

Sean Sanders 0:03

A very warm hello and welcome to this latest science custom podcast series created in partnership with BOLD - the blog on learning and development. I'm Sean Sanders director and senior editor for custom publishing at science. And I'm delighted to invite you to join me for the first episode in a new series of podcast interviews with outstanding researchers who are attempting to make positive changes in the lives of children and adolescents by seeking practical solutions for a complex world. Apart from this common goal, they are also all recipients of the prestigious Klaus J Jacobs research prize, a 1 million Swiss francs grant awarded by the Jacobs Foundation that recognises exceptional achievements in the field of Child and Youth Development. Today's guest is Dr. Laurence Steinberg. He is the Laura H. Carnell professor of psychology at Temple University, where he studies adolescent brain development, and how adolescents make decisions, particularly risk-taking behaviour. I appreciate you taking the time to join me today, Larry,

Laurence Steinberg 1:02

good to be with you. Thanks for inviting me.

Sean Sanders 1:05

The first question I want to ask you is how do the brains of adolescence differ from those of younger children and adults?

Laurence Steinberg 1:13

Well, adolescence is a time of transition for the brain, there's a lot of rewiring that's taking place, then, and there is pruning of important brain regions, which make them much more efficient in the way they function. And there's a dramatic increase in white matter, myelin, which allows different brain regions to communicate with each other more efficiently as well. So, the adolescent brain, I guess, it's fair to say is more mature than that of child, but it's still not as mature as that of an adult. We can talk specifically if you'd like about the actual aspects of the brain structure and function that are different. So perhaps the most widely discussed, brain development during adolescence involves the prefrontal cortex. That's the part of the brain that's active when we're engaged in higher order cognitive tasks. And it also is very important for self-control. The prefrontal cortex is one of the last parts of the brain to be pruned. And it's a process that's pretty much over by the time, we are 16 or so. But in addition to that, the prefrontal cortex has connections with other brain regions. And those connections are still developing throughout the teen years, and at least until age 22, or so. So, there's a much more efficient brain in the works, but it's not as good as the brain of an adult.

Sean Sanders 2:43

You studied risk taking behaviour in adolescence, and I'm interested to know whether this type of behaviour differs between boys and girls.

Laurence Steinberg 2:53

It does, and it doesn't. So, let me let me address each of those, the difference between boys and girls in the mean levels of risk taking, that we see in each sex, so boys are much more likely to take risks than girls are. And that's pretty much the case throughout all of adolescence, and during adulthood as well. However, the similarity is that in both sexes, you see an increase in risk taking, that begins in childhood, and that peaks in mid to late adolescence, and then a decline. So, it looks like an upside-down U if you graph risk taking against age, the shape of that is a little steeper among males than females. But you get that upside down U in both sexes. So, I think it's safe to say that for boys and girls, adolescence is probably the most common time for risky activity in human development. But it is more that for boys than it is for girls.

Sean Sanders 3:56

Now, how can this work on risk taking behaviour inform how we understand the behaviour of adolescents, particularly when it crosses the line into activities that are criminal or anti-social?

Laurence Steinberg 4:08

I think it's important for a couple of reasons. Perhaps most important, is that our new way of thinking about risk taking during adolescence is a departure from the standard psychological explanation. So, it's been known for quite some time that adolescents take more risks than adults. And the explanation for that, historically has been adolescents are ignorant about risks, or they underestimate them. And studies have shown that that's not the case. If you give teenagers and adults a list of potentially risky activities, and you ask them to identify the ones that are risky and to rate their level of riskiness, you don't see differences in their responses. And I think that's important because the belief that adolescents take a lot of risks because they're ignorant about the risks is behind a lot of educational interventions designed to deter adolescent risk taking. In other words, if adolescents don't understand that driving after you've been drinking is dangerous, then it makes sense to have driver education classes where we teach them that it is. But if the difference between adolescents and adults has nothing to do with knowledge, and it has more to do with the way that the brain functions, that makes us think differently about how we might intervene to diminish adolescent risk taking, and we now understand that the development of two different brain systems along different timetables in the brain provides a good explanation for why risk taking is so much more common during adolescence. So, let me say a little bit about that. During the early part of adolescence and triggered mainly by puberty, there is an increase in the arousability of an area of the brain known as the limbic system, which is important for how we process emotions, and social information and rewards and punishments. And during adolescence, that system is much more easily aroused than it is during childhood or adulthood. At the same time, you have this other system that is localised mainly in the prefrontal cortex. And it has connections to other brain regions, that has to do with self-control. That gives us the ability to put the brakes on our urges and impulses. And you have this mismatch, where during middle and late adolescence, that limbic system is very easily aroused, but the prefrontal cortex is still immature in ways. And I and other people have described this as the time when the accelerator is pressed down to the floor. But there's not a good braking system in place. And so, knowing that should make us think differently about why adolescents take risks and what we might do to dissuade them.

