

## **Building the Brain: Supporting Children's Early Brain Development**

Amelia Bachleda: Hello, everyone, and welcome to "Baby Talks." We're so pleased to have you join us today. "Baby Talks," as you may know, is a series of webinars for teachers, family child care providers, and home visitors working with infants and toddlers serving Early Head Start, Head Start, and child care programs. These webinars will introduce you to some of the recent research behind the Head Start Early Learning Outcome Framework, or the ELOF. My name is Amelia Bachleda. Hello everyone from the National Center for Early Childhood Development, Teaching, and Learning. And my colleagues and I are from I-LABS, the Institute for Learning and Brain Sciences, and we'll be presenting three webinars this year. I-LABS is a partner organization of the NCECDTL Consortium, and we're one of the leading infant research centers in the country.

Today, I am so excited to talk about one of my most favorite topics, brain development. Oh, I like to think of our brains like a garden that we nurture over the course of our lifetime. What we tend to, what we focus on and practice – those connections in our brains blossom and grow strong. And just like a garden when we hit a rough patch – too much rain or sun – we adapt, plants grow deeper roots or maybe make room for new growth, new ideas. But in order to grow a healthy brain or a robust garden, we need extra support in our earliest days. So, today, we're going to talk about this early growth and support. Together, we're going to cover the early stages of brain development and what we can do to nurture children as they grow their incredible brains and minds.

So, here's our learning objectives for today. By the end of the webinar, you should be able to identify the early stages of brain development and how experiences shape the brain and explore strategies and activities that support children's brain development. So, let's go ahead and just dove right in.

Before we talk about development, let's take a few minutes to talk about the brain itself. Your brain is part of the nervous system, which is the network of connections or neural pathways that sends signals throughout our bodies and our brains. You can think of your nervous system like your body's very own communications team. These are neural networks are an information superhighway that enables us to learn and adapt and react to our surroundings that change all the time. The cells that generate and transmit these signals are called neurons. All the neurons work as part of a network, receiving and sending information to many, many, many other neurons, so they're very well connected. Connections between neurons – those are called synapses. And the average neuron makes about 7,000 connections or synapses to other neurons. So, they are connected to many, many other neurons through these synapses, through these connections.

We have neurons also in our eyes – in addition to our in our brain – in our eyes, tongues, ears, skin, nose, any sense what's happening to us and around us. These neurons send signals to our brain where they all get sorted out. So, based on all that information that we're constantly

taking in through our senses, through our eyes and nose and skin, our brain decides what's important, what we need to respond to, and what we should do next. There are lots of signals that don't always make it to our conscious awareness, but that doesn't mean that they're not there.

So, for example, right now, you're probably not paying attention to how your clothes feel on your body until just this moment, right, when I draw your attention to it. These neurons in your skin that are – that are sensing how your clothes feel, they're still there, and they're busily sending messages to your brain. But your brain is busy focusing on this training, right ... Or maybe you're thinking about e-mails that you have to send, or what's for dinner, or maybe probably likely all of those things at once.

So, the adult brain has about 86 billion brain cells, and infants are born with most of the neurons that they will ever have. So, 86 billion brain cells. Generating these billions and billions of brain cells is one of the earliest phases of brain development. And it happens before we are even born. When children are born, their brains are already about 25% or one quarter of the volume of an adult brain. Now, while this makes sense, all of those 86 billion neurons, they need to fit somewhere, right? It is quite incredible. The rest of a newborn's tiny body, not even close to one quarter of their adult size. But it doesn't stop there. The brain doesn't stop there. We know that children's brains continue to grow and to grow quickly.

If a child's brain is 25% of its adult size at birth, what percentage of adult size do you think it is at 1 year? What do you think? What did you guess? I bet you maybe didn't guess this number. By the end of their first year of life, a child's brain is already 75% of adult size. That is an incredible amount of growth in a single year. It certainly surprised me when I first learned about it. To put that in perspective, if a child was already 75% of their adult height at 1 year of age, they would be 4 feet tall. That's almost as tall as I am. Imagine working with a room full of 4-foot-tall 1-year-olds. By 5 years of age, our brains have grown to about 90% of their adult size, but it's really important to note here that while a 5-year-old's brain may be 90% of the size of an adult brain, that doesn't mean that the child's brain is 90% finished developing by age 5. A 5-year-old has much, much more to learn.

