Interview with Sally Goddard Blythe: reflexes—intrauterine, primitive, and postural

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Abstract

This interview discussed the role of primitive and postural reflexes in development of the central nervous system. Primitive and postural reflexes are present at key stages in development. An individual's reflex profile reflects maturity in the functioning of the central nervous system and can be used to evaluate possible causes of presenting developmental difficulties, provide indications of appropriate remedial intervention and measurements of change before, during and after intervention. Methods of assessment and types of remedial intervention developed at The Institute for Neuro-Physiological Psychology (INPP) in Chester, UK are discussed in relation to specific learning disabilities, sensory processing problems and autistic spectrum disorders.

Keywords: primitive and postural reflexes, learning disabilities, sensory processing, autistic spectrum disorders, school programs, interhemispheric functioning, myelination

Good morning, and welcome to Autism: Help, Hope, and Healing. I'm Teri Small. We welcome from England, Sally Goddard Blythe, who is the Director of the Institute for Neuro-Physiological Psychology and International Director for the International School for Neuro-Developmental Training and Research. Sally Goddard Blythe is the author of the books entitled Reflexes, Learning and Behavior: A Window into the Child's Mind and The Well-Balanced Child:Movement and Early Learning. The INPP assesses children and adults with neuro-developmental delays, and administers remedial programmes to correct the underlying, and previously undetected, causes of their presenting problems. INPP is also a training center for those professionals from various countries working in special needs of children, and those professionals working with adults who wish to use the techniques that it has developed.

Sally, thank you for talking with us today.

A pleasure.

What are the general categories of reflexes?

If we're looking at reflexes that appear early in development, it's generally accepted that there are three main groups. The first group are called intra-uterine reflexes. These are reflexes which start to emerge as early as five to seven and a half weeks after conception; they're very, very early, and they should develop during uterine life and gradually start to be integrated or modified during life in the womb. Then the second group are called primitive reflexes and these are reflexes which also start to emerge during life in the womb starting about nine to twelve weeks after conception. These should be fully present at the time of birth in a full-term baby, (forty weeks' gestation) and then are gradually inhibited by the developing brain in the first six months of life so that they should not be active in the older child or the older individual beyond this age. They in turn are gradually replaced by what are called postural reflexes, which are reflexes that begin to develop after birth, take up to about three and a half years of age to be developed fully, and should ideally stay with us for life to support automatic control of posture, balance, and movement capabilities in a gravity-based environment.

Now, to reiterate, you mentioned uterine, primitive, and postural reflexes and when you were describing primitive reflexes, you used the terminology "full term baby," and so that brings to mind the question. Iif a baby is premature, might they have a greater likelihood of having a dysfunction in their reflexes?

Only if they're born very prematurely, then the primitive reflexes will not have developed completely because they need up to forty weeks' gestation to be fully developed at the time of birth. In the baby who is born eight to ten weeks early, we know that things like the rooting and suck reflex are not as well-developed; so in addition to other problems that premature babies have anyway, these children may have difficulty latching onto the breast, sucking, and being able to feed in the first two weeks of life.

Okay. And that's interesting. You also bring up" in addition to other problems they may have," so in addition to other problems that developmentally delayed children or children with neurodevelopmental disorders have, might people overlook problems with reflexes because they're attributing deficits to something else?

Yes. The tendency is to look at the most obvious presenting symptom in a child and try to treat that without necessarily taking the lid off and looking underneath to see if there are other

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factors which might be contributing to the thing that's the most obvious on the surface.

Yes. In learning about this whole area, Sally, I've just been struck by the importance of it and also how overlooked or underrated or rarely spoken about it is. So thank you for being here with us today and bringing us this information. So we've talked about the general categories of reflexes, intrauterine, primitive, and postural. Now what are the body's systems or senses?

Systems generally refer to units within the body, which should operate together in cooperation. Senses are rather different. The senses describe our ability to feel and gain a qualitative experience of the world in different ways. There are many more senses than the five traditional senses we normally hear talked about; the obvious ones are vision, hearing, touch, smell and taste. We also have the vestibular senses that tell us about our bodies' relationship with balance. We have what are called nio-receptors which inform us about pain, and bio-receptors which tell us about pressure, but there are lots of other different sorts of sensory systems. The main element of each of them is that they provide a specific type of information to the brain and to the body about the physical world, and that they are in essence *receptor* systems; they're telling us about incoming information from the environment.

Receptor systems that you mentioned for pain and pressure—could you repeat what the names of those two were?

Nio-receptors that tell us about pain and baro-receptors, they're like a barometer, that tell us about pressure.

Okay. All right, so would you please describe some of the primitive reflexes one by one, as well as what they're used for?

There are certain ones which almost anybody would recognize. If you place your finger in the palm of a small, newborn baby's hand, the baby's thumb will come across the top of your finger and then the other four fingers as a group. The baby will grasp and won't let go as long as it's under the influence of that reflex. And similarly reflexes like the rooting and suck reflexes—if you stroke down one side of a newborn baby's face, the head will turn and the mouth will open, looking for the breast or the bottle; and the rooting reflex should then automatically lead into sucking so that the baby will start to feed. But there are other less generally known reflexes which have a very important part to play in later development, some of which are collectively known as a group called the tonic neck reflexes.

