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Transcript — Dyslexia and the brain

[0:00] Introduction

[**Title slide:** Dyslexia and the brain; Understood logo]

[**Description:** A person with shoulder-length blond hair wearing a coral blazer and chunky jewelry, sitting in an office and speaking directly to the camera. A window, bookshelf, and photos on the desk are visible behind them.]

[**On-screen text:** Guinevere Eden, Ph.D., Director of the Center for the Study of Learning, Georgetown University]

Guinevere: We've known for some time what children with dyslexia look like in terms of their reading skills, skills in areas of language like rhyming, and what's called phonemic awareness.

But the brain research has really added to this by showing us what the brain looks like when people read and what the brain looks like when people with dyslexia read. And there are some differences.

When we think about reading, we need to remember that we are really probing a person's ability to understand that words are made up of sounds and that those sounds have a representation in their written counterparts, in the letters.

And this is where things can become very difficult for a child. Understanding that a word that sounds just like one continuous sound, like "cat" or "dog," is actually made up of three sounds that are joined together so seamlessly that you would hardly know that they are, in fact, three sounds. And because of that, are represented by these three letters.

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaway: Dyslexia involves trouble connecting the sounds that make up words with the letters that represent those sounds.]

[1:13] The brain and reading

Something that many of us take for granted and forget is just how complicated reading is. There's nothing about our brain that was designed to learn to read. When our brains learn to read, we rearrange them quite significantly, and we draw on a range of skills that were designed to do other things.

[**Description:** A rough, profile drawing of a brain appears onscreen. As Guinevere explains each part of the brain, the areas are highlighted in the drawing. A purple area representing sound appears in the middle, toward the back of the brain. A blue area representing vision appears below the purple area.]

The same mechanisms that we use when we read, which is accessing the sound representation of language, that area in the brain is involved when we read. It's clearly become directed towards reading and not just spoken language. And it is integrated with areas in the back of the brain that help us recognize words that we then, at some point, begin to recognize by sight.

[**Description:** The blue area representing the visual part of language pulses from dark to faint.]

Because the oral part of language is important in helping us put the sound representation on words. But after we see a certain word a number of times, we don't necessarily have to sound it out every time, but we begin to move it to a part of the brain that helps us visually support recognizing a word by sight.

[**Description:** Guinevere speaks directly to the camera.]

The more we see those words, the less we have to actually sound those words out, but we recognize them almost like a picture.

And it does seem that, in fact, the area in our brain that we use to see pictures and our visual environment becomes hijacked by reading. It literally, reading as it establishes in the brain, says, "Move over. Now I'm going to use this part of the brain to help us recognize word forms."

[**Description:** Back to the visual of the brain. A green area representing spoken language appears toward the front of the brain, at about the same level as the purple area.]

And then we also have a part of the brain that helps us pronounce the word and pull out the right pronunciation. And that's in the front of the brain.

[**Description:** Guinevere speaks directly to the camera.]

So, reading is made up of different components. And likewise, what we see in the brain, is a network that reflects those different components that we use for reading.

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaway. Reading uses different parts of the brain to:

- Sound out unfamiliar words
- Recognize familiar words by sight
- Think about how to pronounce the words]

[3:09] Dyslexia and the brain

When we study children or adults with dyslexia, we find that some of those areas aren't activated quite the same as they are in people who do not have dyslexia.

[**Description:** Two brain drawings side-by-side. The brain on the left represents someone who doesn't have dyslexia and shows the purple, blue, and green areas described earlier. The brain on the right represents someone who has dyslexia and shows the green area as being the same, but the purple and blue areas as significantly reduced.]

The imaging research has given us kind of a very nice inside view of the reading brain and how it differs in struggling readers.

[**Description:** Guinevere speaks directly to the camera.]

And it's also given us an opportunity to ask the question: What happens in children or adults who have had difficulties with reading when they are given some tutoring and they're given the skills that they need to sound out those words, to really apply the code to allow them to pronounce the words and get better and more fluent at doing that?

The research shows that if you are very explicit in instructing children about the rules of phonics and understanding how language is structured, and then how it relates to the written counterpart. And if you use methods that show children — in a very structured way and a very intensive way — how that works, that that really is a key component to a successful intervention.

