average, everything. We encourage it. Every text book can be designed to what the -- what the average fourth

grader knows. But if there is no average fourth grader then you've created artificial weights on most kid's shoulders, right? The kid is a struggling reader and it's math class. Well, guess what, now it's a reading test, right? And you've just exacerbated the demand on the kid and you're more likely to produce stress in terms of pathways when there is a fixed rate and the kids needs a little more time. And the only way you can get more time is if we give you a label of a disability? It causes stress, right? So we could actually create flexible and adaptive environments that aren't just good for kids in terms of getting performance out of them, they actually help to mitigate some of the effects of the stress.

But by far the biggest factors in play here has nothing to do with these first appraisals, nothing to do with technology, it's really about the relational element in the room. And --

MR. NOCERA: Well, let me just throw this in. As I listen to you talk I wind up thinking there is really two different kinds of stress, one of which you're talking about one of which you're kind of not. And maybe Pam could address this. The stress you're talking about is the class, is the stress of classroom which can be unnerving for a lot of kids but especially for kids from -- who traumatize kids.

But there is a second kind of stress which is the stress of warning about whether you're going to get shot on your way to school and that stress is not going to get mitigated by what happens in the classroom.

MR. ROSE: Before Pam jumps in I'd just say -- actually I would disagree.

MR. NOCERA: Okay.

MR. ROSE: -- actually we have really good data that shows that it's not that we just say, hey, it doesn't matter if you're worried about getting shot, that really matters, it's really hard to overcome. But one of my

colleagues Gavery Paul Slickman (phonetic) did groundbreaking work showing that preschool environments to kids from traumatized backgrounds and violent, have to be taken from their families because of violence that you could do things in the preschool environment to bring down their cortisol levels to mitigate. So there isn't two stress responses, there is one.

MR. NOCERA: Okay. And that leads to in fact what can be done in the classroom to alleviate stress, I suppose.

MS. CANTOR: Well, before we get to the classroom, I think Todd raised something that's critical and that is the most powerful thing we know of which is the power of the human relationship. And so how many people in this audience, first of all if you're here you probably heard about this, but the marshmallow study, do we know about the marshmallow study? Okay. So the marshmallow study very simply was that an investigator was looking at the ability to delay gratification in kids.

So you give a child a marshmallow and you say that if you can wait to eat the marshmallow for 15 minutes you're going to get a second marshmallow. And then they synthesized all the data from this and correlated the ability to delay 15 minutes with like greater SAT scores, getting into college, successful jobs. And it was, you know, one of these landmark incredible studies.

But there was a researcher working in a homeless shelter who was thinking about the marshmallow study and thinking about the idea of whether the kids in her environment were going to wait because why would they wait, if you waited to eat the marshmallow some other kid was going to eat the marshmallow. So she decided to repeat the study to try to figure out what was the most important factor in a child's ability to delay and what it was was if you trusted the person who gave you the marshmallow.

So it complete -- oh, okay. All right.

MR. ROSE: It's -- just for those who want to look it up, it's Celeste Kidd from University of Rochester, she is a fantastic researcher. I just want to add to this. They produced -- she produced the biggest effect ever seen in the marshmallow test by only varying half the kids before they did the marshmallow test they had a little art contest where they get to decorate a cup. And the adult in the room said, oh, if you will wait -- and they only said if you only wait for two-and-a-half minutes I'm going to get brand new art supplies.

And, you know, to a preschool kid that is like everything. For half the kids the person come back and say I'm sorry, we didn't have them and they got the box of half-broken crayons, that's it though, right? That kind of sucks. But like, you know, that's not getting shot at, right. The other half, all the people did was say, here is your new art supplies. Then you give them the marshmallow test. The kids in the -- with the trusting relationship were -- had delayed gratification four times longer as a group. I mean --

MS. CANTOR: So this factor of trust. So I want you to picture in your mind that pathway that we talked about with stress and the cytokines and all of that. The most powerful thing we know of today to interrupt that pathway, interrupt that cortisol release is the power of relationships with deep connections, deep trusted connections between adults and kids. So remember the thing that Joe was talking about about the kid who is frightened walking into school already under high stress. But imagine that kid walking into a place that they know is going to be filled with adults that they can trust, filled with adults that they have a relationship with.

