

## Are you raising a reader? Pediatrician can tell by looking at a child's brain

By Dawn Miller

**T**he more time we spend reading to the babies and children in our lives, the better their young brains organize themselves, forming networks essential to learning to read around age 6.

Dr. John Hutton can see it in their brain scans.

When we pacify babies and children with screens, even supposedly educational apps, we disrupt essential connections that the brain is primed to develop in the first years of life.

He can see that, too.

A pediatrician at Cincinnati Children's Hospital and "spokes doctor" for the national campaign, Read Aloud 15 Minutes, Hutton presented some of his findings to doctors and educators at Marshall University in October 2019 at an event sponsored by Marshall's June Harless Center for Rural Educational Research and Development.

"Why does this matter to pediatricians?" he asked. "Reading we know is a major public health concern. It is considered a social determinant of health."

### First, some background

Human brains are born ready to do certain things, such as see and speak.

"But out of the box, there's not an actual network in the brain that automatically knows how to read. We have to make it," Hutton said.

Human beings do this by using brain networks that evolved for other things. So, as parents talk and sing with babies, their language networks are stimulated.

"This tends to happen in a predictable sequence," Hutton said. As parents show picture books to babies and toddlers, other brain networks are engaged – vision, attention and executive function, for example.

"All these areas need to be stimulated during early childhood. The more you stimulate them, the more they form networks to work together. The more you stimulate

them the stronger they get."

### Long before the ABCs

Emerging literacy is a collection of skills – how to read, background knowledge, and attitude, Hutton said.

The how-to includes how a book works. Turning pages. We read from left to right. Children learn these details years before it is time to learn ABCs and to sound out words.

As children listen to books, look at pictures and converse with others, they build up a store of words and ideas. Later, when it is time to "learn to read," children draw on those words, matching them to words they are learning to decode in school.

Children who hear and learn fewer words during their first four years do not read as easily as children with more words.

And then there is attitude.

"This is the underrated part," Hutton said. "Do I like to read? Did I grow up in a home that valued reading? Is reading fun? Or is reading more of a chore?"

"That's one of the challenges we have, to really reinforce the idea that reading is

something that should be seen as a fun and nurturing and positive thing, not just something that is all about how you are going to do on the test later."

### The brain, on books

Earlier surveys counting books and reading time, for example, showed that children who spent more time with books from an early age had better reading skills and scores. But could you observe a physiological difference?

Hutton and colleagues did MRI scans on healthy preschoolers. They scanned brains while children listened to stories, and again when they heard random noises.

"What we found was there was a difference," he said. In children who had been read to more, there was more activity, including in the part of the brain associated with vision. Doctors think that is the child's imagination.

"It's pretty amazing," he said. "Kids who have more practice, more experience with books and reading, have more ability to activate the part of the brain that's involved in imagining what's going on in the story and then understanding what it means."

"This is pretty exciting. It's really the first study to show reading early on makes a difference in how their brains function," he said.

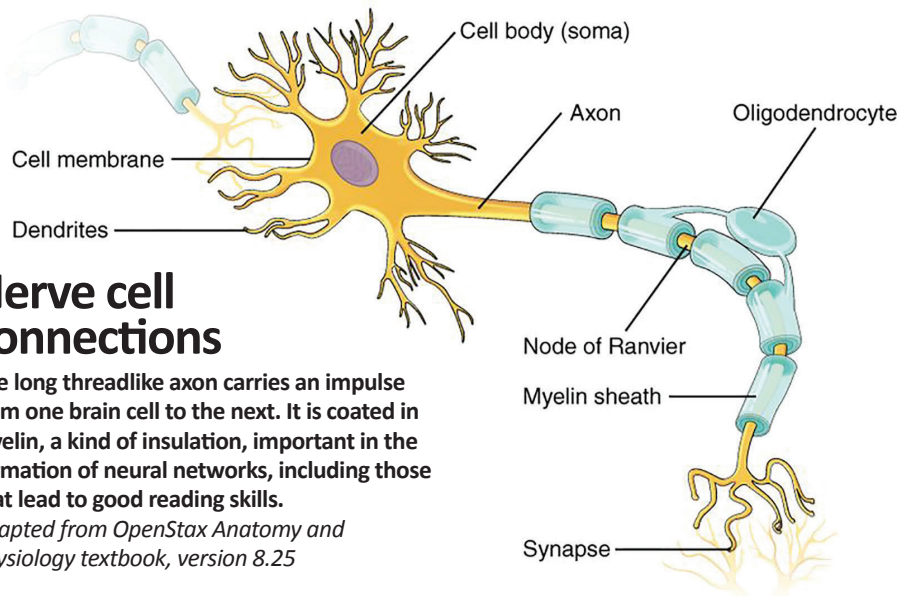
### Quality counts

So, the number and frequency of books is important. What about quality of the experience?

