Interview Transcripts – North American Edition

Names starting with G to L

This document contains transcripts of the expert interviews in *Introduction to The Science of Early Child Development, North American Edition*. Transcripts are listed alphabetically by the name of the interviewee and the name of the video clip. Click on a name below to go to that person's interview transcripts:

Gluckman - developmental origins concept (00:39)

Brain Development – 2.1B Prenatal brain development

Well the concept is very simple. It simply says that things that happen early in life, from before you're conceived, through pregnancy and in infancy, have consequences for the rest of your life. They affect your risk of getting obese, of getting heart disease, of diabetes, mood disorders, bone disease and so forth.
It's not just one mechanism; it refers to the fact that a lot of different biological mechanisms are affected early in life which have echoes right through life, and potentially into the next generation.

Gluckman–developmental plasticity (3:29)

Brain Development - 2.1B Prenatal brain development

One of the principles of biology is that we are more plastic early in life. Clearly when we are only a bundle of a few cells, influences on those few cells magnifies through to bigger effects across those tissues as tissues develop from those individual cells. And many organs remain plastic only for a limited period in their life. So for instance, the brain is far less plastic by the time you are an adult, than when it is when you are a child. We can't regenerate muscle cells beyond fetal life and so forth. And so the principles of developmental plasticity are fundamentally that the fetus is taking information from its mother, and making subtle changes in its development to try and optimize its success through life if it can.

It's not so dramatic in humans, at least to our visible eye, as it is in some other species. The most obvious example is the honey bee. If you take the honey bee female larva; if the honey bee female larva is fed only on royal jelly, it will develop into a queen bee. If it's fed on a mixture of royal jelly and other sources of food, it develops into a worker bee. Now a worker bee and a queen bee are quite different; one's big, one's small. They have different metabolism; they have different behaviours. They've got exactly the same genes. The only difference is the gene switches in early life. The plasticity of the organism has been changed to develop into a queen or into a worker.

Now that's a dramatic example, but what we think is happening in the fetus is, subtle changes are happening. The fetus and the embryo are taking information from the mother, and using that to make changes in the way its genes are turned on, how its organs develop, and how they function. Now of course it's not a one to one relationship between what mother does and what the fetus sees, because in the middle there is another organ, called the placenta. And so there is many steps along the way; from mother living in the world, what she eats, the environment she sees, and what the fetus experiences which is largely buffered from the world out there by the placenta. But if the placenta is healthy, the only information the fetus is really seeing are the nutrient signals crossing the placenta, and some hormonal signals crossing the placenta. But if the placenta is not well, like in the case of preeclampsia, or in gestational diabetes, or malaria infection, then the placenta can is more likely to send a misleading information to the fetus, which means that it is more at risk.

So it's a very complicated story, but again the bottom line is simple. That we want our mothers to be, our mothers when they're pregnant, mothers before they get pregnant, the fathers before they get pregnant, to maintain healthy lifestyles, because it will make for better outcomes for the child in the next generation. And that's what every parent wants.

Guhn – eliminating child poverty (3:11)

Developmental health - 3.2 Shaping public policies

Having done this research now for a while coming to a social determinants of health research environment here at UBC and having worked in this field for many years the one thing that strikes me, I think stronger and stronger as I go along, is the universal presence of a very, very strong socioeconomic gradient of health. And it brings up questions about equity and fairness in our society. If you live in Vancouver, and I guess it's the same for some other places within Canada, historically and geographically speaking we're living in a time of plenty, on average. But we also live in times where child poverty rates are terrifyingly high. There are twenty percent, plus minus depending on how you do the counting, in BC and also in the same ballpark in other provinces. And the question is how do we as a society allow that one in five children live in poverty because we know what the dire consequences are when you look at long term consequences of poverty in terms of disrupted – sometimes – sleep patterns, access to nutrition, exposure to environmental pollutants and there's a whole sequence that's associated – it's not necessarily causally determined by poverty – but it's associated with it. You look at some populations in single parent families, sixty percent of those children live in poverty and the poverty rates for aboriginal children are absolutely shocking and the question is if we look at the values you ask any Canadian on the street and ask, "What's one of your values?" and they'll say equity and fairness. But that's not the society in which we live. But we do have all the resources we need to make this a more equitable society. So one of the underlying fundamental goals of our work is to shine the light on the inequity that we see and to motivate people to take action on it because there's a lot that can be done. Denmark has basically eliminated childhood poverty. They're not richer than Canada as a country, they're not smarter than Canadians but they have a history of looking at policy decisions that said "we want to eliminate childhood poverty" and they have done it and there's no reason for Canada not to do that. So I hope that by keep pushing, keep shining a light on inequity and the consequences for us as a society, whether it's the well-being of children right now, which is really, really important, but also the long term consequences of living up – living – growing up in those kinds of experience, how detrimental they are for our society, so that's my main hope with this type of work.

Guhn – MDI social support data (2:33)

Developmental health - 2.3 Monitoring early child development

Well there are numerous key findings that have come out of the MDI. I think the main contribution of the MDI is to literally put on the map the importance of social relationships for the well-being of children. And it's confirming other research, but for the MDI what we do is we collect data from an entire population. So we don't do a sample, we ask every child within the jurisdictions. For example, in Vancouver we go to all three or four thousand children in a given class – in a given cohort - and then that allows us to map results by neighbourhood. And so we can look at variability by neighbourhood and what we really are seeing is that the moment children report fewer social strong peer relationships or support by adults, you see that's also reflected in their well-being. So we see neighbourhood by neighbourhood variability and how well the kids are doing and one of the strongest predictors, how well they are feeling supported by adults in their environments and how strongly they feel connected to peers.

So we knew those things in principle from research but showing that there's large variability between social contexts is quite eye-opening for parents, for professionals, for administrators, for service providers, for policy decision makers, because they think how can it be that in one neighbourhood the children are feeling well and they're well connected, in another neighbourhood they're not connected and they're not feeling well. Even though we're all living within the same city, within the same country with generally speaking the same rights but apparently not the same resources and access to resources for everyone. We have also shown in some of the research, and of course it validates other research, that children who do have high levels of peer support and high levels of social support on average are doing also better academically. It's not always the case, I'm not saying that there are never exceptions but generally speaking if you provide meaningful, stimulating experience in the social environment that has – certainly has an effect also on their motivations, their learning and their long term achievement yes.

Guhn – Middle Years Development Instrument (1:12)

Developmental health - 2.3 Monitoring early child development

The Middle Years Development Instrument or MDI for short is a student survey that we have done now for over five years, both in BC and other provinces in Canada and also in Australia. And it's a survey on which students report on their own well-being primarily, on their social emotional well-being, on their physical health and well-being but also on the experiences they make. In school, after school, questions related to nutrition, questions related to their sleep, questions related to their physical activities, sports, music, after school activities and so forth. So it's a very comprehensive survey to understand how our children are doing and what are the contexts around them, the social connections, the social relations to their peers, social support by adults and their environments. In BC we have collected data with children grade four and then grade seven but in other jurisdictions they have also done it with children who are in the grades in between or even older.

Guhn – population-based data collection (4:04)

Developmental health - 2.3 Monitoring early child development

In the School of Population and Public Health and specifically in my research unit, The Human Early Learning Partnership here at UBC, we often conduct data collection in a manner that we refer to as population level based data collection. And commonly, a lot of research is done with large samples, sometimes even with small samples. And in order to come up with correlations, associations, even causal mechanisms, samples can be very effective. When you want to be effective in terms of reaching a population for conversation, if you want to make impact in relation to policies, decision making, having data on the entire population can be extremely powerful because it allows you to put things on the map, literally speaking. You don't have to say, "Oh this is representative for all of Canada," but you can for each local unit, neighbourhood by neighbourhood, city by city, town by town, however you want to cut it up you can show the variability. And when you speak to parents, and I have this experience many many times, you go to a local community and you talk about research. The moment you talk about the children in their neighbourhood the discussion changes. If I say, "Oh yeah a study in New York city found… a study in Germany found… a study in Australia found… that here's a connection between physical activity and obesity" maybe some of the generic message stands. The moment I talk about our children in our respective neighbourhoods it creates a whole different set of meaning and it connects emotionally, socially to the audience you're trying to reach. So one of the main advantages is for communication purposes, engagement purposes, by mapping our data we can engage with the local communities in a much more differentiated manner.

Another advantage of population level data is that you can look at subpopulations in a much more differentiated manner. If you have a representative sample within Canada of two thousand children often the conclusion is, "Well that's maybe true for Canadians in general but we don't really know how some of the subgroups are affected by this because our sample is too small for that to make a meaningful inference." While with the population level research, you have data on everyone.

The third example is; a third benefit of population level data, especially if you integrate into a data base that's linkable, is every time you have administrative school records, you have birth records, you have all kinds of administrative data, you have data on everyone. And the moment you want to look at associations with things like well-being, social relationships, after school time, the way we do on our MDI survey you can link it to other existing resources and still have a large enough sample to make meaning inferences from bringing all these different data sources from different disciplines together. So there are multiple and methodological, communication related and policy related advantages of collecting data at the population level.

We also have to acknowledge that population level data collection is a trade-off. You get all the benefits we talked about but of course you can't go into the same depth as you can with certain other types of research designs. If you really want to get into very, very deep meaning, yes qualitative interviews, talking to people for

several hours, doing document analyses is of course critical. So in that sense it's one methodology that compliments a lot of other methodologies. You cannot necessarily get the same depth as elsewhere but it gives you coverage for the entire population so it has that benefit but it of course is a trade-off for other things.

Guhn – proportionate universality (3:25)

Developmental health - 3.2 Shaping public policies

Proportionate universality is a very interesting concept that speaks to societal solutions, policy solutions to address inequity in our society. So if you think of a socioeconomic gradient, the fact that the haves versus the haves not are doing better or worse on health outcomes it's related to access to different resources. And generally speaking there are two types of policy tools that you can do. You either provide access and resources for everyone, you give a tax break– you know, like a childcare benefit or some other incentives. You provide public education or you target your intervention to a very specific group that's specifically in need.

Proportionate universality relates to the concept that there's – in principle there is access for everyone to all the resources that we think are necessary like education, access to drinking water, fresh air, play spaces and so forth. But we also acknowledge that in some areas or for some populations facilitating that access is a bit more difficult given the history, given the context, than for others. So proportionate universality means we help everybody but we pay a little bit of extra emphasis on those populations that in our society have been disadvantaged in order to make the access more equitable. There's different rationales for looking at proportionate universality as a principle or as a policy tool to enhance equity in our society. If you give more to everyone that's in a way good but it also mean that the differences between the haves and the have nots may remain the same because everybody is lifted up. Also what we have seen in the past is that you provide additional resources, you channel resources into let's say into child care or to play resources, family support services, often what we've seen is that those families that are most advantaged have the best access to make use of those additional resources. For example let's take child care spaces; some populations may have very, very easy access to them by – due to the fact that they live close to a child care operation. If you don't have transportation and you don't – or the childcare facility doesn't operate during the hours that coincide with your working schedule or they don't match your cultural value system all of a sudden even though you provide additional resources you may still be excluding or still not facilitating access for certain groups within your population. That's very commonly seen that even though we think we provide resources that are accessible to everyone unless you address certain barriers that effect some groups more than others like transportation, like scheduling of hours and their cultural barriers and so forth you're effectually not reaching the entire population and potentially contribute to even more increasing inequities in our society.

Guhn – SES gradients and policy decisions (1:32)

Developmental health - 1.1 Shaping life course trajectories

The Socioeconomic Gradient of Health is very very prevalent not just in BC but around the world. You always see that the children who have access to the most resources are doing relatively well and the ones who don't are not. But there's not a cut off, there's not a magic cut off. You see that this threshold holds at every level of socioeconomic status. And of course it raises questions about equity and inequality. How come that in a society in which we have a lot of resources, a lot of wealth overall a lot of the children are cut off from the access to these resources and what can we do to change that to make it a more equitable society. So what we see both on the EDI and all of our other measures that there are very, very stark socioeconomic gradients in regards to children's well-being, in regard to their academic achievement, in regard to other indicators of their health and the question is why is that the case. So by providing that information at the local level to policy makers, to schools, to parents, we're trying to also motivate people to do something about because there's – from an equity perspective, from a child right perspective, from an ethical perspective - there's nothing to justify that we see these extremely stark differences between the haves and the have nots in virtually every outcome that there is.

Guhn – school response to MDI results (2:00)

Developmental health - 2.3 Monitoring early child development

The main response we have seen from schools is that they start having conversations on these topics. I think traditionally schools have been asked to primarily focus on academic content, on providing knowledge information to the children and hope that they will learn and be prepared that way for what comes after school. And of course now with longer school days and changing society, the whole role of well-being within the school context has gotten a bigger role and it's gotten a bigger importance. And traditionally teachers have not been prepared to deal with those topics. So the fact that we now have a survey that systematically tries to understand how children are doing, how their social contexts relate to their well-being now opens the door for asking questions, for having discussions and looking at some of the things that are or are not in place. I'll give you one example. In one of the Vancouver schools, one of the teachers noticed that a lot of the students said they don't feel well connected or well supported by adults in the different contexts, whether it's at home or in the neighbourhood or in the school. Whereas in some other schools or neighbourhoods around that school, they saw that that was indeed the case so they thought why is there such a stark discrepancy between adjacent schools or neighbourhoods. And so these teachers would go to other schools and have a conversation, "What are you doing to support your students?" The fact that the MDI opens the door for having these discussions in a well-informed manner and then ideally motivates people to find solutions in a collective way, that's one of the biggest developments we have seen.

Guhn – valuing social connections (1:37)

Ecology of childhood - 3.3 Creating child and family friendly communities

I think the one of the number one accomplishments if you will, or success stories of the MDI is that we are starting to see a different type of conversation around both social relationships and the role of schools in communities and the role of social relationships of children for their well-being. And it's not as if people in the past have not been aware of the importance of social relationships. You talk to anyone and they will say, "Of course. My family, my friends, that's one of the most important things." A core question is how do we organize our society to allow time for social relationships, playing together, talking, because that's the essence of our being but we – there's – if we only think about transportation and GDP and some other competitive forces; we cannot lose this part because at the end of the day we're all going to be unhappy.

So I think there has to be a healthy balance and measures like the MDI, of course there are other initiatives, they really help us to put these things into perspective. We have to create space in our society, whether it's school or the work place or in our communities that allows people to spend time together. And that has always been the case but what we now see based on the MDI is there a lot of children that say they're not connected, neither to their peers nor to adults in their environment and the question is why is that the case because that's fundamentally wrong, it's against the human nature.

Gunnar – attention (1:39)

Coping & Competence – 2.4 Executive function

And one of the new frontiers now of course is we just can't keep finding out that the early experiences matter, and that you can be in deep trouble if you don't have supportive early experiences. We have to try to figure out what to do about it. And the attention area is one where I think people are going to make the biggest headway, sort of the soonest. Because we're beginning to understand a fair amount about interventions that improve your ability to focus, your ability to attend. And there are a number of different programs out there that are working on areas like this. So there's the, what is it, Tools of the Mind, Adele Diamond has studied that, and you are improving attention and attention regulation with some of those kinds of activities.

So, there's a lot of interest out there, one of the things that folks are looking at is yoga; mindfulness meditation - the kind you would do with kids - which is really about focusing, calming, etcetera. So they're trying things like that. Do we know what to do yet? No, there's a lot of activity out there of doing what we call pilot work, the initial, so you get an idea. It might work. We tried some mindfulness training in the preschool down here last summer and it improved executive function. It improved their attention over, I couldn't believe it. Now you've got that data, you've got to go back to NIH and say, "Okay, we've got some evidence now, can we do a randomized trial in a larger scale to see if it actually works?" And can we try it with children who have more difficulties etcetera. So, it's a new horizon.

Gunnar – attention abilities (3:16)

Coping & Competence – 2.4 Executive function

We know that there are many children who struggle with attention and attention regulatory problems. And we know that some of those kids have had absolutely the most perfect, gentle, sweet childhoods. They probably carry a very high genetic load for attention regulatory problems. But, we also know that many of the kids that we see with those problems come out of a context of chaos, and adversity, and so on. If you go down the socioeconomic ladder to kids that are growing up under poverty and you look at those kids in school, you see much more evidence of Attention Deficit Hyperactivity Disorder.

We, in my own research, I have studied children adopted from orphanages. And part of my interest in those kids is they certainly have been growing up in contexts without the relationship regulators of stress biology. We know that when we look at the biology of stress in the context of the orphanage, we're seeing very clear evidence of chronic activation of the systems. And, yeah, when they're adopted, they go into homes with families that have really jumped through a million hoops to adopt them, and are pretty well educated, typically, making reasonable income, because that's what happens, know how to look for resources for their kids and are doing about everything they can think of. They aren't perfect parents but I have never met one. I mean, I'm not one. You're probably not one. Perfection is really a tough one, but they're, generally speaking, quite good parents.

So, I can look at what the impact of early adversity is on these children's development. One of the biggest signals we see is Attention Deficit Hyperactivity Disorder, is they have problems regulating attention. And even the ones who are not at the level of being classified with that are struggling on all the kinds of tasks that we have that require using drawing in your prefrontal cortex to regulate your basal ganglia to perform tasks in sort of a competent-we're doing a lot of work trying to figure out exactly which regions in the prefrontal cortex, which tasks have been the most influenced.

The have problems with working memory. I'm pretty sure that that's going to be one of the chronic ones. They aren't too bad on planning, but they certainly have problems with what we call cognitive inhibitory control. Real struggles with playing red light, green light for example. Or Simon Says. Those kind of tasks where you have to inhibit a prepotent response they struggle with. So if you have kids who are growing up chronically in really adverse environments, and they have these attention regulatory problems, they also often have aggression problems.

And we talk about externalizing. They are the ones that drive you crazy in the classroom. And they're likely to pop another kid and show real problems with aggression. The kids that we're seeing out of orphanages have the attention regulatory problems, they don't, often they don't have the aggression problems. And we know from research where you improve concurrent parenting that you can really pull externalizing problems down

for kids. So we think that what we're seeing is the impact of early adverse care on brain development in the context of pretty supportive caregiving, and the kids really wanting to do the right thing. But they still can't do it with their attention.

Gunnar – brain and stress (4:10)

Coping & Competence – 1.2 Individual differences

The brain is one of the major target organs, as we talk about it, for the stress hormone that I study: cortisol. There are many receptors for cortisol in the brain in very different regions. Whether or not you want to talk about it as a problem for the brain or what the brain is supposed to be doing, you see effects of this hormone on the brain. To understand these effects, you need to know that there are two different kinds of receptors for this hormone. One kind is called the MR receptors and these are typically occupied, that is, the hormone is hooked to the receptor causing the receptor to make the cell do what it's supposed to do. These are typically occupied when cortisol is in its base or typical non-stressed range. Those effects tend to be what we call promotive. They're healthy for the brain. They help support the brain doing sort of healthy, growth-promoting things. As the hormone rises into the stress ranges the other receptor, called a GR receptor, begins to be occupied. The GR receptor tends to do and trigger those events that are energy demanding of the cell. And many of the effects we talk about as being challenges or threats to the brain are due to the fact that you get the cell operating in a very energy demanding mode.

But it reduces the ability of the cell to take up glucose which feeds the energy processes. So what you get are cells that are threatened because they're working very hard and they aren't able to pick up the energy that's necessary to return them to a quiescent state. So you do actually see changes in dendrites, the connections between brain cells, in high energy use areas like the hippocampus which is an area that's involved in memory and the dendrites begin to be sort of curled back and not as able to talk to one another. Or you actually see death of cells in these high energy use areas like the hippocampus. So one! implication of this is with very high levels of this hormone over long periods of time, which the body doesn't like you to do, it tries to fight against that, you do see reductions in memory abilities, specifically what we call episodic memories. Memory for explicit events like where you parked your car this morning. And so you see those things.

In another area of the brain the amygdala, which is very involved in emotion processing, cortisol actually seems to up regulate or increase the activity there. So that with chronic stress exposure you get an area of the brain being on sort of a hair trigger for receiving and responding to threat and a memory capacity that's reduced. Those are two of the kinds of effects that people have looked at the most because we can model them in animals. Cortisol also has lots of receptors in the frontal regions of the brain which are involved in what we call higher order thinking: working memory, ability to plan, ability to inhibit behaviors, and so on.

Here we don't really know as much about what cortisol is doing. And probably the other thing for your students to realize is this system tends to operate in an inverted u-shaped pattern. Too little isn't good, too much isn't good, it's like Goldilocks and the Three Bears. There's a range of this hormone that's promotive of healthy adaptation. So it's not like we want to say "Let's get rid of this hormone from the body." "Let's never

react to stress." Not true. What you're looking for, with healthy adaptation is a moderate stress response but it can be turned off and you get the benefits and you avoid many of the costs of stress.