One of these is called an Asymmetrical Tonic Neck Reflex (ATNR), simply meaning that it affects muscle tone differently on one side of the body from the other. If the baby were to turn its head to one side, as the head turns the arm and leg on the side to which the head is turned will straighten and the opposite arm and leg will bend. It is sometimes referred to as the "fencer reflex" because it looks rather like a swordsman standing in the "on guard" position. The ATNR should help the baby, first of all, to be able to move around in the very confined space of the womb. One theory is that it (the ATNR) also helps in a normal birth process by giving some flexibility to the shoulders and the hips as the baby works its way down the birth canal. In the days when we used to place babies to sleep on their tummies, it should insure that the head automatically turns to one side so that there's a free airway and the baby doesn't actually suffocate by burying its head into the mattress.

In later development it has been suggested that the ATNR is the earliest hand-eye coordination training that the baby ever has, because at birth babies are terribly short-sighted—they can only see at a distance or focus at a distance of about 17 centimeters (16¾ inches) from the face. While the ATNR is active, wherever the head goes, the arms, the eyes, and the hands all have to move together, so the baby may be watching its hands coming and going from in front of its face, and as it turns its head to one side, the arm extends and the eyes actually follow the movement of the fingers as they move farther and farther away from the head, In this way, the ATNR helps to extend the baby's focusing distance from 17 cm in the first few days and weeks after birth to arms' length and gradually it will start to learn the next visual skills and so on. Each one of these baby reflexes, at the time that they should be present in the first six months of life, provide rudimentary training for many later voluntary skills.

Well, that's really fascinating. I don't know how often we think of that dear little movement when we've put our finger in a newborn's hand and they grasp. I don't know how many people actually realize that that's a reflex.

I know, it is not generally recognized.

Right, and the fact that the Asymmetrical Tonic Neck Reflex actually can help with the development of vision—is that correct now? You mentioned something about the Asymmetrical Tonic Neck Reflex helping in the birth process and that brings to mind delivery. Why might a natural delivery be important for a baby's reflexes?

It is suggested that the reflexes are in themselves strengthened as they are utilized as the baby passes down the birth canal, and that one of their functions is to help facilitate a natural delivery. The process of delivery also in turn *strengthens* the reflexes so that they're fully active for the first few weeks after birth to complete the functions which presumably nature designed them to carry out.

Your book is really wonderful in the description that it gives of different layers and areas of the brain and the functions of these areas in relationship to reflexes, etc. So this reminds me of your explaining how various physical exercises train the brain or put an imprint in the brain, of how to become better at certain physical activities. And when you're talking now about these baby reflexes insofar as the delivery is concerned, helping with the development, helping the development to mature, it reminds me of your talking about the brain and practicing physical exercises actually increases the child's capability in doing certain physical tasks.

Yes.

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I don't think I articulated that really well. Do you want to clean that up for me a bit?

Yes, I'll try. I don't think it needs cleaning up. I think you did a very good job of it. I think probably what we mean when we talk about this is that physical activity helps to build pathways, neuro-pathways between the brain and the body. The more we practice those movements, hopefully the better we get at them, so that movements that are habitually practiced in the first few years of life, help to build pathways which are rather like a motorway or super highway between the brain and the body. If the highways are well-built and well-constructed, then certain skills can be carried out easily with very little conscious effort. If for any reason there is an interruption in the building of those super highways and the child has to use a less well-constructed road or route in order to achieve that task, it's going to be harder, it's going to take longer, it's going to be more difficult. So we use the reflexes when we look at an older child as a way of assessing a number of things. Has the child gone through the early integration processes that would normally inhibit the primitive reflexes and put the postural reflexes in place? The postural reflexes act like deputies to higher parts of the brain, in carrying out the instructions of higher parts of the brain, and freeing up the executive part to do its job.

Okay, so primitive reflexes have to do with lower parts of the brain and postural higher parts?

Yes. If we think of where the spinal cord comes into the base of the brain, at the very lowest level of reflexes are spinal reflexes whose main characteristic is withdrawal. If they (spinal reflexes) are activated, the organism will withdraw away (flexion response) from the source of stimulus. Then a little bit higher up we come up to the brain stem where we have the primitive reflexes which should be hardwired into the brain at birth, and which should gradually be inhibited as the result of innate maturation processes, but which are also partly dependent on environmental opportunity. We could say that the maturation process is hardwired into the brain at birth but the software is the environmental opportunity that is available to the child. These are dual processes by which the primitive reflexes are transformed into postural reflexes. Postural reflexes are mediated at a higher level still—at the midbrain level. Postural reflexes provide the automatic basis for the control of the body, balance, movement, and coordination. So I think "deputies" is probably the best term to use. Higher parts of the brain can issue a simple "what I want you to do" instruction to the postural reflexes, which will then help the body carry out those movements or those instructions without having to use continuous conscious effort to carry them through.

Okay. A couple of things, I think you used the word "pathways" and I think the word that I had been searching for earlier was "connections," going through the birthing process or repeating a physical activity helped build connections. Is that what you mean by "pathways?"

Yes, connections and pathways are systems of communications which when they're habitually used become more efficient.

Neurological?

Yes.

Okay. And another thing that you reminded me of when you said it would be harder later to train someone whose reflexes didn't develop at the proper time, etc.—I know with children who have autism (I've heard that what something like ABA does), and I hope I'm quoting this correctly, it can circumvent areas that aren't working properly and train the brain, train the child, to do certain things. Now it sounds to me from what you're saying is if these reflexes aren't inhibited, certain reflexes aren't inhibited at the proper time and others don't mature at the proper time, you need to rehabilitate them, but it could take a lot longer, be a lot harder work?