Children's brains are uniquely primed to learn from the experiences that they have every day. At this stage, the brain is kind of like a rough draft or a garden in the spring, ready to learn from the experiences of life to continue shaping it into the specialized brain of an adult. OK, so we learned that when children are born, they already have the majority of the neurons that they'll ever have, like 86 billion about. So, what's going on in the brain during this incredible and amazing period of growth? So, while we have most of the neurons, many of the connections or the synapses – remember when we talked about how neurons connect to each other through synapses – those haven't formed yet. Every time we learn something new, we either make a new connection between neurons in our brains, or we strengthen connections that we already have. And this is really the beauty and power of our brains. Our experiences shape how neurons in our brains connect and communicate, and we each become an expert at living our own lives.

And no one has more to learn than a newborn infant. All of us must learn not only how to walk and talk but also about living in relationship, how to understand emotions, what stories and narratives are important to our cultures and communities, what foods we love, who we love, what we love, and ultimately who we are. And while this process takes a lifetime, we're doing this throughout our life. Young children have so much to learn in such a short period of time that from birth to 3, researchers estimate that children's brains make an incredible 1 million new physical neuronal connections each second. One million – that's incredible. This burst of new connections is why children's early experiences have such a huge impact on their life. Their brains are primed to learn from almost every experience they have, rapidly learning and incorporating the information into the developing architecture of the brain. The more often children have a particular experience or a set of experiences, the stronger those neural pathways become. This is true of both good experiences and difficult or traumatic experiences. And while we can always learn new things and teach ourselves a new way to react and be in the world and to heal from difficult experiences, it takes more time and effort as adults. It's our earliest years and the experiences that we have that shape our brains, setting the foundation for a lifetime of learning and living to come. So, it's important to remember that families are a child's first and most important teacher. As we continue to go through this content together, I invite you to reflect on how you can partner with families to nurture their young children's brains and minds.

As we think about how our earliest experiences shape our brain, I really want to encourage you to think about experiences with a broad lens here. It's not just about the books we read, right? It's about the people, places, languages, and traditions that surround us. These fundamental early experiences build our brains and our identities. From our families and communities, we learn about who we are and how we connect to the world and those around us. As educators, it's critically important to continue nurturing and building on the carefully tended garden of experiences and strengths that each child brings with them wherever they go. We support these experiences through interactions we have with children directly as well as the support we provide to children and families through virtual means. If you feel comfortable doing so, I invite you to reflect on your own childhood and think about how your earliest experiences of family and community shape you.

I want to now take a closer look at what this period of brain development looks like. The drawing on the right is a more accurate representation of just a few neurons in the brain. These darker, triangle-shaped spots – those are the neuronal cell bodies. And the thinner lines are the parts of the neurons, the axons and dendrites, that carry the messages between these cells.

We've learned that within the first few years of life, the number of connections between neurons increases dramatically. So, I want to explore this together through a little activity. If you'd like, you can follow along on the screen or there's also an activity sheet that you can access from the green resources widget. Your choice, either way, works just fine.

So, on the right side of the screen are pictures of what the brain looks like at different ages in development. The ages are pictured on the left, and they're also listed on the left of that hand

out that you can find in the green resources widget. Using the activity or looking at the screen, match the age group to the picture that you think best represents the brain at that stage of development. So, for example, do you think the brain at 1 month looks like picture A, picture B, picture C, picture D, picture E? OK, I'm going to give you a few moments to work on this, so jot it down on a piece of paper looking at the screen or if you'd like, you can use that activity sheet in the resources widget.

This activity is also great to use in trainings or with families, so feel free to use this resource sheet in the future. It's a great way to have a conversation about brain development and really get a great picture of what's going on in the first few years of life. I find it's really helpful to have a visual representation so we can get a glimpse into what it actually looks like in the brain as those cells are connecting those millions of connections, that million connection that's forming each second. It's a great way for staff and families to think about what's actually going on in the brains of the children that we're nurturing. I'll just give you a moment or two more, think about getting these all matched up.

