



## A Lower Brain Connection

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In our ten-plus years of facilitating the Brain Highways program, we have successfully worked with many participants who were given a diagnosis before we met them. Many of those diagnoses (e.g. Attention Deficit Disorder) were based on established clinical criteria. Other diagnoses (e.g. William's Syndrome) resulted from a genetic disorder caused by a chromosomal aberration or an absent or defective gene.

Our initial screening showed that these children also had retained primitive reflexes, underdeveloped lower centers of the brain, and poor sensory processing. Therefore, our goal and expectation for change for them was no different than for our other participants: These children would not reach their full potential until they inhibited their primitive reflexes, finished developing their lower centers of the brain, and improved their sensory processing.

The Brain Highways program differs from most in that it does not accept that certain behaviors are simply a given because a child has a particular diagnosis. Instead, we're always asking, "Why? Why would a child's brain need/want to do whatever behavior is being observed?"

Note that such a question is not asked to challenge a current diagnosis, treatment, or therapy. Rather, the Brain Highways curriculum is offered as an enrichment program. It is a way to help determine if some (or many) of a child's behaviors might be caused by retained primitive reflexes, underdeveloped lower centers of the brain, and poor sensory processing. If so, then it's possible to eliminate those related behaviors once the brain has reorganized itself. In turn, such children have a much easier life, with fewer concerning behaviors.

Learn how retained primitive reflexes, underdeveloped lower centers of the brain, and poor sensory processing may relate to specific diagnoses and problems commonly associated with them.

### **ASPERGER'S SYNDROME**

Peripheral vision is acquired with pons development, so **avoidance of eye contact** can be a sign of an underdeveloped pons. We don't often realize that we use our peripheral vision as "anchors" to help us maintain eye contact. When we try to make eye contact without peripheral vision, we're forced to stare. Since staring becomes uncomfortable rather quickly, we naturally turn to look elsewhere.

Kids may also avoid eye contact because their eyes do not team, in sync, to see one image. In such cases, these children may see multiple images when looking directly at a person's face. Again, the more natural inclination is to look away (multiple images can be very distracting)—especially if the child is trying to process what that person is saying.

**Heightened sensitivity to loud noises, lights, strong tastes and textures** can be signs of an underdeveloped midbrain. One of the midbrain's functions is to filter unimportant sensory information. If the midbrain is not fully developed, too much unnecessary sensory information floods the child's cortex.

**Problems with coordination** can be a sign of poor vestibular and proprioceptive processing since both are related to balance and spatial awareness.

**Not understanding social cues** can also be signs of poor sensory processing. In order to respond appropriately to social cues, information has to first be interpreted and processed correctly—something that may not be possible when higher centers of the brain are continually preoccupied with compensating for the underdevelopment of the lower centers.

**Delayed motor development** can be a sign of retained primitive reflexes since they interfere with the brain's natural way to develop gross and fine motor skills. Primitive reflexes also make a child more prone to **reactive, rather than reflective, behavior**.

Children who **dislike change in routine** may be missing several automatic functions that are associated with a well-organized brain. Since such children are always compensating, an unfamiliar routine requires new ways to compensate—and that is stressful.

## ATTENTION DEFICIT DISORDER AND ATTENTION DEFICIT HYPERACTIVITY DISORDER

Kids with retained primitive reflexes and poor sensory processing may be **easily distracted** since they are often more preoccupied with survival compensations than the task at hand.

Children who are easily distracted may also have an underdeveloped midbrain. An underdeveloped midbrain is not able to filter unimportant sensory information from bombarding the cortex. So with everything competing for the brain's attention, it's truly difficult to remain focused on the task.

**Poor organizational skills** and **procrastination** can be further signs of an underdeveloped midbrain. When the brain is well-organized, it is able to see the "larger picture" and prioritize tasks. In contrast, a disorganized brain often can't figure out how to start a task (let alone complete it).

**Not listening when spoken to** can be a sign of an underdeveloped pons. Visual and auditory awareness only develop when the pons is fully functioning. So children with an underdeveloped pons will not likely "hear" someone calling them or giving them a direction if their backs are turned to that person. It's as though people do not exist unless they are standing directly in front of these kids.