At INPP we reckon on taking on average a year from when we first see a child prior to assessment to feeling we have got as far as we can at that time. The exercises would need to be done every day for about five to ten minutes a day for a minimum of a year. Now that's assuming that we are seeing children with perhaps lesser problems than children on the autistic spectrum—so we might be looking at children that have come to us with a diagnosis of dyslexia, Developmental Coordination Disorder or Attention Deficit Disorder. The more severe the presenting symptom, the longer one is probably going to need to be on a program to put that foundation level right. It's not always true, but there's a general trend that tends to be the case.

Now is this rehabilitating the same pathways that were supposed to develop in the same portions of the brain or actually using a different portion of the brain? Or do we know?

We assess the whole cluster of primitive and postural reflexes and we will look to see which is the earliest developmentally abnormal reflex in this particular child. This will give us a clue as to what stage in motor development we need to begin our intervention program. For example, if we have a child who has no primitive reflex abnormalities but had underdeveloped postural, we would start our intervention program developmentally at about four to six months of age. If we found that there were a lot of primitive reflex abnormalities, we would go right back to the time of birth and we would replicate infant movement patterns which should have been made at the time of the reflex would have been going under inhibition. We would take the child through developmentally, stage by stage, until we see changes in each of the reflexes in the hierarchy as we go through.

Okay. We have talked about the general categories of reflexes—intrauterine, primitive, and postural; we've talked about the body's senses such as vision, hearing, touch, smell, vestibular. I know there's olfactory and proprioceptive and you've described the Asymmetrical Tonic Neck Reflex. Let's put

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these things together. Which reflexes have something to do with particular sensory systems?

Well, certain groups of reflexes affect different types of sensory systems so there are those that are activated directly as a result of touch. An example of tactile reflexes would be things like the rooting reflex activated by touching the side of the face. If you touch the fold, nasal fold above the skin of the upper lip, you will activate the suck reflex. If you put something in the palm of the hand, you'll get the palmar grasp reflex and if you stroke down one side of the spine, about an inch away from the spine, something called a spinal galant reflex is activated. These are what we call specifically tactile elicited or activated reflexes. But then there are others which are directly related to stimulation of the balance mechanism located in the inner ear.

Most of the reflexes that are connected to the functioning of balance carry the words either labyrinth or tonic neck within their titles, so they would be things like the tonic neck reflexes, tonic labyrinthine reflex, and head righting reflexes. Head-righting reflexes are later reflexes, which should start to come in after birth as the baby learns to hold its head up in line with its body. You have one reflex that is multi-sensory and that is the Moro reflex. The Moro reflex can be activated by movement of the head below the midplane, sudden change of light, sudden loud noise, change of temperature; any one of the sensory systems, if the event is sudden and unexpected, can activate the Moro reflex in a child under four months of age.

All right, so you're mentioning reflexes in relationship to what stimulus can activate them, such as touching the baby's palm of the hand, activating a palmar reflex or sudden light or sound activating a Moro reflex. But what reflex dysfunctions will affect the different sensory systems?

Probably the one that is most connected to sensory problems is if the Moro reflex is retained. This is where sometimes it's very difficult to ascertain. Is the problem we are seeing the result of an abnormal sensory processing problem that has caused the reflex to remain there as a protective mechanism or, because the reflex has failed to be integrated at the correct time, is this child's sensory system operating at the level of a much younger child, and therefore the child is inappropriately hypersensitive to certain types of stimulus? For example, at the time that the Moro reflex is inhibited at about four months of age, the acoustic stapedius reflex should start to develop. The acoustic stapedius reflex activates the muscles in the inner to middle ear. When the reflex comes into play it should naturally dampen down the volume of sounds that are coming into the ear, so the volume is reduced by as much as twenty decibels. The reflex should also come into play when a child starts to speak, to use the sound of their own voice, to stop the child from deafening itself with the sound of its own voice.

In many of the children whom we see, there are children who still have a very strong Moro reflex and who are also hypersensitive auditorally. There are two ways of actually treating this: you can try to use an auditory training program, reduce the hypersensitivity with auditory stimulation and the Moro reflex may start to decline; or else you can work with the Moro reflex and as the Moro reflex becomes inhibited, in many cases the auditory sensitivity also starts to improve. Sometimes it's difficult to know which side to start with first and that's really where clinical assessment techniques should help to give you an indication.

This is really interesting, so you're bringing up that adjunct therapies such as auditory training can be a complement to a reflex remediation program?

Exactly.

Okay. Now I know in our case we did some auditory training, we attempted that, and it didn't seem to work out for us and I was told by another professional that it's not that it was a bad therapy, it just wasn't the right time and that there was something else that we needed to work on first. Now you're talking about a very strong Moro reflex and so it seems as if for us, that would be more appropriate to start with. So I guess if someone uses an auditory training program and it doesn't seem to work out, they might explore the area of the Moro reflex as a possible course for hearing hypersensitivity?

Yes, it can be difficult to decide which one do you start with? I also suppose that it's often a matter of whichever symptom they find first, is the one that they will go for. I think you've probably said exactly the right thing which is, you know, if it works it's wonderful but if it doesn't work, you may have to ask the question, "What else can we do next?" And if it hasn't worked, is it because there are immaturities in the functioning of the nervous system (which means that this child is not yet ready to be able to alter their processing and functioning information)?

Well, the child's time is really precious and so we want to optimize the use of their time and also the family's and others' resources. So, I would think it very important to try to assess the level of the child's neurological development in order to optimize the order of operations so to speak. So it is important, the order of operations in which you do things?