Gunnar – impact of child care (3:26)

Ecology of Childhood - 2.2 Early childhood education and child care

One of the things that, as I did discover in my research which I had not anticipated, and I've spent quite a while following up, is that if I watch children at child care, they elevate these stress levels over the day. That's a very unusual pattern; normally we start high and go down as our normal diurnal rhythm. But they go up over the day. They go up especially in poor quality child cares, but they go up in any quality child care. I've never found a child care quality place where we don't see elevations over the day, especially for the younger kids. It's an age-related phenomenon.

So our babies don't do it as much as our toddlers. Our toddlers, up to about age two, they're showing the largest increases, and then by about five you don't. Now that's nervous making. Does it matter? It is affected by the quality of the care giving. We know that the more intrusive, over-controlling caregivers are the ones who drive this up more, They're creating contexts that are developmentally inappropriate. They're trying, they're doing tons of circle time with two-year-olds. They're doing "learn your ABC's". They're intrusive and over-controlling and they're creating a context that's just very over-challenging for younger children.

And hostility on the part of the caregiver, that's no surprise, will drive these hormones up. They also drive the behaviour, and, I mean, this is no surprise, the behaviour and the hormones are telling us pretty similar stories.

To try to find out if it mattered, the kids we've always been more concerned about, are the ones who are more anxious and fearful. Because, I explained to you, what parts of the brain should this be affecting? The regions that are regulating anxiety and fearfulness. It should be tipping you towards being more anxious and fearful, if you are anxious and fearful, you activate stress biology, it becomes like a little snowball going down the hill. So, we've in research where we were studying children in family day care, we did that not because we thought family day care was more stressful, if anything, it probably should be less, but we wanted to have one child in each child care so that we didn't have to statistically worry about trying to control for multiple kids in the same settings etcetera.

So we were studying children in family day care, we observed them, we collected their saliva, we tested them in the laboratory to know how fearful and anxious they were, we followed them up six months later to see how their behaviour had changed. And what we found was, if you elevated cortisol across the day and you were not very fearful and anxious, it didn't make any difference. The stuff went up. Yeah, fine, went up. If you were high anxious, and you elevated over the day, you became more anxious over time. If you were high anxious, behaviourally inhibited, and you were in a context where you weren't elevating, you decreased your anxiety at child care over time. You became less fearful and anxious.

We've had a debate for a long time over what's the impact of child care? And what should we do for fearful and anxious kids? Nathan Fox has said, "Oh great. Send them into child care. It reduces their fear and anxiety". But other people have found that, "Gee, those are the kids, who if they're not in good quality care, actually show increasing problems". Well, this study is right. They're in the mix. So if you're fearful and anxious, a little inhibitive kid, and you're in child care where you're not elevating, you're learning to be less fearful over time. If you're in a child care where you're elevating, you're retaining all that information about every single instance where things were scary and it's becoming more fearful and anxious for you.

Gunnar – measuring stress (2:45)

Coping & Competence – 1.2 Individual differences

It seems very odd to people when I say well, I study stress, I study the stress hormone and the first thing they ask is how do you get measures of this? And I say I just take spit and that's very strange but the logic is simple. When we produce this hormone in the adrenal it goes into our bloodstream and goes around and does its work in the body but some of it seeps out into saliva through the pyrotic gland. The part that seeps out is the part that is actually not attached to proteins and that's the part that's biologically active in the body. So we can measure the concentration of this hormone in saliva and get a very accurate index of its concentration in blood. And that's why we measure it in saliva and of course with kids it's great, it's an easy thing to do with many children. Nothing is easy with all children but most children are happy to play our games. We don't ask them to spit. Surprisingly little kids don't like to spit. They'll spit if you tell them not to but not if you ask them to. So we use various techniques. One of them is a little bit like dip-stick candy. Maybe your students know what that is. We give them a roll of a long strand of cotton and a little cup with a few grains of sweetened crystals in it. They dip it into that, eat it, dip it again. The wetter your cotton is the more you're collecting all the little grains and then we just take the cotton away. And as far as they're concerned they've played what we call the tasting game.

(Example of tasting game done with children)

Non-invasive and it allows us, because the kids like it, to do it repeatedly so we can study them over the day. We can study them over a session in the lab taking as many as six samples in two hours. We can study them across days in child care and it's so simple parents can collect for us at home which allows us to look at home versus another setting.

Gunnar – prefrontal cortex (1:58)

Brain Development – 3.2 Observing children's development

The regions in the prefrontal cortex, the higher order thinking and reasoning regions of the brain. But some of those regions in the medial –middle-- area are involved in stress regulation. The logic here, nature's logic, seems to be, that if you're going to grow, if you're going to live in an environment of threat, you need to be an act first, think later person. And so these biases you're seeing, and what's happening to the brain, are getting you to perceive threat and react, and the prefrontal cortex isn't saying, "Wait a minute, let's think about it. Should we run? Should we not run? Was it a tiger? Did it have stripes?" It's going [slap] "outta here!"

And you're getting bias towards that. That's what we think is happening. We're looking for evidence of it. It certainly fits with what we think is one of the biggest challenges for children who grow up under really chronic stress. Which is they get into environments, like school, where they need to think, a lot, and inhibit action, a lot. And it's really, really hard for them. Especially when there's any distraction around, especially if anything's going on at home, which it often is, which is making them feel more anxious that day, is that they really are getting tipped toward act first, think later.

And the school context, the context we need for making a really good living, is a struggle because the brain, through eons of evolution, has mapped itself towards survival in a very different kind of environment. And we're learning ways to help those children rewire, right, and we're looking for evidence. The clearest evidence we ever see is a reduced brain volume, especially in the prefrontal lobes. That's been the, I mean, consistent, over and over and over and over again, our finding the prefrontal cortex really struggles to develop in the context of adversity.

Gunnar – relationship buffer stress (2:14)

Brain Development – 2.2 Nurturing

So, I spent a good part of my early career trying to understand what regulates stress in very young children who were too young to regulate stress by controlling and predicting and all of those things. And the biggest thing was relationships. So what regulated, incredibly powerful stress regulators, to be in a secure attachment relationship with a person who is present. Not just to be in a secure attachment relationship and that person isn't present, but to have that person present and you trust, and we're still trying to figure out but I think it actually influences a region call the orbital frontal cortex, and it probably actually short circuits the signals to stress biology.

So what, for example, we studied babies when they were going to their Well Baby checkup—I use doctors a lot to stress babies because they could do things to make the baby healthy that were way more stressful than I could do—and we were interested in the physical exam and the shots that babies get. Two big shots. One in each thigh. Two months, four months, six months, and sometime in the second year. And we followed babies over those shots, and boy, at two months they're little bodies were going off like crazy, but that was probably okay because they don't have all those receptors yet for stress biology.

And then it began to shut down and by 12 months, they didn't elevate at all. Now, they cried like heck. They hated having shots. Their heart rates went up. But their cortisol didn't budge. Unless they were in an insecure attachment relationship with their parent, in which case it activated, not horribly, but it was as if the presence of that secure relationship was serving as a buffer. And the less secure relationships were sort of leaky buffers. We of course know that if you take that buffer away, if you send a child to child care, and they're alone, they've lost their buffer and they haven't yet made the relationship with the person in the day care centre, it's going to take weeks of every day that baby's going to elevate, a lot. But after a time, after about two, three weeks, they only elevate a little bit.

Gunnar – sensitivity and responsiveness (2:49)

Brain Development – 3.3 Caring through everyday experiences

So we constantly hear about the importance of sensitive and responsive care and the challenge is figuring out what that actually looks like. One way to translate that that we've talked about is like a game of tennis. Serve and return. This is the basis for all early learning is that kind of serve and return, you have with a sensitive and responsive adult. So the baby goos and you respond.

The challenge is whether you're responding too much and that's where the sensitive part of this comes. I don't know if you had a hovering mother. Luckily I did not have a hovering mother, but the kind of parent that is just over you all the time. Every little breath you make. They're there. They're wiping your face. They're looking at you. They're trying to be, they're being so responsive they're driving you nuts. That is over-responsiveness and it's not sensitive to what the child needs. And that's why we have both of those words: responsive and sensitive.

So, it's critically important to be able to read the child's signals to figure out when they need you and when they don't, when it might be important to step back and say, "No, you can do this" or when the child falls down say, "Oh, you're fine. Get up" kind of thing is actually more sensitive than, "Oh poor baby you fell down. Are you all right? Oh my goodness". Because what you're trying to do as a parent is to find that balance between what my child wants, what my child needs, and where my child needs to be tomorrow.

And you don't want to under-respond: "Oh, you're fine. Get up". You know, my parent never understood that I had needs. "You're fine. Get up." But you don't want to over-respond. It's a tough job being a parent. It's a horribly, horribly tough job. Some kids are much more forgiving than others. They can grow up into being robust kids in a range, even if we don't quite get it, none of us by the way get it right, and a robust range of us getting it wrong, other kids are more delicate. They need a bit more, the range of your variation is a bit more narrow.

But of course we can generally judge by watching how the kids are. And if you're watching families, if you're watching families, I sometimes tell my students to stop thinking and just, "How do you feel?" If you're watching and you're feeling is "Ahh, that feels good", then that's probably they found a reasonable balance. If you're watching, you're getting tense, and you feel like, "Eww, I don't know what's wrong but I don't feel good watching this", something's off and when you do the analysis you might be able to figure it out.

Gunnar – stress biology (3:13)

Brain Development – 2.3 Stress

The research I do is research studying the effects of the biology of stress on human brain and behavioural development. Stress is a, the biology, the physiology of stress, is a really important mediator of the experiences we have and the impacts that that has on our brain development and our physical and health development as well. So, I'm very interested in that biology and we study that to try to understand how experience, some experience, especially adverse experiences, get under the skin and shape the way that we develop and our health.

So there are two arms of the mammalian --we're mammals—of the mammalian stress system. One of which people are very familiar with because we get really direct feedback from it. And that's the sympathetic adrenal medullary system. That's the adrenaline surge system. The one that you have a fright experience, you feel your heart suddenly racing, you get a lot of energy and you can run like heck for a very long period of time. The fight-flight system.

And we get measures of that by measuring heart rate. We can look at the two sides of the nervous system: the parasympathetic calm down side, we measure something called vagal tone. It's the extent to which you have variations in heart, in beats, timing between beats, that's related to respiration. And that's what the vagal system does. And the sympathetic arm of that system which we look at as something called pre-ejection period: the time between when your sinoatrial node says "beat", and your heart beats.

And so when you have more adrenaline flowing, that's shorter. So, the heart says, "beat" and it goes. Okay, so we can measure autonomic activity to get an idea of the fight-flight side. Also supporting, and extremely critical, is the hypothalamic pituitary adrenal cortical system. Notice that the adrenals are involved here in both sides. This is the outside part of your two adrenal glands. It produces something called cortisol in humans. It's a steroid hormone and it organizes long-term responses to stress.

So it helps you to sort of go from running immediately to being able to sustain that for a longer period of time. It also shapes the way the brain will respond to the next adverse experience. So we're very interested. My lab is particularly interested in that side of the stress system because, in terms of that question, how does it get under the skin and shape the way we develop, I'm interested in the regulation of that hormone which will shape longer term responses to stressors and life's challenges.

And we measure that in saliva. Because you produce this hormone, this steroid hormone, it goes into your blood stream, and some of it just seeps into your spit. So I can collect saliva and get a sense of how much of this has been produced in the child's body.

Gunnar – stressful events (2:19)

Coping & Competence – 1.2 Individual differences

So in thinking about the kinds of stressors that children can encounter, we've talked about sort of the positive kinds of stressors. Right, where the child is actually in their repertoire to maybe figure out how to deal with it. There's a supportive caregiver around. They're developing competence while they're doing it. And we've talked about toxic stressors where there is no supportive caregiver, or the caregiver's gone over to the other side, the child isn't able, and they're producing chronic activation of stress biology which is wearing the system down.

There's an intermediary, or a different type that we talk about that is tolerable. Stress. And that's, boy, big activation of stress biology, typically because of things that are way outside of the range of what a child can deal with on their own. Natural disasters. A terrible car accident. Death of a parent. We can go down the list. Famine. War. But we know that in those contexts, still, the most important predictor of whether the child will do well is, is there someone who is serving as that protective, supportive other that can step in as the biggest mediator of this. If there is, then the child will probably be able to do reasonably well. Maybe even learn something from those situations.

But if the, unfortunately, what makes those things shift over to toxic stress, is they frequently break the caregiving system also. And that's why as a society, we try to step in when we're doing it right to re-establish a caregiving system in those contexts. But we're not always very successful.

It needs to be someone who can be consistent, responsive, I mean we do what we can right. I mean if the caregiving system is completely broken we try to identify somebody for at least a period and then try to get them into permanency. It's that shift to permanency we often struggle, struggle with. And in many contexts, there's just not the infrastructure to be able to do that. So there are a lot of kids worldwide who are growing up learning to act first, think later.

Gunnar – stressors vs stress (3:42)

Brain Development – 2.3 Stress

So when I start talking about stress and the impacts that it can have, the story sounds pretty scary. And very quickly parents and educators would like to remove all stress from a child's life which is really a bad plan. In research on stress, we distinguish between those things that can activate stress biology, and we talk about those as stressors, not as stress, because not everyone will react the same way.

We talk about stress as the actual activation of the biology, because in terms of what can impact the body, it's the activation of the biology that we've got to be the most concerned with and the way the body reacts to that activation. So, on the side of stressors, everybody's a little different when we start talking about things that are milder. So, I don't know about you, you might like to ski, but being on top of a mountain on skis, looking down at that little clubhouse down there is a massive stressor for me because I don't know how to ski and I'm going to kill myself trying to get down the hill.
So how we react to events has a lot to do with our interpretation of those events. Whether we feel safe, or threatened, or whether we think we can control those events, or not, whether we can predict when they're going to happen, or not. And for young children, especially whether we have a partner with us who is capable of providing safety.

So that's the stressors side, and we can talk about all sorts of particulars. The stress side, we're designed to be able to activate these systems. We need these systems. If you can't activate these systems, you're dead meat. And we know this because, in premature babies, for example, sometimes as a result of being born so premature, they're not able to mount effective stress responses. Those babies have terrible blood pressure. They're at risk of dying. They're actually given stress hormones to try to get their blood pressure up and to try to get them capable of managing.

So we have to be able to activate these systems. But these systems, along with doing wonderful things to mobilize our energy, and focus our attention, and help us remember what's dangerous and threatening and so on, are also very catabolic. They're all about breaking down energy stores, making nerve cells shoot, and fire off and create chemicals, etcetera. So it's like too much of a good thing. It really becomes a bad thing. So, if you're chronically activating these, running them high, then you're sort of, you're producing incredible wear and tear on the body. Something that's been called "allostatic load".

So we're preserving ourselves through activating these systems, allostasis, but there is a cost to that; an allostatic load. And it's all that allostatic load that builds up over time and creates big risk for mental and physical health including diabetes, and cardiovascular disease, and effects on the immune system, and increased risk for emotional disorders, and learning problems.

With young children, these stress hormones are even more problematic if they're run unchecked. Because the brain is developing itself in the context of these chemicals that are potentially creating problems, and are shaping a highly anxious, fearful brain. So, anytime in life, chronic stress ain't so good for us. Chronic stress. Chronic activation of these systems. Early in life, we're building the brain, and the context of chronic activation, and that's sort of a double, double issue

Gunnar – the importance of the early years (2:06)

Developmental Health – 3. Supporting developmental health

So you're spending a lot of time trying to help people understand the importance of the early years. And this is something that science is now, I think, in a much better position of being able to help people understand that the early years are not just important for an individual's development. The early years are important for a society's development. It's an old saying that, you know, our children are the, you know, the nation's future, but we're beginning to understand what that really, really means on a biological and scientific level. We're beginning to understand that our concerns about health care for the older generation, the seeds of those problems are sewn in early development.

We're beginning to understand how early adversity increases your risk for cardiovascular disease. Boy that costs a society a lot: for diabetes, for obesity, which of course is also, you know, influences diabetes, all sorts of health problems for alcoholism. I mean you have to, it's not just modeling that people are drinking, but these early adversities shape the way your nucleus accumbens functions, and your dopamine system and it makes you at risk for becoming an alcoholic if you ever start drinking, etcetera. We're beginning to understand this biology.

So if we want to have a society where we can solve our problems, and we have people who are making enough money to pay enough taxes, so that we can solve our problems, we need to worry about what we're doing in those earliest years. We know that we can probably always do things that will fix what didn't happen right early on. But to fix it is costly, it's not as certain, and our biggest expense, of course, prisons which fix it by getting rid of them, are probably some of the most expensive things we can do and we're understanding the biology of how early adverse life events increase the risk of these negative outcomes later.

Gunnar – toxic stress (1:55)

Brain Development – 2.3 Stress

So, when does it become toxic? That depends on the individual because some of us are a little more robust, we have better repair mechanisms. We're still learning about what that biology of repair mechanisms are about. We have neurotrophic brain growth factors that can fix things and so on. Others are more vulnerable. Many, for various reasons, some of us are better able at turning off stress.

So there are all those individual differences. Genes are going to be important. We vary. The experiences we have during development that write on our genes and affect how our genes function, are going to influence it.

But we do know some things that are very, very difficult for most individuals, and certainly most children, to deal with. And repeat after me. We can always, we can all go down the list. They are those kind, and we call these toxic stressors, that is they're likely to produce toxic stress: maltreatment, physical abuse, sexual abuse, severe neglect, repeated loss of caregivers, bouncing from one foster care home to another, living, growing up in a context of having extreme violence. They're all the things that we know, and in fact, one good way with young kids to figure this out is, if you're not growing behaviourally, if you're falling behind on your developmental milestones, if you're not physically growing as well, that's a pretty darn good indication without taking a spit sample, that what you're seeing is a child who is experiencing chronic stress.

Because part of the whole stress biology is, influences those things. We put growth on hold. Because we're trying to survive in the moment. So growth goes on hold. All aspects of growth go on hold to try to survive. And you just don't develop as well.

Halfon – levels of change (3:46)

Ecology of Childhood – 2.3 Integrating environments for children and families

When you begin to think about how you start to change the system, the change strategies that people routinely employ, and we just went through this in our health reform in the United States, the change strategies that come out of the management literature, are for, one is for a fix-it strategy which is go in and fix what is broken. So you go into the health care system or the early childhood system and you say "okay, we're going to fix things" so you fix the child care centres and you fix what's wrong in the paediatrics. And that's very appealing to the pragmatism and the immediacy of most politicians and you know, and it's usually framed by "if it ain't broken don't mess with it" you know, and so people go in and want to fix things and that's the simplest thing.

The second level is when you try to improve things. And you have a part of the system that you know isn't functioning well, so delivery of preventive services to children, or doing developmental screening. And someone has done an evidence-based trial that says "well there's a better way of doing it". So that's an incremental change that's using an evidence- based approach to improve things. So that's an incremental step that you're taking. And again, that's what we mostly do in health care and in other areas because it's easy to tell, convince a politician that, well, this is more cost-effective or more efficient than doing it the way we're doing it so we'll take the old one out and we'll put the new one in. It's usually a step up.

The third way of doing things is actually making a transition, and where you're transitioning to a new state so that you're doing things in a completely different way. So going from paper health care records to electronic records, or going from using a typewriter to a word-processing computer, or state changes that happen where we completely transition from what we were doing in the past to a new way of doing things. Once people start using electronic medical records, once someone starts using a CAT scanner for looking at the body, when someone discovers a way of assessing children that's more effective and holistic they're probably not going to go back to that way.

But usually to get to that new way of doing things, it really takes a nudge, to sort of nudge you and that's where the behavioural economists talk about that you need nudges, especially since most humans are not rational individuals a la, you know, Spock [?] kind of a, in a more like I think analogy it's more like Homer Simpson. So unless you change the structure, Homer Simpson will go back to doing what he normally does. So it takes nudge strategy to change the system to a new state.

And the last is transformation in which transformation you're really changing the logic model, the operating system, you're trying to create something completely different and new. And getting the transformation is hard because it takes a big change and there's more risk and more uncertainty where you're going to end up. But oftentimes we we see, in complex systems, this comes out of the physical sciences, is that open complex

systems start to take on more and more energy: more information, more people, more whatever it is and then they break it down and try to reformulate it at a higher level of complexity and functionality.

