

# Developmental Dyslexia

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Problems learning to read potentially are multifaceted. Broadly, deficits can fall into one or more of the following areas: difficulty reading whole words accurately and eventually reading them fluently in context; cognitive, language, and vocabulary deficits that limit children's ability to derive meaning from books; and lack of motivation [1]. These three areas not necessarily are independent; a loss of interest in and motivation to read may be the consequence of difficulties in reading or language processing. Within each of these areas are additional processes that may break down and contribute to deficient reading skills.

Lyon and colleagues [2] define dyslexia as “characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities.” These difficulties are unexpected in relation to other cognitive skills and occur despite effective reading instruction. This generally agreed-on definition suggests that individuals who have dyslexia show deficits in the most basic of reading processes, word decoding, which can limit comprehension of material read. Decoding is the process of applying phonetic principals to sound words out. Reading requires children to appreciate that words are composed of symbols and sounds. Once children understand that each letter and many letter combinations have sounds and are worth discriminating from one another, they have attained the alphabetic principal [3], a prerequisite to developing effective word reading skills. Children who struggle to develop the alphabetic principal likely find it difficult to establish decoding skills and find the process of learning to read a challenge. Simply put, dyslexia is a specific reading disorder characterized by deficits in word reading or reading fluency.

## Normal reading development

Appreciating the typical developmental process of reading is helpful to a better understanding of areas that might contribute to reading difficulties

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in children. Behaviorally, children often become familiar with books at the end of their first year of life through grabbing and mouthing them. As children progress through toddlerhood, they appreciate phrasing and intonation patterns used by caregivers when being read to. Toddlers who are read to consistently identify book illustrations and engage in dialog with their caregivers about the content of the written word; children may memorize words and phrases in sections of frequently read books. When asked to pick out a particular book, children at this age often are able to do so as if they are reading the title. It is not unusual for preschool-aged children to “read” books as they sit on the floor, opening books and rehearsing memorized text, even turning pages at appropriate times. During this period, children begin to recognize print as distinct from scribble and even “write” in a meaningful way. The ability to use symbols (scribbling) reflects children’s entrée into the abstract nature of language, oral and written. These early literacy activities are reflected and encouraged best through play.

As children enter formal school settings, they transition from prereading skills to a stage referred to as “phonetic cue reading” [1]. During this period, children systematically begin to associate the orthographic representation of letters with their associated sounds. At this point, however, children are not mapping sounds onto all letters in a word, but only on select letter strings, notably the beginning and ending letters, such as the /b/ and /l/ sounds in ball. To become effective readers, children must progress to the point of recognizing all letters within a word and mapping orthographic representations on the correct phoneme. Children who are in the early stages of developing reading skills exert considerable effort in their attempts to decode words. Each word they encounter may be considered novel and require detective work to read accurately. Only with repeated exposure, reading words in context, can words be transferred into children’s automatic lexicon. It is at this point that reading fluency and speed begin developing.

### *Language and reading*

Language contributes to the development of reading skills on several levels. Two comprehensive reviews of the early reading literature conclude that oral language development plays a critical role in learning to read [1,4]. Intuitively, and perhaps having received the most empiric support, is the strong relationship between oral language skills (including vocabulary) and reading comprehension [5,6]. Vocabulary, however, also plays a role in the development of decoding skills and phonologic sensitivity [7,8].

Phonologic sensitivity—children’s ability to identify and manipulate sounds in words—is a microlevel language skill compared with syntactic and semantic processes. There is agreement that the development of this skill is crucial to the acquisition of word decoding skills. Early manifestations of phonologic sensitivity (often referred to as phonemic awareness) in toddlers and preschoolers include the recognition of rhyming words

(ball rhymes with hall). Typically developing children at this age also often recognize other large phonologic segments, such as syllables, and develop an awareness of alliteration (“Bill’s blue ball was bouncy”). It is not until approximately 5 years of age that children typically are able to develop phonologic sensitivity at a phoneme level [9].

As children enter and progress through kindergarten, the single best predictor of later reading skills is alphabet recognition [10]. Identification of letters is a better predictor of reading skill acquisition than letter-sound understanding [11]. It seems, however, that learning letter names alone has little direct benefit on reading development; rather, it affects children’s ability to learn the corresponding sounds associated with the letter [9].