Yes, I mean, as a general rule, it is. If I were looking from a developmentally perspective, and of course this isn't necessarily true of every child that needs help, the first two sensory systems to mature are the tactile and the vestibular systems (vestibular = balance mechanism). So when we're looking at say layering different types of intervention into a program, we would generally suggest that the vestibular and tactile work is done first. Once you're beginning to see some improvement in vestibular functioning, then auditory training could be brought in at that stage. We would say that vision is probably the top of the pyramid in as far as sensors involved in the control of eye movement are also linked to what's happening in the balance mechanism. If there is an underlying problem in balance control, almost without exception you will find that there are some problems with control of eye movements and that therefore, it makes sense to correct balance first, then look to see how much visual work needs to be done subsequently. But again, sometimes we see children whose vision appears to have been the most obvious problem and vision has been treated first—then

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we have to do the balance intervention later. So one can't always follow the ideal path.

It sounds to me from what you're saying, Sally, and correct me if I'm wrong, is that the vestibular or balance system is kind of like a master or umbrella system.

Yes, but probably turn it the other way up, actually, and say that it's a platform rather than an umbrella.

It's a platform on which other sensory systems rely for integration of information and sending perceptually stable information to the brain. If there is a problem with balance, a stable reference point is not available and therefore you tend to get fragmentation or disintegration of sensory perception.

Excellently put. So you're actually laying down or attempting to remediate and lay down the correct foundation—you need the correct foundation.

Yes.

Oh, very good. Okay. So how do primitive reflexes that linger too long, underlie difficulties in learning basic skills such as reading, writing, and copying?

Well, it's often forgotten in the quest to make children literate, numerate, and all the other things we'd like them to achieve academically, that all academic learning is connected in some way to the functioning of the motor system. Reading is actually an ocular motor function. A child needs to have smooth, sequential eye movements to be able to follow along a line of print and send a sequential flow of information to the brain—that's a motor function. Writing involves hand/eye coordination—this is definitely a motor function. Even the ability to sit still is dependent upon having automatic or subconscious control of posture and balance. Any underlying problems in control of posture and reflexes will cause postural problems, then you're going to have a child who finds it difficult to sit still and even if they're able to sit still, they can't necessarily coordinate fine motor movements as well as they should be able to. They don't necessarily like sitting in certain positions; they find it difficult to concentrate for long periods of time if they've got to sit still. But really until we can control the body, we are not ready to give all our attention to focusing on higher aspects of learning.

So it sounds as if proper reflex development and proper motor development are really prerequisites to optimal academic achievement or cognitive function?

I would say so, yes.

All right. Are many misbehaviors really a child's attempts at trying to handle dysfunctioning reflexes?

They can be. If you take something like the spinal galant reflex for example which is activated just by contact—and it could be contact with anything—it could be the waistband of the clothing they're wearing or putting the small of the back into the back of the chair; hat tactile contact will cause the hip on one side to move out to about 45 degrees if the reflex is there in its fully retained form.

If the Spinal Galant reflex is present in a school age child, it will make it very difficult for the child to sit still. Even if the child is able to sublimate it to the degree that they can sit still, they have a constant irritant at play within the body. These are the children who, if they do sit still, will tend to make a noise. They cannot do anyhing and I describe them as being like having a bothersome blue-bottle fly buzzing around the classroom all the time because they are unable to sit still *and* keep quiet. These are the same children who tend to have difficulties with concentration.

If there is a retained spinal galant in a child who has a history of continued bedwetting above the age of five, we find that when the spinal galant is inhibited, the bedwetting also stops or improves. Bedwetting is often seen as an emotional problem; in some cases it can be, but not in all.

Other examples of reflexes affecting performance include the child who has a strong Asymmetrical Tonic Neck Reflex. Every time the child tries to turn its head to follow the movement of the writing hand, the writing hand wants to straighten and the fingers to open. This makes the physical action of writing very, very difficult for them. They may be the children who avoid writing, who might be very articulate if they're asked to answer questions orally, but if you ask them to write something down, they'll write two lines of unintelligible scribble, and they're often criticized for being lazy, for not trying hard enough.

Another example would be the Moro child, who tends to be over-reactive to things going on in its environment and whose behavior generally tends to be emotionally immature. This was best summed up to me by an adult patient's husband many years ago, who when we were describing her symptoms, he said, "Basically what you're saying is, my wife has grown up on the outside but she's not grown up on the inside."

Many of the behaviors we see in these children who appear to be immature and inappropriate can be because the body's inner communication system, the nervous system, is operating at the level of a much younger child than their chronological age.

Well, so here we have another situation where children are being reprimanded for things that they should actually be helped with. You mentioned spinal galant reflex, they're squirming, they can't sit still in their chairs, and you mentioned other primitive reflexes such as Moro and asymmetrical tonic neck reflex and palmar. So you've described some primitive reflexes. Let's move on to the postural reflexes. What do the postural reflexes allow the child to do, what are their names, and how does the child move from the primitive to the postural reflexes?

At approximately four to six months of age, a postural reflex called an amphibian reflex should develop. This can be seen when a baby is lying on its tummy on the floor. As it tries to shift its position a little bit, the leg on one side only will bend or flex slightly. This is a very small, tiny movement which doesn't look terribly important, but actually that one small movement is

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the beginning of breaking up the four quarters of the body so that one section of the body can operate or move in a different way to the other parts, which will then permit the baby to learn to crawl on its tummy like a commando a few weeks later. These little reflexes should come in at key stages in development as a result of maturation taking place within the brain. The maturation process means that higher centers or connections to higher centers in the brain, are getting stronger and stronger every day. Eventually the highest center, the cortex, should increasingly take overall control over the lower centers in of the brain stem. You can see this hierarchical control developing up into the midbrain and the cerebellum as the postural reflexes emerge and the primitive reflexes start to go to sleep.