Halfon – preventing problems by investing early (2:07)

Developmental Health - 3.1 Advocating for early child development

When one looks across some of the nations and you see that Canada, Australia, England and the US, we're all countries that were established under a, an ideology that really comes out of the Elizabethan poor laws that basically said that children and families had to fail between, before government was going to step in. What we've seen in the last 10, 15 years, with all the brain science, and all of what is learned about early child development, what we know now, is if we wait for children to fail, and wait for our systems to detect that they've failed and then intervene what we're going to do is, we're going to is, we're going to send lots of children into very low trajectories. Because once you intervene at age eight, or nine, or 10, for learning problems, behavioural and other things that could have been assessed and diagnosed or prevented at age two, three and four, not only is it very expensive to do, it's not usually as effective as preventing the problem in the first place.

And so what we're starting to recognize is that we need to revamp our systems. We can't use the old ideology, we can't use the old rescue tactics, and we can't just focus on the disabled, but we really need to be thinking about how do we actually have, as is the meeting laid out, you know, "Equity from the start", how do we actually optimize development from the start, how do we make sure that the developmental trajectories of children are, you know, reach their maximum potential by design, not be default. And so that's a different way of doing things. So what we're starting to see, in the English-speaking countries, as they try to, you know, throw off the yoke of the Elizabethan poor laws, is that they're beginning to think about, how do we restructure and re-engineer the systems.

Halfon – transitioning (2:32)

Ecology of Childhood - 2.3 Integrating environments for children and families

And I think that's what we're seeing in the early childhood world. We have all this new information about brain science, we have all this information about longitudinal studies about early development, about stress and toxic stress in children's lives and what effects they have. Maternal depression, all this is like new energy coming in the system. We have a bunch of new techniques, we have better ways of measuring things.

All this is coming into the early childhood world and it's starting to break down the way that we have traditionally done things. And the system is trying to reformulate itself at a higher level of functionality and complexity. And doing that, you know, managing that process, or helping that process go along is not just working service by service: child care, throwing more money at child care, throwing more money at some health service and developmental screening. All those are important to get those particular services but oftentimes you have to work more at a sector level and then at a system level so how do you get all the early care and education services: the child care, the home day care, the special library services and reading services and literacy services – how do you get them as a sector to integrate because they're all about education. How do you get all the health and mental health and early intervention services to all work together?

And then how do you start to align the education and the health services so that you have mental health services in your child care centres and you're doing, you know, the kind of promotion of literacy in your health care setting, So that creates those cross [unintelligible] bridges and linkages that actually begin to transform the system from it's previous version to a higher level of function. And I think that that's where we're trying to head. We're trying to move the system and some of that will take, you know, fixing what's broken but we can't spend all of our time just fixing what's broken because a lot of that's looking backwards and trying to repair a system from another era, another, another from an old design and what we really need to be doing is thinking about how do we redesign for the future. What kind of transitions need to take place? And what are the nudge strategies that need to take place? What are the nudge policies that we need? And what are the policy jolts that we need that are really going to take us to another level?

Hertzman – barriers to access (1:12)

Ecology of Childhood – 3.1 Sustaining home life

The barriers of access to programs for children's services is an absolutely crucial issue. From the standpoint of families, there are 10 problems that we've identified over and over again.

First, a program or service simply doesn't exist in an area. Second, it may be too expensive. Third, there may be transportation barriers to getting to programs. Fourth, the programs may be offered at inconvenient times. Fifth, there can be problems of social distance between families and the providers that lead to trust barriers. Sixth, there can be language problems. Seventh, there can be problems of system fragmentation so that you can't get your kids all the places that you need to get them. Eighth, there can be problems of conflicting expectations where you would like things to be organized in a certain way but have no voice in that. Ninth, you have the problem of parental consciousness per se, that is to say there's no adult within the child's environment at all who is conscious of the fact that, let's say, a child who's three-years old not saying a single word, that that's maybe an issue that ought to be looked into. Then there's one other one that I've forgotten.

Anyway, there are a range of those kind of barriers that exist and we have not addressed those barriers systematically.

Hertzman – developmental health (2:45)

Developmental Health – 1. The developmental health perspective

Well, developmental health then is basically this concept that arose out of looking at the early childhood aspects of population health. In other words, it's got to do with a state of doing well across those three broad domains of child development I mentioned earlier on: the language and cognitive, the social and emotional and the physical development. Now people divide it up in different ways but that's the way I like to do it and so developmental health basically means, you know, doing well across those three different domains, right, and of course, then in turn, what's important are the factors that influence that, you know, and those factors begin obviously prebirth and carry forth. Some of them are socio-economic in nature and clearly the more resources that families have and the more control they have makes a difference for how kids do.

But things like parenting style make a huge difference. Being an interactive, flexible parent leads to better developmental health than say being an authoritarian or apathetic parent. Similarly providing a rich language environment in the home makes a lot of difference. And then factors at the neighborhood level make a lot of difference as well. Neighborhood safety, cohesion, having mixed neighborhoods rather than poor ghettos all make a difference. And then the quality and accessibility of services make a difference as well. Quality child care makes a difference. Having timely access to things which will pick up vision, hearing, dental problems and so forth, all make a difference. And so those things all layer on top of each other. What it means is that in a society like Canada, where we haven't done a particularly good job of actually delivering universal access, if I can say, to the conditions for healthy child development, that by kindergarten age you can already see large socio-economic differences emerging in how kids do on those three broad domains of development. And you know those differences are largely preventable. And so developmental health, I think, is about addressing those things.

The real question though is whether or not the gap between kids at the top and the bottom of the socio-economic spectrum in terms of their development has been widening or not over time. And we just don't know. What we do know is the gap is wide now. And it is certainly true that now we're in more and more of a knowledge-based kind of an economy that differences, for instance, in kid's ability to cope with language and cognitive concepts and also on the social and emotional side, people being able to operate in a workforce where you have to be very interactive, presumably is going to bite pretty hard for people who don't have those skills. And so the cost of differences in developmental health is definitely going up.

Hertzman – early childhood educators (1:17)

Ecology of Childhood - 3.2 Strengthening early child development programs

Well, I think it is clear when you look at environments that work for children that ones that are rich in language and responsive, and ones that are well-managed in terms of the social and emotional environment are the ones that work the best. So I think when we're talking about taking more community responsibility for children now, we have to be very cognizant that we want, you know, a critical mass of the front-line staff to be verbal, to be interactive, to be socially and emotionally very secure, and so forth.

On the other hand, we really do have to have an understanding among childcare workers as to how important social development is in that window, sort of from about two to five, in particular, because you know people like Richard and Tremblay have shown, that's the window in which kids can unlearn physical aggression. The model is not one of kids learning it from tv, you know, when they're teenagers or something, but it's a question of unlearning physical aggression during a window of opportunity early on in life. And so, you know, having skills there to look for that, to look for kids who are overly anxious and to be thinking about how do you change the environment so that these kids can develop the best possible, you know, is very important. And that takes a lot of skill.

Hertzman – fostering early development (3:33)

Developmental Health – 1.1 Shaping life course trajectories

Everywhere in the world we do see socioeconomic gradients in children's development. But everywhere in the world we also see trend buckers. We see resilient children and resilient families. That is to say families that are able to create an intimate environment around the child which transcends socioeconomic circumstances, that is stimulating and nutrient in ways that allow kids to be able to take advantage of all sorts of opportunities.

If you think about it, what do kids need? Well obviously they need food, they need hygiene, they need a rich and responsive language environment, they need protection from disapproval, teasing and punishment, they need opportunities for self-expression. But any one of those can be disconnect from the social circumstances of the family as long as there's in effect food and hygiene. So that the vast majority of the places now there is access to basic food and hygiene. So even in sub Saharan Africa for instance surveys of parents have shown that over 80% of parents feel that they can provide those rock basics for their kids and what they want is 'education', which means the opportunity for their kids to develop.

So within families then and within supportive communities, if you can get around the child a group of adults and older children who understand about how human development works then the possibility of creating environments which are optimum for development is large. And in fact if you have environments where there is multi generations, where this is arrange of different adults close to the child and all the rest of it, you can actually get environments that would work better than nuclear family environments. I mean the problem that we've got in our society is that we've moved in the direction of the nuclear family, we've moved from the direction of full participation in the economy. And the premise of the nuclear family is that the parents that you have been dealt are the best nurturers for you, right. And that may be true but it may not be.

If you could imagine a more traditional village environment where there are a range of adults around, it may be that the adults that you resonate best with are not your immediate family and that was more traditional. However what's happening now globally is because of the way the global economy is working there is no society in the world where children, where more than 25% of children have daily access to extended family. Well that's starting to break down. And yet going back to my favorite slum in Nairobi, when they finally moved to universal access to education they actually found that the highest functioning primary school in the country was in one of these slum areas. And this was an area where the family dynamics and the community dynamics were positive enough to transcend the fact that there wasn't much money around for instance. So we know it can happen. And it may in fact be easier in societies where the mechanisms of social distance that have emerged in Western society are not as deeply embedded yet.

Hertzman – healthy development (4:02)

Brain Development – 1.2 Experienced-based brain development

The first question I'd like to address is this: Why is early child development important and particularly important for people like you to think about? And the answer is very simple. It's because it is a determining influence on subsequent life chances and health. In other words, the conditions of early childhood and early child development go on to influence health, wellbeing, learning and behavior throughout the balance of a child's life course.
This animated graphic shows very clearly why that would be true, and what it shows basically is that in those early years and as you can see along the bottom axis it shows from zero through to seven showing the preschool and the early schooling ages, that there are a whole series of different basic competencies that the developing brain is developing, and when they are at their maximum sensitivity, that is to say when each of these curves reaches the top, they are sensitive to the environments where children are growing up. That's what sensitivity means, so brain cell to brain cell connections are being made and irrelevant connections are being sculpted away and they are occurring according to the qualities of the environments that children are growing up in. You can see that there is a whole series of different major competencies here.

But what I'd like to do is focus your attention just on three to four and five. During that period of time, the child really needs a lot of opportunity to have a consistent set of faces up close at about 13 inches or 20 centimeters or 25 cm I should say at the focal length so that they can start to recognize facial expressions and encode facial expressions in terms of emotional information. This is what allows attachment to occur, and children who don't get strong visual connections in those early years then have very much trouble understanding the information that human faces provide them around and are at risk for a number of negative social outcomes because of that.

Another example is the pair of emotional control and habitual ways of responding. Here what we understand is that in a critical window between age 2 and 5 is the greatest chance we have to help children become helpful and empathic and to get away from being physically aggressive in their social interactions with other children. So it turns that out in the second year of life, as children are mobile enough to interact with each other physically that a large proportion of them simply declare themselves to be physically aggressive. And it is during this period of time then that if the kids are in strong, nurturant environments that we can transform those physically aggressive responses into language which allows them to develop negotiation skills.

A third example is language development itself and as you can see the peak of sensitivity here is reached at about age 2, but the brain is highly sensitive to language development throughout the early years. What we know during this period of time is, is that your ability to understand language, and your ability to express language in the ways that you need to do in the modern world goes up as a straight- dose response with the amount, and the richness and the variety of language that you hear in your day-to-day living. So children who

don’t hear much language spoken to them or only ever hear it spoken to them to give them orders will have a much more restricted ability to understand language and express themselves in language than children who are asked questions, who are read bedtime stories, who are talked with about their thoughts and their feelings, who adults get down at eye level with them so that children can decode the social and emotional information that goes along with their language. And these are the principle concerns of early child development.

Hertzman – health platform (1:39)

Ecology of Childhood – 2.3 Integrating environments for children and families

One of the things about the health care system globally is that it's actually working better than many people would imagine. When we think internationally we're usually thought to think about war-torn areas but if you leave aside the war-torn areas the fact is over the last 30 years the idea of promulgating primary health care platforms around the world has largely worked. And so primary health care is in more communities around this planet than anything else, including school.

So we have outposts, we have people, we have vehicles for bringing nurturant environments to people who are going to have children, to identify vulnerabilities, to improve parenting skills, to connect with the home, to connect families with resources that can help them support their children. And the notion of that model being spread globally is real and we see models of that in middle income countries like Chile, in mobilized societies like Cuba. In Sub-Saharan African societies like Kenya and Eritrea where the platforms are being used for these purposes. And so the idea that the primary health care system is where we find the children and find the families and connect them through with things, I think is a sensible, global kind of policy objective.

Hertzman – key factors (2:41)

Developmental Health – 1.1 Shaping life course trajectories

As I said, the importance of the early years is that it influences the rest of the life and so by the second decade of life, we see that children who have not had a good start are at an increased risk of school failure, of becoming pregnant early on in life, and of getting involved with problems with the law and criminal justice. By the third and the fourth decade of life, they are at more risk for obesity, for elevated blood pressure, and for depression which is a huge problem throughout the world. By the fifth and sixth decades of life, they are at increased risk for heart disease and for diabetes and then late in life they are at increased risk for premature aging and memory loss. We know this because children have been followed from birth right across the life course, so this is not rhetoric, this is about real measurement of how the early years influences health and well-being as well as learning and behavior across the entire life course.

So then, that raises a very important question. What actually are the key factors that influence early child development? Now many of us get caught up in empty discussions about this. Sort of is it family or is it society? And the key word there is "or" that somehow or another it's gotta be one or the other.

This little graphic with the ducks shows you what's the problem with that kind of thinking. Here we have a mother duck with her babies following her along, doing what a mother duck is supposed to do. But in this second panel here, you notice that she encounters a social condition that is beyond her control and she has to navigate her babies through that social condition. And what happens? Well you can see at the end, only one survives. So, is it family or is it society. Is she to blame or is society to blame? And clearly the answer here is, that we have to have a partnership between family and society, exactly the way we have committed ourselves to in the convention of the rights of the child. So that families want to do the best for their children but they need support from society at all levels and I'd like to talk more about that.

Because the answer to the question is really this. That early child development depends upon the experiences that children have. Like we've talked about before, the human faces up close, the language, the opportunities to develop socially and emotionally and that those experiences occur in the environments where they live, learn and grow up.

Hertzman – population health (2:16)

Developmental Health - 1. The developmental health perspective

Well, population health is the study of why some groups of people in society, in regions, etc., etc., are healthier than others. And so in a society like Canada, one could ask, you know, why are non-aboriginal people healthier than Aboriginal people? Or why are people, as you go up the socio-economic spectrum, increasingly healthier than those as you go down the socio-economic spectrum.

It turns out when you actually delve into the question of population health that a lot of the factors that determine whether or not people live healthy lives as well as have a high sense of well-being and competence, really emerge from the early years of life. That's one of the things that's come out of our study of population health. In particular, early language and cognitive development, early social and emotional development and early physical development all contribute to health across the life course. And so people who are interested in early child development need to understand that what they're doing can have a life-long impact on health.

I think there's good reasons to believe that what goes on very, very early on does have a long-lasting effect. Now, one has to be very careful when one says that because some people think that means you're saying it's all over by age X. And it's difficult to get people to understand certain kinds of population context. What we're really saying is if you take 1000 children who are not doing well on one or more of their domains of development by the time they reach school; you take another 1000 who are doing well; and then you watch to see where they are 10 years, 20 years from now. On average, what you will see is the 1000 who are doing well will be doing better than the 1000 who weren't. However, within each of those groups there will be huge variations. There will be kids who are doing great going into school who are doing terribly 10 and 20 years later. More importantly, there are kids who will not have been doing very well who will be doing great 10 or 20 years later. Right. But on average, those are the differences that you will see, right. And so it is difficult to get people to understand how to think in these population terms and understand what we're saying.

Heymann - benefits of universal access (1:14)

Developmental Health - 3.2 Shaping public policies

The experience in most countries is that universal programs have more success, not only in reaching everyone, but in reaching the most vulnerable. And the reason for that is fairly simple. When programs are targeted only at a few, they're easy to cut from government budgets, they're easy to do poorly; there aren't enough people to advocate for them.

So when we've created, for example, successful primary school or secondary school as societies around the world, none of our countries have said we're only going to create primary school or secondary school for a small number of children. We've said it needs to be for everyone. We have to do the same for 0-5. Likewise on healthcare, overwhelmingly what all of our countries have done is said healthcare should be available to all, not that we should provide it to 5% or 10%. And we need to do the same for health and nutrition to our youngest children.

Heymann – child outcomes (1:14)

Developmental Health - 2.3 Monitoring early child development

I think we should be able to know that all children have a chance at healthy development; that they are all ready to start school. So much when you look at unequal outcomes in primary school; when you look at unequal outcomes in secondary school; that's all been determined by the state children were at when they were five. We need children to be able to have an equal start at school which means they have to have had enough health, nutrition, development at that very beginning that they have an equal chance. That they're really starting at the same starting line. So we should be measuring that and we can.
Right now, we're really just measuring the most basics across countries. Do children survive? Of course that's crucial but that's not enough to know if they're going to have an equal chance to thrive regardless of their gender, regardless of where they have a disability, their race, ethnicity, their income, their social class. We need to begin to measure, are they all ready to thrive?

Heymann – comparable data (1:44)

Developmental Health - 2.3 Monitoring early child development

All of our countries can benefit from truly comparable data. Now each of us may want to compare our experiences to different groups. So we may think that the country's experiences who are most relevant to us are those in our region. They could be those who are in our income group. They could be those who share political systems or societal structures to ours. But we can always benefit from looking at other countries that we think are truly comparable in saying what are they doing that works? And as well as sharing what are we doing that works. Because of that having information across countries on basic issues. Do mothers have paid leave; do fathers have paid leave? Can breastfeeding breaks be taken? How affordable is early childcare; how is it made affordable? What nutrition programs are there? What programs are there to support parents and other caregivers in stimulating children? That allows us to look at who's getting the most successful outcomes and what can we learn from those successes. Now, of course, each of our countries and in fact each of our states or provinces will also have some questions that are very specific to our local circumstances. So it's important to add that kind of data and information that allows us to answer our local questions at the same time.

Heymann - economic investment (1:50)

Developmental Health 3.1 - Advocating for early child development

I think there are two things that mistakenly often keep countries from investing in young children. The first is the notion that it competes with other investments, that we have to take away money from something else to invest in young children. And while that may be true for a very brief time, the returns to investing in young children are so powerful in terms of better economic outcomes for their families, better economic outcomes as the children grow, better educational outcomes, reduced adverse outcomes that it more than pays for itself, this is totally affordable. The second is that we think it's just easy to forget about young children. They're not claiming policy makers' attention, they're not organizing in the streets and they seem so resilient and of course in many ways they are resilient. But the price of not investing in them is enormously high, and the return is extraordinary. So I think the question for all of us is 'How do we motivate our own governments to make this investment that we know could have such a powerful impact on the lives of everyone – on the lives of the children themselves, on their lives as they become adults and on the success of all our societies?'

Janmohamed - corporate social responsibility (3:05)

Developmental Health 3.1 - Advocating for early child development

We have done a lot of pioneering. We were the pioneers in terms of tourism in Kenya, in Tanzania and I think the, our mission is very clear. It's; yes, profits are important. Our projects must be self-sustainable but we've got to make a difference whether it is, you know, with the local communities that live around where we are present, whether it is with our staff, our human resources. We invest quite a lot in their capacity building, training them, developing them. When it comes to environmental issues, you know, we will not develop a property unless we have carried out environmental impact assessment studies to make sure that we're not going to damage the environment.

Wherever we are we will, we will look at what difference we can make whether it's; a good example in Tanzania when we first started, perhaps 80 % of our supplies used to come from Kenya or South Africa. Today, 95% of our supplies are local. So over a period of time we encourage local suppliers to meet our standards, to try and you know, meet our standards and you know, gear up to supplying us. We've done the same in some of our remote areas wherever we are. And I think, you know, this is, this is very important.

We are very fortunate to work for an organization that really values a lot of these you know; whether it's the environment, whether it's being responsible, transparent, making an impact in the areas we are in, you know this is pretty unique. And I think that is satisfying. We are just not judged on the amount of money we produce. If you look at our board reporting, there is a whole section on what, you know what we do whether it's for the communities or on our reforestation programs or turtles in Mombasa.

We believe that we must conserve nature and there are many such examples where we have demonstrated that, you know, we've got to be responsible players. We've got to make sure that, you know, we are making a positive impact where ever we are.

Janmohamed – recommendations (1:53)

Ecology of Childhood – 2.1 Families

There are three things that are coming up, one is that in the same way that we're, are comfortable talking about the development of language or social-/emotional development, we need to embed, in course content, gender development and sexuality, and I think that that comes from the perspective of children's development, as a way for educators to understand that it's very much a part of our being.

The second thing that I think that's important is that, in the material that we actually use in class, with the students, we need to be able to embed content that relates to gender identity, sexual identity, so that people are comfortable, and start to understand that families come in all sorts of shapes and sizes, and they come just slightly more different than we thought that they would be.