Children who are developing phonologic sensitivity and an appreciation for English orthography and whose syntactic and semantic language structures are intact are in a good position to develop strong word reading and decoding skills.

### *Reading comprehension*

During the primary grades, learning to read is defined as learning to recognize and decode words. At this point, reading comprehension is constrained largely by limited print word awareness. As decoding and word recognition skills improve, there are other factors that play a critical role in children’s ability to derive meaning from written text, including vocabulary, oral comprehension, and working memory [12]. Children use multiple metacognitive approaches to help with understanding text. Children need to understand the structure of reading material, which varies with type of text (ie, narrative or expository) [13]. Having an understanding of story structure influences how one reads, interprets, and ultimately understands a piece of literature. The same can be said for how individuals approach a textbook (expository text); that is, the cognitive schemata for a particular subject influences the author and the reader. Readers also use various strategies to enhance comprehension. Examples of studied strategies used frequently include goal setting, inference making, identifying the main idea, summarizing, predicting, monitoring, and backtracking [13].

Children grow up in families with varying levels of literacy and social interaction. Evidence to date suggests that the home literacy environment predicts kindergarten literacy skills modestly to strongly [1,14]. Family influences on reading development tend to fall into five areas: value placed on literacy as reflected by parent reading and encouraging their children to read; press for achievement, including expectations for children to achieve and responding to children’s interest in reading; availability of reading material within the home; reading to and with children; and opportunities for verbal interaction [15]. The last area speaks to the value of parent-child interactions and its affect, most notably, on vocabulary development, an area known to be an important component of reading comprehension.

## Developmental progression of dyslexia

Although much is written about early predictors of reading problems, the majority of research has focused on reading broadly rather than dyslexia specifically. The connection between early and persistent language deficits and reading is well established. There are early red flags that suggest children are at increased risk for decoding deficits. Schatschneider and Torgeson [16] recently outlined the developmental progression of this disorder, suggesting that children's poor understanding of the alphabetic principal late in kindergarten or in first grade makes it difficult for them to read unfamiliar words (at this point in their life), even though the words may be part of their oral vocabulary. Even before attempts are made to decode words, children must be able to recognize letters of the alphabet. At this age, children's ability to identify letters of the alphabet randomly is a better predictor of later reading difficulties than an entire battery of tests [1]. Results of a large district-wide sample of children [17] suggest that if kindergarten children falling in the bottom 25th percentile of letter naming are identified as at risk, nearly 80% can be identified accurately as having a reading disorder in first grade and only 10% would be missed.

Moving from letter recognition to sound-symbol correspondence requires the ability to map the orthographic properties of the letter on sound properties. Children who have dyslexia struggle with these tasks, which results in their reading slowly, attempting to apply phonetic decoding skills to most words, making frequent errors when reading, and all too often avoiding the reading process because they find it frustrating and difficult. After mastering the alphabetic principal, most children begin to apply phonetic decoding skills effectively and proceed (discussed previously) to frequent reading, which increases sight word vocabulary and in turn fluency. Poor word decoding skills together with few sight words have a negative impact on children's ability to read text fluently. For children who are dyslexic, their poor lower-level skills (phonologic processing and word decoding) create a bottleneck in their academic progress. Impaired reading has an impact on their ability to tap into broad general knowledge. With limited access to text, children, adolescents, and adults who are dyslexic are at risk for having an unfair ceiling placed on their access to knowledge. Stanovich [18] coined the phrase, "Matthew effect," referring to the impact dyslexia can have on individuals. In essence, individuals who can read do read and benefit from doing so. Conversely, individuals who are dyslexic read considerably less than typically developing peers, which affects their continued development of reading skills, vocabulary, and general knowledge. Large-scale longitudinal studies identify increasing cognitive disparities between strong and poor readers [19,20].

## Comorbidities

The co-occurrence of other psychiatric conditions and developmental disorders in individuals who have a reading disability (RD) is high. One study

of disorders co-occurring with a RD included a sample of 179 children; more than half (52%) of the children who had a reading disorder had additional diagnoses [21]. The frequency of overlap between dyslexia and other developmental and psychiatric conditions warrants discussion.