Hutton's team watched parents read to children and scored the range of their behaviors. Some read in a monotone. Some made sound effects and involved children. One even looked at a phone while reading.

They scanned children's brains and found that children of parents who read more interactively, where children had turns at talking about the story, had more activity in both the back and front of the brain. These areas are associated with imagination, chronology,





## Nerve cell connections

The long threadlike axon carries an impulse from one brain cell to the next. It is coated in myelin, a kind of insulation, important in the formation of neural networks, including those that lead to good reading skills.

*Adapted from OpenStax Anatomy and Physiology textbook, version 8.25*

expressive language, and understanding emotions.

Parents, teachers and doctors have long observed that kids who interact more with stories have stronger language skills. Hutton's research corroborates that observation.

"More interactive reading experience leads to stronger activation in the part of the brain that's involved in knowing how to talk," he said. "And also integrating what they hear in the story with how they feel about it.

"It really is a pretty powerful parallel with what behavioral research has shown in terms of the benefits of interactive reading."

### Lost in a good book

Was there a difference in the brains of children who were visibly engrossed in a book compared to those who weren't?

Yes.

Kids who showed greater interest in the story had more activation in the cerebellum, a rear section associated with helping the whole brain learn new things.

"We call it a storytime turbocharger for learning," Hutton said.

Children who were most interested were probably more likely to be learning something. He could see their brains doing it.

"We should be coaching families to get kids involved in the story, sharing the process, to talk about it, to ask questions," he said.

### Goldilocks effect

Then they looked at brains receiving stories in different formats – audio only, an

animated story app, and a traditional picture book. They evaluated how much the different parts of the brain were working together.

Small children who listened to audio only without pictures had much less network activity. There were no pictures to help with unfamiliar words.

"Too cold," Hutton said.

When children looked at the same story animated, there was a lot of activity associated with visual processing, but little else.

"All the sudden the networks stopped talking to each other.

"When animation happens, there is a 37 percent drop-off in cooperation between these networks. The imagination part is less needed, so there is more focus on the visual processing part.

"When you animate a story, it short circuits the child's imagination.

"Too hot," Hutton said.

The old-fashioned picture book?

"When you put pictures with the audio, there is greater cooperation among parts of brain," he said.

"It was just right."

### But wait, there's more

"Books are also a way to learn about feelings," Hutton said.

"It's a way to really exchange emotions with a child, from promoting early experiences of nurturing and feeling cared for to relating to what characters in books are feeling.

"This is how kids learn a lot of these feelings. They are able to put themselves into the minds of other characters."

Social and emotional maturity is also a predictor of school success. Learning to think about the world from another's point of view helps.

"All those things involve practice, and they start early," Hutton said.

"That's another real benefit of reading with a child. You're not only building their vocabulary but also their ability to process their feelings and to put themselves in other people's shoes. I think that's another benefit that may be underrecognized."

### 'Neurons that fire together wire together.'

The American Academy of Pediatrics recommends limits on screen time: No digital media before age 2 except for video chatting and no more than an hour of high-quality children's programming a day for ages 2 to 5.

Dr. Hutton's scans showed brains exposed to more screen time were associated with less myelin, the desirable fat coating of nerve cell connectors. Myelin is what makes the brain's white matter white. It insulates nerve cells and makes them more efficient at signalling each other, like the insulation on electrical wires.

There is an old adage in neuroscience, Dr. Hutton said: "Neurons that fire together wire together."

"The more these areas are encouraged to talk to one another, whether language areas or executive function, the more that coating of the wires is stimulated," Dr. Hutton told the New York Times. "The amount of myelin around a nerve fiber is directly related to how often it's stimulated, how often it's used."

Possibly, he said, kids with more screen time have less myelination of networks important for language and literacy because the screens crowd out other things that are shown to stimulate healthy brain development.

Back in Huntington, Hutton told doctors and educators that the number of books, the frequency, the quality of reading and the format are all important to children's brain development.

"I would interpret this as saying you need books, you need to read them pretty often, read them interactively, and as boring as possible in terms of the format. Boring being straight up picture books.

"I really would argue there's not a better invention. We haven't invented a better mousetrap at that age if we want to stimulate brain networks to develop in the most strong and functional way."



James S. Hutton  
Associations Between Screen-Based Media Use  
and Brain White Matter Integrity in Preschool-Aged  
Children



New York Times article  
Screen Use Tied to Children's  
Brain Development