And then the third thing, I think in practice, where, there is still a fair amount of 'heteronormative' practice in early childhood programs, things like, saying to a little girl, "You look so pretty today, oh look, your boyfriend is here," and that's completely unnecessary with, you know, three and four year old children, but it's actually very much the case, or we don't know how to encourage girl children to engage in the block area, we don't know how to encourage boy children to move to the drama center, and then sometimes when we do come across those boy children who like to be in the drama center, and want to be a princess all the time, we're unsure about how to react, if to react at all, and I think that in the practice situations that those are possibilities of case studies that we can talk about, that would help inform the Early ChildhoodPractitioner

Janmohamed – same-sex families in ECE material (2:36)

Ecology of Childhood – 2.1 Families

In my research study, I did three things. I looked at textbooks, course outlines, course readings, around how families were discussed in early childhood education. I also interviewed parents, and I did a random sampling of parents across Ontario, and I got a good sample from people in rural and northern Ontario, and, the other thing I did was, I did interviews and focus groups with Early Childhood Educators, I've done three different modes of data collection around this particular research question, around what is the experience.

Primarily the textbooks, I would say, that there's a dominance of silence around this particular family construct. What I came to learn was, in many of the foundational textbooks that I looked at, and I looked at them, at four colleges in the Ontario system, based on where the parents contacted me from, and in those college programs, there was only one that actually offered a course around what they called "anti-bias curriculum". But when I dug deeper, even within that course content, there was very little content in terms of same-sex parents. So, we are fairly well versed around talking about diversity, in terms of talking about immigrant status and second language issues, but not in terms of this slightly more difficult topic, I think, in terms of sexuality and sexual orientation, but the reality is that there are more and more parents who identify from the queer community that are having children in all kinds of combinations and permutations, and I think that that silence needs to be opened up, to have a conversation, so that when we exit Early Childhood Graduates, they're just as comfortable working with children that come from families that are somewhat different from their own

And in fact, what I found was that, in the smaller communities they were more comfortable asking questions than they were in the urban programs. The other thing I found was that in several examples, it was the first conversation those educators had ever had about the sexual orientation of parents, or, you know, the gender identity of children, and how that develops.

Janmohamed – studying early childhood educators (1:03)

Ecology of Childhood – 2.1 Families

One of the important things that has come from the, my research around diversity and inclusion is that when we think about that concept in Early Childhood, it includes a lot of different types of identities like immigrant status, English as a second language, sometimes lone parent families, but rarely does the difference around family construct come up.

So, in my particular area of research, I started out looking at same-sex parents and their kids in early childhood. What I came to learn is that it goes far beyond just same-sex couples. It can also include people who are bisexual, there are more 'trans' people having children, and I think that in Early Childhood training, we have a responsibility around understanding the differences in different families in Canada, and also about how our own Early Childhood practice may be impacted on all families, including those kinds of families.

Janmohamed – support to same-sex families (0:56)

Ecology of Childhood – 3.1 Sustaining home life

The one area that comes to mind is, in terms of the demographic shift, that I think it's important for those of us in Early Childhood to understand is that after the Pediatrician's visit, often Early Childhood Education programs are the next place that parents come into, and it's really important for us to be attuned to the fact that we can play a really significant role in supporting the family unit, particularly around the families that do identify as queer, or same-sex, because often those families may not have the support or the backing of their own biological families, and so the extended Early Childhood community can often provide the kinds of supports that, in a normal situation, quote unquote, extended families support.

Janus – children are forgiving (1:04)

Brain Development – 3.3 Caring through everyday experiences

Well, children absorb everything that's around them when they grow up. So they absorb good things and bad things. But what I mean that they're forgiving is that the little things that perhaps are not so good will be very clearly, very quickly superseded by things that we do, like cuddling, and loving and nurturing, and being the best parents we can be. Or caregivers or friends or whoever we are. So this is basically to convey the message that why it's very important to be very aware of what's happening around young children, even older children as well, but not to try to kind of beat yourself up and think "Okay, well I yelled at my child once or twice" or "that obviously that's going to make a horrible impact on their future life". We're all human. So as long as children understand that we are just as human as they are and we, and they always know that we love them, I think that's, it's going to be okay later on.

Janus – EDI explained (2:22)

Developmental Health – 2.3 Monitoring early child development

The full name of the EDI is Early Development Instrument: A population-based measure for communities. It started in the late 90's as a response to an overwhelming request from communities to be able to keep score on children in their communities, not just individual children but whole groups of children at a time. So we've done some research and we found out that while there were plenty of excellent individual measures to assess child's progress and development, none of them were cheap enough and feasible enough to aggregate to population level. And that's why the concept of Early Development Instrument has been conceived.

Early Development Instrument is a checklist that's completed by kindergarten teachers in the second half of the kindergarten year and it's qualities of this instrument that provides a holistic assessment of child development based on the fact that all major domains of child development are included. So, while the concept of school readiness used to be a very narrow concept, usually focused on how many letters a child can recognize, whether a child can count to ten.

We're really covered on the whole spectrum of child development from a child's physical health and adjustment to school, a child's gross and fine motor development: the ability to hold a pencil, ability to hop on the playground, the ability to keep the energy up throughout the whole school day, through social competence and emotional maturity: ability to work with other children, ability to, every now and then, show some helping behaviour, some social behaviour to their peers, ability to hold their anger, ability not to show temper tantrums, to the kind of more obvious more traditional areas of what school readiness use to be considered before: like language and cognitive development as well as communication. What's important when children enter school is that they're understood by others. Not just by their parents, not just by the people who are around them all the time but also by teachers and by other children. As well as what's important, is the children understand their peers and their teachers.

Janus – EDI use around the world (1:06)

Developmental Health – 2.3 Monitoring early child development

The EDI has been completed in several other countries, not just Canada. There is an Australian version that's being done in over 60 communities in Australia. And I'm happy to say that we found that the results are almost identical in terms of our means, and even patterns in terms of differences between boys and girls, aboriginal and non-aboriginal populations. We also have a few small scale implementations in emerging economies: in Jamaica and Kosovo. And we find that-- children are children everywhere. And I don't think we have to find that. That's true. Children develop in the same way regardless of which country they grow up in, regardless of the language they speak. So, as long as an instrument is linked to the child development, it can be used anywhere. And it can be used anywhere to look at the specific realities of the community the child grows up in.

Janus – kindergarten population measure (1:39)

Developmental Health – 2.3 Monitoring early child development

As I mentioned the EDI is not a test. So what's not happening is the teacher would sit with the child one-to-one and give a child a task to do. The EDI is based on questions that teachers should have been able to observe during the last four or five months of interaction with that child so they can really easily do it from memory. Once it's done for each child in the classroom, the results are being aggregated, depending on how a community wants to use it, usually to the neighbourhood level. So we're taking into account, not the child's individual characteristics, but the child's place where they live. And we put together a picture of how children are doing in this particular community: neighbourhood by neighbourhood.

From then on, the data on children's school readiness can be used in conjunction with all other data sources. We can look at the participation in library reading programs, we can look at the number of spaces in child care and learning centres, we can look at bus routes, we can look at presence of playgrounds. We can look at many different things that are available in the community to see, perhaps, we can see certain patterns. The most obvious ones that happened in some communities, is lets say, you find that in some area the children's language seems to be lagging behind, or communication issues. And we may find that within the last couple of years there has been a wave of new immigration to that area, so children really did not have a chance yet to learn English enough to participate in school-based activities.

Jenkins – cognitive sensitivity (1:48)

Communicating & Learning - 2.5 How children learn

What we're interested in when we're looking at cognitive sensitivity is how much an educator can get into the mind of a child, and think about what that child is interested in and build on that interest while they're talking to the child.
We've looked at this in parents. We've looked at this in siblings. And what we find in parents, siblings and educators is it's related to children's language outcomes. So, what we think happens is that you really need a close connection to a child in order to figure out what they're most interested in in order to watch their gaze and see where they're looking in order to be able to build on their curiosity. It's a bit like the way children play and we have to think about how can we add to that and support that.

So, we're trying to capture those interests and what we show with that parent effect is that when you have more of that your language skills are better, your – a lot of your school readiness skills, your early academic learning is better. That's true for parents; it's true when you have siblings who are more attentive to you.

We're interested in the same thing with educators and we're – then we're thinking about how can we train educators to get better at that - to be noticing where children are looking, how to build on those interests.

Jenkins – differential parenting (3:00)

Coping & Competence – 2.2 Family relationships

Differential parenting is really about children being treated differently within the family, and it tends to be examined on things like differential warmth and attention and things like negativity. So does one child get more shouting at than another? Does one child get a lot more sensitivity from the parent? Does the parent seem to understand one child much better than another child? Children are sensitive to those differences and they think about those differences. Now, a lot of what we see is absolutely innocuous.

One child is younger than another, and the kid totally understands that the reason why they get more attention than so and so is because they are younger and they need more, and the older kids recognize that and they make allowances for that. What kids tend to get really upset about is experiences of unfairness. So when they feel that an adult is more connected to a child, then those experiences of unfairness start coming out, and that's what we need to pay a lot of attention to.

When you have higher levels of social disadvantage, then as I've said to you, you have greater differential parenting. The parents get spread out, more reactive to individual idiosyncratic aspects of the kids, and when we take account of parents, what we call their reflective functioning, so we interview parents about their own childhoods, their own experiences in their childhoods.

Parents that are more reflective do less of this differential parenting even when they're in these high risk circumstances. So, again for me, that's an intervention pathway. It's really saying let's think about our experience of being parented and parenting our own kids. Let's think about what these kids need on an individual level, and then let's try and bring those things together in the way that we parent our kids.

It's about explaining why I needed to do this differently with Joe than I am with Sam, just explain it, and talk about it, and make the kids see the fairness in what your rationale is for it, and for them, their internal experience of it will be better.

Jenkins – early findings (3:08)

Ecology of Childhood – 2. Ecology of childhood research

What we're seeing is a mapping of that inequality at the macro level, so families that are disadvantages, they then, the disadvantage of individual children is then greater within the family. So what we see are the resources of the family are differentially allocated when those children are experiencing higher levels of social disadvantage in the environment, societies that have more un-equal experiences where the highs and the lows of what people receive in that society, when those are more different from one another then we see more negative outcomes for children, and we're seeing the same thin within the family domain. The more unequal the children's experiences are, within the family in terms of what kids are getting from parents, how much time, or attention or affection. The more inequality, the more problematic for children.

It makes it much harder to parent children in a more equitable way. The parents are worried about financing, they're worried about, they're not, their own psychiatric health might be compromised, so we're seeing the clustering of multiple risks together where families are socially disadvantaged and parents aren't doing so well and in relation to their own psychiatric health and how they're feeling, and it's harder for them to parent the kids and that then plays out in the family environment around this business of some kids are more challenging. We know that just cause of how kids are born and individual differences, and I think what happens at that point is that the parents who are experiencing all this social disadvantage, it's harder for them when they have a difficult kid to really get through that and balance that out effectively within the family.

So instead of all kids getting equal treatment, they have these unequal experiences which don't play out well in development.

Okay, let's see if I understand this…greater distance. So we can think about the inequality that we see in society and we can think about the inequality that we see within family relationships, and we get, when we see greater inequality in those family relationships, when the parents experience in the society is more problematic as well when they are more socio-economically disadvantaged as well. And so for me, that really about how in order to improve children's lives and improve what they're experiencing right within their families we need to do a much better job of supporting those families than we do now. I think that would make children's direct experience and learning within that family better.

Jenkins – kids, families and places (3:03)

Ecology of Childhood – 2. Ecology of childhood research

That's a study that I started with Mike Boyle back in 2004 and the goal of that study was really to look at the macro environment of kids, so things like their neighbourhoods, children's experience of poverty, the micro environment, which would be the family environment, so the relationships between parents and kids and siblings and target children, and children's socio-emotional development, so we're really interested in how kids come to regulate their emotions and all of the influences that are part of that development, so you know if we think of kids going from something like the terrible two's when they're very angry and distressed to the age of four when they'd be able to talk about what's going on for them, they'd be able to regulate their anger much better. So it's those kinds of, we're saying what are the influences on kids that are contextual coming from either their macro environment or their close environment of their relationships and how do those interact with individual developmental challenges of children to explain how that emotion and social regulation occurs.

It's a multi-level study looking at these different aspects of influences on kids, and we go right from the neighbourhood, to the family, and we also look at the biology of individual children because I think what we know a lot about is that kids are individually vulnerable, so environments do not work the same on all children. If you have a parent who loses their temper very easily, that for some kids in the family that's not going to be a problem and for other children that's going to be a large problem and it's going to influence their development. So it's really looking at those contingent influences on children and how those risks at different levels operate together.

We have data on them at when they were born and we include all the older siblings in our studies so that's why, how we can get these sibling influences on kids. So we have data on the children when they're at the time of birth, we look at them at 18 moths, then their older siblings at 18 months. We look at them again when the target child is three years old and the older siblings are anywhere up to about seven or eight years old. So we're tracking at these different stages. We've done three waves of data collection and we're just completing our fourth, and that's the point at which we'll really be able to look at our trajectories of children.

Jenkins – neighbourhood (1:21)

Ecology of Childhood – 2.4 Neighbourhoods and communities

I would say those are the least strong of what we are finding. So yes, we have, we have got some evidence, the reason why that's a tricky thing to look at is because you have to control for the person's own socio-economic influences that get them into neighbourhoods, and those are extremely strong.

We have to do is take account of those effects at a personal level, and then look at the effects over and above the person at the neighbourhood level, and the personal level effects of poverty are so strong that they minimize the effects of the neighbourhood.
So we don't see those as strongly as the person level socioeconomic effects that we see. So yes, we do have a little bit of evidence for some neighbourhood influences, on for instance, differential parenting, but they're not as strong as those personal level influences are.

Jenkins – supporting families (3:22)

Ecology of Childhood – 2.1 Families

We need to do a much better job of supporting those families than we do now. I think that would make children's direct experience and learning within that family better.

We are able to recognize the children than are going to be hard for their parents to parent, they're the kinds of vulnerabilities that we now know about. They're behavioural vulnerabilities where they're tough kids, they're easy to anger, they're difficult to deal with. So we know that. We know about these kids who have language problems. So, it's harder for them to learn language, to learn those skills of communication, and so they're harder to parent. We know from the genetic literature, and we've been finding this as well, that kids with particular polymorphisms are more vulnerable to adverse environmental influences like this disadvantage that I'm talking about, or like the parents being angry and irritable within the family context or the parents not being sensitive to the kids. Certain kids will respond to that more negatively than other kids will and those vulnerabilities are both behavioural and underneath that behavioural element are probably a whole series of things. There are genetic vulnerabilities; there are also how the children have developed in utero.

We know that kids who are very low birth weight are more neuro-developmentally vulnerable to those psychosocial adversities that I study. And so, through all of that we can really say this child's going to need help, and we can do that pretty early on. I think we should be doing that much earlier than we are doing it, and really supporting parents, because as soon as they've got difficult kids, kids who are learning more slowly or who don't have the language or who are much more difficult and irritable to handle then the parenting becomes more of a problem because the parents are, it's so hard to handle that kid, so we should right in those early early ages, we should be putting those supports in for families and I think those supports are two kinds. I think they're one kind of support is child care and is early schooling for kids, and I think as a society that's something we should be thinking about. I think the other kind of support is really intervention for parents, to help those parents understand what those kids are going through. To help them get inside the minds of the children and be able to, through that understanding, to support the kids more effectively so that you don't set up these patterns of real troubled relationships between parents and kids because we know that those troubled relationships are what predict over the whole life course how children manage in their life, do you see…too early?

Jenkins – surviving and thriving (1:16)

Ecology of Childhood – 1. Ecology of Childhood

What we tend to look at is the absence of a problem. We don't tend to look at really good functioning and we don't know how to measure that very well.

We need to do a lot of work on that to differentiate whether it's really a differential susceptibility like this orchid idea, dandelion orchid where really even if a kid has a negative thing about them they could do really well in a positive environment. We don't have so much evidence for that aspect of it yet.

What we've really concentrated on, and that's what thirty years of research has shown us, that you really have the absence of a problem if you can, if even though somebody is at risk if they get something good, it's that whole resilience story, it's only in the last say eight or nine years that people have been talking about the differential susceptibility idea, where really those kids who are at risk might do a whole lot better with a wonderful environmental experience.

Jenkins – training for cognitive sensitivity (4:15)

Communicating & Learning - 2.5 How children learn

We've been working on - in childcare centres throughout a number of different childcare centres in Toronto. We have a coaching model. We do some didactic teaching, a small amount of didactic teaching that we do for the early childhood educators. But we're also going to childcare centres and we have coaches who go in and then try and improve by showing, by videotaping how the educators are being with and talking with the kids, how they're building on their interest. We show those videos back to them and we try and improve their practice by really a greater awareness on their part of how they're interacting with the kids.

We're on our second wave of intervention and so we're just tracking all of the educators at the moment. But I think what is critical in this – when we've looked at a lot of longitudinal data on this process what is critical is about how people – the effect on children's language. So, I think the issue of how you watch what the child is interested in, build on that. So, you follow a child's initiation, you build on that. The child then gives you something back. You build on that. All of that turn taking in the context of what the child is really interested in seems to have an important effect on that early language development, and that early language development in turn is important for executive function, children's reading, their theory of mind. So, the language itself seems to be a critical organizer early on in the children's development for these skills that are totally important to us later on around the kid's ability to self-regulate and learn.

We have this very simple measure that we've been able to develop and it's a good sort of scientific measure. We've been able to look at whole families and how whole families contribute to the development of this and that – so, you know, we get effects of fathers, we get effects of mothers, we get effects of siblings and I think what's important about that is it's really about an enculturation process.

So, you have everyone in the family doing it and I think cognitively for the child it makes it much easier to build up that skill themselves. And so, I'm thinking that the same thing will be operating in childcare centres. The more teachers around you, the more children around you who are able to pick up on what you're thinking about and looking at and interested in and respond appropriately, I think the more that builds the cognitive structure for the skill.

But the context of the childcare is you have three or four children there and you're trying to have the educator sensitive to all of those kids and lift all of those kids. So, we've been thinking about how you do that and how you get the kids not being rivalrous or difficult with one another, how you support the individuality of each kid and what they have to offer to the group.

Jones – epigenetics (1:03)

Brain Development – 1.1 Brain architecture

So the word epigenetics actually means on top of genetics. And so what we mean when we talk about epigenetics is the sum of the modifications to DNA that don't change the sequence of DNA itself but that change the way the DNA is used. So you can think about it like light bulbs.
If you imagine that all of the genes in your genome are light bulbs, then the genetic sequence determines what shape the light bulb is going to be or what colour it's going to be. But the epigenome is like a dimmer switch on those light bulbs. It changes how bright that light bulb shines.

So we know that people's genes affect their health, they affect their personality, they affect their lifestyle. We also know that the environment affect those things almost as much. And so the epigenome is a wonderful way of finding real evidence, biological evidence that those things interact together to influence our lives and our health and our personalities and what we do.

Jones – prism model (3:32)

Brain Development – 2.1 A Genes and environments

One of the reasons that we think epigenetics is so exciting and so applicable to human health is we think it might be a mechanism or something called the developmental origins of health. The DOHaD hypothesis. So developmental origins means that in utero and early life exposures that we talked about might manifest years or decades later as health outcomes.

And so we're using epigenetics to try to see what is this sort of memory of these past exposures that sticks around. It's a concept called biological embedding. The idea that exposures can leave behind a biological residue that can manifest later on in sort of different kinds of health outcomes.

And the way I like to describe the role of epigenetics in the DOHaD hypothesis is if you imagine the way light hits a prism. So a prism in this case, the prism we're talking about is the sum of all of your genome and your epigenome together. The genome is static throughout your life time but the epigenome is changeable.

So if you imagine an exposure like a beam of light. So something happens, you could have poverty or adversity and it's a specific kind and colour of light and it hits this prism. That prism is the current sum of your genetic and epigenetic status of your cells. And you know that when light hits a prism it refracts into a rainbow. And so the quality of the light and the shape of that prism affect what that rainbow's going to look like.

And so in this case, the rainbow is the possible health outcomes later on. So the way we like to think about this idea of biological embedding is that early in life when you have a sensitive period of development, if you have a specific kind or type of light that hits this prism, it can actually alter the epigenome and it can change the shape of that prism. And that in turn of course will change what the rainbow looks like, what the outcomes can be.

What we think happens is that in certain circumstances, this combination of environment and then that change to the prism can stick around. And so that's what we look for in our epigenetic research is indicators later on in life of an early life exposure that's resulted in a change in this prism and alter the possible trajectories in that possible rainbow that you get at the end.

When I came up with this model, I was thinking to myself, "How do we express the idea that changes to the epigenome result in a change in trajectory but it's not a deterministic thing?" We're not getting to saying that changes to the epigenome where you're going to end up here. There's still a spectrum, it just changes sort of where the spectrum is. And that's where I came up with the rainbows. Rainbows sort of make sense when you're talking about health spectrums.