Perhaps the most important of the postural reflexes are the head-righting reflexes. If a baby is allowed sufficient time to lie on its tummy when awake, it learns to hold its head up in line with its body. That head/body relationship is going to inform the balance mechanism in the inner ear and also all the other muscle groups in the body what changes are needed to maintain balance and carry out the next movement that it wants to make. Head-righting reflexes continue to develop right up to three and a half years of age; they start from the tummy and then develop on the back. And as the baby starts to learn to be able to push itself up into a four-point kneeling position, they're recalibrated in this new relationship with gravity on hands and knees. They are recalibrated again when the baby learns to sit up in a semi-upright position and then when it learns to stand, to walk, to run, to hop, to jump, and so on. Head-righting reflexes will re-adjust themselves as each new postural ability is learned in those first two to three years of life. And collectively, together with control of balance, they provide part of the platform on which the control of eye movement and other perceptual processes are going to depend.

Okay, let's go to that. It sounds to me as if each stage in the development of a reflex or reflexes helps with maturation towards the next reflex or stage of reflexes, is that correct?

Yes. I describe it as being rather like an interweaving spiral that as one reflex is coming up to it height and starting to decline so another one is coming in to replace it, and another one and another one. So although we talk about individual reflexes for purposes of theory and assessment, functionally and in reality many of these reflexes exist at the same time together.

Excellent point. Okay, so it's not like one day the Moro reflex, the tonic labyrinthine reflex, palmar reflex, and the Aasymmetrical Tonic Reflex just all stop and the next day you have an amphibian reflex and a head-righting reflex?

No, it's not as simple as that.

So it's a picture of integration.

Yes.

Okay. So you mentioned the vestibular system balance and vision, so why is the vestibular system or balance so important and what's the relationship between the balance mechanism and the eyes?

If you imagine we're in the inner ear, on either side we have three little loops that are the semi-circular canals or the balance apparatus and the semi-circular canals together with the cochlea—the hearing apparatus—are attached to a cranial nerve which sends information to and from four little nuclei in the brain stem called the vestibular nuclei. The vestibular nuclei operate like junctions for pathways that send information to and from the balance mechanism, to the base of the brain, and to a system of loops connecting balance to the body centers involved in control of eye movements and the cerebellum.

One part of the circuitry (one loop) sends information directly from the balance mechanism in the ear, down to the body and back again along something called the vestibular spinal system. So this is our relationship between what's happening to the balance mechanism in the ear and our body control. Then there's another part of the circuit that sends messages from the balance mechanism to the vestibular nuclei and from there directly up to centers involved in the control of eye movement. The system involved is called the vestibular ocular reflex arc (VOR). The VOR should insure that the image, the visual image, remains stable on the retina despite any movement of the head or the environment, so that it compensates if you like for movement of the body or the environment. But even those two parts by themselves are not enough. They then need another part to come in to play—the vestibular cerebellum system. The cerebellum is sometimes called "the little brain." It has long been known to be involved in the regulation and modulation of fine motor movement so that when a movement takes place, the movement is smooth, it's precise, it can stop exactly where the brain wants it to, and there is no fragmentation of movement. The cerebellum acts almost like a fine tuner switch on an old fashioned television. It should coordinate the messages passing from the body, the eyes, and the balance mechanism so that when an action takes place, it refines that action so that it works according to plan.

Now, in order to have stable perception, we need every part of that circuitry—the balance mechanism, the body part, the cerebellum, and the eyes—to be working together in perfect timing. If for any reason one part is slightly out of time with the other part, we will start to experience perceptual distortion. We have all experienced such temporary perceptual illusions in one way or another. If you were to stand up and spin around very fast in one direction for perhaps seven or eight rotations and then stop suddenly, for a few seconds after you stopped, it would seem as if your visual world was moving. This is because you have over-stimulated the balance and the body parts, but you haven't allowed the visual loop enough time to catch up. The brain is temporarily confused and feels the world outside is actually moving. Similarly if you were to sit in a train station and a train standing alongside you started to move, for a few split seconds the brain might be fooled into thinking it was your train that had started to move. Slight misfiring or mistiming between the eyes, the balance, and the body, has caused the brain to have a temporary hallucination. Sometimes when we see perceptual problems in children we find that there is an underlying problem in the functioning of the functional inter-

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relationship between these different loops going back to the balance mechanism again. And when you sort that timing out with therapy, the perceptual abilities start to improve. It could be a visual perceptual problem, a body balance problem or it could be a coordination problem.

Well, I think an important message from this, Sally, is that we can't look at the senses in isolation necessarily. We can't say, oh, I'm just going to address vision, or, I'm just going to address hearing, in a vacuum. Does that sound on target?

I'd agree. You know, we don't wander around as one sensory system in isolation, and we are actually a whole. What we need to look at, is how all these systems are combining and working together.

All right, we haven't spoken much, if at all – we haven't actually named the proprioceptive system and what it does. So could you just describe that and describe the relationship between that, for example, and the vestibular system and the relationship between other systems together?

Okay, I'll try. Proprioception describes private or personal internal awareness of position, movement in space, balance of the body or any of its parts. Our sense of proprioception comes from the feedback we get deep in the muscles and tendons and joints of the body. So the position they're in, any movements of those will give us our internal sense of proprioception, where we are in space.