### *Cognitive*

#### *Language functioning*

The connection between language and reading is clear and well supported. As discussed previously, phonologic processing has a direct causal link to early reading (decoding and word reading) skills; children who have strong phonologic awareness are likely to develop strong word decoding skills and those who have poor phonologic awareness are at much greater risk for being poor word decoders [22–24]. The relationship between oral language comprehension and vocabulary development and word decoding, however, is less apparent. In an informative study from the United Kingdom, Snowling and colleagues followed a group of children identified as having speech or language impairment from preschool through adolescence. Literacy (reading and spelling) measures were administered at 5.5, 8, and 15 years of age. Although elevated relative to the expected population rate (3%–5%), children who had impaired language had rates of word reading (8%) and reading comprehension (12%) difficulties that were not as high as expected [25]. Further, children who had phonologic disorders resolved at 5.5 were at no greater risk for literacy or language difficulties. This picture changes as children enter adolescence. Adolescents who have preschool language impairment, resolved or not, showed significantly greater rates of word reading and reading comprehension deficits than normal controls. The rate of word reading deficits rose to 49%, and reading comprehension deficits greater than 1 SD lower than the mean increased to 54% [26]. Nonverbal cognitive functioning did not explain these changes entirely.

This set of studies provides evidence for a concept Scarborough [27] refers to as a period of “illusory recovery.” Children who have early language deficits resolved by school entry seem to progress nicely with early literacy skills. In the absence of phonologic processing deficits, these children are able to develop word reading and decoding skills in a manner similar to same-age peers. As they progress through the grades and the language demands, oral and written, change dramatically, however, children who have early language delays not only lack the language-processing skills, impairing reading comprehension further, but also their early deficits bleed into their ability to decode words effectively [12,26].

The relevance of this phenomenon to dyslexia is seen in the evaluation and diagnosis of reading problems in adolescents and young adults. Dyslexia is considered a developmental disorder, although evidence suggests the need to obtain a thorough speech and language history from middle school- and high school-aged children presenting with reading problems.

What may seem to be late-appearing, word-reading deficits may be a residual language disorder.

### *Matthew effect*

Less a comorbidity and more a correlate of poor reading skills is the concept referred to by Stanovich [18] as the Matthew effect. The idea behind this concept is the boot-strapping effect of early literacy skills: individuals who have strong phonologic processing (and general language) skills likely develop the alphabetic principal and, in turn, strong word attack skills. The ability to read begets an interest in reading, which translates into a greater likelihood to engage in literacy activities [19,20]. There is evidence that reading (or avoiding reading) has a reciprocal effect on basic reading skills (phonologic processing, decoding skills, fluency, and so forth) [28] and several cognitive processes, including children who have dyslexia showing a slight drop in verbal cognitive functioning over time [29] and having smaller vocabularies [28], which have a further impact on reading comprehension.

### *Motor functioning*

The occurrence of motor problems in children who are dyslexic is not surprising in light of the identified involvement of cerebellar functioning in this population [30,31]. There is evidence that the motor problems typically associated with attention-deficit/hyperactivity disorder (ADHD) may be mediated by RD [32]. Motor deficits seem to be global in nature, encompassing fine and gross motor impairments [32,33]. There is some question about the severity of these deficits; Kooistra and colleagues [32] and Iversen and colleagues [33] suggest that impairment is severe enough to warrant a diagnosis of developmental coordination disorder and referral for a motor evaluation. Review of the data reported by Kooistra and colleagues [32], however, finds that groups of children who had RD had average scores on the Bruininks-Oseretsky Test of Motor Proficiency [34] and the Developmental Test of Visual-Motor Integration [35], although significantly different from controls. Further, scores of less than a single SD were considered by the investigators to be at or below the cut-off range for clinical significance. Iversen and colleagues [33], alternatively, found that greater than 50% of children who have RD have motor coordination problems (manual dexterity and balance) that place them at or below the fifth percentile.