All right, great. Let's go through the answers together. I'll reveal them one by one. Here's the answer for 1 month... For 3 months, that's A. For 6 months, that's C. For 4 years, that's E. And for 6 years, that's B. OK, how did you do? Did any of these answers surprise you? When I was first learning this, there was definitely some that surprised me.

OK, so take a moment to compare the density of the connections in the brain of the 4-year-old, pictured here in gray, and the brain of the 6-year-old, pictured here on the right in blue. A 6-year-old's brain actually has fewer connections than a 4-year-old's, so this is amazing. In fact, our brains overproduce connections in the first five years of life. Children are learning so much so quickly that the brain actually makes more connections than it needs. A 3-year-old has about twice as many neural connections in their brain as you have or I have in my brain. This process of refining the number of connections between neurons is called pruning, and it's a really essential part of brain development.

You can think about this process a little bit like tending to a garden over the course of a year. So, in the – in the spring, there's this period of rapid growth. That's when the brain is blooming. During this time, the brain is in, like, super learning mode. Children learn so much so fast that the brain makes many extra connections. After a period of blooming in the brain, connections are refined or pruned based on the experiences we have in our lives. So, the connections are neural pathways that we use often, those ones are kept and made stronger. The connections that we don't use often and ultimately those make it more difficult for our brain to function, those are removed. The result of this process is a brain or a garden that's really healthy and thriving. The connections that are left are stronger, and the brain is more efficient.

Throughout brain development, there are multiple periods of blooming and pruning. These bursts occur at different times and in different regions of the brain, and scientists think that these bursts of blooming and pruning align with what we call sensitive periods in the brain. A sensitive period is a time when our brains are particularly open to new experiences and to learning. And what this means is that there's times of development that our brains are

particularly primed to learn specific skills. You can think about it like a burst of blooming and pruning – like a burst of blooming and pruning. Blooming and pruning happens first for our sensory development, followed by language and motor development, and then higher cognitive abilities. And the higher cognitive abilities, that's a period that stretches well into our teens and even our 20s. The experiences that we have during these periods, these bursts of blooming and pruning, these are sensitive periods, and those experiences are particularly influential.

So, I want to take some time to take a look at how each of these phases develop and how they shape children's brains over time. So, while all of the basic structure of the brain is in place when a child is born ... So, all of the basic structure is in place. We rely on our early experiences to refine those connections and strengthen neural pathways. Hearing is one of the earliest senses to develop. Beginning in the third trimester, developing infants can actually hear the voice of their birth parent, which is pretty cool. And as they listen, that experience begins to strengthen those connections that are forming in their brain. Researchers have found that within the first hours of birth, newborn infants are already able to recognize and identify their birth parents' language or languages, which is very cool.

Touch is also finely tuned early in life. We know that, for example, physical touch is one of the easiest ways to soothe and comfort and express care for infants, right? That's an early way we have to communicate. Brain imaging research has shown that as early as 6 months of age, the infant brain responds to touch in the same complex way that adult brains do. For example, there are specific regions of the brain that respond when our hands are touched and a different region of our brain that responds when our feet are touched. What's more – this is interesting – these regions in infants' brains were also active when they saw another person's hand or foot being touched. So, when they just watched someone else's hand or foot being touched, and while there's still a lot more research to be done, certainly, these results suggest that from a very young age, infants are able to understand what it feels like when another person is touched. It's as if they're able to recognize "I know what it ... You are like me. I know what it's like to have my hand touched, and I can understand what it must be like to have your hand be touched." So, from an early age, touch plays an essential role in building relationships. And our ability to understand someone else's experience underlies more complex processes, like empathy, that we're going to be building over the course of our lives.

While our brains begin to refine our sensory systems earliest, language and motor skills are not far behind. We just learned that at birth, children already recognize the sound of their birth parents' language, and as children continue to hear language, their brains are rehearsing. They're building connections between the listening and the speaking region of their brain. This all happens in children's brains before they even say their first word, which is one of the reasons why it's so important for young children to hear language before they begin to speak. These early language experiences build the language pathways and systems in the brain that are necessary for speaking, so connecting those listening and speaking regions of the brain to making those connections between those regions of the brain strong and efficient.