I like the prism model because it really describes health in terms of trajectories and not in terms of destinations. So that's the nice thing about this, the idea of a rainbow because it's a spectrum of health outcomes from point A to point B. We don't necessarily know what those points necessarily are. And so specific health outcomes; specific early life exposures may alter the probability that you're going to end up in one of these two ends of a spectrum but it's not a deterministic model. It's not that you have this exposure, you're going to end up with this particular health outcome. People are complicated. And there are so many other individual factors that affect this but it is about this sort of shift in potential risk or opportunity that I like to use the prism model to describe.

Jones – prism model example (1:57)

Brain Development – 2.1 A Genes and environments

So one example of how this prism might work is there's a particular animal model called Agouti viable yellow. And it's a funny name but what it means is it controls the colour that these mice turn out to be. So it controls their hair colour. And Agouti viable yellow is really interesting because if you have just a regular population of mice that have Agouti viable yellow they are on a spectrum from yellow to brown and lots of different sort of mottled in between colours.

And so I like to use that as a visual representation of how that rainbow would look at the end of the prism. So you have brown mice at one end and you have yellow mice at the other and they're all the way in between. And so the way this works if you feed a pregnant female mouse regular mouse chow which is a thing that you could buy in the store, you can buy mouse chow. Then you get a smaller sort of spectrum. Typically, you get mostly like mid-yellow, mid-brown offspring. The mice turn out to be medium yellow, medium brown.

But if you alter her diet, and you change some of the macro nutrients in the diet, you actually get a change to that prism. Her offspring's epigenome changes shape and that results in a different spectrum of coat colours. You get more yellow mice or more brown mice depending on how you change the diet.

And that's an interesting thing. You get different coat colours, that's cool but what does it mean in terms of health is mice that are very, very yellow, mice that are very, very brown, when they're young, they're very similar. But as they grow older, the yellow mice become quite obese, they become insulin resistant and they get all hallmarks of mouse diabetes. So this is an indication that an early life exposure; this change in maternal diet during pregnancy result in this sort of shift in the spectrum because of those changes to the prism that can result in much later life health outcomes that are different between the two ends of that rainbow.

Kaiser – button pushers (2:44)

Coping & competence – 3.1 Understanding feelings & behaviour

A button-pusher is when a teacher feels that a child's behaviour is just making them feel like they want to explode because they are just – it touches something that they haven't dealt with yet. It's the behaviour that they are almost afraid of and when they do respond to it they usually respond in an out of control manner because it was something-sometimes it's an unexpected behaviour but more often it's a behaviour that they just don't know how to deal with it, like running away. What do you do? If you run after them then you're playing the game. If you don't run after them when the parents come to pick them up at the end of the day and you say "Well, at 10:00 he was in the block area but I don't know where he is now," you run in to a bit of a problem. So for me, that's a button-pusher because I'm just not sure how to respond to it in a way that will support the child.

Well what research has shown is that when our buttons do get pushed we have something called an amygdala hijack. And when that happens, our cortisol level really rises. Our blood pressure goes way up. And what the research has also shown is that it takes about six seconds; it takes about six seconds for your brain to reorganize itself. So when you feel that you're starting to see red and oh, I can't believe she did that, if you take a deep breath and one way to kind of get the rest of your brain, the thinking part of your brain to function is to maybe create a math problem where you need to have your frontal lobe active, in order. So even just something in your mind as 5+3=8 will encourage your mental process to change. And what I suggest to teachers often is that when the children are out of control, they're often experiencing their own mini-amygdala hijack so that if you actually share with the children-"this behaviour is making me really angry; I'm going to take a deep breath and I'm going to count to five or I'm going to, you know, 5+3"..or whatever you would say out loud, you're role-modeling a strategy as to how they can deal with when they're having that behaviour as well. I think our biggest job is that of a role model and so if we can demonstrate the importance of self-regulation they begin to see that they can achieve it as well. If we lose it then we're role-modeling behaviour that we don't want them to engage in.

Kaiser – cultural influences (2:15)

Communicating & Learning - 1. Communicating and learning in early childhood

I believe that culture is probably the underlying theme of how we see the world. And so that when a child engages in a behaviour that we find challenging, the reason we find it challenging is probably very culturally-based. Because a behaviour that I might find challenging in my first world, North Canadian culture is not necessarily a behaviour that would be challenging in another country where that behaviour is considered acceptable. So I think we need to understand ourselves first and the influence of our own culture on our expectations of children's behaviours and abilities. And then as an educator, we need to recognize all the gifts that every child brings with them through their culture because every child learns the skills they need to become the best citizens possible within their own world. And so some of those skills may not be skills that you really want to encourage in your classroom. And an example of that is that some cultures when you're interested in something, you get involved. You start talking. Everybody starts talking at once and this shows that you're listening, that you're interested, that you're caring. But when we teach kids – is to raise their hands, to wait their turn, to talk one at a time. So he doesn't even realize when he's talking as someone else is talking that this might be inappropriate. So we need to see why are they behaving that way and recognize it and respect it and find ways to make that culture appropriate in the classroom. So explaining that, you know, in this room if you need to talk that's terrific but we'd prefer it if you raised your hand. But we'll have times when everybody can all talk at once so you can feel valued too and I think that's very important. I also think that the culture influences how we respond to that behavior. So we need to understand the culture, our own culture and the culture of the children and their families and respect it and find a place for it.

Kaiser-innate rights of the child (1:59)

Coping & competence - 3.1 Understanding feelings & behavior

I think that what we have to recognize is that every child is special, every child has a gift, every child brings something with them. And when there is inappropriate or challenging behaviour, we often lose track of that and our response is punitive. And punishment doesn't teach children anything. So when we look at the rights of a child, I think the child has the right to grow up to be the best person he can possibly be and that the adults in his world's job is to ensure that that happens. So if we respond to inappropriate behaviour in a punitive negative way, we are in no way supporting that child.

So what we need to do is we need to learn the skills required to understand why that child is behaving that way and provide the support and guidance and teach them the skills they need because there's a reason for that behaviour. And if we know the reason for the behaviour, we can teach them better ways to meet those needs. And what I say to educators when I do my workshops, is if I ask them what behaviours they find challenging. And then I say to them, if you know, if they say for example… he has, if you add the three words he or she has difficulty controlling his emotions, he or she has difficulty joining in groups, he or she has difficulty … whatever it might be, and those three words imply that your job isn't to punish but if a child has difficulty your job is to teach. So I try and guide educators in that direction and not necessarily thinking so much about the UN Rights of the Child so much as the innate rights of the child that the UN recognized.

Kaiser – time out (2:01)

Coping & competence – 3.1 Understanding feelings & behaviour

I think that timeout is something that a lot of educators use but they don't think they're using it because they don't have that specific timeout chair. But that's not really how I identify timeout. I identify timeout as asking a child to do something they don't want to do so that if they're engaged in the block area and they hit a child in the block area and they're knocking over all the blocks and you say to them, "You need to go look at a book. You need to calm down. Go look at a book." Or "You need to calm down why don't you go to the quiet area or why don't you draw." Why do we expect this non-compliant child to go, oh ok. I don't really want to be here and I'll just trot off to the book area. So now what do you do? Do you spend 20 minutes convincing him that he needs to go to look at a book? Or do you ignore him when he says no and just forget about it because you don't want to engage in that kind of battle? Or do you pick him up and move him? And either way, what are you really teaching the child?

So I think teachers really need to recognize the difference between if the child is engaged in that kind of play in the block area that they say to them, you know, "I think you're having a hard time here. Why don't we go look at a book?" Or "Why don't we see what markers we have in the drawing corner?" So that it's something that he's being supported in and then once you're there and he's calm and you have a teachable moment, because you've got to remember the importance of teachable moments, then you can say to him, "What happened there? How are you feeling? What else can you do?" and you can help identify whether or not that behaviour was a result of not getting, you know, wanting something that he couldn't obtain. Or wanting not to do something that his friends were asking him to do or maybe just wanting to make it more exciting and change the level of stimulation.

Katz – developing an inquiring disposition (1:19)

Communicating & Learning – 2.5 How children learn

There is some evidence, and it was published about 20 years ago I think, is that teachers tend to teach the way they remember being taught in first grade. And they weren't taught that way, and I think also that very few teachers have actually seen a good model of that kind of teaching, now you do see that in Reggio, where the teacher will probe, "Well if it's like that, then what will happen next? These are such simple things and kids will make up silly answers, but they'll make up a few good ones and they can test them.

So they have to have access to good models, and I think that's an important mission for us, is to identify these teachers who will engage children in doing what I call, asking the question, questions like what makes you think so? If a child makes a statement, why not say, "What makes you think so?" not "Where the hell did you get a dumb idea like that from?" no, but what you're trying to do is encourage the disposition to go on with an idea, what makes you think so, could be this could be that, how could we find out? Or, how could you find out?

Katz – insight into behavior (2:15)

Coping & Competence – 3.2 Getting along with others

For example, a child who's very shy, it's not much use to say "Why don't you go over there and play with them?" it doesn't work very well, but you could say to that child, "If you want to go over and play with those others, I can help you, just let me know." So the child takes initiative, and that's an important part of early social development, which kind of reminds me, on one occasion I was working at a, in a lab school in a different country, and in the mornings the teacher of the four year old class would go around at ten thirty with a tray with crackers to give to the children, now, nothing unusual about that. This happened to be in February so the children had been in that, four year old children had been in that group since September.

But there was one little girl in the group who had never, ever spoken in school. All the evidence was she spoke perfectly normally at home, and in the neighbourhood, and with her cousins and her brothers and sisters, but in school, not a word. And I was watching the teacher and she would go around offering the children, with the tray, offering them a cracker, and when she got to that little girl she said, "You can't have a cracker unless you use your words." And what did the girl do? Walked away. And so I talked to the teacher and I said "You know, try this, see if this helps, say to her, 'You don't have to talk if you don't want to, but if you change your mind, I'll be over there'". And within a week she was talking. Now, I've often wondered about this, how, is that, why didn't that teacher think of that? And it's what we call insight. It's not technical; it's not a technique to use. It's an understanding of what might be causing the behavior which in her case is she dug in her heels no matter what, she was probably a very stubborn kid, and once she dug in her heels, she wasn't going to un-dig them for somebody, by somebody else's command, she was going to do it when she thought. And it worked fine, and in many situations like that.

Katz – intellectual content in Reggio Emilia programs (2:48)

Communicating & Learning – 3.3 Creating curriculum

I was, as usual, visiting schools and working with teachers, and I would begin to ask the question, "When I observe teachers interacting with children, what is the content?" and I was amazed how much of it was what we call 'housekeeping'. "Don't forget to hang up your jacket, it's time to come and wash your hands, stand in line over by the door before we go outside, you, where's your lunchbox?" All of this kind of housekeeping, but there was no real intellectual content. About what you're planning to do next, and how far did you get, and do you need any help with this, and so on, and I, I saw a lot of that really good content in Reggio Emilia, which some of you might be familiar with, these wonderful pre-schools in a small town in northern Italy where they, what they do is quite remarkable, and there are many things that are remarkable about it, but one of them is there's lots of rich content because the children are making things and investigating things, and trying to figure out how to represent.

I watched a videotape there recently with four, four year old boys were together at a small table, and they were, they had decided, I don't know how they decided, or why, but they were going to make out of clay, a table. So they had a big clump of clay on the table, and they took pieces of it and were rolling it to make the legs for the table. So they'd roll it and say, "Oh this is a leg!" and by the way, constantly talking to each other through this. And stand it up, but it curled over, so they said, "Oh it's not standing. Maybe, maybe if I add more clay," and so there's a lot of talk, and another child would say, "I got it right, 'cause mine's thicker!" And so all this conversation, eventually they got the four legs, pretty thick legs. And then they took a big clump of clay together to make the tabletop, and they were rubbing it hard, and they argued, is it going to be round or square, should we do it this way or that way, a lot of talk, it's so important, there's something to talk about. They finally finished it, and they picked it up, and they put it on top of the legs and it collapsed. And they said, "too heavy, try it again." Now that's just a very quick picture of what happened, but they must have worked on it for, I would say, about forty minutes. A lot of talk, trying things, what didn't work, and this worked, and that didn't, so there's content for the relationship, that's real, not phony. So that's one of my concerns about what kind of content do the children's interactions have? You've got to have something interesting going on to make rich content.

Katz – project approach (4:14)

Communicating & Learning – 3.3 Creating curriculum

I got a call from a superintendent of a school district in the Chicago suburbs, and he said, "Would you please come and train our teachers to do project work?" and which is what I'd been doing for a while, and, "Come in august before school starts and I'll give you three days with the kindergarten teachers, three kindergarten teachers." Very, very wealthy suburb, very, so I said "Okay," and it's only 150 miles from where I live, so I went up there and I met with the teachers, and it turned out that the school, which was quite, which was pretty old, was on the same piece of ground as a wildflower sanctuary that had been developed when that community started about, I don't know, 90 years ago or so. But the children had never been in it. Never. And you didn't have to cross the road, you just walked across the tarmac where the parking lot was, but they'd never looked at it, they didn't know about it. Anyway, so I went with the three teachers, we went into the sanctuary, and I strongly urged them to have the children study it in detail. And one teacher, the kids could, her class could do the trees and bushes around it, another group could do the plants and wildflower grasses and so on, and another group could do the insects. And they reluctantly agreed, but the superintendent had brought me in, so they didn't have that much choice. And I agreed to come back and see what they had been doing, in late October. And there I was. And one of the teachers, in her 31st year of teaching, got the children, 19 were there that day, lined up to go outside and they were going to measure the circumference of the tree trunks, and the children were arguing again about who had the nicest clipboard. And off they went, and one of the children dropped a pencil in the poison ivy, and that was bad, so she took the kids back into the classroom and called the nurse. That was the end of that.

Then she got them all to sit down because she wanted to read them a book before lunch. So they're sitting around, and she had a beautiful book, really lovely book, of photographs of leaves. Now this is October, in our part of the world the leaves in October are beautiful, Maple and Oak and all kinds of trees. So she's turning the pages, "Look at this, isn't this pretty," and this is a natural coloured leaf of some kind, "See this is purple," and so forth, and the kids were pulling each other's shirts and stuff like that, they weren't really, she didn't interact with them, she just turned each page and so forth. But I was kind of fascinated by this, and when she finished I said to her, "Could I ask a question" she said, "Oh sure," and I said, "Why do the leaves fall off the trees?" and I was serious, and a little girl sitting next to me stood up, turned to me like this, "Because it's fall," she said. And I said, "Well that's why we call it fall, but where I grew up, which is England, we didn't call it fall, we called it autumn. But look out the window." It was a windy day and the leaves were falling. That doesn't tell me why. And the little girl sort of said, "Mmmm."

Then another little boy raised his hand and he says, "I know, I know, 'cause it's windy!" and it was windy, and I said, "Yes, it's windy today, but the wind blows in the spring and the wind blows in the summer, but the leaves don't fall off the trees." And he said, "Ahhh," You know, sort of, "Yeah, you're right," kind of thing. Then the third boy raised his hand and he started to explain, but changed it into a question, he said, "Because, because

it's cold?" and what did the teacher say? "it's time to finish your pumpkins." She had got supermarket brown paper bags, stuffed them with newspaper, tied the tops, and they were supposed to paint a pumpkin face on them because it was right before Halloween. She never picked it up.

Katz – project on balls (5:03)

Communicating & Learning – 3.3 Creating curriculum

One that I remember, that sometimes teachers say to me is, "Well, there's nothing in our neighbourhood to study." I can't tell you how often I've heard that, and it's never true, but anyway, one teacher who was working at a school, about, I would say 25 miles southwest of Champaign Urbana where the university is, she said "Oh there's nothing in our neighbourhood, we're in the middle of the cornfields, and we only have a small community, about four thousand people." It's required, you're in my class, you have to do a project. Anyway, they ended up, the next part of that story is, she went back to her class, kindergarten kids, and she said to them, "When you go home, I want you to ask your moms and dads and grannies and aunties and uncles and grandpas and neighbours to look in their attic or look in their basement to see if they can find any old balls that they no longer use, they can give to you so you can bring them to the class 'cause we're going to study them."

And by golly, these kids got into it, and the collection was amazing, an old beach ball, a soccer ball, a football, a baseball, a tennis ball, ping pong ball, billiard ball, golf ball, on and on it went. Wonderful. But one of the boys brought an old world globe. So the teacher took it, she held it up in front of the class and she said, "Well, is this a ball?" and they said, "Yeah sure!" and she said "Well what makes you think so?" that question is so important, "It's round!" and then she had a paper plate on her desk. She picked it up and she said, "It's round isn't it?" "Yeah" "A ball?" "No," "Why not?" "It doesn't bounce." Well it turns out, the bowling ball doesn't bounce. They got, she got them into the concept of sphere, and they loved spitting that word at each other, and spherical as well. And, it went on, and then they talked about what was inside of them, and that was an interesting part of the project too, but the children divided up into small groups, and one group of three or four took each ball with string and measured the circumference, which was another word they liked to spit at each other.

And they cut, it wasn't easy, a marble, how do you put a string around a marble? But they wouldn't give up, and that's the other thing, teachers have told me over and over again, once they get into a project, their motivation is very strong. And they got all the pieces of string and they suspended them from a rod, vertically, so you could see the biggest circumference and the smallest, and so on and so forth. Another group of children did rubbings of the surface texture of each ball, and evidently, I don't know this myself, but they told me a golf ball has dimples in it or something, but the basketball has little pimples on it. And on and on, and tennis balls and so on and so forth, and they did the rubbings and they portrayed them, and they said to the teacher, "How do you write basketball?" and that's the other thing about the intellectual emphasis, they ask for help with their academic skills in the service of their intellect, and I feel very strongly that's an important part of developing good academic skills; it has a purpose. It's useful.

I can write the word basketball, and when my, my Moms or Dads or neighbours or the other classes come past the documentation that's on the wall, which by the way is another lesson from Reggio, they can read it, 'cause they wrote it, and they asked how to write it. Then another group put a tape measure on the bookcase, which

was suspended vertically. They got the teacher to show them how to read the tape measure, and they bounced each ball, they predicted which balls would bounce the highest, by the way they got them wrong, and they recorded, so here again, we're talking about kindergarten children, they're saying, "How do I write, "I don't know, "Two feet?" or whatever it was, and they recorded the bounce of each one. Another group put, used a hollow block, about, you know, this high maybe, and a plank, and rolled each ball down to see how far it would roll depending on whether it was on the linoleum, on the carpet, or outside on the grass.

So they were engaged in a tremendous amount of measurement, of weight, and distance, and height, and bounce, and on and on it was. It was a wonderful project. So, again, the disposition to use basic skills, measurement skills, writing skills, came in the service of their intellectual pursuit. Why not? They didn't need a federal grant to do it, it was a great project.

Katz – reading skill and disposition (1:39)

Communicating & Learning – 2.3 Literacy

I often talk to teachers about the distinction between having a skill and having the disposition to use it, and the best example I can think of is that you want children to have the complicated skills of reading, but you want at the same time, that they have the disposition to be readers. It is possible to find learning to read, especially in the English language, which is one of the worst, so painful that you'll never read when you leave the school building. In which case you've got the skills but not the disposition, but of course it wouldn't be much use to have the disposition to be a reader if you haven't got the skills.

So the important thing for us, as teachers, is to say, to ask ourselves, "How do I help children so that they acquire both together." the skills and the disposition to use them, and by the way there is some evidence that children who are around adults that they see reading frequently, doesn't matter what they read, the point is young children who are around people whom they observe reading tend to learn to read more quickly or more easily, or with more enthusiasm, shall we say.

So the question is how do we help children to acquire the skills and, at the same time, the disposition to use them, and that's true of all skills, it's having the disposition to use them. And a lot of that depends on whether they're reading something that's interesting, not necessarily something that's easy to read.

Katz – representation with "graphic languages" (2:15)

Communicating & Learning – 3.3 Creating curriculum

One of the other really powerful lessons from Reggio Emilia, is that the children, very early, do drawing. If you ask a two and a half year old, you give a two and half year old a pencil and paper and say, "Why don't you draw whatever", they will try it, but if you wait 'til a child is five, most of them will say, "I can't draw." You ask any adult, I ask you, or people around you to draw a building or the car, they'll say "I can't draw," but when they're very young, they don't know they can't draw. Some draw better than others, that's always going to be true, but what they do, and I found it very helpful as a lesson, is they don't talk about art, they talk about representing. What you're looking at, what you remember, what you're planning, and you represent it with what they call graphic languages, it can be pencil, it can be painting, it can be clay, it can be anything.