In sum, the evidence to date suggests a link between motor impairment and dyslexia; at the least, children who have RD are at greater risk for having minor impairment in fine and gross motor skills. The question of whether or not this level of impairment has a functional impact on these children, and in turn warrants comprehensive motor evaluations, is not clear. This requires evaluation by astute clinicians who are aware of the potential relationship between reading and motor problems to screen for deficits and make appropriate referrals when necessary. One potential area for functional impact is graphomotor skills. Berninger and colleagues [36–38]

have provided considerable evidence of the potentially negative impact graphomotor deficits can have on written output, including development of written expression skills. They provide additional evidence indicating that early and intensive intervention can minimize the effects of motor impairment on written output [33,38,39].

### *Psychosocial*

The relationship between reading problems and psychiatric status, most notably disruptive behavior disorders, is well established [40–43]. A recent nationwide study in the United Kingdom found the odds ratios for the psychiatric conditions ADHD, conduct disorder, anxiety, and depression in children who have RD range from 1.04 (depression) to 3.82 (ADHD); all but depression were statistically significant. Despite high risk ratios, however, a small minority of children met diagnostic criteria for any disorder [40].

Willcutt and Pennington [43] sampled more than 200 twins who had RD and a matched sample with a mean age of 10.5 and found that subjects who had RD showed significantly elevated symptoms of ADHD, oppositional defiant disorder, conduct disorder, anxiety disorder, and mood disorder. After controlling for ADHD, none of the other disruptive behavior disorders were related significantly to RD; internalizing symptoms were not mediated by ADHD. There was a gender interaction, however: externalizing behaviors were related more strongly to boys who had RD and internalizing behaviors were related exclusively to girls who had RD. One consistent finding is that the inattentive type of ADHD is related more strongly to RD than either combined type or hyperactive/impulsive type [40,44].

There is considerable speculation about the nature of the relationship between disruptive behavior disorders and dyslexia. Several theories are forwarded, including unidirectional (reading problems cause behavioral disorders or vice versa) and bidirectional. Willcutt and coworkers [44] provide evidence for bivariate heritability between ADHD-I and RD, but not ADHD-Hyp/Imp. Trzesniewski and colleagues [42] also identify common genetic influences in ADHD-I and RD. Conversely, they report a reciprocal relationship between RD and antisocial behavior and the absence of heritability. In other words, reading problems contribute to acting-out behaviors, which in turn affect reading development negatively.

Although research into the relationship between disruptive behavior disorders and dyslexia is more prevalent and the link stronger, there is evidence that internalizing disorders also have a disproportionate impact on children who have dyslexia. Anxiety consistently is reported higher in subjects who have RD than in controls [40,43], with the greatest risk for generalized anxiety disorder and separation anxiety [40]. Data on mood disorders and RD are less consistent. Although clinically the general belief is that RD and depression are related, the data do not support this notion consistently. A

reasonable conclusion from the data available is that boys who are dyslexic are at greater risk for showing externalizing symptoms broadly and girls are more likely to exhibit internalizing symptoms, especially anxiety. In view of the strong relationship between anxiety and mood disorders, however, the latter must be appreciated.

### *Assessing and diagnosing dyslexia*

Although the assessment and diagnosis of learning disabilities (LD) at first glance may seem a straightforward process, the conceptualization of and guidelines for the identification of these disorders are evolving. Historically, LD has been defined as an unexpected problem learning in one or more of several academic areas and has been operationalized as a discrepancy between aptitude (as measured by IQ) and academic achievement. The *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* [45] and the *International Classification of Diseases, Ninth Revision* [46] use a discrepancy definition for diagnosing learning disorders. As early as 1975, when Public Law 94-142 was implemented in the United States and LDs were considered a handicapping condition warranting special education services, the discrepancy model was one of the defining features. The same definition was adopted as part of the 1997 Individuals with Disabilities Education Act (IDEA). In the most recent IDEA revision, use of a discrepancy no longer is mandatory, although it is optional. Research to date is critical of this approach to defining and assessing any type of learning disorder. Discrepant (IQ > academic achievement scores) and nondiscrepant (nonmentally retarded but IQ not significantly discrepant from academic achievement) poor readers do not differ from each other in their response to educational interventions [47,48] or prognosis over time [49]. Empirically, there is no justification for using a discrepancy model for identifying a reading disorder. Many states and local education agencies continue to use this model for identifying and serving children as having LDs, however, and psychologists often continue to rely on the *DSM-IV* for guiding their assessment and diagnosis of LDs.