So here is what happens. Because there is another hormonal pathway to talk about here. And it's a pathway based on what happens when you are experiencing that feeling of connection to a trusted adult. It's dopamine, it's serotonin and it's something that's called

the love hormone, oxytocin. And the effect of that hormonal cascade is that it reduces cortisol release.

So when you look at this picture, this is not just a hug, you're looking at a principal and a child. This is from one of our schools. This is a child who knows that that principal cares about him, believes in him. If he has a day where he is frightened to take on a task or has a failure or doesn't have the courage to persist against odds, he knows that person is there. And that changes everything.

So here is what I'm saying to you. If you think in your life about the person in your life that you couldn't let down, you couldn't, okay, it might have been a parent, might have been a teacher, but that person is the person who made you you. And maybe you were fortunate enough to have a lot of those, but for many of the kids growing up in poverty, the school is the place where they are going to have or not have people who are that to them. So when you hear the beat-the-odd stories of the kids, what we didn't understand is that beating the odds was happening on a neurobiological level, okay? So we can use the science, not to have kids beat the odds, but to change the odds for kids and their ability to know success.

MR. NOCERA: Todd?

MR. ROSE: I agree.

(Laughter)

MR. ROSE: I mean, I'm talkative, but this was -

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MR. NOCERA: How long has this deep science been around?

MR. ROSE: So here's what's funny; anyone that's been a teacher is like really, like you needed science like my grandma said, you needed statistics to tell you that? Like the thing is, is that it's been around off and on for a couple of decades, but what's changed now is our

ability to collect massive amounts of data quite frankly. Our ability to not just talk about the effects of context and the reciprocal relationship of social factors, but to actually model it. And once we can start to get a handle on it, we -- just opens up all kinds of possibilities both to understand and nurture kids. And what I get excited about is there's a sort of combination here of new, exciting things like the interface between individuality and technology and artificial intelligence and some stuff we're going to have to be able to do and we can do. And then there's this sort of seeing old things in a new way, right, or turns out these folks 20 years ago were pretty smart, right? And what I love about it is I will be the first to admit, I thought the relationship stuff was squishy.

You know, I'm a cognitive neuroscientist, like we do the hard stuff, right, but man, in the last 10 years all the big victories in neuroscience have come from what we call affect of neuroscience or social neuroscience, and it's just -- look, we just know way too much to be doing as little as we are right now.

MR. NOCERA: And so what you're trying to do, so we have two different things, I mean for my brain, it still feels like we're doing two different -- we're talking about two different things.

SPEAKER: We trust you.

MR. NOCERA: One is what the science of individuality or what individuality can do using what we know about individuality, how we can use that to improve the way classrooms operate, the way teachers teach, and Pam is talking about the extent to which relationships and trust can change the experience of students, make them less stressful, and make it possible for them to learn and be successful, but I still -- what I'm still not seeing is the mush between the two of you.

MR. ROSE: Sure. Sure.

MS. CANTOR: Okay. So let's do the mush.

(Laughter)

MR. ROSE: Yeah, let's do the mush. Now we've thought about this mush for a little while now together. So here's the thing; we tend to think of things like individuality -- I mean, the biggest buzzword in education is personalized learning, and so it's -- individuality is one thing, the relational aspect stuff is another thing, but in fact if we think about what the real goal here is, which is to have systems of education that no longer just batch-process a rank, but nurture and get to all instead of just some, then the individuality and the relational aspect are fundamentally intertwined, right? So just like I was saying a while back, if you want to understand stress and how you create environments, well, you can think about jaggedness, and you can think about pathways and you can create flexible, adaptive, environments that play a role, right? But that is not going to solve the problem by itself.

You have to understand the social element, but what I think is really important is when you get away from thinking of stress as this objective thing of what, nothing's wrong with you, you know, because I don't think anything is wrong with you, that's usually the interpretation. You realize it is fundamentally individual, right, and highly subjective in some ways and that's okay. And when you give up this idea that you can't study that you start to find really important universals.

So if we want to get the most out of kids, if we want to say -- and from my perspective say yeah, there are kids from this system simply is failing them right now, right? But the great news to me is that if you take these two things together, individuality and the relationship aspect, the solution isn't just good for those kids, it's good for everybody, right, but if you only take the social and then you put them into an average-based environment, that gets us a certain distance, but it doesn't get us all the way. Just like if we designed better environments, but we ignore the social element, we'll get a certain distance, but not all the way. If we want the environments that reach all instead of some and nurture

instead of sort, you've got to have both.