So this act of representation also involves looking. And I've worked with teachers who've been trying this and it's so interesting they say, the children say, "Yeah I'm drawing this, but, what's that bit? What is it called? Why is it there? Who made it? Where did it come from?" That's what you want, that's the intellectual content of the interaction between the children, and between the children and the adults in the classroom.

And so my point was that the children are engaged extensively in examining, studying, asking questions about things that are going on around them, that are real. And using what they call the graphic languages, drawing, painting, and various other sort of languages to record their observations. They certainly argued with each other about what they'd seen, or what they'd done. They, there's one, I have some pictures of a big mural the kids made of small drawings of bird feathers. They'd gone to a local museum and they'd shown the kids how, what, bird feathers are very complex, I'd never thought about it, but they have all kinds of shapes and sizes, but that's, you know, one of my main, sort of causes, is get the children involved in examining, closely, things in their environment. When they get older, they should examine other peoples' environments. Historically way back, geographically far away, but the young ones, there's so much to see in their environment.

Katz – selecting a project topic (2:13)

Communicating & Learning – 3.3 Creating curriculum

I have written about how to select a topic, and which topics work, and the topics may a big difference to the quality of the work and to the children's motivation. And I have made a list of criteria, it should be something children can interact with directly, observe directly, that's one, it should be something worth knowing more about, and I feel strongly that we should encourage the children to ask questions about things around them, where do they come from, who does what? How do they do it, what do they use, and so on and so forth. And if, one of them, that one of my local teachers did, across the street from her school were these grain elevators, the children had never looked at them, they passed them every day, nor had the parents, by the way, nor had the teachers. But she had to do a project, she was in my class, what they learned about grain elevators, how you fill them, how important it is to do it right otherwise the corn inside will explode, and their drawings are absolutely wonderful, and the other thing, again this is a Reggio learning, they drew them the first time they went to see the, went outside the school to look at the grain elevators, then three weeks later, draw the same things. And the drawing differences are enormous. And then, they sit down and look at their own drawings. This is a time one drawing, this is my time two drawing, I left that out the first time, but I got it in there now. I didn't know there was that until the second time I went there, and so on. That's developing the intellect, to look closely and ask, "What is it for, and what is it," in their own environment.

So, the quality, the topic is an important element, by the way, sometimes a topic works well with this class, but next year that class isn't interested. That happens too, that happens in Reggio too. The other thing, to think about, is sometimes a child will say, "Well okay, they're studying cars," or something, which is a good topic, but I'm not interested in that, and the teacher has to learn how to say, "Well I'm sorry you're not interested in that, and I hope the next project we do will be something you're interested in, but in the meantime, go over there and help Annie and Jim with what they're doing," you won't hurt children that way. They will learn that everybody's interests, even though they're not always shared, are treated with respect, and that's something to learn.

Katz – self definitions (2:23)

Coping & Competence – 1. Coping & competence in early childhood

Interesting research, a large body of research now suggests that unless children achieve at least a minimal level of social competence by roughly about the age of six, they will be at risk for the rest of their lives. Because, not because they can't, just can't learn, but because once a child has experienced being defined as unlikeable or has been avoided by peers, then that child tends to define itself as unlikeable, and we've got plenty of evidence that children will bring their behavior into line with their definition.

Like sometimes the child is defined as the class clown, well this child from the studies we have, would rather die than not be funny, because that's his identity or her identity, and that's the same with the child who's unlikeable, and that, generally speaking, that child's avoided, and what we do have reason to believe now is that when those children like that are teenagers, they find each other. And they solve the problem of being unlikeable by joining together with the shared bitterness for the rest of society. So they have the experience of closeness based on shared bitterness, and they would rather be, make trouble than solve their problems, because if they solve their problems they won't have the shared bitterness so they'd lose the closeness, so getting the social development right in the first six years is hugely important, and by the way, we know a lot about how to do that, and I've spent a lot of my time with teachers helping them to help different kinds of children with these problems. But most children we say, for the sake of the discussion, all children who see themselves, by the time they're about six, as unlikeable, have to be helped by an adult. They cannot solve the problem by themselves. But we do know how to help them.

Keating – biology (2:08)

Developmental Health – 3.1 Advocating for early child development

And we've already talked about some of them. So one of them I think is really getting people to have less fear about Biology. The reality is that we are biological creatures, we have an evolutionary history, we come from an animal kingdom, so we are members of that animal kingdom and that creates certain opportunities and it also creates certain constraints. And so, one of the things that I think it interesting when one, as I've had the opportunity to talk about with social scientists and talk about with social policy people in a variety of things, they get very anxious and nervous sometimes when you start talking about Biology, but I think it's fundamental to understand and I certainly would hope that practitioners would understand this as well.

It has to do with what it is that's having an impact and why is it having such a durable impact? It has an impact because in fact as I've said what we're doing is building brains with these experiences; directly through the neural circuitry, indirectly through the epigenetic regulation of genetic processes. And so, we are fundamentally impacting on the biology and the social policy the practitioners experience has to understand that we're laying down important tracks here that are going to have a long lifespan. Again, not a fixed one, not one that cannot be altered by an experience, but it gets harder and harder to alter some of the things if the wrong circuits, if the wrong things happen early on, and recognizing when things may be going off the rails not because anything wrong has happened in the child's environment but that they have some anomaly that needs to be dealt with, right.

So, for both normally developing children and children who are challenged in a variety of ways, figuring out and understanding that we are in fact in the business of building brains when we're in that early child environment when we are parenting children, that is what we are doing, and we have to accept the fact that that's an important responsibility that we have. So that's one lesson I think that science can have.

Keating – developmental health (2:39)

Developmental Health - 1. The developmental health perspective

So the first question is what does developmental health mean and why do we need to understand the concept of developmental health? Well, basically developmental health is a concept and a term that we arrived at by looking first of all at a whole lot of different evidence. The basic evidence is that if one looks at the kinds of pathways by which individuals get to various kinds of outcomes that we think are important outcomes we see a lot of similarity in the pathways that they arrive at so for example, the pathways by which individuals get to higher levels of physical health, higher levels of mental health, as in the absence of emotional behavior problems, higher levels of achievement or competence in terms of literacy and mathematics and coping skills. What we find is that there is a lot of similarity both at the individual levels of experience as well as in terms of how populations function. So in a sense, rather than somewhat more longer list of talking about that these kinds of characteristics and kinds of experiences are important for health and mental health and emotional and behavior, avoiding emotional and behavior problems and coping skills and competence and achievement which is rather a long list. it seems as thought there's a lot of reason not just for convenience but in terms of the evidence to put them together. In a notion of developmental health which essentially says that the circumstances in which we create in early childhood particularly beyond which we lay the groundwork for these things to function in a healthy and positive ways.

It also means that we should understand that one of the reasons to understand it is that we can have common concern that is if we are concerned about trying to promote health or trying to promote mathematics, which we often don't think of as in the same kind of category but in the early years if we want to promote both of those things a lot of the things that we would think about in terms of creating environments and creating contexts and creating circumstances and experiences for kids are going to be very similar kinds of things. So basically at one level it's driven by evidence and to talk about the convenience of a developmental health category because a lot of the pathways do overlap in important ways but then also from the point of view of what do we do about that, it helps us to understand and to realize that the things that will ---- that in later life and create a foundation for that in later life are very similar kinds of things and that --early years across different outcomes that we care about.

Keating – early interventions (0:43)

Brain Development – 2.5 The social brain

We know a lot more about how early we can detect reading difficulties and what sorts of things we can do, and how early we might be able to detect autism; what kinds of things we might be able to put into place that would mitigate those things. We're not going to be able, I suspect ever, to make a truly dyslexic child exactly like a child with fluent reading, but we can in fact build the workarounds that make that happen quite well and quite competently. We're not nearly as far along that road in autism as we are in dyslexia, but I suspect that we are going to get there, we are beginning to understand that the earliest interventions are the best and understanding how to get those services delivered early are very important.

Keating – parenting (1:28)

Coping & Competence – 2.2 Family relationships

One of the most rigorous and replicated findings in all of developmental psychology is that parental effects do matter and they matter to a very substantial degree and that standard findings have been replicated also within that literature that essentially it's a combination of warmth and responsiveness of the parental figures in the early years particularly mother who's typically the primary caretaker. When the mother is the primary caretaker it's that warmth and responsiveness. Whoever the primary caretaker is that's an important thing, and by warmth it's obviously means kind of general acceptance, a sense of love and affection, emotionally communicated affection as well as responsiveness to needs as they arise, so responsiveness that's time sensitive; the younger the child, the more time sensitive those responsiveness needs are. So there's a warmth responsiveness dimension, higher being better, but then there's also a dimension that is in the area of expectations or demands; the sorts of things where parents place limits on their children that children get to understand that there are limits, because for many children, for most children, the absence of limits is a terrifying thing, so needing to have the structure of where the edges are in their behaviour, where the edges are in relationships, where the edges are in things that they do, is an equally important component to their felt security and to their ability to learn to function, to explore and to be comfortable in the world.

Keating – universal and targeted (2:59)

Developmental Health – 3.2 Shaping public policies

Obviously in the last century in the 20th century we developed and expanded the notion of universal education for everyone. That was a massive universal intervention and has had huge positive impacts in terms of the skill levels of populations, in terms of all kinds of downstream benefits to that. That's a universal intervention. We need to be thinking about what's the equivalent really good universal intervention for early childhood. We really need to figure out how to do that. It won't follow exactly a school model, but it's not going to be entirely different either. We now regard k-12 schooling at least and then post-secondary and tertiary education beyond that as an absolutely settled institutional issue. We have to remember a century ago it wasn't, it wasn't a settled issue. It wasn't even presumed that everybody ought to go to school; elementary much less high school. So these are institutions that we build to acknowledge and recognize and devote our resources to things that we think are important.

Then we have the targeted interventions, kids who are at risk either because of difficult early experiences, disadvantaged social circumstances and so forth or anomalies that are arising for physical reasons, for genetic or epigenetic anomalies that have arisen. We need to try to figure out how to identify those risk factors earlier and earlier, and what we now are understanding is there's hardly any of those things that can go off the rails that don't benefit from being identified and dealt with earlier. And so clearly early targeted programming for kids who may be at risk either biologically or socially is a hugely important kind of thing and again, emphasizes that impact, the investment impact difference that we see in early childhood.

And frankly on the clinical side we outta be prepared to recognize there's a pretty serious problem going on sooner than we do. We now don't wait until fourth grade to say oh this child can't read, let's start an intervention, we begin that process quite early on now, and many other areas we're doing the same sort of thing, and even earlier we can probably begin to do that. So, the blend, the mix of universal, targeted, and individual services is obviously a blend that we need to think about. They have strengths and weaknesses, but they are complimentary. Universal are expensive in total but they're cheap per individual. Targeted are a little bit more expensive, but they have a fairly big impact, and when you need to have someone who's already off the rails to help them get back on a positive developmental pathway, well the sooner you do that the less expensive it's going to be. And so the basic notion we have to keep in mind is that the appropriate mix of these things that will enable us to both support healthy development where it's already happening, get it back onto a healthy pathway where it may be at risk of or has already gone off the rails, that is the way to flatten the gradient, and that's the kind of social policy that we need.

Kershaw – Canadian family policy (2:07)

Developmental Health – 3.2 Shaping public policies

The first thing to recognize is Canada has a long ways to go by any international comparison. Canada was ranked last by UNICEF recently, the Organisation for Economic Cooperation and Development ranked Canada last a few years ago, and even by my own research which tries to show 'Oh no, but Canadians do some things well, like, like health care'. We still really don't climb that far up from the bottom of the ranking. So that means we have a lot of room to move in order to get to the place where other countries are at. But I do see some moments of hope. First, 10 years ago, 12 years ago now, Quebec's inroads around early learning and care services--or child care as a lot of people call it—and more recently, parental leave, and their efforts to combat poverty really gets at the time, resources, and community services side beautifully. They're not all the way there yet, but by Canadian standards, they've made real inroads. It's pretty typical for North Americans who are interested in this kind of social policy to look to Scandinavia where, for decades and decades and decades now, they've recognized the relationship between family policy and fertility--and they wanted to keep their population up—family policy and gender equality, and family policy and child development. So there they have robust parental leave programs. They create labour market systems that allow parents to work less time than we do in North America.

We have places though that are less affluent. I think about Spain and some of the other Mediterranean countries, where from early days on, they recognize the role of putting in place community supports and although they do struggle on those areas more with the gender equality issue, and who is taking leave and if leave is available. So I'm not wanting to say that Canada hasn't been doing some important things well, but some of our strengths around family policy, and gender equality which is a key part of that, have been eroding and over the last few years our ranking from the World Economic Forum in terms of gender equality slipped from about 14th to 31st. But the countries that have the best family policy also have the best gender equality policy and, you know, there the high rankings come again in Scandinavia, and to some extent in France.

Kershaw – community engagement (2:34)

Ecology of Childhood – 2.4 Neighbourhoods and communities

We've been collecting that data for the best part of a decade. And one of the amazing things is that because the Early Development Instrument speaks about the children in our neighbourhoods, people get mobilized. It's not a random child, it's the child out there on my street in my backyard, in my park, who I see as I drive to work. And that get's people excited. And in British Columbia, in short order, we know that in a four-year period, 500 local responses emerged to our data showing that over one-in-four kids was vulnerable. That's impressive. That is a tremendous amount of local and community development that was happening on the ground. People said, "we're working harder", "we're collaborating better", "we're volunteering in more efficient and smarter ways", and that is exciting. But despite that, over the exact same time period, vulnerability rates rose in British Columbia. Now I can't imagine how high they would have risen, had it not been for all that local community development work that people were doing by focusing attention on the early years in a way that had not been done before in British Columbia. But it also shows that the local is not going to be the sufficient place for community development in Canada because Canadian federalism doesn't work that way.

The places where we have the greatest opportunity to shift the way we live, and organize and institute policy, are at our provincial and federal levels. So community development has to have this groundswell of interest and be informed by the values and commitments of the people locally, but it needs to be directed evermore, to our provincial and federal levels. Local community development requires citizens to be more savvy when they digest information from our senior levels of government. But we need to now recognize that we've been so slow to implement good early child development and family policy that a modest incremental change is not going to do it. Eliminating the rate of vulnerability from 29% down to 10% where it ought to be, it's going to cost us, in British Columbia alone, three billion dollars. Across the country closer to $22 billion. A year. And until people start hearing those numbers, then local community development can't get distracted by saying "Oh we'll spend a couple, you know, a million dollars here, or a $100 million there across the country". It's not going to be sufficient and so we need to be more savvy, more intelligent in the way we digest theses policy announcements.

Kershaw – nurturing environments (2:54)

Ecology of Childhood – 3.3 Creating child and family friendly communities

Well we know that the early years are critical for predicting a range of things later on in the life course. And we know that early nurturing environments, including community environments, are critical for influencing early development. So for instance, we know that the early nurturing environments, by one's second decade, are going to influence school achievement, without a doubt, and interaction with the criminal-justice system. As we move into our third and fourth decades, it gets at levels of health issues around obesity, diabetes, and things like mental illness and depression. And as you move on toward later in the life course you will see that the early years still are very predictive of later health and well-being.

A nurturing community doesn't think that we eliminate child poverty or child vulnerability by only putting up pictures of children and focusing on what children are doing. A nurturing community recognizes that children grow up with adults. And so supporting adults is just as important as supporting children. In fact you support children often by supporting adults. So a nurturing community is one that provides time, for parents to fulfill their responsibilities as parents, and their aspirations to care personally. I mean one of the challenges that we're running into is that sometimes people are putting more time into the labour market and we worry that that's at the risk of having the time, but if we ask them to take more time, then we're having people who are poor. And there's no doubt that the income poverty is a major predictor. So we need to recognize how to put in place income supports and rely on the labour market to provide people with wages that are sufficient for them to tend to the income needs of their families.

We have started to adopt rhetorically, this notion that it takes a village to raise a child. It's a really lovely African proverb. But we don't live it. And we certainly have in place a system that, even if you are rich in Canada, you're going to find it hard to access services before your kid is aged six that you think are important. Child care services are an example. But even if your child is identified say with an extra support need, try and find some support services to address that issue. Or issues at pre-k or some of the monthly interaction with professionals who could help you recognize what are the important developmental stages from month to month. We could do that. That would be nurturing. But we're not yet doing it because we have a vision that there's something magical about age six. I'm not sure what's magical about age six, but I know then as a community we become more nurturing because we'll create schools and invite everyone to come there. And we don't call them institutions that are robbing our families of time with their kids. We think "no, okay that's an important place where society can kick in". And, we'll put in place health care, although disproportionally as, you know, people get older. So those are things that make a society nurturing.

Kershaw - recommendations (2:28)

Ecology of Childhood – 3.3 Creating child and family friendly communities

We need to have a pan-Canadian system of early learning and care that kicks in at about 18 months, for all families that want or need to use it. It's not mandatory but that's where we need to create that as a viable option that recognizes two things: it supports parents to be in the labour market—and we expect people to be there to earn their income and support their families—and ensures kids get quality nurturing environments while their parents are doing that work.

On the time side, parental leave is critical. Parental leave is a period that recognizes those first months where, you know, parents and children have so many new adaptive needs not something we have a lot of time to enjoy. And breastfeeding's going to be a big deal. And carving out time for fathers, not just to be family helpers, but to be engaged and primary caregivers. That means we need to carve out time for people to do that. And raising the parental leave system eligibility from about 12 months to 18 months, per birth, reserving the last six months primarily for dads, is critical and that's going to cost us in the order of about four-and-a-half billion dollars more.

We'd also have to recognize Canada has intolerable levels of family poverty and by international standards we're going to, we really are doing something that I don't think Canadians recognize. But other countries have all but eliminated it and we tolerate it at really high levels still. And so we need to spend in the order of about six-and-a-half billion dollars to make our welfare system more generous, and also to play with our tax system to make work pay, and/or have employers make work pay by having higher minimum wages.

There's one thing we already do relatively well in Canada. Because we have invested in our health care system—and this is something we take such pride in. And so, after children are born, on a month-to-month basis, we need to get the health care system, and all the health care professionals organized in the health care system, to interact better with family resource programs—things we call in British Columbia like Strong Starts, you have analogues to that all over the province—a range of other non-medicalized professionals, and then collaborate and coordinate, so on a monthly basis interact with families with young kids, and start to help them monitor and screen when their children might be having developmental delays and pick that up way before they get to school, 'cause that's when it will be inexpensive to deal with, and then we can—or less expensive at least—and then we can support their families so that when they get to school, hopefully children will have caught up and if they haven't we'll be better ready to have them more seamlessly enter the school system where they can continue to thrive at their level as best as possible.

Kidder – family centred care and the hug hold (2:27)

Coping & Competence – 1.2 Individual differences

When we talk about family centered care, we utilize that approach in a lot of different ways. One of the situations is how do we use family centered care when a child is going to experience a procedure like having a needle, like having an IV. start, like having electrodes applied to their chest, and a blood pressure cuff, and an occimeter for sedation, for a medical procedure. What we've learned is, the most important person that's going to help that child cope it their caregiver, the most trusted person. It could be a mother, it could be a father, it could be a grandparent it could be a foster parent. Whoever is the most significant adult with that child you want to maintain that relationship so if we keep them together, they're both going to cope more effectively.

So for example having an intravenous start, we could have the child sitting on the adult's lap that could be enough. But if it's a young child there's still going to be arms moving, legs maybe moving. A child who is 3 is losing a sense of control. The last thing they want is to be restrained for a needle. The most we can do to help them psychologically and emotionally is to hug them, and we've discovered that if a child straddles his or her legs around the parent and the parent hugs that child, the nurse has access to the child's arm while the parent is gently giving the child a hug, is helping the child as opposed to being restrained, and we really need to be mindful of that when we're working with children. Children do not like being restrained. They do not like losing their sense of control. Any time we can avoid that, we're doing good work. If we restrain, we may be causing harm.

Kobor – early life epigenetics explained (2:29)

Brain Development – 2.1 A Genes and environments

Basically epigenetics, offers a number of opportunities to understand human health, and I think the most exciting one is to understand really the impact of early life experience on things that happen later on in life. The reason for that is something we like to think of epigenetics is that we have 25 thousand genes. All of us have 25 thousand genes and I always equal a gene with a light bulb. You can think of a light bulb totally turned on or totally turned off, and if you have a fancy home you might have a dimmer switch. And so you can think of this light bulb either totally on, totally off, or anywhere in between. The epigenetics to some extent actually serves as a dimmer switch for brightness of this light bulb. And so if you think you have 25 thousand light bulbs in every single cell and you have 25 thousand dinner switches that can be set differently depending on your early life experiences, you appreciate there's quite a complexity in the system. But the key thing about it is that once that dimmer switch has been set, it often sticks with you for a long time.