### *Intraindividual model*

In view of the current state of practice and in an attempt to be proactive and forward looking, this article reviews the assessment process for reading disorders that is used most frequently and evidenced-based methods foreign to most pediatricians (although they will have to familiarize themselves with the process to understand individualized education plans [IEPs] they receive for their patients). Among elementary-aged children, assessment of reading skills requires, at minimum, objective measurement of word reading, reading fluency, and reading comprehension. Evaluation of word reading must include, in addition to reading whole words, reading of nonsense words that

require application of phonics-based decoding skills (sounding words out). When evaluating children's ability to read words, they are presented simply with a list of words and asked to read them aloud. Similarly, assessing children's ability to use phonetic decoding requires patients to read a set of decodable nonsense words that that progressively are more difficult to read (eg, tib or blub). For younger children (eg, kindergarten and first grade), who are in the process of developing decoding skills, evaluation of skills critical to early reading is a better predictor of later reading problems than the actual measurement of word reading [27]. This includes evaluating phonologic awareness, working memory (memory span), serial naming, and expressive vocabulary. Each of these areas also should be covered in evaluations for children who are beyond the primary grades. Appreciating that reading the written word requires language and visual skills, assessment of orthographic coding is of value. Orthographic coding refers to children's ability to form mental images of words, letters, and letter strings [50], which in turn has an impact on their ability to recognize and retrieve the images rapidly. As outlined by Peterson and colleagues elsewhere in this issue, phonologic processing deficits are at the core of deficiency for the large majority of children who have dyslexia. Clinicians must be in a position to recognize deficits other than those considered typical reasons for a condition, however, because they may have a differential impact on recommended treatment.

Reading is a process that allows humans to access information and in turn increase knowledge. As such, the process of reading, to be most effective, should require minimal cognitive effort. Stated another way, eventually reading words should become a quick and automatic process. For children who are dyslexic, reading fluency often is the area most resistant to treatment and most persistent [51–53]. Many children who have RD develop adequate sight word reading vocabularies and even reasonable word decoding skills. The ability to read words quickly and efficiently, however, does not develop. Evaluating fluency is a critical component in any reading evaluation, especially beyond second grade.

Children's ability to understand what they read can result from several factors, including limited vocabulary [54], poor oral comprehension [55], and word reading deficits [28]. Not only must any reading disorder evaluation include a measure of reading comprehension, it is incumbent on evaluators to understand why children have poor comprehension skills. It is not sufficient to assume that children's reading comprehension problems are the result of decoding deficits exclusively if oral comprehension and vocabulary have not been measured. There is considerable evidence that children who have language impairment have not only comprehension deficits but also phonologic processing limitations that contribute to word reading deficits [56].

As discussed earlier, there is no empiric justification for using an IQ test to diagnose a learning disorder; however, that is not to say that a measure of cognitive functioning cannot contribute to a comprehensive evaluation.

Even if clinicians are comfortable that children's ability levels are within normal limits, there may be cognitive factors that help to explain reading difficulties. For example, most measures of intelligence include a vocabulary component, which plays a critical role in reading comprehension. Various memory dimensions also are included in IQ tests, again a factor that potentially could be helpful in diagnosing RDs and understanding why children are struggling to develop reading skills. Consequently, the constructive use of measures of cognitive functioning can contribute to a LD evaluation. Using an IQ test as a measure to identify the presence or absence of a discrepancy cannot be justified.

### *Response to intervention model*

In the revision of the IDEA that took effect in 2005, the United States federal government included a Response to Intervention model as an empirically supported method to identifying LDs. Unlike the approach discussed previously, this model focuses on multiple short assessments to determine children's status and response to educational interventions. The idea behind this approach is that children at risk for reading problems (and learning problems in general) are identified early and provided with empirically supported treatments. Children are evaluated regularly to monitor progress and those not responding to interventions receive more intensive levels of service. Once it is determined that children have not responded to empirically supported methods of remediation, a diagnosis of a reading disorder is made. This article is not the venue for a comprehensive discussion of this model, yet it is important that pediatricians be aware of this approach, because many of their patients who have learning concerns may be involved in the process, which may be helpful to schools and possibly the children, but does not provide physicians with test results they are accustomed to reviewing (see Fletcher and colleagues [57] for a comprehensive review of assessment of LDs).