MR. NOCERA: And so Pam, and obviously from the point -- really from the starting point of Turnaround, the ideas behind relationships and trust have been core, but has individual -- I mean have you sort of implicitly understood the importance of individuality at the same time or is that something sort of new -- is that a newer concept for you?

MS. CANTOR: Well, let's put something very, very practical out there. I was talking to you earlier today about what an adversity-filled environment is like, okay? And it's like a war zone. So you have to understand that the starting context in the schools we're talking about is chaos, distrust, aggressiveness. Okay, these are not safe, emotionally or physically, learning environments. So you could have the best differentiated learning system that Todd's talking about, blended learning, personalized learning, whatever system you would use, you could never insert it in a school like this and have it work, okay? You would have to put it in schools where the teaching and learning environment had been not only stabilized, but in fact had become a really supportive environment to kids, then it's going to work.

So I think what we're trying to say is that education reform has loved to look at these things in pieces, but kids are not pieces. Kids are whole entities and they have to have certain needs met at the same time. When you think about your children and how they were raised and what you provided for them, there was an integrated context to that. You didn't know you were doing it that way, but you were doing it that way. So here's an example of what I mean "picture chaos," and I want you to just imagine the following classroom; imagine a classroom where three things have happened to produce this.

One is that all of these schools that we're talking about that are significantly underperforming, often have a small percentage of kids that have such extreme needs they can bring the school to its knees. If you don't get real good, highly effective support services

to those kids, you often can't work around them. So it's very important to build those systems back into schools with a social worker, a team, a lot of training for the support staff and the teachers in order to be able to both identify the right kids and get them real help.

And then there is really good partnerships to community-based resources like mental health resources, but also health and other things. But when you think about stress and adversity that we've been talking about, it affects lots of kids, not the 10 percent that are going to get services, and we want to bring about that neurodevelopmental healing in exactly those parts of the brain that have been affected by stress. So that means the classroom has to be the delivery system and intense training of school staff have to be the way in which this is going to happen.

MR. ROSE: Yeah, one thing that just as we keep doing this interplay is just like we can do all the differentiation we want and you don't do what Pam was talking about, it doesn't really matter. You've got to do these things simultaneously. When we study kids with reading disabilities, they can have the most loving home environments and it does matter, it matters a lot, but you watch what happens to the course levels, the second they wake up and realize they have to go to school, because school's a bad place because everything is a reading test, and that would be fine when it's English class, but in math class where the goal is not reading, it's still a reading test, right, and they can't meet the demands and they're showing the same cortisol level response.

You would not be able to differentiate them physiologically from someone who was worried about getting shot. You can't. And the second piece, which I think is really important that brings us -- it's not just about those kids. Look at high IQ kids in gifted and talented programs, have enormous problems with cortisol levels because they have environments that actually don't fit very well. And so the thing is, is that -- what's interesting is it's hard to feel sympathetic, right, oh, poor kids that are doing so well. But it does matter, right? So this issue of pulling these together

simultaneously as a path to getting to real, like new educational environments that nurture I think is just fundamental.

MR. NOCERA: Go ahead.

MS. CANTOR: Just wanted to finish how we get to the classroom that can do the things that we're talking about. So now imagine a classroom that is busy, kids talking, lots of noisiness and so forth, but a teacher walks into the classroom, raises her hand and in 10 seconds the class settles down and focusses. Imagine that instead of kids lined up in seats, having a teacher talk at them, the kids are in groups of four, working on things together, talking for the purpose of problem-solving and for doing work together and supporting each other in the process, and imagine kids being explicitly taught that smartness is a function of effort. It's not something you're born with, we call that a growth mindset. But many, many kids growing up with adversity have to be taught that. And what about kids being taught about how to think and take think-time before they answer a question, before they write something down?

Every single one of these things are teachable skills to teachers, but what they do for kids is increase their self-regulation, increase their executive function skills, increase their growth mindset. In fact they increase exactly the skills that are most affected by the impact of adversity, and all of this can be woven into the regular practice of teachers. This is not a program that then gets cancelled when there's a budget crisis. This is about great teaching and great nurturing of kids' development.