The proprioceptive system is partly fed its information concerning balance of the body by the vestibular system, the balance mechanism in the inner ear and vice versa. So if we have, for example, inappropriately obtained tonic neck reflexes, the neck acts as one of the main junctions between the balance mechanism in the ear sending messages down to the body, and the body sending information back. Inappropriately retained tonic neck reflexes are going to create a "mismatch" between messages passing from the balance mechanism to the proprioceptors and back again; and that very same type of mismatch can then under-pin perceptual problems such as the ones described earlier

All right. I had heard a story about a boy with autism and he flapped his hands and he was able to communicate at that time or later and was asked why he did that, and it was so he could be aware he was alive, and I thought that that was so sad. That he could be aware of his existence because he was flapping his hands.

Yes—by giving him the proprioceptive feedback to the brain, saying, " I'm here and I can acknowledge what I feel and what I see".

There can be another explanation for hand flapping going back to infant development. I often describe movement as being our first language. But long before babies can speak to us in sentences, we understand what they want and what they feel through their body movements, their gestures, and the postural changes that they make. So that if you were to look at young babies and their bodies when they are sitting in their prams being pushed through the streets, when they start to recognize something or become excited, they actually "talk" with their hands and their feet. They will flap their hands in excitement to show that they have recognized somebody. Just before they start to cry or coo or babble you see a huge amount of leg and foot movement, often extension and curling of the toes, which to me, is baby's pre-language, the language of the body before they have the ability to access spoken language. I don't know if it's a correct hypothesis or not, but I've often wondered if the flapping that we see in some autistic children who have limited spoken language capabilities is them using what body language they have because they cannot access their "higher" aspects of language.

You know what—I've noticed that in conjunction with excitement or being in a new environment.

Yes.

Some people might think it's anxiety. I took it as excitement, you know?

I would tend to take it as excitement as well.

And to me the story of the boy who is just trying to affirm his existence to himself by flapping his hands, that was so sad to me and it's another illustration to me of why it's not appropriate to reprimand children but – for doing things like doing, you know, squirming in their chair because they have a spinal galant reflex that's not developed properly, or bedwetting, or flapping their hands, but whatever, help these children; help them instead.

It was Carl Delacatoso many years ago who taught many of us that behavior is language, even if it's bad behavior, it is trying to tell you something and it's trying to fulfill a function of some kind or another. This view does not give a child "carte blanche" to behave badly because, you know, we don't know what else to do with it, but it does suggest that the discipline we use should be appropriate to the child and the situation. Discipline means to teach, and that presumably means trying to find a better way of helping the child express itself and modify its behavior.

Yes.

I know that an American colleague came to one of our courses recently and she was reminding Peter Blythe how years ago, for children who couldn't sit still in school, they used to give them a three-legged stool where the legs were uneven lengths. This meant the child had to move the bottom all the time in order to maintain balance and sitting posture Paradoxically, it was noticed that while these children were busy controlling the balance in the middle of the body, their concentration got better.

Yes, I think bullying doesn't address the root cause of things. Addressing the root cause is better—taking care of the children's real medical needs.

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Yes.

Much better and much more respectful and merciful solution. So what kinds of other practical things can happen due to improperly developed reflexes such as a child ending up being more accident prone?

Well, take for instance the tonic labyrinthine reflex. This is a reflex that is activated when a child puts its head back. If it's very strongly retained in an older child, the muscles in the body will all go into extension; if the child puts its head forward, the muscles will start to flex. As a result, the child can have either too much floppy muscle tone or too much extensor muscle tone.

Now provided the head is in the middle (midplane), the child will be pretty much in control of himself but if he puts his head too far forward or backward, the head movement can throw off the center of balance as a result of a change in muscle tone. So you'll get the child who tends to fall over easily and because they don't know why or when it occurs, they don't seem to be able to do much about it.

It can cause clumsiness, trouble with perhaps muscle strength or muscle tone and under different conditions it may result in difficulties at physical education activities—the old days when we used to have to put a jump over a horse or a box or do a forward roll. These children don't seem to be able to get their bodies to do what they want once the head is put into a certain position.

Similar problems arise if the symmetrical tonic neck reflex (STNR) is retained. The STNR can create an invisible midline barrier between the functioning of the upper and lower portions of the body, so if the head is in a certain position, the upper portion of the body wants to be straight and the lower body wants to be bent. If the head is put into flexion it works the opposite way around. These children, again, have poor sitting and standing posture; they have hand/eye coordination problems particularly when bringing their hand towards themselves. So they may be the children who are messy eaters—they are fine if you give them a sandwich or a burger or a banana—something which they can pick up with their hands and shovel in; but if they have to try and manipulate a knife and fork, not only do they have the bringing-the-hand-to-the-mouth problem, if they've also got an ATNR, they've got left/right integration problems as well. These may be the children who make a tremendous fuss at mealtime and also are fussy about the type of food they eat because the process of getting the food into the mouth is so hard for them.

All right. Now your book also makes a connection between coordination problems and poor postural control and also having emotional difficulties under increased academic stress, how can this be?

Well, if a child is trying to concentrate all the time on the basic physical skills, there's less concentration energy available to process information, ideas, and thoughts. Supposing we go back to the concept of the postural reflexes acting like deputies to higher centers in the brain. If the deputies are not doing their job, the executive is going to have to work twice as hard to compensate and the law of compensation always demands a price somewhere. That price tends to be paid with fatigue, in stress, or emotional functioning.

All of us, adults included, if our stress levels become too high, cannot tolerate the outside world. We have a tendency to become more emotional and less rational in our behavior. Children will do exactly the same. They become frustrated if they can't succeed at things, they become tired, then they will start to act out in a number of ways, and the most common ways are tantrums or avoidance of the activity that they're supposed to be doing; they might play the class clown because at least that way children laugh with them instead of *at* them. Or they may just give up and decide that they're a failure and they're never going to try anything again. They very quickly learn; whereas, with other children, practice seems to improve functioning, for them no matter how hard they practice, if somebody changes the nature of the activity, they can't reapply that practice learned skill to something new.