### **Pediatric evaluation and management of reading disability**

It is not the responsibility of primary care physicians to make a diagnosis of dyslexia. Physicians often are the first to hear from parents worried about a child's academic progress. Furthermore, although referring children for an IEP team evaluation is a reasonable first step, teams at schools are in place not only to identify children's educational needs but also to determine if services should be provided. It is possible that children may have a LD, such as dyslexia, but do not qualify for any type of service. There also is a range of services that may be available within a specific school system. For example, all schools have early intervention programs for reading and most for math. Involvement with a reading specialist at this level may be the best option for children at that time. The issue not necessarily where the child receives

reading assistance (special education versus a reading specialist) but the type of intervention provided.

Being aware of a family history of language or reading problems is critical. Children who have positive family histories or who show other early risk factors should be considered for evaluation or for an interventional plan. Finding out from parents if their 4- or 5- year-old child is reciting nursery rhymes or interested in playing rhyming games provides an approximate indication of early phonemic sensitivity. Pediatricians even can ask 5-year-old children to produce a few rhyming words (eg, "Tell me a real word that rhymes with ball...mat...car," and so forth). By the end of kindergarten, are children able to recognize lower and upper case letters of the alphabet and are they beginning to associate sounds with letters? Again, in addition to asking parents, physicians can screen by showing children randomly a few letters and asking them to name them and identify the associated sounds. Asking parents if their first-grade child is beginning to apply phonetic decoding skills gives an idea if the child has begun to apply what should be being taught at school. Avoidance or lack of interest in reading, especially when paired with observed (either by parents or teachers) reading difficulties should be cause for concern. It is better to intervene early; evidence to date suggests that taking a wait-and-see approach to reading seldom is successful [19,49,52].

Interested pediatricians have access to screening measures for learning difficulties [58]. One such resource is the Wide Range Achievement Test 4 (WRAT4) [59]. This instrument has solid psychometric properties and includes a nationally represented normative sample for individuals ages 5 through adulthood. The WRAT4 consists of three subtests that measure word reading, spelling, and arithmetic calculations. Administration time is approximately 10 to 15 minutes. Adequate performance on either the word reading or the spelling component does not rule out dyslexia. Poor performance, however (ie, below a standard score of 90), in the context of reading concerns reported by teachers or parents may warrant a referral for a comprehensive evaluation by a psychologist or neuropsychologist. The two cases in this article present common patient concerns expressed to pediatricians.

## Summary

Reading skills progress in a stage-like manner, like many other developmental processes. There is no evidence that reading, unlike language, develops without direct instruction. Failing to develop preceding skills has a dramatic impact on development of more sophisticated reading skills. For example, children who have poor phonemic sensitivity struggle to develop phonetic decoding; poor word recognition and word decoding skills have a negative impact on reading comprehension. Primary care physicians need to be aware of reading and potential reading problems and frequent comorbid conditions. Awareness and recognition of risk factors can help

physicians direct children early to badly needed resources. Although there is no guarantee that remediation of reading problems allows children to avoid co-occurring and comorbid conditions often associated with dyslexia, at the least it decreases the risk for and minimizes the impact of one additional challenge for these children.

## Case 1

### *History and symptom presentation*

Jim is a 9-year-old African American boy who just began third grade. Parents and teachers always have believed he was making adequate academic progress in all areas. In fact, parents stated that he was “reading” books at 5 years of age, and although he struggled somewhat with second grade–level books, he was able to understand the material well. They gave examples of him laughing while lying in bed and reading a few of the books in the *Captain Underpants* series. When asked what was so funny, he was able to tell his parents all about the story and the potty humor that was so appealing. Third grade has been a challenge, however. His third grade teacher had been told by previous teachers that Jim was bright and needed to be challenged, yet the teacher was perplexed because Jim did not like to read aloud during reading group and began to act silly and goofy during those times. When evaluating his reading skills informally, the third grade teacher placed Jim in the lowest reading group, explaining to his parents that he had good “strategies” for reading words, including use of picture cues and context cues to figure out words; however, he seldom applied phonetic decoding principals.