And the third thing everybody knows is leadership matters a lot. And so certainly in our schools to drive this kind of change where you are focused on student development and rigor involves tremendous focused leadership. And our program works with leaders to support them in building this strategy and executing this in our schools. But going back to the thing at the beginning that we were talking about, I would tell you that 47,000 schools in America need this right now, okay? And we're

not going to get there by Turnaround replicating its program in 47,000 schools. But the three principles I just talked to you about of support, teacher practice, leadership, why couldn't those principles be something that others could adopt?

Others being chief among districts which is the single biggest delivery system to the greatest number of schools and then we've got to change the mindset that education reform hasn't known that its biggest enemy was the impact of stress on children's development. And naming that problem and ensuring that people begin to think about the fact that for schools to work effectively for all children, you can't ignore the signs of this.

MR. NOCERA: Before I open up to questions, there's one question that I have is how hard is it for teachers to learn the skills that they need to learn to change the environment in the classroom, and you know, how long does it take you to do it? How hard is it, how much resistance is there? I mean, that -- the key is to getting buy-in from the principal, from the teachers, and ultimately from the students.

MS. CANTOR: Okay, so if I was to ask you how hard is it -- or easy is it for you to change something about yourself?

MR. NOCERA: Hard.

MS. CANTOR: It's hard, okay. So the issue is not whether the practices themselves are hard, the practices are ridiculously easy. They're just ridiculously easy. We are hard as human beings, we resist change. We like to be competent in the things that we already know how to do and we don't like changing to do other things. But the thing that often makes us change is when we see good stuff happening. So that is what is true, at least in our experience of teachers. If teachers get an immediate bang for the buck doing something a different way, so they're not screaming at kids, so their own cortisol levels are not through the roof because they're feeling like failures, the adoption is viral, and teachers want to know what's working in other teacher's

rooms. So there is a change management against resistance. That's the heart of any professional development strategy, but it's not about the practices being hard. They're not hard at all.

MR. NOCERA: We have about 15 minutes. I'd love to take a few questions. He's got the mike and I'll start with you, sir. Well, he had his hand up, but -- okay, go ahead. Front row, right here.

MS. LACKEY: Okay, hi. I am Kara Lackey (phonetic). So I have a sister, who used to be a math teacher in McDowell County, which as you know is one of the poorest counties in the country. And I wanted to just ask question about another aspect of this which is that when she taught in that school system, it has a very high turnover rate for teachers, lots of young teachers, the pay is very low and the administration had a high turnover rate because there is a lot of stress of course. The students in that county, they might only eat when they are at school because they're so poor.

So how do you think that that can be addressed helping keep teachers in those kind of districts, helping to provide them with these kind of skill sets in these very poor areas?

MS. CANTOR: Sure. I mean there is a epidemic of high turnover throughout the entire education system that serves kids in poverty. And the reason for it is exactly the one that you say, that the stress level for the adults is enormous. But the other thing to say is that our education system thus far has not focused, not at the higher end level or the in-service level on the tools for those people. Those people have been working in a desert, and they haven't been working in any way with the context of adversity. They've been applying things that they got in their teacher training program to a context that has nothing to do with that.

So we are -- there is an enormous, enormous need that we can't ignore and we can't ignore it because these schools haven't moved and if we ask the question why have they not moved, it isn't because they don't have the best-

best-best curriculum, even though that could be a factor. The single biggest reason is the fact that the learning brains of children require a set of competencies and we do have to give teacher those -- teachers those tools.

In our own schools, teacher turnover goes down, as the culture gets better and as teachers feel more successful. That makes a lot of sense. But that really isn't true across the country especially in places like you're describing.

MR. NOCERA: Yes sir.

MR. NADOFF: Michael Nadoff (phonetic). Recent article on the *Times* about the GI flora producing the tablets which affect brain metabolism. So it's you are what you eat.

MR. ROSE: Yeah.

MR. NADOFF: And how that could be affect the development. Can you comment on that?

MR. ROSE: Yeah. That's -- the thing that -- in some ways isn't surprising, but it is like this sense of once you stop thinking, you can carve off this reduction as kind of you of specific lines of thinking about people in isolation. You realize the system level backs of you are what you eat and it plays a role. And these systems -- all of these systems where our body are coupled, right, and so I can say I care about the brain, you can't care about the brain without caring about the gut. It doesn't work that way, right?