Wow. What an interesting point. Let me ask you about that old saying "practice makes perfect." If you do not have the prerequisite correct development of reflexes, no matter how many times you try to get that basketball in the hoop, are you going to make it?

Not if the hoop is moved next time. Provided it's in the same position, you can use the skill you've just practiced, but if the target has changed in any way, then these children seem to have to go back to the beginning again and learn it all over again.

Okay, if you have a child whose hand has difficulty grasping a pencil or holding on to something no matter how many times they try to do that skill, are they going to be able to do it if you don't correct the prerequisite reflexes?

Probably not. If a child's got a retained palmar reflex like a small baby, every time they try and place a pen between the thumb and forefinger, the thumb will want to come underneath and the other fingers to curl on top. So they will tend to adapt their pen or pencil grip to "accommodate" the reflex. As parents and teachers we tend to come along and say, "Now hold your pen properly," and the answer is, "Yes, I can for a couple of seconds, but don't ask me to hold my pen properly and write for any length of time." So you start to see specific symptoms.such as abnormal pencil grip or the pressure they use when they write; it may be the way they position the page as once again they try to accommodate the reflex. Alternatively, they simply just get tired very, very quickly and they give up sooner than other children.

I appreciate the point about fatigue, particularly because I had a friend who had CP, cerebral palsy. Now she was an adult and she explained to me how she would get prematurely fatigued.

Yes.

And I didn't understand it at the time but I have a better understanding of it now. So a lot of parents have children who seem to be doing well developmentally, on target; they were

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sitting up; they were holding their neck up; they were rolling over; they were doing a lot of things developmentally on target which from this conversation, to me, would indicate that their reflexes were doing just fine and then something went awry and their development really went off track. What might be an explanation for that? What kinds of events can cause damage to reflexes? Could it be physical trauma, biochemical trauma to the brain? Is anybody able to determine the cause of the primitive reflex problems in a child such as differentiating between birthing injury or pre- or post-natal exposure to alcohol or toxins?

It's a million dollar question. Amongst the children whom we see regularly here, there could be any number of things developmentally that could have caused the reflexes not to be inhibited or integrated at the correct time.

If we go beyond the autistic spectrum and we look at more general learning disabilities such as dyslexia and developmental coordination disorder, we know that up to 50% of those type of problems carry a genetic/hereditary *tendency*. I use the words with care because the law of genetics go back at least four generations and therefore you can have a thread or possibility that weaves its way through the fabric of certain families which can either be *sup*pressed or *e*xpressed as a result of pre-conceptual health, events through pregnancy, the birth process itself, and illnesses, accidents, injuries in the first year or years of life—any one or combination of these factors might trigger off a genetic susceptibility or suppress it so that it never shows itself.

Then you have at least 50% or more where there does not appear to be an underlying pre-disposition. Nevertheless, these problems appear at a later age. Sometimes you can look at the early developmental history and there's something very obvious; the child had a difficult birth, there was oxygen deprivation at birth, and in extreme circumstances you would find that cerebral palsy is a result.

If you found that the child had experienced oxygen deprivation or severe trauma at birth, there can a be definite injury to higher centers in the brain and cerebral palsy might be one result. But more often in the children we see, there is nothing as severe as cerebral palsy and neither does there seem to be a single event in the child's history which you can put your finger on and say, "Well, that must have been the cause." So we use a developmental screening questionnaire, which carries a whole series (I think it's 26 questions) on developmental factors like family history, pregnancy, birth process, early feeding patterns, age at learning to walk, age at learning to talk, did they crawl, did they creep, and so on.

Over the years we have found that if a child scores more than seven "yes" answers over the first part of that screening questionnaire, it is highly probable if we proceed to carry out a Neuro-Developmental assessment we would find that there were underlying abnormal reflexes. In many cases it's actually a *cluster* of factors that you see, one on top of the other, that provide a profile that suggests somewhere in development something has gone in a different direction. But you can't necessarily put your finger on any single cause and say "what" and "why".

Okay. I'm a little confused. In your questionnaire you ask them about when the child walked, crawled, rolled, when they did creeping, how their feeding was?

Yes.

And if they give seven or more yes answers, then yes these things were on target?

No, if they were late at achieving these milestones.

If they were late –

If the child had more than seven indications of difficulties on different markers in those first few years of life –

Now is it age sensitive? I'm sorry, because if a child was feeding, walking, creeping, crawling, rolling, standing, etc., and then something went awry, how do you differentiate?

Then it's much harder to decide. The question is, what happened about the time that development stopped or changed its direction?

I know that there has been a lot of debate about vaccination in autistic children and whether the MMR and other vaccines are responsible. There seem to be so many schools of thought. Andrew Wakefield's work definitely suggests that there are traces of measles in the gut of a small number of children diagnosed with Autism who have never had Measles as an illness. The question is, how could measles have entered the gut if it was not as a result of vaccination? Then there's the other school of thought that discounts vaccination as a possible cause questioning why vaccination doesn't affect everybody in this way? Why is it only true for a certain population?

There is some quite recent research I believe, that suggests that there may be certain families where the children are more vulnerable to vaccine damage than others – particularly families where one or several family members suffer from atopic (allergic) conditions. In my view, instead of producing more and more research just saying that vaccination is safe for all, we should be looking more closely at the families where they *believe* that development altered at the time of one of the vaccinations to investigate whether there are common denominators in family history *prior* to vaccination. If common factors are established, we might in the future be able to screen for those children who might be vulnerable to vaccine damage in the future. There does seem to be a small subgroup who are vulnerable. If we look at the majority of the population, vaccination seems to be fine and vaccination has obviously been a very good thing for the majority. But if it adversely affects even *one* child, then we should be asking the questions "what" and "why"?