And for children who are born deaf and are learning sign language, a very similar process happens in the brain. As they see signs, language regions in their brain connect the motor pathways in their hands, and those begin to strengthen. As children are learning to sign – as children are learning sign language, excuse me, they babble with their hands and their fingers, which I love.

During the first year of life, children's brains are also beginning to specialize or become better at recognizing the sounds of language or languages that they're learning. And so, by 11 months of age, children who are learning more than one language show strong neural responses to the languages that they are learning. So, this means that the experience of listening to multiple language at this early stage is already changing their brains as they build these strong language pathways.

The first year of life is when our brains are most sensitive to language sounds. It's easiest for us to learn new language sounds early in life. As we age, we always can learn a new language, but it becomes harder. Our brains just aren't as good at recognizing those language sounds that we didn't experience as young children. This window of opportunity is critical to supporting children who are learning more than one language. And accordingly, part 1302 subpart C of the Head Start Program Performance Standards indicates that infants and toddlers – that for infants and toddlers, programs must include teaching practices that focus on the development of the home language. The Head Start Program Performance Standards recognize bilingualism and biliteracy as strengths. And so, for infants and toddlers, teaching practices focus on developing their home language, along with exposure to English. Learning more than one language doesn't only affect the part of the brain specifically dedicated to processing and producing language, it shapes other regions of the brain, as well. When researchers look at the brains of babies who are learning multiple languages, they see an increase in brain activity in a region of the brain that's responsible for many important cognitive functions like planning, paying attention, solving problems, and switching between tasks. This region is called the prefrontal cortex, and that's right here in the front part of our brains. One of the cognitive functions that's associated with the prefrontal cortex is flexible thinking or something that scientists call cognitive flexibility. This is the ability of our brains to quickly switch from one task to another or to multitask. And there's a growing number of studies that suggests that being multilingual may increase our cognitive flexibility. When we speak more than one language, our brains get practice switching back and forth between vocabulary and grammar sets, as well as social and cultural contexts. And this all gives our brains this really cool flexibility boost.

Flexible thinking belongs to a suite of cognitive skills known as executive functioning skills. Executive functioning skills are fundamental for success in life and school. In addition to thinking flexibly and solving problems, they also include the ability to pay attention and focus on a task, to remember rules and procedures, and the ability to control our impulses. The region of the brain that we just learned about, this prefrontal cortex, that plays a critical role in our executive functioning ability, but the connections in and networks in this part of the brain are developed over the course of our entire childhood. And it really takes years of experiences to build the connections in this part of our brain. However, we can help young children start to

develop these critical skills through responsive caregiving. And responsive caregiving refers to a parenting, caregiving, and effective teaching practice that is nurturing and responsive to a child's individual temperament and needs. This type of care lets you get to know each individual child, what their strengths are, their challenges, and to customize your interactions accordingly.

One important aspect of responsive caregiving that is particularly important for children's development – developing executive functioning skills is nurturing children's ideas and initiatives, something that researchers like to call autonomy support. And autonomy support looks like offering choices and encouraging children's interests, acknowledging children's perspectives and feelings, explaining why you're asking for a specific behavior, and making modifications to a space that allow children to do some things independently, like the modifications to the sink that we see in this picture on the screen. We're going to take a minute to talk a little bit more about each of these different bullets here.

OK, so following a child's lead, offering choices and encouraging their interests is a key part of helping to build executive functioning skills. For infants, this can look like following an infant's lead as they explore, talking about – to really talking about what they're interested in and providing different materials and toys for them to play with. In classrooms and family child care settings, think about how you can make toys and other materials easily for children to access all on their own so they can go and access that whatever, some toys on their own. During home visits, think about how to support parents in nurturing their child's ideas and initiatives. So, work with parents to help them identify really what their child's interests are and coach them in ways to support but not dominate or take over the activity that their child is doing. And this is a great place to start helping families with this process. Children learn so much by being able to explore their interests with a supportive adult. Talking about this concept with parents is a great way to facilitate children's learning at home, too.