And so what I think is -- I think is important, when we think about policy and stuff like that is that there's a way of showing of this kind of evidence that things like ensuring kids get healthy meals is not just about some bleeding heart kind of thing. It's just fundamental if your goal is to even produce good outcomes, right? So I think what's interesting is to me it provides incredible ammo for showing -- supporting some of these existing programs and expanding them that we've had in place.

MR. NOCERA: Somebody on this side. Ma'am?

SPEAKER: Thank you. Hi, a quick question. What tools do you use in schools to have children become aware of their own stress and be self-aware what cortisol does and how do they manage their own stress in any stressful environment?

MS. CANTOR: The thing that I think you can see by the number of programs on this here at Aspen Ideas this year is a focus on mindfulness. And mindfulness is proving to be an incredibly useful tool in high-stress environments both for the adults as well as the kids. So I think it creates an atmosphere and people get it in different ways, I mean there are social-emotional learning programs that do this, and specifically mindfulness tools that do this.

But student awareness of their own stress and being given a chance to breathe and calm down before the school day starts and adults having those tools are really critical. It wouldn't surprise me at all if this becomes -- it's a very scalable tool and really tremendously important for both adults and kids.

MR. ROSE: We have some preliminary evidence just by the way that when we combine this with better metacognition instead of, like we say, we want kids to know themselves, but again, well, what type are you or what's your -- like, what does it mean to know yourself? When we focus on having kids have a sense for their own jaggedness and also the contextual effects of their -- the if-thens. Hey, it turns out, if I'm in math class and I am feeling kind of stupid and I have a male teacher who is kind of aggressive, I tend to get upset. Like that level of sophistication and the knowledge and power it gives kids seems to have some effect on reducing the stress effects of the environment. Now, it's preliminary, so we'll keep pushing forward, but I think again the combination of using this knowledge, these two sets of knowledge.

MR. NOCERA: Yeah, you.

MS. FORD: I think it's terrific that -- okay. Katie Ford, *Texas School Business Magazine*. You mentioned that the brain is malleable and I'm curious if there is a lessening of that malleableness as a person gets older and we were talking -- we've been talking a lot about kids in a classroom. As a volunteer, I teach women in prison, writing as an expressive tool for healing. And I'm curious if there is brain development that happens, I see anecdotally transformation and healing. But is there something happening in the brain as well as we become adults?

MR. ROSE: To -- in terms of more or less malleable?

MS. FORD: Yeah.

MR. ROSE: Yeah.

MS. FORD: Ability to change --

MR. ROSE: Yeah.

MS. FORD: -- that -- those pathways.

MR. ROSE: It's funny because for a long time we thought, well, you're really malleable as a kid, not so much later on. But I think based on the evidence that the reason we were seeing that before was more that your brain -- your brain is -- you only have the brain to predict your own environment, right? Like, you consume so much energy, like 25 percent of all your body's energy. It's trying to make predications of its own environment, right, to get a jump on things.

Most of these -- as you get into adults, you have some pretty laid down tracks of things that predict pretty well. Now, they may be not very productive from an outside -- but they are what they are, right? So this sense of -- your brain, like, is highly resistant to change because it is incredibly biologically expensive to remap those networks. But it doesn't mean that they can't. And so -- but I think what it means is, and

probably you would know way more than I would about the conditions that you have to create that actually trigger that kind of change. And you can see we see with adults unbelievable change that feels almost like qualitative instead of this slow transformations sometimes.

But I think it just takes a different kind of approach to catalyzing that than young kids simply because they've mapped these networks for so long. So I think we -- skipped.

MS. SPENDER: Grace Spender (phonetic) from Washington D.C. As you're probably aware, there is a tremendous number of children, not just from poverty, but well-to-do families that are a seriously ADD. And as long as we're teaching children the same way we talk 50 years ago, to me these kids that are ADD become extremely stressed when they can't learn, as stressed maybe as the child that's afraid to come.

What can be done to the way they're teaching because you said there's no normal and all of the books and the way that you are teaching isn't applying to them. So how can we do something that will help?

MR. ROSE: Well, this is the area that I care a lot about and do research in -- I'm sorry, I just --

MS. CANTOR: Go, go.

