

MARILEE SPRENGER

*Wiring the  
Brain for  
Reading*

**BRAIN-BASED  
STRATEGIES  
FOR TEACHING  
LITERACY**





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*Brain* *for*  
*Reading*



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Strategies for  
Teaching Literacy

Marilee Sprenger

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# *Contents*

	<i>Acknowledgments</i>	ix
	<i>About the Author</i>	xi
	<i>About the Book</i>	xiii
CHAPTER 1	<i>Language Development</i>	1
	From Neural Sensitivity to Neural Commitment	2
	The Right Way to Babble	4
	Encouraging Speech	5
	Windows of Opportunity	8
	Experience and Brain Development	9
	Ages and Stages in Language Development	11
	An Enriched Environment for Language Development	13
	Language and Gender	16
	Speaking Out of Both Sides of the Brain	18
	Activities	20
	Summary	23
CHAPTER 2	<i>Imaging and Imagining the Brain</i>	25
	The Structure of the Brain	26
	How We See the Brain	29

	Brain Cells	32
	How Cells Communicate	35
	What We Thought We Knew	37
	What We Found Out Along the Way	38
	Two Diverging Roads	40
	Learning and Memory: A Definition	43
	Summary	46
CHAPTER 3	<i>The Body-Brain Connection</i>	47
	Food, Glorious Food!	48
	The Learning Brain's Diet	54
	To Sleep; Perchance to Remember	57
	Making the Right Moves	62
	Sunshine Came Softly Through My Window	64
	Brain-Body Basics	65
	Stress Can Hurt the Body and the Brain	68
	What Does Bullying Do to the Brain?	71
	Summary	72
CHAPTER 4	<i>Breaking the Code</i>	75
	Phonemic Awareness	78
	The ABCs of the ABCs	82
	Mirror, Mirror	82
	Neurons That Fire Together	83
	Dr. Seuss and Mother Goose?	84
	Getting to the Core	85
	Teaching Phonemic Awareness	87
	Activities	87
	Summary	95
CHAPTER 5	<i>Patterns and Programs and Phonics! Oh, My!</i>	97
	Patterns and Programs	98
	The Alphabetic Principle	102



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	One to One? Not Exactly	103
	The Common Core: Where Do We Stand with the Standards?	103
	Decoding Development in the Brain	104
	Phonics Instruction	107
	Factors That Lead to Learning	108
	Eenie, Meenie, Minee, Moe. Or Is It Eeny, Meany, Miny, Mo?	109
	Activities	111
	Summary	113
CHAPTER 6	<i>The Fluent Reader</i>	115
	What Fluency Means	117
	The Brain’s Pathway to Fluency	119
	Reading Is Pleasure	120
	High-Frequency and Sight Words	121
	Some Steps to Fluency	122
	Activities	125
	Summary	127
CHAPTER 7	<i>Building Vocabulary</i>	129
	Two Types of Vocabulary	130
	Vocabulary Development	131
	The Common Core State Standards and Vocabulary	132
	The Common Core College and Career Readiness Anchor Standards for Language	134
	Choosing Our Words Carefully	135
	Activities	139
	Summary	143
CHAPTER 8	<i>Comprehension</i>	145
	Modeling Comprehension	147
	Comprehension Strategies	149

	Before, During, and After Reading: What These Strategies Have to Do with the Brain	158
	Activities	161
	Summary	186
CHAPTER 9	<i>Putting It All Together</i>	187
	For Parents	187
	For Teachers	188
	Keep Learning About the Brain	189
	<i>References</i>	191
	<i>Index</i>	201

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*In memory of my mother,  
Mollie Broms,  
the woman who taught me  
how to read, to love reading,  
and to read everything I see*

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## *About the Author*

**M**ARILEE SPRENGER IS A HIGHLY REGARDED educator, presenter, and author who has taught students from prekindergarten through graduate school. She has been translating neuroscience research for over twenty years and has engaged audiences internationally. The author of eight books and numerous articles, Marilee is a popular keynote speaker who is passionate about brain research-based teaching strategies, which include differentiated instruction and wiring the brain for success.