Children who have trouble **sustaining attention** may be missing several automatic functions that are associated with a well-organized brain. For example, if eye teaming is poor, the two eyes do not work together to see one image. These kids often see words as multiple images, or they see the ending of one word shifting into the beginning of the next. This will make it difficult to read or write for any length of time.

**Fidgeting and squirming in chairs, getting up when asked to remain seated, and dashing around** can be signs of poor vestibular processing. Movement stimulates this system, so these kids will intuitively move in order to help a sluggish vestibular system get going. This system is also related to balance, and it is actually much easier to balance while moving.

**Appearing to zone out** can be yet another sign of poor vestibular processing. If such children are not able to move to awaken the sluggish system, they will not be able to focus or stay alert.

In short, the lower centers of the brain are supposed to support the higher cognitive functions. When the brain is organized this way, we can choose what we focus on. In a disorganized brain, we don't always have that option.

## AUTISM

In addition to behaviors associated with Asperger's Syndrome, other common behaviors associated with autism can also be signs of retained primitive reflexes, incomplete development of lower centers of the brain, and poor vestibular and proprioceptive processing.

**High tolerance of pain** can be a sign of an underdeveloped pons. Therefore, **self-injurious behavior**, such as head banging, may actually be an attempt to seek extraordinary stimuli just to "feel" something.

Appearing **unaware of visual and auditory** input can also be signs of an underdeveloped pons. Until the pons is developed, such kids just see and hear whatever is right in front of them. When these children are not directly in front of a speaker (and even then, some additional tactile stimuli may be needed), that person no longer exists.

**Extreme tantrums** can be signs of retained primitive reflexes. In such cases, these children immediately react, rather than reflect, as soon as something does not go their way. While these survival reflexes are helpful to small babies, they were never intended to remain active once the child was upright.

**Repetitive, self-stimulating movement**, such as rocking, pacing, and spinning, can be signs of poor vestibular processing. Kids will often initiate such movements to awaken a sluggish vestibular system. Note that poor vestibular processing also affects the ability to pay attention, as well as how information is processed by the other sensory systems.

**Hitting a particular body part** over and over again may actually be in response to poor proprioceptive processing. Such kids will often hit body parts that their brains do not innately “sense.”

Children who **resist cuddling or snuggling** may have distorted sensations to touch. When the midbrain is not fully developed, such kids’ brains may register light touch as anywhere from unpleasant to painful.

**Perseverating** over a thought or object can also be a sign of an underdeveloped midbrain since another midbrain function is that it gives us the ability to “shift gears” easily. When midbrain development is incomplete, these children often get stuck on an idea or object, and they can’t seem to move on to something else.

Children who have **problems with communication** may be missing several automatic functions that are associated with a well-organized brain. In such cases, the brain prioritizes survival skills and compensations as a higher priority than language development.

## **BIPOLAR DISORDER**

**High tolerance of pain** can be a sign of an underdeveloped pons. Therefore, **self-injurious behavior**, such as cutting, may actually be an attempt to seek extraordinary stimuli just to “feel” something.

**Anxiety** and **suicidal thoughts** can also be signs of an underdeveloped pons. When the lower centers of the brain are not developed, the brain is wired to be “on guard” all the time. Almost everything is viewed as a possible threat. Such a state of hypervigilance can create a lot of anxiety.

Likewise, if the Moro reflex is still active past the first four months of life, such children are wired to react with a fight or flight response whenever something is perceived as a threat (even if others do not view it that way). While a mild form of flight behavior is to retreat from an activity, suicide is the most dramatic expression.

**Poor concentration** can be a sign of an underdeveloped midbrain. If the midbrain is not fully developed, it will not always filter unimportant information from flooding the cortex. A disorganized brain must pay attention to much, much more than an organized brain.

Children who experience **insomnia or oversleeping** may be missing several automatic functions that are associated with a well-organized brain. For example, the hypothalamus, which is part of the midbrain, generates many body functions that include our sleep/wake cycles.

## **CENTRAL AUDITORY PROCESSING DISORDER**

**Problems with processing auditory information** can be signs of a poorly functioning vestibular system. This important sensory system is located in the inner ear, and it’s the first to receive input before sending it on to the other senses. However, if the initial vestibular input is poor, then the other senses (e.g. auditory) will not have good information to act on. In such cases, the root of the problem may be with the vestibular, rather than auditory, system.