MR. ROSE: So one of my favorite things about ADHD is the biggest biological marker we've ever found is a variation of a dopamine -- it's called DRD4 repeat allele. It is the genetic variation for risk-taking and it's also the genetic variation that leads to high curiosity. And what's really cool about this is that same variation, so by the time we put him in environments for which it's rigid for which curiosity -- no matter what our mission statement is, we do not value curiosity, I'm sorry. Because curiosity -- curious kids can kind of annoy you, right, like they disrupt --

(Laughter)

MR. ROSE: -- really, right? Curious by definition you're asking things that maybe even the teacher didn't want to think about. But the problem is that that mismatch between who they are in that environment, they are the canaries in the coalmine. Like, you are seeing the effects of a lack of fit in a profound way, but what's interesting about it is when we do systematic research, when we put in flexible adaptive environments, when you have a focus on relationships, and in schools that do that, the behavioral problems, like, my guess is I would argue half the kids have this label would not have the label if you tested them again.

And one of my biggest peppies, in fact it makes me pretty pissed off frankly -- since he said shit I can say pissed off.

(Laughter)

MR. ROSE: -- is that those same kids get put in these environments that are so terrible for them, and these kids are under constant threat response and you can measure it and see it, right? And so behaviors under a threat response, high emotional reactivity, you know, aggression, things of this -- if you are really threatened, you are trying to survive, right?

So what do we do? We interpret that as, oh, they must have oppositional defiant disorder and we give them another stupid label. And we do it all the time and we think by naming something we actually understand and we do not. So to me there are some basic elements here about flexible environments and stories that matter. Sorry, we skipped over.

SPEAKER: I think we also don't have the (inaudible).

MR. ROSE: For sure.

MS. SIMMS: My name is Eckie Simms (phonetic) and I'm a psychologist, and I want to thank you all for looking at all children because I think that we are now just looking at poverty and the stress is in all children

today in the 21st century. I mean, families are under stress, 60 percent to 70 percent of caretakers are back at work by the time the child is 5-months-old. So my question to you is are you working with parents at all in the schools, and if so what age do you start some of your programs? Because we know from birth to 3 is also of your critical time in brain behavior and development and environmental support or connection is very important. So how are you looking at that and framing that within what you're doing I presume for preschool kids?

MS. CANTOR: Actually our work is K to 8. So we're not in the preschool environment. And I think that the thing that we want to create in these schools is a community where parents are welcome, where parents are engaged, and where parents are part of the community. And our starting point is that parents are frightened, parents stay home, and are fearful of what coming to school means because it almost invariably means their child is in trouble.

So I think that the whole change process that I was talking about before is a process that would make a school welcoming and engaging for parents as well, and that is something we see in our schools. Go ahead, Todd. What do you have to say about that?

MR. ROSE: I was going to say my nonprofit, we haven't announced it yet, but we've made a partnership with a San Francisco-based organization called Parents Education Network to create national chapters, local chapters for parents, and it's not just for any particular group of kids, you know, just as -- that's trying to disseminate this knowledge. We're using Hollywood and some great market because you've got to -- you can't just disseminate jargon. You've got to actually deliver it in a way that they can understand and act on.

We're making a huge bet. I firmly believe, this is just my personal opinion, parents are the only constituency that can actually drive this change nationally because think about, like, educational choices are so fragmented -- the power -- it's states, it's local, it's really not federal beyond just like some basic rules

and a little bit of funding. So who is the group that you could actually have that -- has the passion if you enable them and empower them? To understand these new ideas and why, and drive that change locally, we're going to make a huge bet on parents.

SPEAKER: And this is about all parents?

MR. ROSE: Yes.

MS. CANTOR: This person.

MR. NOCERA: Hold on one second. It is 1:00 o'clock, but I'm told that this room is not going to be used for a session right after this. So we can go a little bit longer unless somebody tells me not to. So this woman right here has been --

MR. ROSE: But if you want to get your hot dog wine.

MR. NOCERA: Yeah, exactly. Exactly.

SPEAKER: (Inaudible) more copies that were handed out earlier?

MS. CANTOR: Yes.

MR. NOCERA: All right.

MR. ROSE: Maybe we can let people transition or stay --

MR. NOCERA: You know what, why don't we do it this way? Anybody wants to come and talk to Todd and Pam, come on up

(Applause)

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