Marilee is a member of the American Academy of Neurology, the Learning and the Brain Society, and the Cognitive Neuroscience Society. She is an adjunct professor at Aurora University, teaching graduate courses on brain-based teaching, learning and memory, and differentiation. Teachers who have read her work or heard her speak agree that they walk away with user-friendly information that they can apply at all levels.

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## *About the Book*

**T**HERE IS NOTHING MORE EXCITING THAN having the privilege of helping people, children and adults, learn to read. The thrill of seeing the smile on their faces and the sparkle in their eyes as they realize they have broken the code is priceless.

Mary Ann Wolfe tells us in *Proust and the Squid* (2007) that learning to read begins the first time a book is read to an infant. This often happens in an environment filled with love for the child and the love of reading. Unfortunately, not all readers have that magical moment that provides security and attachment for the developing brain. There are children who come from homes filled with books and a love of reading. Their parents read aloud to them nightly and have elaborate conversations with them that increase their vocabulary and background knowledge. And then there are students who come to us from homes where literacy is limited. Their parents work long hours and have little time or energy to provide the background that encourages reading. Although there is no guarantee, children who come from homes filled with reading seem to have a better chance at reading success.

In this book, I share some of what I have learned about reading through my own teaching experiences, neuroscience research, and educational research and the experiences of teachers with whom I have had the privilege to work. The science of the brain has revealed exciting and important information that, when added to

the educational research, creates standards for best practices in teaching reading.

There are six thousand languages in the world, and babies are born with the ability to master any of them. But the brain changes as children develop, and language acquisition can become more difficult. In chapter 1, discover how children learn their native language and how the brain's approach to new languages changes with age. Developing language is exciting for parents, children, and teachers. Research is continually being done to educate us more about how to encourage better language skills.

Through brain imaging, neuroscientists have discovered what neural connections are necessary for a brain to read easily. Chapter 2 covers the theories and applications of this research. For example, neuronal recycling is necessary for a reading pathway to form, and an understanding of how this and other parts of the brain function helps educators develop best practice and parents how to make a difference in their child's reading progress.

Reading readiness relies on the body as well as the brain. Chapter 3 introduces physical movements that enhance the brain's ability to read. The brain-body connection is powerful. Scientists believe that significant brain development occurs through movement and play.

Chapter 4 reveals how the path to reading begins. Phonemic awareness is the first step toward learning the alphabetic code. Although this skill is emphasized in kindergarten and first grade, it is important for all teachers and parents to understand the significance of making sound and letter connections. Examples of relevant activities are provided in this and other chapters.

After breaking the alphabetic code, the brain needs to be taught how to recognize patterns. Phonics is introduced in chapter 5. The task of learning to read now becomes visual as well as auditory



as students learn how to associate sounds with visual representations. Phonics teaches students the most common sound-spelling relationships so that they can decode, or sound out, words.

The next logical step in teaching reading is fluency. Chapter 6 discusses what fluency is and why it matters. The ability to read with expression, speed, and accuracy allows the brain to focus on the content of the reading and enables better comprehension.

Chapter 7 covers teaching vocabulary. The importance of having a large vocabulary is reflected in two important research discoveries: that 85 percent of standardized tests are based on vocabulary and that vocabulary is one way to increase academic background knowledge (Marzano & Pickering, 2005). Learn which vocabulary words from the Common Core State Standards (CCSS) are vital to success, as well as strategies to increase tier 2 words (high-frequency words that occur across a variety of domains), which are considered a large part of the mature reader's vocabulary.

Finally, chapter 8 focuses on reading comprehension. Discover how working memory aids with comprehension and learn many before-, during-, and after-reading strategies to enhance comprehension and memory.

The CCSS heavily emphasize students' ability to read complex text independently and proficiently at every level of development, from kindergarten through grade 12. In order for this to take place, all teachers need the skills to recognize reading difficulties and have strategies to assist struggling readers. Teaching students how to read closely and deeply using a strategy like questioning will help reveal where in the reading process a problem may lie. For instance, if a student cannot summarize what she reads, the teacher or parent can ask who, what, where, why, and how questions to get at the heart of the matter: a memory problem, a vocabulary issue, or an inability to sound out words properly. They can take use information to find a starting point to help train the learner's brain for reading.