**Problems with paying attention and filtering background noises** can be signs of incomplete midbrain development. One of the functions of the midbrain is to act as a filter of unimportant information. However, when this is not working as intended, it’s very difficult to focus since everything entering the brain competes for attention.

**Poor spelling** can also be a sign of an underdeveloped midbrain. With a developed midbrain, we are able to process more detailed information, including hearing the differences among similar sounds (e.g. how short i sounds in comparison to short e). Without such awareness, we will not be able to accurately spell a word by sounding it out.

Children who routinely **need information repeated** may be missing several automatic functions that are associated with a well-organized brain. For example, these children may process the rate of speech a little slower than how everyone else is hearing it. So they just need a little more time to finish processing the original message. If the speaker waits a few seconds after the child says, “What?” or “Huh?” the child usually responds appropriately.

## **DYSLEXIA**

**Problems with motor skills and handwriting** can be signs of retained primitive reflexes. For example, in the early stage of hand development, the baby has difficulty releasing whatever she is holding. So not only will children with the Palmar Grasp Reflex need to override this reaction when writing, but they also won't have acquired the kind of flexibility and control that comes with subsequent natural hand and finger development.

**Problems with auditory discrimination** can be signs of an underdeveloped midbrain and poor vestibular processing. For example, poor vestibular input can affect the child's ability to distinguish the differences among sounds.

**Problems judging space** can be a sign of poor proprioceptive processing. When this sensory system is not functioning well, children may not move easily through their environment (e.g. they bump into furniture).

Likewise, our sense of direction depends on our knowledge of where we are in space. So, if children's directional reference is faulty, they may write **reversals**.

Children who make **transpositions, omissions, and substitutions** while reading and writing may be missing several automatic functions that are associated with a well-organized brain. For example, if eye tracking and eye teaming are poor (or nonexistent) as a result of incomplete lower brain development, it will be difficult to read and write with accuracy.

**Difficulty sustaining attention** can also be a sign of a brain that is mostly preoccupied with survival. Such children often appear highly intelligent and articulate, yet they have great difficulty when asked to read, write, spell, or do math.

## **DYSGRAPHIA**

**Illegible writing** can be a sign of one or more retained primitive reflexes. For example, if the Palmar Grasp Reflex is still active, such kids are still “wired” to clutch whatever they are holding. So they will not naturally develop the tripod pincer grip, and the latter is what we use to hold a pencil correctly. These kids then either spend a great deal of effort trying to override the Palmar Grasp Reflex (and then what is left to remember how to write the letters?), or they will attempt to write without a proper grip. Both scenarios often result in illegible writing.

A retained Asymmetrical Tonic Neck Reflex (ATNR) and Symmetrical Tonic Neck Reflex (STNR) interfere with writing in a different way. When these reflexes are still active, head movement causes the arms and legs to bend and straighten involuntarily. For example, a child with a retained ATNR will want to straighten his arm every time that he looks at the pencil. But every time that he looks away, his arm will want to bend. Such back-and-forth movement affects the motor control of the wrist and fingers and results in **poor penmanship** and **fatigue when writing**.

Until the ATNR is inhibited, it's almost as though there is a “wall” between the left and right brain hemispheres. When such kids cannot get across the wall, they may not be able to retrieve information that was stored in the opposite hemisphere. This, then, may explain why some children are **inconsistent in recalling how to write letters**.

Writing letters also requires the ability to see details that differentiate letters from each other. Being able to see details is acquired when the midbrain develops.

## DYSPRAXIA

**Problems with hand-eye coordination, fine motor skills, and the integration of two sides of the body** can be signs of one or more retained primitive reflexes. For example, if the Asymmetrical Tonic Neck Reflex is still active, it's as though a wall separates the left and right brain hemisphere. This makes it difficult for a child to cross the midline and do tasks that require right and left brain integration.

**Problems with clumsiness, tripping, spilling, and lack of awareness of body position** can be signs of poor proprioception. A well-functioning proprioceptive system provides on-going information that tells us where our body parts are and what they're doing (without looking at them), and where we are in relation to other people and objects in the environment.

**Problems with balance** can be a sign of poor vestibular processing. Without a natural sense of balance, motor activities such as riding a bike may not be possible.