So for example, some of the work we have been doing is showing that this dimmer switch can be set by, in infants, in part by the stress of the parents; the stress level of the parents. So if you're very stressed it might just tweak with that dimmer switch a little bit and then we can see that 15 years later. And so, if it happens that some of these dimmer switches affect genes that are involved in a variety of diseases, you could easily imagine how that could be very important for the development of disease, or for that matter, the prevention of disease.

It's really early days I think we need to be aware of this. It's really an emerging field, but I think there is now a growing body of evidence that indeed, particularly these early life experiences can tweak with these dimmer switches, and not only do in a temporary manner, but likely do so in a persistent manner that really, as I said initially, helps to explain how experiences literally get under our skin to affect the activity of our genes in a long lasting fashion. Social experience, nutritional experience, all kind of experience.

Kobor – epigenetic examples in the early years (2:19)

Brain Development – 2.1 A Genes and environments

We have shown for example things like in our most recent work we have shown that it's the parental stress that kids are exposed to, and it's actually quite interesting in this particular work that we just recently published in collaboration with folks at the University of Wisconsin, and here at UBC, that actually it's quite distinct, so it seems like the stress of the mother affects these dimmer switches in infancy. In contrast, the stress of the father affects these dimmer switches during the preschool period, and even more specifically, it only affects it in the girls, versus the mom's stress affects both girls and boys, so that's quite remarkable, and it fits very well with what people know about the interplay of parental influences and kids' behaviour during these developmental periods. We've also shown, and others have shown that as well, for example, early life socio-economic starters can tweak with those dimmer switches. So for example, if you grow up in a low socio-economic status environment for the first five years of life, we can see that 20-30 years later in those dimmer switches in that they are set in a way you're more likely to have inflammation and things like that in your system. That in turn, we actually also found reassuringly, that can be buffered up to some extent by maternal warmth. So it's this kind of social environment. if you will. which can set these dimmer switches. There's work out there that physical environment, certain chemicals in the environment can set these dimmer switches, so I think it's very early days for this research, and I'm looking forward over the next few years to have a much broader catalogue of influences that can set these dimmer switches and also perhaps to understand whether there are particularly sensitive periods. We always think that the early years are very sensitive, there's certainly evidence for this, but we haven't really tested, in a longitudinal fashion, how that actually develops over, say, the course of childhood.

Kolb – brain plasticity (2:12)

Brain Development - 1.2 Experience-based brain development

Brain plasticity is a word that was begun to be used in the 80s and has become a lot of things to a lot of different people. Basically it's the idea that you can mold the brain, that you can do this at various levels. So one level is behavioral. So if I learn something there's some plasticity. But what's the mechanism? Well I can look at it in terms of how the brain's organized and I can do that at lots of levels. I can measure electrical activity; I can measure genetic activity and so on. So brain plasticity refers to the idea that the brain is changeable but refers to it in a whole bunch of levels and we have to be careful when we talk about it, what level we're implying.

So during development the brain undergoes a sequence of developmental events. So you make cells, the cells migrate to the location that they need to be; the cells begin to differentiate; turn into a visual neuron or a motor neuron or whatever kind of neuron it is. The cells then form connections with other cells. In order to expedite this process so that it works smoothly, all sorts of growth factors are present in the milieu, the extracellular milieu. In development there's a lot of them there. And they're needed because you're making kazillions of synapses. Later in life, you're making modifications to the existing blueprint, if you like, that you made during development and then discarded a lot of. And so those growth factors aren't there any longer. Only certain ones are there.

And so what happens is it's more difficult to add the synapses later on. And that's a good thing because you don't want to go changing the brain all around and forget your mom's name. You want to keep these things in there. So the brain has to be less plastic, if you like, as it develops so that it keeps all the stuff that's in there that presumably is important. One way to enhance the plasticity later in life is to put in some of those factors that were in there early. So if, for example, you have a case of dementia or a case of somebody with a brain injury or something, you want to enhance that plasticity and bring back some of those factors. But remember that there's a risk here of erasing stuff that was put down earlier. So you have to be really careful about it. But that's why there's a difference between early and late plasticity.

Kolb – changes in play (1:27)

Coping & Competence – 2.6 Play, coping and competence

The second thing is if you look at play, it shows an age related change. So as animals grow older, the nature of their play changes. The rules begin to shift somewhat, which makes some sense. If you look at little children, infants playing versus five year olds playing versus 12 year olds playing, they don't all play the same, and that's true in other animals as well; there are changes in play behaviour. Now, one question we've asked is what if you manipulate the amount of play animals are allowed to engage in. So what we can do is we can say we'll take an animal when they're weaned and we'll place them with an adult animal. Adult rodents don't play with the offspring; they interact with the offspring, they'll tolerate the play for a few seconds then they don't want to do it. It's really one sided because it's rough and tumble play and you couldn't have an adult male rat playing with an animal that's a fraction of his size without hurting the animal probably. So we've got the situation where we take away the infants, or the juveniles now, place them with an adult, or several adults, so now we've manipulated the number of animals that are there. Or we can have them live with one sibling, or several siblings, so controlled two things here; we've manipulated two things: the amount of social interaction which will vary with the number of animals you're living with, and the amount of play. The more animals there are to play with, the more play you're going to engage in, which makes sense.

Kolb – early brain development (1:11)

Brain development - 1.1 Brain architecture

Historically we thought the brain was little when you were born and just got bigger so it was a small version of the brain that we have. But that's totally wrong, it's a different brain. And what nature has done is to use what I'm going to call the Michelangelo solution which when he made the statue of David he started with a big pile of stone and chiselled away most of it and he said that David emerged from the stone.

So our brain emerges from this infant brain which has more, about twice as many cells as we have and what we do is we post-natally get rid of and basically we have chisels which are hormones which are experiences and so on. So we get rid of cells, but neurons, but over the first two or three years we develop connections and we develop again twice as many connections as we need and then we start pruning them. And for some regions of the brain such as visual areas we prune really early starting by age three or four and we start getting rid of them. But for other regions such as the frontal lobe we don’t until we're in adolescence.

Kolb – play and brain development (2:54)

Coping & Competence – 2.4 Executive function

So when we let the animals engage in play we can then look in their brains as adults and say what happened? And what we find happens is that the cells in the frontal lobe are profoundly altered, so the cells in this region in the rat brain which would be equivalent to probably this region in our brain, change their connectivity. They actually reduce the number of connections.

So we can control, we can manipulate two things: the number of animals you live with, and the amount of play you engage in. We can do that by having you live when you're weaned with one adult or several adults, or we can live with one littermate or several littermates. The more littermates you live with, the more play you engage in, the more adults you live with the more interaction there is with the other adults but there's virtually no play behaviour. If we then look in adulthood at the frontal lobe of these animals what we find is that both experiences alter the way the frontal lobe developed. It's counter intuitive in what happens because if you look at frontal lobe development in rodents or in humans what happens in you have this rapid increase in the number of connections which peaks in the frontal lobe of humans around five years, between two and five years and then shows this decline that's rather rapid through the pre-adolescent and adolescent period but actually continues until about at least age 30 years. In the rodent it's compacted, but it's the same logic, that is you have this increase and drop and during the adolescent period a rapid drop and then a leveling off into adulthood.

So what we find is a reduction in the number of synapses in this region related to the amount of play. The more play you engage in, the fewer the connections are, and you might think well that's a bad thing, you have fewer connections, but it's not. The number of connections whether it's bigger or smaller doesn't predict very much

So now what we've got is the frontal lobe, which is the brain's executive be influence profoundly by this early play experience. So what? Well, there's two ways to go here. One is to say, alright, if play's important for adult behaviour, what kinds of things during development will interfere with play? Peri-natal stress changes play; animals play less and the other animals don't really want to play with them. Peri-natal exposure, and then juvenile exposure to drugs such as methyphenoate, so stimulants in general actually reduce the amount of play and actually the play behaviour the animals engage in isn't normal, they don't follow the rules and so other animals don't want to play with them. Autism, you can fill in the blanks. All sorts of early experiences alter play. What's that mean? If you alter play, you're altering brain development. The frontal lobe isn't developing the way it ought to develop because of that change in play.

Kolb – play learning (2:39)

Coping & Competence – 3.3 Valuing play

I would say the more different kinds of learning experiences you can have, one of which is play based, the better off your brain development's going to be and the better off you're going to be in the end.

I think the schools need to pay attention to the fact that play is necessary. I know there are schools that are going away from recess, going away from play periods because of perhaps litigation issues or worries about children being injured and so on, but what they're doing is they're changing brain development by not allowing kids to engage in these kinds of play. Furthermore, the attention span of kids, especially boys, in the absence of having engaged in play is clearly reduced. Perhaps less so in girls, but nonetheless I think it's equally important that they've got to engage in play behaviours. Certainly when I was a child a very long time ago, going to school, we played at recess. There was a soccer ball and all the boys chased it around the field when it wasn't snowing. Then when it was snowing you did other things, running around the field. That was important. If you can't do that sort of thing and you're supposed to sit and be quiet, that's not engaging the brain in any way, it's turning the brain right off. I think if play has a function, and I've suggested that it does, you've got to recognize and respect that function and say okay, how can we enhance this, how can we do it in a way that we don't have children getting injured, although I don't recall anybody getting injured on the playground when I was there, but perhaps some were.

I have this worry that what parents have done and what schools have done is they've overprotected kids to the point that they're interfering with normal cognitive and brain development because they're not allowing the kids to do the things the brain evolved to do a hundred thousand years ago. It's a sudden shift that may not be all that good. That's my gut feeling.

Given the developmental changes that are going on in the brain and particularly in the frontal lobe, both during the infant period and then the pre-adolescent and adolescent periods, the importance of play, and normal play if you like, peer related play really comes to the forefront. This is going to have huge impact on frontal lobe development and the ability to do the kinds of executive functions that the frontal lobe is engaged in. Now, I focused on the frontal lobe because that's where we see the changes most easily. Is it the only place, probably not, but it's one where they jump out and smack you in the nose and you go wow, those are big changes.

Kolb – play mammals (1:47)

Coping & Competence – 2.6 Play, coping and competence

One of the real energy drains on developing animals is play. All mammals play, birds play, most vertebrates play, and they play, if you think about mammals, mammals play and there are rules. One of the rules they have is reciprocity; I get to do something, you get to do something. There are also rules with respect to sex. So the way males plays with males is different than the way males play with females, and females play with females. The details vary across species, but the story is the same. Now if we look at play, the question we can ask is why do animals spend so much of their time playing? Why would they burn up so much of the resources engaged in a behaviour that doesn't seem to have any function? So the obvious conclusion is it must have a function. So what it the function?

The other question we can ask is if we look at play, is there something about play that is affected by early experiences. So for example, if we look at early stressors, pre-natal stressors for example, do we find that animals play the same way? Do they play less? Do they play more?

Okay, so the question that we want to ask is what kind of factors influence play, and if they do, does that have some consequence down the road. So let's just talk first about play behaviour, and my colleague Sergio Pellis has studied play behaviour in all orders of mammals except cetaceans probably. About 60 species of monkeys, rodents, people and so on. And there's no question that all mammals play, there are rules as I described with respect to reciprocity, and the way in which they engage in the play, and there are other rules as well. That's the first thing.

Kolb – play problem solving (3:21)

Coping & Competence – 3.3 Valuing play

So what we've got now is two things: we've got experiments with nature, early stress early exposure to drugs, I didn't mention brain injury, early brain injury, all change play and they all change the way animals behave as adults. And we've also done is we've manipulated play directly, and shown that it seems to have a real impact on brain plasticity. So the logic here is that the function of play is to make the brain more changeable. Now why would that be? Well, according to Fraser Mustard, play is problem solving. So if you're problem solving then that makes you better at problem solving later. When I described the data, that was how he explained it, and I think it's probably right. So it's not the play per se, it's what play is: problem solving. We're having this tussle, and so if you're a rat what you're trying to do is you're trying to nuzzle the back of my neck, and I'm trying to do the same to you, and so you get this what I'll call popcorn behaviour, if you've seen kittens, when they play, it's all rolling, they're doing the same thing, they're trying to nuzzle, it's not fighting, they're not fighting, because if you're fighting, the last place you're going to put your mouth is anywhere near the other animal's mouth. You don't want to be near the teeth, you going to go after the butt, there's no teeth there. So when animals fight, they bite one another in the rump. When they play, they play around the head.

So our thinking here is that it's problem solving practice is what play is. So when you look at in adulthood problem solving, the more problem solving practice you have early, the better you are at it later. And it just so happens that play is the mechanism Mother Nature has chosen, or one of the mechanisms, and early experiences that alter play behaviour are going to alter as a result, problem solving in adulthood. Now one can be, perhaps, not p.c. here and say oh, so you're saying that if children are one-child families there's going to be less play, and if in those one child families they have home schooling, you can see where I'm going here, there's going to be less play, are they going to pay a price for that, and the obvious conclusion is that if the rat studies are correct, they might. So what it's really important to do in situations where you've smaller number of kids, which is the demographics now that these kids have to be involved in activities that encourage play. And of course we do that. We've got kids; if you're a parent you drive them all over the place for all sorts of activities. So the more activities they're in, the more play they're engaged in, the more problem solving and so on. So although the number of children has gone down and there's less play probably in the household, there's been compensation by having play outside the house. But any situation that's going to reduce the chances of that child engaging in play outside the house is going to be detrimental, and that's why programs like Kids Sport that, I don't know if you're familiar with Kids Sport, but Kids Sport where the agency, actually started by my sister, will pay for the entrance fees or registration fees for kids in soccer and so on to get them out playing. It's so important because this is getting kids out doing what's necessary to make their brain plastic as adults.

Kolb – prefrontal cortex (3:25)

Coping & Competence – 2.4 Executive function

So, the question is why do animals have a prefrontal cortex, why is it bigger in people, in humans than in other species, and the thing we have to recognize is that the prefrontal cortex was not selected by nature, behaviour was, behaviour that the prefrontal cortex is engaged in. So now you say well what is it that the prefrontal cortex's function is that was being selected for, which made it bigger. One of the things it does is it clearly is a way in which you can take all sorts of sensory experiences and put them together and make a single, unifying theory as to what's going on. So if I'm wandering around the world I've got visual experiences, auditory experiences, tactile experiences, I've got experiences that are internal, memories, things from the past, thoughts about the future and so on, how does it all fit together? How do I make some sort of story up about the world? The more complicated the information is that's coming in, the more complicated the prefrontal cortex is going to be. So we know that as the number of sensory areas increases in evolution, and it does, so if you look at rodents versus primates, the number of visual areas goes from three or four up to 20, 25 visual areas. That's a huge increase. So obviously whatever we're doing with visual information, we're really making the visual world more complex. The world we're creating is more and more complicated; the frontal lobe increases in lock step with that, so the prefrontal cortex increases with it.

So as that frontal lobe has gotten bigger and bigger, our schema that describes the world has gotten more and more complicated. One of the real complications is what I'll call autobiography. So if I said to you, tell me something that happened to you in grade three, you can not only tell me that you went to in my case Glengary school in Calgary, but you can tell me, well, we used to have fire drills and air raid drills and these were some things we did and I remember this experience that happened. I can also go in the future. That's autobiographical information that happened in the past, I can also say well what do I plan to do? I'm 65, what am I going to do when I'm 70? What's my plan? I can actually give you that plan. I'm willing to reckon that a chimpanzee who's got a pretty big frontal lobe does not have the capacity to recall a specific memory, although we can't really tell, from when it was young, that's a hard thing to determine, but I'm pretty darn sure it doesn't think about tomorrow very much, whereas we have this unifying element of time, past, present, future, that's in the frontal lobe, that's a unique sort of emergent property that we have. If you start messing with frontal lobe, you can lose that. You can lose the capacity to plan, for today or tomorrow. You can lose the link with the past in which case you cannot actually identify unique experiences that you had. You can identify experiences about, let's say grade three in my example, but you're not so good at identifying ones that relate to you. If you can't relate to you, and this is clearly going to make a difference as to how you relate to things in the present and in the future, so that's what the frontal lobe changes are about.

Kolb – sensitive periods (1:32)

Brain Development - 1.2 Experience-based brain development

The word sensitive period and critical period are usually interchangeable although I think historically critical meant it was really a tight period that went from time one to time two and sensitive was a bit more blurry. But today in usage we tend to use them interchangeably.

So there are critical or sensitive periods that vary depending on where in the brain we're looking. So, for example, in the visual system which is early on we know there's a period where you must have input to both eyes that's in focus or you're going to get amblyopia, lazy eye. And that period, you only need a short window to have that normal input but if you don't have it you've got a problem because the critical period closes and that region of the brain is no longer plastic and so it's very difficult to repair. It's possible, we now know ways that we can turn the critical period back on again but it's a bit tricky.

Other regions of the brain the critical period is later so for audition it's a bit later than vision and for things in the frontal lobe, for example, it's much later. But these, if you think about it imagine you're on a train and you're on the Orient Express and the windows are open and you can look out and at some point the window closes and you can't look out anymore. So that closing window is the end of that critical period and it's biological, there's a lot of molecular breaks that break the period but that's basically what it is.

Kolb – social interaction (2:01)

Coping & Competence – 1. Coping & competence in early childhood

So the question we can ask is do kids have to play with other children or can they just play with puzzles? They're both kinds of problem solving, and I think they're both important kinds of problem solving. The studies of Tom Boyce suggest that the interaction of children and the way they engage in play-related behaviours is very important. That playing with puzzles or doing word games or whatever may be important for certain kinds of activities, but children set up social hierarchies when they play with one another, and these hierarchies are important in children learning how to engage with one another. If you think about the most complicated behaviour that we have, it's social interaction because, just give you a simple example, if I'm around my mother, if I'm a child for example, I'm around my mother or I'm around my friends, I do not behave the same way. If I'm around my mother versus some other adult I don't know, I don't behave the same way. If I'm around my conspecifics, my peer group, and it's made up of six individuals, and then another time it's made up of another six individuals but they might have an overlap of two, my behaviour might be very different in the two situations. Just watch teenage girls, I mean the way they interact with one another with one group of girls versus another is completely different depending on their experiences earlier. Males aren't so affected by those early interactions. So I think that those actual one to one interactions rather than one to puzzle interactions are really important for getting the frontal lobe up to speed in terms of how you keep track of all of this contextual information that you're going to need as an adult in a complicated world.

Does that mean that puzzles aren't important? No, it doesn't mean that at all. It just means that the social interaction is a really complicated form of problem solving. You need to do it to learn it; you can't be told how to do it.

Kuzawa - prenatal stress (1:46)

Brain Development -2.1B Prenatal brain development

So there's more and more evidence now that if a mother is stressed during pregnancy, that this can permanently alter how the stress system in the offspring operates, and influence how they respond to stress. And so we have; there are good animal models of that, there have been for a long time showing that if you stress out say pregnant rats that the offspring will have altered stress physiology. But now we have more and more evidence that this also operates in humans.

And so one example of that is actually is one of my former PhD students, Zaneta Thayer, who worked in New Zealand. And she worked with kind of a multiethnic population there. And she looked at measures of deprivation and stress during pregnancy; so she actually measured women during pregnancy; she measured their cortisol levels which is a stress hormone. And then she followed up with the babies after birth. And of course it's not ethical to stress out a baby, but we already do that when they go to the doctor and they get vaccines and this is a very stressful event that they already go through. What she did is she looked at stress hormones before and after that as a way to see how they are responding to that stress. And interestingly, she found a very clear relationship. The more stressed out the mother was during pregnancy, based upon her what she reported during pregnancy itself, the larger the stress hormone reaction of her baby at six weeks of age to that vaccination. Now we don't know that that necessarily traces back to the prenatal environment. It could be that those women who were stressed during pregnancy, also raised their kids differently in those first few weeks. But, it seems likely that part of what might be going on actually is an intergenerational effect of stress during pregnancy, that's a reasonable kind of working hypothesis.

Lee – cognitive development and lying (2:12)

Coping & Competence – 2.4 Executive Function

So why are some kids who are telling lies at this young age and why are some kids don't tell lies. You know, the first thing that would come to your mind would be, 'ok, must be the parenting, the moral character in the child, but it turns out that's not true. So that's another surprising thing was that it is actually executive functioning. So if the child has a better executive functioning then the child tends to lie earlier so that's number one.

Another thing that's very interesting is theory of mind, so the child's ability to read mind. So the sooner you learn how to read mind and then the earlier you're going to tell a lie. So lying turns out to be something that is an indication of better development, at least in terms of cognitive development. So not something that is sinister or something that is part of your bad moral character, so that is very surprising to us. Another thing of course is by seven years of age almost everybody's child lies so you can tell lying is a very, very normal behaviour so I think that's something that is very surprising to us.