# *Language Development*

**M**AEVE WAS BORN ALREADY RECOGNIZING THE voices of her mother and father. She had been able to hear her mother while in the womb as soon as her ability to hear sound developed by the end of the second trimester of the pregnancy. Soon after, as Maeve's daddy started reading to her and speaking to her in his soothing voice while keeping his mouth close to her mother's belly, she began to respond to the sound of his voice. The clarity of such verbiage to the unborn child has been questioned. But the moment Maeve was born, she responded and turned toward the voices of both Mommy and Daddy.

Maeve's brain at birth will allow her to learn any language and repeat any phonemes (the individual sounds that make up a language) that she hears. If she has been born into a bilingual or multilingual family, she will easily learn the languages that are spoken to her. This ability is short-lived, however. By the time Maeve has been on Earth a year, her brain will have pruned away the neurons (the brain cells that do the learning) that were not used. In other words, her ability to hear some phonemes will be gone or at least partially diminished. She will focus on the sounds that she hears, and by approximately eight months of age, she will begin to attempt to mimic those sounds. Along with the vowels and consonants she will mimic, she may also express other phonemes that are available to her developing brain. Her parents, however, will recognize only the sounds that they know. So when Maeve begins to babble a string of sounds like, "ma, ba, goo, eh, neh, un," what her parents pick up on (especially Mom) is the first sound, "ma." So Mom begins to repeat the sound while she beams

at Maeve. “Ma, ma, ma ... you said my name: ma, ma, ma.” Eventually Maeve gets the idea that this particular sound gets a great response from her mother, and she will begin to repeat the sound to please her mother and get instant feedback. It doesn’t matter that within her babbling, she may have shared phonemes from multiple other languages. Since no one will repeat these back to her, she won’t strengthen the connections for those sounds. As language is learned, brain cells connect to remember and recreate the sounds that are heard, but connections that are not used often grow weak and unusable.

There are almost seven thousand languages in the world, and babies are born with the ability to master any of them. But the brain changes as children develop, and language acquisition can become more difficult. In order to be able to read, a child must first learn the sounds of the language.

### *From Neural Sensitivity to Neural Commitment*

After an infant is six to nine months of age, only those neurons that have learned the sounds of the language’s phonemes spoken to the baby remain. They gain in strength and connections as they are repeated. As this specialization occurs, neurons become committed to those sounds (Bronson & Merryman, 2009).

In 2007, a study by Zimmerman, Dimitri, and Meltzoff stated that DVDs and videos directed to babies are actually harmful to them. The researchers had found that infants who watched these DVDs and videos had smaller vocabularies than babies who did not watch. In fact, the more television a child watched, the fewer vocabulary words he or she knew. The authors of the study gave possible reasons for the vocabulary differences they found:

- Some parents put their children in front of the television for up to twenty hours per week. They thought watching this

material would help with brain development, but in fact it meant less time that the babies spent with people talking directly to them.

- Learning speech is partially a process of reading lips. Babies need to see people speaking in order to learn how to move their mouths and lips. Many baby DVDs instead show abstract pictures with voices talking about them.
- It is not possible to segment sounds in speech without seeing people speaking.
- These videos and DVDs lacked the visual and auditory components of speech interaction that are appealing to babies, that is, a face and voice to perform for and respond to.

Videos and DVDs could be made for infants with people speaking directly to the screen, and that might make a little difference. However, this would still leave out the most important component of learning to speak: human interaction.

A recent study published in the *Proceedings of National Academy of Sciences* suggests that babies lip-read as they learn language (Lewkowicz & Hansen-Tift, 2012). The study, from Florida Atlantic University, was conducted using 179 babies aged four, six, ten, and twelve months from English-speaking families. The study stated that the four-month-olds looked at the eyes of the speaker, but as the children got closer to beginning to babble, their gaze shifted from eyes to mouth. By six months of age, the babies spent half of their time looking at the eyes of the speaker and the remaining time at their lips. The eight- and ten-month-old babies spent most of their time watching the mouth of the speaker. As the babies prepared to begin speaking, most at the age of twelve months, their gaze shifted back to eyes. Confirming the need for lip reading was accomplished by having these babies watch a Spanish speaker.