## EATING DISORDERS

**A decreased sensation of appetite**, the primary symptom of anorexia, can be a sign of an underdeveloped pons. When the pons is very underdeveloped, the brain does not "sense" that it needs to eat.

**Preoccupation with food**, the primary symptom of bulimia, can be a sign of an underdeveloped midbrain. Here, the brain never gets the feedback that it is "full."

**A distorted body image** can be a sign of poor proprioceptive processing. In such cases, the brain does not "see" the body as others do. This may explain why some teens can think they're overweight when everyone else is concerned with their low body weight.

## LEARNING DISABILITIES

The criterion for having a learning disability is **a considerable difference between intellectual ability and achievement**. However, such discrepancy is also a hallmark of a disorganized brain.

Retained primitive reflexes, incomplete development of the lower centers of the brain, and poor vestibular and proprioceptive processing are going to affect a child's ability to express cognitive thinking, perform motor skills, and learn the content curriculum with ease and success. Such kids will have **trouble registering, storing, and retrieving information** and that, in turn, causes **problems with reading, writing, and math**.

For example, both brain hemispheres need to work *together* to solve a math problem: We use our right hemisphere to recognize symbols and numbers and to test the plausibility of an answer. We use our left hemisphere to understand the meaning of symbols, register procedures, carry out sequential tasks, and align numbers in correct columns. So a retained Asymmetrical Tonic Reflex can interfere with good communication between the hemispheres. As a result, such children often experience difficulty in math.

## **OPPOSITIONAL DEFIANT DISORDER**

**On-going arguments** and **frequent temper tantrums** can be signs of a retained Moro reflex. In such cases, the child is in a constant fight or flight state since this reflex stimulates the production of adrenaline and cortisol. When that happens, the body is physiologically wired to fight—and will do so in response to the stress hormones that were just released.

Children who routinely **refuse to comply** may be missing several automatic functions that are associated with a well-organized brain. For example, it may seem like a child is being defiant when he doesn't want to get dressed. However, certain fabrics and clothing tags may register as extremely bothersome to his brain if the midbrain is underdeveloped. The child's refusal to get dressed is based on a physical reaction, rather than a desire to be uncooperative and defiant. Likewise, kids with a disorganized brain are continually compensating, so life is simply easier when *they* control what happens. Insisting on doing something their way ensures that they won't fail at a task—and avoiding failure may supersede being viewed as compliant. Refusing to do what is asked also gives these children a brief sense of control, something that is not often experienced with a disorganized brain. They feel empowered when they thwart everyone else's sense of calm.

Children who routinely express **negativity and resentment**, and **blame others for mistakes** may also be trying to function with a disorganized brain. Since these children are smart, it is very frustrating when they're not always able to perform like others whose brains are functioning as intended. Such on-going frustration often turns into vindictiveness towards others.

## **OBSESSIVE COMPULSIVE DISORDER**

**Recurring thoughts and images** can be a sign of an underdeveloped midbrain. It's as though a thought or image is stuck on a gear that keeps spinning around and around, and the brain does not seem to know how to naturally transition to something else.

Children who experience on-going **anxiety**, especially when what they worry about seems odd to others, may be missing several automatic functions that are associated with a well-organized brain. For example, if the Moro reflex is retained past the first four months of life, kids will continue to be anxious, even though their anxieties seem strange to others.

**Acting out an obsession** can be a way a disorganized brain compensates. In doing so, such kids feel as though they have some immediate control over what is making them feel anxious at that moment.

## **REACTIVE ATTACHMENT DISORDER**

**Problems with trust and attachment** can be a sign of an underdeveloped pons. In natural brain development, the primary caregiver meets the baby's needs so that she can feel safe and secure. However, children who were abused, neglected, or had medical emergencies that interrupted natural bonding between the parent and child may have missed important parts of pons development.

As a result, these children continue to rely on the primitive areas of their brain, even when they are no longer in those prior stressful environments. **Fight, flight, or freeze responses** to anything that is perceived as stressful may have become the norm since such kids live in a constant state of hyper arousal. These children's prior experiences may have also "taught" them that people are unreliable. As a way of coping, they may then believe that they do not need others.