Another thing that is very surprising to us is as we age, as children age, by about 12 years of age, the lying rate actually drops down, back down to about 60%. We have no idea why but there is this U-shape to development, reverse U, so going up, up, up and then by 12 years of age you start to go down and that is also against our assumptions. We thought, you know, teenagers must be the worst liars… So they would be very more likely to tell lies than the rest of children's group. But turns out they don't which is very interesting.

Lee – cultural differences in lying motivation (4:26)

Coping & Competence – 2.4 Executive Function

What really motivates a child to lie is a very big question. But, so what we have found, there are two basic motivations. One kind is basically to avoid punishment and to benefit, to gain personal benefits. So lying to cover up a transgression is one of those lies to - for personal protection. Typically, what happens in a regular household is if a child transgresses, and sometimes parents will say, "If you tell me the truth, I'm not going to punish you", but actually that's not true. So observational studies have shown that when a child confesses about his or her transgression, the parents always punish one way or the other. So the child learns very quickly, it's actually a much better way to avoid punishment altogether by just lying to cover up a transgression.

There's another kind of motivation that is we socialize our kids to be nice people to others and so this motivation is really instilled by parenting, by socialization. So, for example, white lies – so we want to be polite to others, we want, we do not want to hurt others feelings by telling white lies and because of that we learn how to tell white lies. White lies starts about three years of age as well but at the first the child typically tells it out of fear. For example, if they see someone giving you a gift you really don't like but you don't want to say it because you don't want the gift-giver to be mad at them but they are not thinking about - if I tell you the truth, you're going to be hurt in terms of your feelings. But with time, by about four or five years of age, they actually figure it out and then they start to tell white lies about 50-60% of the time and then the rate of lying goes up quite dramatically with age. So now they start to tell white lies to be polite to others, to avoid hurting another person's feelings. And that goes hand in hand with their understanding of why we need to tell white lies. So in North America these are the two major motiviations.

But, however, in other countries, there are other kinds of motivation. For example, in East Asia, in Japan, in Korea, in China, in Taiwan, Hong Kong or Singapore even, kids also learn to tell different kinds of lies. So one kind of lie they tell that's very different from the kids in North America is to be modest. So for example, if you have got a very high grade from your exam, when your friends ask you how do you do in the exam, instead of saying "oh, I got 100", you can say "oh, I'm not very good". But in these more collectivist cultures you are not supposed to be different or superior to other kids. That's going to damage the cohesion among the group, so what you do is you have to minimize your personal achievement. So then kids learn to do that by telling so-called modesty lies and goes, younger age, 7 years of age, Chinese kids or Japanese kids don't do that. They still would be very proud, so "I got 100 or 99" or whatever. But by the time they get to about 11 or 12 they start to hide the fact they have achieved something that others have not achieved. So, and that goes hand in hand with the understanding of the moral norms of these, the cultures they are living in. So that's another kind of motivation.

Lee – cultural norms and early socialization (1:47)

Communicating & Learning – 1. Communicating and learning in early childhood

In Chinese culture when you interact with each other, you're not supposed to look in to people's eyes. But in North American culture, you have to do that otherwise you be considered impolite and et cetera but in China, it's the other way around. So what we have found is, at about three or six months of age, babies are not that different when they're looking at their own race and other race faces. So they're typically looking at the eyes because eyes are very, very attractive to all the babies all over the world. But by about 10 months of age, Chinese babies start to avoid looking at own race, Chinese people's eyes. They start looking at the nose and Caucasian babies continue to look at the eyes. And then with age that doesn't change. So Chinese individuals, children, pre-school children, school-age children, adults, they'll be looking at the nose of the own race face but when we show them other race faces such as Caucasian faces, they are not afraid, they look at the eyes. So our culture actually shapes the way you look for, where you look in the face to make sure you comply with the norms of your society. And the surprising part is it starts that early, you know, about nine months of age they already learned about how to do it in a Chinese way, I'm talking about the Chinese babies. I'm sure the Caucasian babies in North America or most of the babies in North America probably are learning the norms of our society here and then they will be paying more attention to the eyes than the nose.

Lee – early preferences for familiar faces (2:05)

Ecology of Childhood – 2.5 Cultural Context

Children's visual system is very, very sensitive to what they see in the environment. For example, it takes only three months for them to realize that there are faces that their parents are that belong to one race and there are faces that do not belong to their parents' face. So if you are living in a mono-racial family for example, the child quickly develops the preference for own race faces at about three months of age. And by nine months of age, they start to recognize their own race faces better than other race faces. And by about 12 months of age, they start to have some kind of racial biases, for example, they like to learn from a person who is of their own race, a teacher who is of their own race. However, if you live in a bi-racial family or you're living in an environment where there are many, many people from many, many countries, like in Toronto, then they don't develop these kind of biases. So it's not because our parents are socializing our kids to be this kind of implicitly biased towards their own race but rather the visual experience is such that because if you see day in, day out your own race faces, it's inevitably you're going to develop these kind of biases.

Kids are so good at picking up statistics. So, for example, we also have done is to look at gender, you know, do you like male faces or female faces? Turns out, if you're raised by your mother most of the time and you tend to prefer female faces. But if you're raised by your father most of the time, you actually prefer your male faces at three months of age. So they just picking up the statistics in their environment and then they show these biases at that young age.

Lee – lying for the group (2:07)

Coping & Competence – 2.4 Executive Function

There's another kind of motivation that also happens in North America but not very widely, is about lying for your group. It's called a blue lie. So telling blue lie is really for the benefit of a group and in these collective societies such as China, Korea, Taiwan, what's happening in these cultures is that you have to learn to be a member of the group and the group's interests, the group's goals are more important than personal goals and at some point you may have to sacrifice honesty in the name of collective. And it turns out that also motivates kids in these cultures to tell lies to protect the group's interests and benefits. So sometimes these kinds of lies actually are immoral because sometimes they violate certain rules but it's because you are telling it for the group, it's sanctioned by the culture. It happens also in North America, for example, sometimes police officers have been reported to tell these kind of lies as well in the name of justice. And the team sports – sometimes a whole team cheats in a game but nobody tells the truth about it because they want to protect the team so that happens in North America as well. So this is yet another kind of motivation that would drive people, including kids, to tell lies.

So only by about nine years of age they start to do that and because they have understood what is expectation from their culture.

Lee – lying research (3:30)

Coping & Competence – 2.4 Executive function

The research about lying really is concerned with how children learn to communicate with others practically. Sometimes we as parents and educators always think honesty is the ultimate goal, one of the most important moral characters is actually honesty. Now we want our kids to be honest and that must be true all over the world. But when you look at, in reality, when you interact with each other, you actually do not, as adults, we do not tell the truth all the time. For example, we actually sometimes tell white lies, you know, you look great, your haircut is great, your dress is great and et cetera.

Our kids, we don't really teach our kids explicitly about these kinds of rules but at the same time we are teaching our kids not to lie. And so then they come in to situations such as a politeness situation, they don't know what to do and sometimes get punished, sometimes get scolded, sometimes get bad reactions from the people they have told the truth to. But then the question is how do we learn in one situation we ought to be honest because we know that most of the adults are very, very honest. But they occasionally tell lies and some of the lies are, you know, innocuous and some of the lies actually are told for politeness purposes. So then it becomes a very challenging, social task for a child and so that kind of intrigues me. How do we crack this mystery, you know, as a child, while we are learning language, learning the rules of society, norms of society and how to read, how to write, math and all sorts of things you have to learn. But how at the same time you also are learning this so that intrigues me.

One of the things we were very surprised by was the age by which a child starts to tell a lie. So it's about two and a half years of age which interestingly was reported by Darwin about his first son and he wrote the very first report about kids telling lies in a scientific journal and that's the very first… 1887, something like that, about his own son telling a lie to cover up his transgression which is to steal sugar from the kitchen at two and a half years of age, so interesting. So many years later, you know, I actually found evidence to show that's true. But any case, so two and a half years of age kids start to tell lies.

But another interesting thing is not everybody's lying, not all the two year olds or three year olds are lying – only a small group of kids are lying. So two years, two and a half years of age, it's about 25% of the kids who are lying. By three years of age there's about 50% of kids lying. By four years of age, is about 90% of kids lying, by seven years of age is about 100% of kids lying. So you have this interesting development or change and we have replicated this finding in different countries. Others have done so as well so it seems to be very universal, you know, when and how you develop the tendency to tell lies.

Lee – responding to lying (2:06)

Coping & Competence – 3.1 Understanding feelings and behavior

My message for parents and for teachers is that if you find out that a child is lying, you should not be alarmed. It's just a normal part of their development so that's number one. Number two is, if you catch a child lying and that means you actually are lucky because most of the time we actually cannot catch a child telling a lie. So if you catch that and that would be a golden moment or teachable moment for you to talk to the child in a very calm fashion about what is your expectation about honesty, why lying is bad in some situations and why truth-telling is expected. And by having this kind of discussion, I hope you would promote the idea that honesty is important – it's part of the moral virtue. So using an incident of a child telling a lie as a teachable that would be my advice to parents as well as to teachers. But the most important thing is always have a discussion in a calm fashion, not yelling, screaming and being worried that their child is going to turn in to a psychopath in the future.

When they tell a white lie in front of their child to someone else, afterwards they must explain to the child why I did that and that's very, very important. So you set it aside so the child knows the distinction between the lies they are not allowed to tell and the lies they are allowed to tell. So actually giving it a name, like fibbing, fib, is a very good strategy so you kind of set that aside, set these kind of lies aside with different names so the child knows, 'oh, that's a lie and that's a fib'. So this kind of discussion is very, very important.

Lee – studying babies (2:00)

Ecology of Childhood – 2.5 Cultural Context

I have two labs. In one lab I study how children as young as a few months old would recognize faces and how experience in their early life would shape the way they form different kind of categories of faces such as own race/other race.

So how do we find out babies who cannot talk are actually liking certain things or they are preferring certain things, they can recognize certain things? So the way we do it is actually very simple, straightforward. The techniques have been developed for close to 40 years and the earliest methods were developed in the 1960's and we're basically using some of these methods with more modern techniques as well.
So the way to do it, to look at the preference, what you do is to show babies as young as a few days old, typically in a lab we'll be looking at babies as young as 28 hours of age. Then what we do is we show them two pictures – one is let's say, their own race face, the other one is other race face. When they see own race, referring to the parents race, and the two adult faces and just side by side in front of them. Then we have video camera behind the two pictures. You can easily tell which side they prefer to look at by looking at the reflections on their cornea. So by doing that we can actually count how many minutes or seconds they have spent on own race faces versus other race faces.

But in the modern time now what we do is we're using eye trackers so then we can precisely look for not only how much time this child spends on a particular face but where they look at the face and that turns out to be very, very sensitive.

LeFevre – ECEs and math (1:01)

Communicating & Learning - 2.4 Early mathematics

I think we all are very familiar with a message that you should read books to children and everybody's supposed to read lots of books, whether it's pre-school or daycare or at home. And so we sort of started from that point and said okay, we know that, we know early literacy is important. How about early math? Is that important as well? What do people think about it?

And so we surveyed I think almost 800 early child care people and we went to conferences and we followed up on connections and so on and we did find some interesting things about differences again, contrasting it to their knowledge of early literacy. So, for example, people felt they knew less about early mathematics than they did about early literacy learning and they as a group were somewhat less knowledgeable about what children were able to do at different ages as well.

LeFevre-executive function (1:19)

Coping & Competence - 2.4 Executive function

Executive function, theoretically, there's a lot of overlap with what executive function is but you always have to end up measuring a particular construct, right? So the way that we measured our attentional pathway was with a task where children were shown, well we called it the 'lily pad task'.

So, they were shown some green circles and invisible frog jumping from one circle to the next. And they had to remember where the pathway that the frog went and they had to reproduce it. And, you know, it seems like kind of a strange task in a way but children don't seem to mind having imaginary frogs that they're following around.

It measures what you could call spatial attention, which is a component of executive function. Why is it executive function? Because you have to keep track and you have to remember where the frog went and then you have to reproduce it. So, you're doing this the very much back and forth between what we usually refer to as working memory and sort of the pulling in all the other information that you need to do that particular task.

LeFevre – learning to count (1:20)

Communicating & Learning – 2.4 Early mathematics

One of the most important things that children learn roughly between about 2 and 4 is how to count. And we can think about counting in two ways. We can think about verbal counting or what's sometimes called rote counting. And that's just learning the string, the verbal string of numbers starting at 1 and going up as high as possible. And it's not just about memorizing those, although, that's what they do first. I'm sure we've all heard young children go "1, 2, 3, 4, 5, 6, 7, 8" and they don't really break it down into words. But eventually, they start counting in a more deliberate way. So verbal counting is one aspect of counting that's important. But children also have to learn how to count objects.

And so if I show you a group of four toys and say to you, "How many toys are there?", you need to learn a process for determining how many. Pointing to each toy, saying the verbal label, which is why you need to know what the count sequence is. And then understanding that when you've pointed to all of them and said a word, that the last word that you say is the quantity of the set. And that's referred to as cardinality. So, both cardinality knowledge and verbal counting are often referred to as counting but they're actually two quite different separate kinds of knowledge that children need to learn.

LeFevre – mathematics and numeracy (0:52)

Communicating & Learning – 2.4 Early mathematics

Early mathematics skills for young children is a good umbrella term for a lot of the kinds of activities and knowledge that we would like young children to have about mathematics. Numeracy refers to a sort of subcomponent of that. The part to do with numbers. I would say that quite a large component of early mathematics knowledge does involve numbers.

It involves quantities, it involves verbal labels for numbers, it involves learning the symbol that goes with the particular quantities. So knowing what the number 4 looks like and being able to name it and so on. So numeracy is not a terrible way to talk about early mathematics but it's only a part of all the other kinds of mathematical skills that we would like young children to learn.

LeFevre – math in early childhood programs (2:48)

Communicating and Learning - 3.1 Guiding and teaching

There are so many things I think that early childhood educators can do to support children's early learning about symbols and the mappings and the quantities. Providing children with lots of opportunities to see the quantities existing in the world. So if you're setting the table, how many spoons do you need for everyone who's going to be sitting at the table? Counting as children are sitting down. If they're sitting down in a circle, they could be counting. I'm 1, I'm 2, I'm 3, I'm 4.

There's so many opportunities to work with objects, to do things that are related to mathematics. And so it would be good to capitalize on that and build that into their play and their activities.

Even though mathematics seems like a separate thing from language that many of the same kinds of activities that they already enjoy participating in, more mathematics, more number related activities could be brought into it. So, for example, if we think about storybooks, right? Kids love to be read to.

There are more and more storybooks that have number related content in them and teachers can—in ECE, people can use those storybooks to emphasize things. The kinds of things I was talking about before. So, for example, the idea of—the little story, 10 little monkeys jumping on the bed, right. You can imagine a storybook that sort of structured that way as well. Seeing the symbol for a number, being able to count that many monkeys, talking about how say, five monkeys is one more than four monkeys and so on. There's lots of opportunities like that.

When children are interacting with the objects at school or in their environment, so much of what they do has mathematical and spatial properties to it. So, for example, if I'm building a tower of blocks and I put the small block on the bottom and try to put the big block on the top, that's not going to work, right? And so those spatial relationships are part of early math knowledge as well.

And for example, being able to order things in terms of size, which could be part of lots of different kinds of activities. There's so many things that we—I think we kind of take for granted how much spatial mathematical logical information is kind of embedded in the world.

And so I think that giving children lots of different kinds of things to play with and maybe prompting them a little bit to do—maybe use them in different ways could lead to a rich and interesting set of activities that would also facilitate their early mathematics knowledge.

LeFevre - numeracy and mapping (2:23)

Communicating & Learning – 2.4 Early mathematics

I would say that the next level of early numeracy knowledge in particular that children need to acquire is the knowledge of how quantities, once they know how to determine those quantities through counting, how those map onto written symbols. So, if we think about the three kinds of representations that you can have of a number: the quantity, the verbal number word and the written symbol- learning the links between those we usually refer to as mapping. So children need to learn the mappings among those three representations.

In research that we've done, children as young as 2 and 3 years of age, a lot of them know how to name the symbols. So if you show them a 4, they'd be able to say 4 and they can say the count sequence up to 10 pretty easily. They may or may not know how to actually count the set of objects. So that's kind of the difficult part.

So between about 3 and 5, they're mastering that counting objects part of it with the goal eventually of being able to look at a written symbol and know how many that that symbol stands for without having to have five things in front of them. They know that the symbol 5, what it stands for.

So being able to map across those three different representations kind of forms the foundation for a lot of additional kinds of knowledge that children have to acquire. They have to understand for example, that six things is more than four things. They could do that if you show them six things and four things by counting them at one point, you know by probably 5, most children would be able to do that. But you also want them to be able to look at the digit 6 and the digit 4 and know that the digit 6 represents more objects than the digit 4 does.

So it's kind of- the research that we've been doing suggest that that process of moving from external concrete objects to understanding the verbal symbols and being able to map them between words and written symbols and then being able to work with those symbols as if you had the objects in front of you kind of from 2 to 6, those are the critical early mathematical processes that children have to acquire.

Levine – experience-based brain development (0:41)

Brain Development - 1.2 Experience-based brain development

It means pretty much what it sounds like. That the brain develops in a context, and the context is the experience that surrounds the brain on a variety of levels. Experience can be what happens to a cell as it's moving into place to form connections with other cells. And it can also be a whole organism life experience that may be formed by family environment or by the broader social environment by economic class and by a variety of other considerations.

Lye- cohort studies (3:26)

Brain Development - 2.1B Prenatal brain development

So the Ontario Birth Study is a study in which we're seeking to follow mothers and their babies through pregnancy until birth. It is a study in which we have, after the woman consents to be part of the study, access to her clinical information of the pregnancy. It has access to biospecimens, blood samples, vaginal swabs, samples of urine and such like; but they're taken at times when those samples would normally have been taken for clinical reasons, they're not additional samples. And then we have, questionnaires that the mothers complete about her past medical history, about her socioeconomic circumstances, education, exercise, nutrition, psychosocial aspects. And so we hope to get a very, very detailed set of data about that entire pregnancy. And with the biospecimens, we'll be able to look at the genetic makeup of the mother and the baby. We'll be able to look at the microbiome. We'll be able to look at the interactions between the mother's environment and that genetic makeup. And so we believe we'll get a tremendous amount of information about the importance of these gene-environment interactions during pregnancy.

In addition, the babies are being followed after birth. They go into a cohort called "Target Kids", which follows them in the primary health care system, whether that's GP practices or pediatric practices. And again, we're following those children during their early life up and through school. Again trying to get an idea of what are the environments that are around those children? And how do those environments interact with their genetic makeup to set them on trajectories of hopefully optimal health, learning and social functioning?

So we think over time, this cohort will become one of the largest in the world. The anticipation is that as people do research studies on the cohort, their data will be put into the data warehouse of the cohort so the analytic data, and the information within the cohort will become richer and richer. It will become available to investigators around the world. So, you know, the present model of research is that, I get a grant to do a study. I do the study; it might be the genetics of preterm birth. I'll genotype the mothers, the babies, I'll look at outcomes. I'll publish that data, but then that data stays in my lab. In this new model, that data will go into the cohort and be available for other people to come along and ask other questions such as: 'How does the genetics of the mother influence her development of her microbiome or the baby's microbiome?' So it's a new model that really is a collaborative model rather than individual model.

Lye – three things the brain needs (2:46)

Brain Development - 2.1B Prenatal brain development

So I think we're at a very exciting time. We know so much about how the brain develops. We know that the brain essentially needs three things. It needs nutrition because – and that's nutrition of the mother, particularly during pregnancy, because it's during pregnancy that the brain cells form in the child's brain. In fact, by the time birth occurs, that baby has 100 billion nerve cells in its brain. That's as many stars are there are in the universe and as many brain cells as we all have in our lives.

So you need good nutrition -- nutrition that produces energy because at the time of birth, most of the energy used by the body is used by the brain. You need good nutrition because you need a mix of calories, and protein, and lipids. A lot of the brain cells are formed of lipid, and so we need that.

And then in addition to nutrition, you need stimulation, because once you form all the brain cells, you have to connect them. It's the connections between brain cells that form largely in the early first months and years of life that allow us to learn, that allow us to memory, and that provide the ability to develop social relationships. And these connections require stimulation. Early in life, the brain is like a sponge. The child is soaking up the entire environment around her. And stimulation from that environment helps form strong connections between the neurons that underlie our memory and learning ability.

And then thirdly, the brain needs to be protected from abuse, neglect, and violence because those circumstances result in stress within the individual in high levels -- chronic high levels of stress hormones like cortisol that actually damage the formation of those connections and even damage the formation of the brain cells themselves.

So a brain is a complex organ that underlies everything we do. And in order to build that brain, we need nutrition, and stimulation, and protection.