OK, we all know how good it feels when someone really gets us, really gets us and recognize our feelings, and children are no different, of course. Sometimes children's big feelings and tantrums they might look a little different from how we express our feelings, but it is important to validate what they're experiencing. So, for example, you could say something like, "I can see that you are feeling really mad right now. It is so hard that you can't see your friend, but when we throw toys, we can hurt ourselves or others. You know what? Let's find a different way to help get that mad and sad out." Right? So, for infants and toddlers, acknowledging their perspective, this also means paying close attention to their behavioral cues, like fidgeting, for example. If they're fidgeting, that may be their signal to you that they're really ready to move on to something else. Explaining why you are asking for a specific behavior, like why it's important to be quiet during nap time, helps children connect what they are doing with why it's meaningful. So, for example, for infants, talk about why you are doing a task together. We need to put on our warm coats because it's so cold outside, and we want to stay toasty and warm. So, connecting what you're doing – putting on a coat – to the reason why we want to stay warm when we're outside, and it's so cold. All children need modifications to help them move through space on their own and be able to choose what they want to explore. So, for example, baskets of toys are materials that are easy to grab and play with.

For children with a disability or suspected delay, I encourage you to think about what additional supports need to be provided so that children can really fully explore their ideas and do the things they're interested in as independently as possible. So, if a child's not able to access a space or a toy, that's really your cue to change it. This might mean physical modifications to a classroom, family child care setting or providing additional emotional or instructional supports. Home visitors might help families make modifications to spaces in their home so that children can more easily participate, so like, for example, creating a more open floor space and pathways so that children can move easily throughout the home and participate in all of the activities.

While we've touched on some of the most basic phases of brain development, perhaps the most important thing to know is the importance of relationships. For all of us but particularly for children, we learn best in the context of relationships, and it's through our relationships with parents, families, and communities that we're going to learn best how to support children's individual interests and strengths and to create learning environments where a children's full identities and experience are not only welcomed and celebrated but incorporated into curriculum and care programs, so really incorporated into the curriculum and care. Reflect on how you work with families to understand the strengths of the children you serve and how you can work to integrate those strengths into your everyday programs and activities for children and families.

When stressful, challenging, or traumatic things happen, the positive relationships children have in their lives act as a buffer. Every family experiences stressful and challenging events; that is a given. And for children, these experiences are a part of development. With the support of adults in their lives, children learn to cope with stresses and challenges that life brings. Some families also do experience more severe and traumatic events. With the support of caring, responsive adults, children can heal and recover even from the most traumatic experiences, and while healing can happen at any time in our lives, children are both especially sensitive to the events that are happening in their lives and particularly flexible and adaptable. Impactful relationships can take many forms from family members to foster parents to community members and elders to teachers. In these supportive relationships, children learn that there are people in their lives that they can depend on. They are freer then to focus on the main tasks of learning, playing, and growing.

Without that support, though, children do their best to become self-sufficient, learning behaviors that help them weather a crisis. When the crisis passes, though, children often remain in that crisis mode, having spent the energy on survival and making it through that would otherwise have been devoted to learning new things and exploring. Children who have experienced trauma may need some support learning new behaviors and building trusting relationships in the safety and responsiveness of the world around them. Learning to recognize the signs of trauma is critical to supporting children's healthy brain development. And as the signs are really varied, it's important to keep a developmental lens in mind as you're assessing behaviors. So, for example, those experiencing trauma may have problems sleeping. However, sleep disruptions are common and developmentally appropriate when you think about infants



and toddlers. Finding ways for children who have experienced trauma to feel safe in our care is our focus. The handout located in the resources list widget provides helpful resources for you to explore and learn more about specific trauma-informed practices, and we encourage you to take a moment to check it out.

It's also really critically important that you take the time to care for yourself. Those who work with others experiencing and/or responding to trauma in their lives may develop a vicarious trauma or secondary traumatic stress. Personal factors such as a history of personal trauma or high life stressors can contribute to the development of this type of trauma. Knowing your own signs of stress and practicing self-care strategies and having a supportive network is especially helpful to promoting positive well-being. And so, I invite everyone, and especially program leaders, to take some time to think about how you can build flexible support networks and work cultures that center care and connection. As we wrap up today and with the importance of relationships fresh in our minds, I wanted to offer three important ways to support early brain development. They are responsive care, which we've already touched on a bit today, child-centered social interactions, and predictable routines. We talked earlier about how responsive caregiving supports children's emerging cognitive skills. It's also critical to supporting children's social and emotional development. As adults, we draw on our life experiences to help get us through tough times or big feelings, but infants and toddlers don't have that same experience to draw on. They are still developing the parts of their brains that help regulate emotions and control their impulses.