And once you understand the relationship between sounds and letters and you can read, you then need some time to become a more fluid reader. Give your brain the time to not just increase the skills in phonological processing, but also now have the experience of encountering words again and again, so that you can commit them to your visual word memory, and have the practice, and then go on to use that skill to derive meaning.

What isn't considered an effective intervention are the kinds of things that focus on trying to train eye-movement control, trying to change a child's ability to balance, and those kinds of things.

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaway. Effective interventions for kids with dyslexia:

- Teach the relationship between sounds and letters in a very explicit and structured way
- Help struggling readers recognize words they have seen before
- Do not focus on things like balance or eye movement]

[5:26] Using brain imaging to understand interventions

Really, at the heart of dyslexia, is a difficulty in mapping language to print. And it's that skill that these interventions really address as a way to give the child the key that they need to access written language.

[**Description:** Two brain drawings side-by-side. The brain on the left represents someone with dyslexia before intervention. It shows the green area as being the same as someone without dyslexia, but the purple and blue areas as significantly reduced. The brain on the right represents someone with dyslexia after intervention. It shows the green and purple areas as being the same as someone without dyslexia, with only the blue area significantly reduced.]

And the imaging has shown us areas in the brain that now, after the intervention has occurred and after their reading has improved, areas that increase in brain activity and other areas that are compensating and helping out to make that person a better reader.

[**Description:** Guinevere speaks directly to the camera.]

And those kinds of insights tell us something about the mechanisms of reading and struggling readers, and perhaps why certain brain areas participate in the process of making a person a stronger reader. And that's where the neuroscience insight helps.

The scientists can look at those brain changes and deduce from that, "Well, what are the areas in the brain that support that change? And why those areas? Is it the language areas in the left hemisphere that we use for language and reading? Or is it some other areas?"

And the researchers use that information to try and understand why those brain areas, why did they change, and what is it about their relationship to the intervention that makes this a good intervention.

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaway. Researchers are using brain imaging to understand how structured literacy interventions help people with dyslexia.]

[6:46] The brain is changeable

One of the things that we're learning from brain imaging is how malleable the brain is in several different ways. So, for example, when we learn to read, our brain is changing quite dramatically through that process. People who become skilled readers differ from those who never learn to read in brain anatomy and brain function. So reading itself is a process that changes the brain.

And then the other thing we can do is ask questions about, "Well, what about children who are struggling readers and adults who are struggling readers?" Maybe as an adult, you would think you can't make any more gains in reading, but in fact, you can. And your brain is still changing, changing in ways to support those skills to make you become a better reader.

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaway. Our brains are very changeable. Even adults with dyslexia can change their brains to become better readers.]

[7:37] Visual spatial skills

And what we're also now beginning to see with brain-imaging research is a focus on other skills that we have, skills that maybe even be enhanced in people with dyslexia.

So now we see a sort of a new phase of research where people are beginning to ask questions like, "Why is it that we hear reports of people with dyslexia being better at seeing the big picture? Maybe at being better at visual spatial skills?" So, working in a visual environment and being very good at pulling together a lot of visual information and seeing the big picture.

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaway. Researchers are beginning to study visual-spatial skills and other strengths that may be linked to dyslexia.]

If you translate that into a laboratory environment, you may test that by asking people to see images where your ability to detect differences really requires you on taking in the big picture rather than just focusing on a detail. And those have shown that people with dyslexia, when faced with that kind of a task, are better than those who do not have dyslexia.

And now the question with the imaging is, how is that information processed in the brain and how does it speak to the other differences that we see in those brains? Is there a trade-off? Does the dyslexia come with a heightened skill, or does the experience with dyslexia produce that heightened skill? And what does that look like in the brain?

[**Description:** A white screen with a purple heading and dark gray text.]

[**On-screen text and narrator:** Key Takeaways

- Different parts of the brain are used to sound out unfamiliar words, recognize familiar words by sight, and pronounce the words.
- Effective reading interventions can change the brains of kids and adults who have dyslexia.
- Brain researchers are starting to study strengths that may be linked to dyslexia.]

[**Description:** Understood logo]