Sean Sanders 6:59

Do we need to consider the adolescent brain in a special way within the justice system? Considering that they, they do have these differences.

Laurence Steinberg 7:08

A lot of my work has been on the application of adolescent brain and psychological science to juvenile justice policy, and practice. We know at least under that under American law, your punishment for a bad act is supposed to be coordinated with the degree of responsibility that you had for that act. So, we typically punish premeditated crimes more harshly than we punish impulsive ones, or we punish crimes committed by individuals acting on their own volition more harshly than ones where somebody might have been coerced into committing a crime. Now, if it's the case, that because of the way their brains function, adolescents are more impulsive than adults, are more susceptible to peer influence than adults, are more likely to focus on the rewards of a risky choice rather than the costs, then that means that I think simply put, adolescents are less responsible for their behaviour than adults are through no doing of their own, it's just happens to be the way that their brains work in that the way their brains are changing during adolescence. You know, a lot of us have argued that those differences in brain anatomy and in brain activity should make us think differently about how we punish adolescents for crimes. And whether those punishments to be fair should be less harsh than the ones that we expose adults to. This is the argument that was made before the United States Supreme Court in a number of very important cases that took place within the last 20 years or so, one that abolished the juvenile death penalty, and two that placed constraints on the courts use of life without parole as a sentence for juveniles on the grounds that if adolescents are not as responsible for their behaviour as adults, they shouldn't be exposed to punishments that we've reserved for people who are fully responsible for their criminal activity.

Sean Sanders 9:18

Larry, what role does peer pressure or at least peer social networks play in adolescent behaviour and risk-taking

Laurence Steinberg 9:26

In our lab, I've been studying the role of peers and adolescent risk taking for quite some time now. And what we have found is that the mere presence of peers leads adolescents to take more risks. So, we've done experiments in which we've compared risk taking behaviour in laboratory tasks between individuals who are performing those tasks by themselves, and those who are performing those tasks with their peers watching and we've done this, whether their peers are in the same room with them or whether the target subject is being scanned in an MRI and the peers are in another room watching that person's performance on the monitor. And we get the same results, which is that for adolescents, when their peers are around, they take more risks than when they're by themselves. But we don't see that for adults. And we probed this a little bit further and found that one of the reasons that the presence of peers seems to increase risk taking during adolescence is that when adolescents are around their peers, the reward centres of their brains are activated in a way that makes them more drawn to the potential gains or rewards of a risky decision, and less attentive to the costs. We don't see that activation of reward regions in adults, when they're with their peers compared to when they're alone.

Sean Sanders 10:54

Have you considered the possible evolutionary reasons for risk taking behaviour in adolescents?

Laurence Steinberg 11:00

Yes, I have, and a number of my colleagues have as well. In most mammals, and mammals go through puberty. So, we can learn about human adolescence by looking at what mammals do, as they transition into and through their stage of pubertal development. In most mammals, shortly after puberty, the juvenile mammal leaves the Natal environment and goes out, to establish independence and to mate and to reproduce. That is a risky, risky behaviour, because the juvenile animal is now going out into a world without the protection of the adults that have raised it and is going to be competing with older and bigger and stronger and smarter animals out in the wild. So, it's a risky thing to do. If the juvenile didn't take that risk, it would be much more difficult to mate and to reproduce. So, we think that as a period of development, adolescence is a time when the brain is wired, to be more risk tolerant. Of course, this all happened when we evolved. The world that we live in today is quite different from the world in which humans evolved. But there are always remnants of our evolutionary history that stick with us, even when the context in which we live has changed. And we think that the kind of risk taking that we see adolescents engage in now is a vestige of the priming for risky behaviour that became associated with adolescence, as humans evolved.