**Poor eye contact** and **self-injurious behavior** can also be signs of an underdeveloped pons. For example, children with an underdeveloped pons will not likely have good peripheral vision, and that is needed to maintain eye contact. They may also have high thresholds to pain, so such children seek extreme action (e.g. cutting themselves with razor blades) in order to help them "feel" something.

## READING PROBLEMS

**Difficulty with decoding** can be a sign of poor functioning vestibular system. Such kids do not correctly process how letters sound. That then makes it difficult to decode words with accuracy.

Poor vestibular processing may cause children to **lose their place** when reading. The vestibular system is supposed to act like a tripod to the visual system. However, if this tripod is not still, words may move. For example, the ending of one word may run into the beginning of the next, or whole words may move around the page. Both scenarios make it difficult for kids to keep their place when reading.

A retained Asymmetrical Tonic Neck Reflex may also cause children to lose their place while reading. When this reflex is still active, the eyes have difficulty moving smoothly across the midline and tracking sentences on a page. As a result, the eyes sometimes “bounce” when they are unsuccessful at crossing the midline. When that happens, the eyes skip elsewhere on the page.

Good eye tracking and eye convergence develop naturally when the pons and midbrain are fully developed. Both skills need to be automatic in order for children to understand what they read without distraction. However, if such eye movement skills are not mechanical, then these children may have **poor reading comprehension**. It's not that they aren't *capable* of understanding what they read. Rather, they lack adequate eye skills that enable them to register the information—and none of us can recall something that never entered our brains in the first place.

Children who **avoid reading** may be missing several automatic functions that are associated with a well-organized brain. Avoidance is a way of compensating since such children already know that they're not going to experience joy or success when reading.

## SENSORY INTEGRATION DISORDER

In the hierarchy of brain development, reflex inhibition and pons and midbrain development are supposed to happen early on. Such initial development is necessary in order for our other senses to work optimally.

Therefore, retained primitive reflexes, an underdeveloped pons, and an underdeveloped midbrain may explain *why* a child has **difficulty processing sensory messages from the environment accurately**. For example, a retained Tonic Neck Labyrinthine Reflex will affect vestibular processing. A child first needs to inhibit this reflex before his vestibular system will function optimally.

## SPEECH AND LANGUAGE DELAY

Children who **fail to meet the developmental milestones for language development** and who have **incomprehensible speech after three years of age, difficulties with placing words in a sentence in the correct order, problems with articulation, and distortion of certain sounds** may be missing several automatic functions that are associated with a well-organized brain. For example, articulation and intonation are functions of the midbrain, so they can be affected if such development is incomplete.

Moreover, a child's brain will be preoccupied with survival if primitive reflexes are still active, pons and midbrain development are incomplete, and sensory processing is poor. Natural language development may be put on hold since the brain can only attend to so much at one time. If we are put in the position of having to select survival or language, we are wired to choose the former.

## WRITING PROBLEMS

**Skipping over words** (when copying) and **inconsistent spacing between letters and words** can be signs of poor eye movement skills. Such skills are acquired naturally with pons and midbrain development.

**Too dark or too light handwriting** can be signs of poor proprioception. If this system is not providing the correct feedback, these kids will not sense correctly how much pressure is needed to write on the paper.

**Illegible handwriting** can be a sign of one or more retained primitive reflexes. For example, if the Palmar Grasp Reflex is retained, kids don't pass through subsequent natural stages of hand release and finger mobility. These more advanced skills are needed to produce good handwriting.

Kids may also **fatigue when writing** since retained primitive reflexes may additionally make it difficult to sit and write for any length of time. For example, when Tonic Neck Reflex is on, there's an extra gravitational pull to the earth. While that pull is helpful to an infant, it may cause an older child with this retained reflex to slouch or put her head on the desk when writing.

Children who **write just the minimal requirement** may be missing several automatic functions that are associated with a well-organized brain. For example, kids with retained primitive reflexes, an underdeveloped pons and midbrain, and poor sensory processing are just too preoccupied with survival to pay attention to much else. Such distractions always receive first priority, so there's not much chance that these kids are going to also generate creative thoughts, let alone remember spelling, grammar, and punctuation rules.

**Avoidance of writing** can be another general sign of a disorganized brain. Since these kids are missing so many automatic brain functions to write with ease and success, it's too difficult to find ways to compensate. So, they just avoid writing altogether.