Science Careers From the journal Science

http://sciencecareers.sciencemag.org

Nadine Gaab (CREDIT: Children's Hospital Boston)

Career Profiles

Scanning for Early Signs of Reading Woes

The average dyslexic child isn't diagnosed -- and so doesn't begin to receive intensive reading help -- until she is in the second or third grade. By that time, as she struggles to make sense of the baffling squiggles on the page, some of her classmates have already followed Harry Potter through 7 years of magical exploits, spent countless hours absorbed in the pages of *The Magic School Bus* series, or -- alas -- mastered the smart-alecky stylings of Junie B. Jones. Almost all can read independently to greater or lesser degrees.

The diversity of her mentoring prepared her well for a career in translational research, Gaab says.

That delay in diagnosing dyslexia is not just unfortunate; it's probably preventable, says **Nadine Gaab (http://www.childrenshospital.org/cfapps/research/data_admin/Site2545/mainpageS2545P0.html)** , a cognitive neuroscientist at the Harvard Medical School (HMS) in Boston who studies the disorder. Although it is usual to wait until a child has been failing to read for 2 years or longer before diagnosing dyslexia and other reading disabilities, intervening during kindergarten or earlier is known to be effective. The trick is in making that early intervention possible.

Studies in preschoolers have shown that glitches in certain prereading skills, such as rhyming or rapid object naming, are associated with later dyslexia. However, such behavioral measures on their own are not accurate enough to reliably identify at-risk children. Gaab hopes to pin down markers in younger children, perhaps even infants.

She's off to a good start. Gaab and her colleagues have found that preschoolers with a family history of dyslexia tend to have less gray matter in brain areas involved in mapping the sounds of language onto their written counterparts -- areas known to differentiate older children with and without dyslexia. The more gray matter that is present in these areas, the better children are at quickly naming objects, a skill known to be a precursor of later reading ability. The group is beginning to do similar studies in infants.

In other research, Gaab and her colleagues have found an intriguing link between children's reading difficulties and neural deficits that prevent them from properly processing fast-changing sounds; they also found that computerized sound-training exercises "rewired" those faulty brain circuits.

Training

Gaab's interest in working at the intersection of basic, clinical, and education research was piqued when she was doing her doctoral work in neuroscience, studying how auditory or musical training affects the brain. This work was only on healthy brains with performance characteristics that were average or better. She wanted to apply her knowledge about the healthy brain to clinical populations.

During her postdoc, Gaab had three mentors. Rutgers University neuroscientist **Paula Tallal (http://www.cmbn.rutgers.edu/research/tallal/)** , an expert on neuroeducation and language-related learning impairments, mentored Gaab on learning disabilities and how the brain responds to training. Cognitive neuroscientist **John Gabrieli (http://bcs.mit.edu/people/gabrieli.html)** , then at Stanford University, taught her about neuroimaging and helped her

understand how to integrate her various research interests and results. Gaab says, "He also encouraged me to think outside the box and let me follow research ideas like the idea of imaging 5-year-olds -- which, back in 2004, nobody thought would be possible -- or looking at the connection between musical training and language processing," Gaab says. Her third mentor was Stanford University polyglot **Gary Glover (http://soe.stanford.edu/research/layout.php?sunetid=garyg)** , who, she says "pushed me to my limits in terms of understanding neuroimaging and questioning methodological practices."

Special Issue: Early Childhood Education

This article coincides with a **special issue (http://www.sciencemag.org/site/special/education2011/)** of Science devoted to the topic of **early childhood education (http://www.sciencemag.org/site/special/education2011/)** . We recommend **this companion article**

(http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2011_08_19/caredit.a1100085) from *Science* Careers and encourage you to explore the other parts of the special issue.

The diversity of her mentoring prepared her well for a career in translational research, Gaab says. Joining the HMS faculty in 2007 with a joint appointment at Children's Hospital Boston (CHB), she looked for ways to advance the basic science of reading disorders and make a difference in the real world -- translation that she says is sorely needed. "A lot of the research in reading just happened in the lab," Gaab says. "That's what teachers always complain about: 'You come, you do your research study, and then you disappear, and we don't know whether we should teach differently based on your results.' "

Gaab takes a different approach. Gaab frequently leads professional development workshops for teachers, participates in school "brain awareness days," and meets with teachers and principals to help them find ways to translate research on how the brain learns into meaningful classroom applications.

One of Gaab's newest projects, which she is developing in collaboration with at least one Boston-area school for children with dyslexia, is a blog that will provide useful information about emerging research to parents, teachers, and community workers. Even though such outreach activities carry no paycheck and are a considerable time investment, Gaab views them as an essential part of the research partnership she has established with schools.

When she first went into schools with the idea of helping translate research into practical classroom applications, Gaab says, "I thought, 'Oh, this will be easy.' " It didn't take long to figure out that she was wrong. "As a scientist, I don't know enough about curricula, or about how it is to be in the classroom. I can't tell them how to teach phonological processing. They're the experts, and I'm learning a lot from them." For example, "the whole idea that musical training and language development may be connected came from me talking to a couple of teachers who said they had students who were poor readers and who also struggled with learning to play a musical instrument and with copying musical patterns and wondered if those two things could be connected."

Similarly, she has gleaned new ideas from collaborations with physicians who diagnose dyslexia and with clinical researchers at CHB's Developmental Medicine Center, whose offices are just down the hall from hers and whose fellows sometimes rotate through her lab. A physician colleague once asked her if she could explain why some autistic kids start