Sean Sanders 12:43

I'm interested to know whether you've seen adolescent decision-making behaviour differ across cultures around the world.

Laurence Steinberg 12:52

Yes, we have looked at adolescent risk taking and decision making in different cultures around the world. And what we have seen is that even though the mean levels in risk taking differ among young people, in different cultures in different countries, this increase in risky behaviour that takes place during adolescence, is seen pretty much around the world, as is the underlying brain change that helps explain it. So, in several studies that we have published, what we've shown is that this arousal of brain regions that govern how we process emotion, and social situations and rewards and punishments, the arousal event that takes place during adolescence is not limited to American young people. We see this in all kinds of different cultures and regional environments. And the same is true for the very slow maturation of the prefrontal cortex and therefore very slow improvement in self-control. That also is seen around the world. So, this accelerator press to the floor with the immature braking system in place is not just typical of American kids, we have shown that this exists in in western and Asian and African and Middle Eastern countries, as well as in the United States.

Sean Sanders 14:20

Now, how can parents and educators help adolescents understand their brains, the changes that they're going through and how they can make better decisions?

Laurence Steinberg 14:30

I have found in teaching adolescent development and, you know, I teach undergraduates and so they are late adolescents and adolescence, you know, proper wasn't that long ago for them. They're fascinated by it. And high school students are also fascinated by learning how the brain develops and how it changes during adolescence. But understanding why you engage in particular behaviours may not be enough to get you to stop doing those behaviours. So, I'm not sure that there is a great deal that we can do to diminish adolescents' propensity to take risks. What we can do is to try to change the environment in which they're raised so that they have fewer opportunities. Let me give you a well-known example of that. For most countries, underage smoking has thankfully declined over the last couple of decades. But the reasons for its decline don't have very much to do with educational efforts to prevent smoking. They have to do with changes in what I would call the context of smoking, mainly raising the age for legal purchase of tobacco products and raising the price on tobacco products. And both of those strategies turn out to make it harder for adolescents to get their hands on cigarettes and other tobacco products, and therefore lead to a drop in teenage smoking. So, I have written in a number of places that I think we should pay more attention to changing the context in which young people live in ways that make it harder for them to take risks, than to try to turn adolescence into something that they're not. Now, that said, I think another potential strategy is to use the proclivity of adolescents to take risks as an opportunity to provide them with opportunities to take positive risks. So, although most discussions of risk taking are about risks that can do harm to the health and wellbeing of young people, we know that there are lots of risks that young people take that are good for them to take. They may go out for a team sport, that they're not confident that they can compete in very well, they may take harder classes than they would ordinarily, even if it's risking getting a bad grade, they may express interest in dating somebody that they're nervous about interacting with, which is also a risky thing to do. So clearly, we want adolescents to take some of these socially desirable risks. So maybe we need to provide more opportunities for them to channel their risk-taking propensity into positive experiences and positive activities that are going to benefit them.

Sean Sanders 17:18

Larry, just one final question for you. And that is, how will your work have a measurable impact in the lives of children? And how can this be assessed?

Laurence Steinberg 17:27

It's always hard to know whether one's research actually makes a difference. I've been fortunate in being able to see our research influence court opinions, not only in the US Supreme Court, but in many state courts as well. And they've influenced court opinions in ways that I think have made the legal system better in the way that it treats young people who commit crimes. So, there's some concrete evidence that educating the justice system, about adolescent brain psychological development, has led to better policy and practice and has therefore improved the wellbeing of young people that have come into contact with that system.

Sean Sanders 18:09

Larry, my sincere thanks for taking the time to talk with me today about your work. It's been a real pleasure.

Laurence Steinberg 18:14

My pleasure. Thank you for asking me.

Sean Sanders 18:16

And thank you to our podcast audience for joining us. If you'd like to send us your feedback or suggestions, please send an email to [custompodcast@aaas.org](mailto:custompodcast@aaas.org). For more podcasts in this series please visit <https://bold.expert>. Thank you again to Dr. Laurence Steinberg and the Jacobs Foundation for making this series possible. I'm Sean Sanders. Thank you for listening.