Welcome to friends and families of the Developmental Cognitive Neuroscience Laboratory. This year has been an exciting time for the lab. Through the generous help of Northwestern University, we have doubled the space of our lab. Our lab now includes a comfortable waiting room, a new testing room and a mock scanner (MRI) room.

As many of you know, our long-standing funded project on the neural basis of learning to read and reading disabilities (dyslexia) is in full swing. In addition, we have recently received funding from the National Institutes of Health (NIH) to study changes in the brain when learning math and in math disabilities (dyscalculia). We have also received funding to study how the brains of children with Attention Deficit Hyperactivity Disorder (ADHD) are different.

Because our lab is growing, we have added several staff members. Our staff is dynamic, extremely committed and absolutely critical to the success of our projects. An important goal of the lab is to train young scholars, so many students also play essential roles in each of these projects. In this newsletter, you will learn about people in the lab involved in our projects. You will also learn about some of the interesting findings emerging from these studies.

The mission of the lab is “understanding disabilities in developing brains”, and our research will guide identification and treatment of children with different kinds of disabilities. We want to thank you deeply for your commitment to science and for being involved in the important studies in our lab.

Jo Ann G and Peter F Dolle Professor in Learning Disabilities

DCN Lab group

The DCN Lab currently includes over 25 volunteers, undergraduate and graduate students, and full-time staff and researchers.
**Reading project**

Any parent of a child with dyslexia could tell you that something is different about the way their child processes language – and we’re working to figure out what that ‘something different’ is.

**What we do**

Using fMRI (the ‘f’ stands for function) we look at how the brain functions when your child reads and hears words or is asked to make rhyming judgments (like “Do cat and hat rhyme? What about jazz and has, or pint and mint?”)

We take two approaches to understanding language in the brain: 1) we look at how things change over development, by comparing children and adults, and 2) we look at reading impairments by comparing children with dyslexia to children without dyslexia.

**What we have learned so far**

Typically reading children and adults use a similar ‘network’ of brain regions to read words, but the way in which these regions interact differs over development. When reading novel words, adults rely more on decoding resources than they do while processing familiar words. Although the kids we tested were great readers, they use similar brain regions to process both familiar and novel words. This is interesting because it tells us that it takes some time for the pathways that are involved in reading to become well laid.

We expect that children with reading difficulties will use the same network of regions too; however, the way they do so will be different from typically developing children. We believe that differences will be related not to difficulties with vision or sound processing, but rather with how word information is combined across multiple brain regions.

**Science is hard but rewarding work!**

We’ve been enjoying your visits to our lab and are happy that you’ve been a part of this important work. With time (and more families like yours!), we will get closer to understanding why some children have such difficulties with reading.

**Participate in the reading project!** We are currently recruiting typically developing children and children with dyslexia or language based learning disabilities, ages 8-13 years old.

**Attention project**

The newest project in our lab is being run by the newest member of our lab, Gillian Cooke, who has come all the way from Ireland to think about ADHD. In particular, she wants to get a better understanding of the types of memory problems that children with ADHD display, and what might play a factor in those problems.

**What does reward have to do with memory?**

It’s not surprising that a little reward can go a long way in helping a kid do better in memory tasks. But what we think is that this reward could actually change the way that they are able to process memory tasks. It’s not just a (Continued page 3)
Math project

One of the newer projects in our lab involves taking a closer look at how children process mathematics, and the differences that children with math disabilities might face.

What is Dyscalculia?

Dyscalculia is a specific learning disability involving difficulty in learning mathematics. Although less well known than other learning disabilities, dyscalculia affects about 6% of the childhood population and continues into adolescence. Dyscalculia can develop over time and can affect the ability to understand or manipulate numbers. It can also affect the memorization of mathematical procedures (i.e., multiplication tables, formulas) and comparison of magnitudes or quantities.

How do we learn about math disability?

In order to think about dyscalculia in children, we first begin with what math representations look like in the adult brain. We asked 26 adults to answer multiplication and subtraction problems while in the fMRI scanner, and compared that brain function with function during rhyming judgments (i.e., “do these words rhyme?”) and numerosity judgments (i.e., “which pattern has more dots?”). We found that rhyming judgments and multiplication problems recruited a similar network in the brain, and numerosity judgments and subtraction problems recruited a similar network.

Bridging research and the classroom

In order to guide the identification, diagnosis, and treatment of children with dyscalculia, it is important to advance our understanding of the brain patterns underlying math development and math disability in children. We hope that understanding how the brain learns math can be used to create alternative instruction methods and may provide a useful diagnostic tool to identify children with dyscalculia at a young age.

![Figure 2: Similar brain regions seem to be at work for subtraction and numerosity judgments, and for multiplication and rhyming judgments.](image)

Attention project (continued)

matter of wanting to do better, it’s that rewarding correct performance could actually improve overall memory performance. Or at least that’s what we’re trying to test!

Thinking about ADHD

In order for kids with ADHD to perform comparably to typically developing children, we think the feedback they get needs to be different. We believe children with ADHD are going to benefit from immediate feedback on work, especially during memory tasks where they are rewarded for their performance.

We hope you will join us for this new study, or pass the word along to families you think might be interested!

Participate in the ADHD project! We are currently recruiting typically developing children, children with ADHD, and children with reading disabilities (dyslexia), ages 8-13.
Thank you to our families

Thanks to the over 250 participants and families that have volunteered their time to be a part of our studies!

We hope you have enjoyed your time with the lab and will return again soon.

DCN in the news

Did you catch us on the news?

This past year, work that came from the DCN Lab has been featured in:

- Chicago Tribune
- New York Times
- Science Magazine
- ABC News 7 Health-beat report

Stay tuned for more headlines from the projects you’ve been a part of!

Help us study learning and learning disabilities!

WHO WE ARE:
Northwestern University’s Developmental Cognitive Neuroscience Lab

WHAT WE DO:
We study children’s brains, and how they change while learning.
We use fMRI (Magnetic Resonance Imaging) to measure brain activity. This is a safe and widely used tool, and it is utilized often in clinical practice.

WHO IS INVITED:
Children ages 8-13 years old:
- Typically developing children
- Children with reading disabilities (dyslexia)
- Children with math disabilities (dyscalculia)
- Children with ADHD

WHAT TO EXPECT:
Participants will be asked to participate in:
- Standardized academic testing
- MRI practice sessions to become familiar with the MRI procedure.
- Real MRI sessions

This is a great opportunity for families to take part in a study to improve the diagnoses and treatment of children with Learning Disabilities.

Participants who enroll in our research studies will be paid.
If you are interested, please call the Project Coordinator at (847) 467-6842.

Principal Investigator: James R. Booth, PhD
www.dcn.northwestern.edu

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