## Nature Versus Nurture

Are children born with an innate ability to speak, or is it their experiences and their environment that pave the way for language? Although the brain was once described as a tabula rasa, a blank slate, many researchers believe that the answer lies somewhere in between a blank slate and a preprogrammed mind.

Although children are born with the ability to learn speech, language learning does not occur in a vacuum. Babies don't begin speaking a language that they have never heard. Little Maeve will learn to speak English because her parents and others in her environment speak only English. If Maeve's Russian grandmother lived in the home and spoke only Russian, Maeve would easily pick up that language, too.

Again the eyes shifted to the mouth so babies could see how the sounds were formed.

When Maeve begins to babble, she will make sounds that imitate the phonemes that she has been exposed to and also some sounds from other languages that she has not heard. She will simply be producing whatever sounds she can. Once she becomes more aware of her own language, she will repeat the sounds that she hears.

### *The Right Way to Babble*

It may be hard to believe that babbling has been researched, but the University of Memphis has researchers who have done just that. Analyzing the sounds that babies make beginning at birth (Oller, 2010) has uncovered some interesting milestones in the process of learning language.

Babbling is an element of brain development in both social and emotional areas as well as cognitive development. It represents the learning that is taking place in relationship to language, and it is also an attempt to communicate and interact with the caregiver. A baby who isn't babbling in a typical way may have problems hearing or processing sounds, or perhaps the baby's brain is not being introduced to enough words.

According to pediatrician Perri Klass, babies babble in all of the world's languages. It is a universal sign of neurological development and an indicator of speech readiness. From babbling, infants and toddlers move on to making the sounds of their language and create words appropriate to their environments.

If a baby is not making those combined consonant vowel sounds, there may be a problem. By seven months (remember that development can vary among babies), if the baby is making only vowel sounds, the baby is not getting the practice she needs to begin to form words. Her mouth and tongue are not working the muscles necessary for good speech either (Stoel-Gammon, 2001).

Babbling may be a signal that babies are focused for learning, indicating an opportunity to have the baby's attention as he explores the world and wants to name the objects and people around him.

### *Encouraging Speech*

Parenting experts offer some of the following suggestions for encouraging babies to use their language:

- *Talk a lot.* Between birth and three months, babies begin to acquire language, even though they cannot yet speak, so parents and caregivers are encouraged to talk to babies often.
- *Point out things.* As you talk to the infant, name items and describe what is going on.

- *Help the infant listen.* Point out the sounds around him: “Do you hear the clock?” “Is the dog barking?”
- *Play games.* The rhythm, rhyme, and play of games such as “Peek-a-boo” and “Pat-a-Cake” show the child that language is fun.

Studies have shown that babies whose mothers talk a lot have larger vocabularies than those whose mothers talk very little. It is possible, however, to take talking to the baby too far. Talking at a baby nonstop is not what promotes good language. Asking questions and responding to what the child says are also important.

The most famous study of children and language was carried out by Betty Hart and Todd Risley from the University of Kansas. Although an older study (1995), it is often still considered the gold standard when it comes to determining language development in children. In this groundbreaking work, researchers went into the homes of families of varying socioeconomic status and videotaped the parents as they interacted with their babies, who were between seven and nine months old at the beginning of the study. The taping was done once a month until the children were three years old.

In their book *Meaningful Differences in the Everyday Experiences of Young American Children* (1995), Hart and Risley state, “By age 3 the children in professional families would have heard more than 30 million words, the children in working class families 20 million, and the children in welfare families 10 million” (p. 132). Although the number of words spoken was different, the style of speech and the topics were similar. The more the parents spoke, however, the more likely they were to ask the child questions and the more varied the vocabulary became, so the children received more experience with different language qualities.

In addition to counting the number of words that parents spoke to the children, Hart and Risley also examined the types of reinforcement the children received. Table 1.1 shows the number



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