### *Test results*

Jim’s pediatrician referred him for a private psychological evaluation. On interview, it was determined that although there was no family history of reading or language deficits, Jim’s father had never read a novel in his life. He reads the newspaper but finds that reading takes too long and tends to get most news from the local TV station or CNBC. His father also indicated that he relies heavily on spell check when sending email messages at work. Jim’s mother said that when she and her husband first were married she could not decipher his spelling, although over the years she has gotten pretty good at doing so. Testing with Jim indicated strong language skills, including oral comprehension and vocabulary skills that were in the 80th percentile. When reading aloud, he could not read the word “erupt,” and therefore could not answer the comprehension question correctly. Later, when asked what the word “erupt” meant, he defined the word easily. Reading of whole words fell in the 16th percentile, which is considered low average, but reading of nonsense words, words that require phonetic decoding, fell in the second percentile. Not surprisingly, phonemic awareness skills fell in the fifth percentile. Test results support the hypothesis that as a youngster Jim was memorizing books and relying on whole words he was able to memorize. When the reading demands increased, he was unable to keep pace with same-grade peers, despite his strong language skills.

### *Disposition*

Jim was diagnosed with dyslexia and qualified for special education services for children who have a specific RD. No comorbid conditions were identified. He began receiving special education services, but because a comprehensive and systematic approach to word reading was not being applied, even after multiple attempts on the part of the parents and the clinician to encourage the LD teacher to do so, the decision was made to seek outside reading assistance from a dyslexia specialist. Although this added an hour to Jim's school day 3 times a week, because he recognized gains and liked the tutor, he generally was okay with attending.

## **Case 2**

### *History and symptom presentation*

Shelly was a delightful, energetic 6-year-old white girl. She was midway through first grade when her parents received a call from the teacher expressing concerns about Shelly's behavior in the classroom. The teacher noticed that Shelly did not seem to understand and follow directions. He gave examples of the class transitioning from spelling to math and Shelly having her spelling material out when the other kids had their math books on their desk. When she looked at the kids in the seats next to her and saw that their math books were out, she quickly would pull out the correct book. The teacher also noticed that Shelly's verbal responses to questions tended to be brief and include minimal verbiage. Although she was developing some sight words when reading, the teacher noted that Shelly still did not recognize a few lower case letters consistently and also continued to mix up the upper case letters, B and D, when asked to identify them orally. The teacher estimated that Shelly was able to identify approximately 65% of letters' sounds.

### *Test results*

The school initiated an IEP team evaluation. The school psychologist found that Shelly's IQ was in the low-average range, reporting the following scores from the Wechsler Intelligence Scale for Children—Fourth Edition [60]: full scale IQ 89, verbal comprehension index 79, perceptual reasoning index 110, working memory index 86, and processing speed index 91. The LD diagnostician administered the Woodcock-Johnson III Tests of Achievement (WJ-III) [61]. All reading measure scores were in the low to mid 80s, where the mean is 100 with a SD of 15. The sound awareness subtest from the WJ-III also was administered, which evaluates different types of phonemic awareness; Shelly earned a standard score of 79. The school reasoned that Shelly's reading scores were commensurate with cognitive functioning and, therefore, she did not have a LD.

Shelly then was seen privately because the parents believed they were getting little direction from the school. On review of the testing completed through the school, it was determined that little additional cognitive or

educational testing was needed; rather, Shelly was referred for a language evaluation. The speech/language pathologist reported scores of receptive language that fell in the 14th percentile and expressive language in the third percentile. Additional evaluation of phonologic processing identified, as expected, severely deficient phonemic awareness and phonologic memory. Test results were presented to the school and an alternative interpretation of the original evaluation was suggested; that is, her low overall cognitive functioning was a reflection of language deficits and related memory concerns, not intelligence.

### *Disposition*

The school agreed with the alternative interpretation of the original test results and accepted the language evaluation completed through the hospital. Shelly was diagnosed with a mixed receptive-expressive language disorder and began language therapy through school twice a week. School personnel still did not believe that she met the criteria of children who have a LD but agreed that Shelly needed early intervention services, and she began working with a reading specialist 3 times a week. The speech/language pathologist and reading specialist consult with each other to coordinate services to make sure phonologic processing skills are addressed and match up with instruction in sound/symbol correspondence.

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