Children under 5 don't yet have those neural networks in place that can control their impulses or regulate their emotions on their own yet, so they need some support from us. Providing that extra regulatory support for infants and toddlers, like holding them to help them calm down is part of responsive care. When we provide this responsive care, children not only learn skills that help them self-soothe later but they also learn there are adults in the world that they can depend on when they're feeling upset. These early relationships are fundamental to healthy brain development.

Social child-centered interactions are especially powerful experiences, and these really help build neural pathways. Infants and toddlers recognize when they're part of the conversation or activities, so make space and take time to let them respond and build on the interaction through language or actions. This gives children the chance to practice social exchanges, turn taking, language skills, and importantly communicates to children that their interests, needs, and presence matter. How child-centered interactions look is going to vary by family, community, and culture, of course.

In some communities, children may be expected to follow along as adult models a task or spend time listening to stories. Even if there's less back and forth and less verbal back and forth verbal communications, these interactions are powerful because they communicate to the child that they are part of a family or a community and that their participation and presence is valued. They're really included in these activities as an important member of the community. So, I invite you to think about how do you take a child-centered approach in your work. As a home

visitor, help families include children in tasks that the family does regularly, as well as encouraging them to build on their child's interests. And learning environments like classrooms or in family child care, think about how to create spaces and routines that really allow children to both participate in everyday tasks and support and build on children's interests and curiosities, and predictable routines.

You likely know the importance of flexible routines in your work. Children typically feel more comfortable and secure when they know what's going to happen, and while routines are important for all children, they can be especially helpful for children with disabilities or suspected delays who may need some extra support during those transition times. We've also learned today that the more often a child has an experience, the stronger those neural connections forming in their brains are going to be. So, with predictable routines, children can repeat and experience many, many times and learn from it. And I'm sure you've probably seen this before, infants and toddlers really enjoy this consistency, and they really often want to do something again and again and again and again. And that's helping build their brains. Establishing predictable routines can be really difficult for families experiencing homelessness, so work with families to help them develop routines that are flexible. For example, establishing a routine where you sing a song before naptime or bedtime rather than focusing on taking a nap or going to bed at exactly the same time every day. For home visitors, you can look for opportunities to help caregivers build and improve their family routines to support consistency. So, for example, if a child is really struggling with naptime, maybe you suggest starting a naptime with a predictable, cozy, quiet time that includes reading from a selection of some of their favorite books.

Well, we've touched on some key practices supporting brain development is really about supporting all domains of child development. Use the Head Start Early Learning Outcome Frameworks as your guide to understand that continuum of learning and development for infants, toddlers, and preschoolers. It's grounded in comprehensive research around what young children should know and be able to do during their early years and is really an invaluable resource as you work to support children's development. The ELOF identifies important learning goals and provides information and examples of how all children, including children with disabilities and children who are dual language learners, may demonstrate what they know and can do and the kinds of support that they might need. It identifies learning goals that are important for all children. It's a really useful tool and really key to helping to support brain development.

A link to the ELOF resources on the ECLKC is included on the resources handout in the resource list. However, you can also use the ELOF2GO, ELOF@HOME, or MiELOF mobile apps to support your work with children and families.

So, today, we talked about the incredible period of growth and brain development that occurs in the first few years of life. While we're born with all those basic structures in place, it's really our experiences that shape how networks and pathways in our brain strengthen and form. Because the brain is making so many connections in the first few years of life, early childhood

experiences have that particularly strong influence on the developing brain. We've also talked today about the importance of relationships and responsive caregiving, and supporting brain development. Our relationships with children and families we serve, as well as the relationships we have with our colleagues and even the relationships we have with ourselves all contribute to creating nurturing environments where children can grow and thrive.

Thank you so much for joining us for this portion of the webinar.