All right. Let's backtrack a little bit and talk about other models of disease where reflexes regress and also talk a little bit about the brain. Let's start off with myelination. What is myelination and what does brain nerve tissue myelination have to do with reflexes?

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Okay. Myelination is like the neurological equivalent of insulating an electrical circuit. It coats the nerve fiber in a fatty sheet which improves the speed and efficiency of information passing within that fiber and along that fiber. It also reduces the amount of interference or cross-chatter from neighboring fibers, so that it doesn't get a lot of interference on the way. The whole system goes through a rapid period of myelination in the first 2 to 3½ years of life at exactly the same time as the rudimentary reflexes are being integrated. One hypothesis is that some pathways to higher centers do not become fully myelinated if primitive reflexes persist, so that the primitive reflexes short-circuit certain messages as they're going in and they get blocked at the brain stem. The response pattern is then a brainstem response instead of accessing the cortex first with the cortex being in overall command and the brainstem following the instructions of the cortex..

All right, so there is much development and myelination you said in the first two to three years of life and that is also the time during which much development in reflexes takes place.

Yes.

And you think there might be some sort of short-circuit in lower brain functions communicating properly with higher brain functions?

Yes. If you think that the process of reflex inhibition shows that connections from lower to higher centers of the brain have become sufficiently established for some of those reflexes to be put to sleep, if we are seeing an older child where the primitive reflexes are still active, somewhere the connections to higher centers in the brain have not been as well established as they should have been and the reflexes persist as a sign of that lack of cortical control.

As far as I know, no research has actually been done looking at the incidence of retained primitive reflexes and myelination because obviously you're going to need a lot of expensive and advanced technological equipment in order to do this. My guess is that where primitive reflexes persist, some of the pathways to higher centers in the brain are not as well-myelinated as they should be.

Some of the pathways are not as myelinated as they should be and that affects primitive reflexes going forward to postural reflexes?

This is where sometimes it's very difficult to know: are all the primitive reflexes a result of lack of myelination or, because they've remained active, those pathways haven't been practiced and worked as well or as much as they should have been and therefore myelination has not taken place as completely as it should have done?

Okay, let's turn this question around a little bit and ask what do demyelinating diseases do to reflexes say in an adult who seems to be operating fine, then got a demyelinating disease? Can you give us some examples, please?

Okay. In things like multiple sclerosis, which is a demyelination disease, as demyelination takes place, messages passing between the higher and lower systems in the brain can start to experience interference so that it's like a telephone line where you've got a lot of cross-connections, cross-chatter. As the higher centers in the brain are no longer fully in control so the primitive reflexes are released because they are our basic survival function, they are there to protect us if accident or injury to higher centers takes place. So in multiple sclerosis, as demyelination takes place, you start to see some of the primitive reflexes emerge and if it goes through a period of remission, they may recede again for a little while. Equally, in Alzheimer's disease, the primitive reflexes start to emerge in the reverse chronological order that they were put to sleep in, in the first year of life. So the last one to be inhibited is the first one to reappear as Alzheimer's starts to take a hold.

All right. So we're looking at multiple etiologies for dysfunctions and reflexes it seems like to me. It seems as if possibly premature birth, birthing injury, some sort of prenatal or postnatal trauma, traumatic brain injury postnatally, all these various things may cause a dysfunction of reflexes as well as possibly anything that causes a demyelinating condition. Is this a fair assessment?

Yes. Demyelinatiion or even destabilizing within the functioning of the body as a whole so that if there are major biochemical disturbances, you sometimes see primitive reflexes present. Once those biochemical problems are corrected with biomedical intervention, the reflex status starts to look more normal. This is because the central nervous system is affected by biochemistry, but equally the biochemical system can be put under greater stress by a central nervous system that is immature. There are always two-way circuits or interconnecting loops; they never really exist in isolation.

Okay. So a major biochemical disruption or a central nervous system problem can cause an aberrant reflex profile?

Yes.

Okay. Let me go on to this. How do the two sides of the brain pass information to one another and what kinds of dysfunctions happen if there's a problem with that?

The two sides of the brain can communicate via millions and millions of connecting telephone wires called the corpus callosum, which allows the left and right side of the cortex, the highest part of the brain, to communicate equally well in either direction—so the right side of the brain will send information to the left and left to the right. However, in addition to facilitating communications, that same structure, the corpus callosum, should also at times be able to screen one side of the brain from information from the other so that the side that is better at a particular task is allowed freedom to get on with its job without too much interference from the side that's not as good at doing it. We need that continuous balance between communication and inhibition when passing information between the two halves of the cortex to be able to problem solve, to be able to

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concentrate on one thing and ignore something else. It's really a conduit for all higher aspects of functioning.

Okay. And what does this have to do with your definition of a neuro-developmental delay?

When we talk about neuro-developmental delay, we are looking at the lower parts of the brain rather than specifically at hemispheric functioning. Our definition of neuro-developmental delay is quite a tight one. We would say that neuro-developmental delay describes a *cluster,* not one or two in isolation, because most people can compensate for just one small problem. But a cluster of primitive reflexes still evident in the older child above 6 months of age or 12 months at the very latest, with or without underdeveloped absent postural reflexes in a child over three and a half years of age. We use the reflexes as sign posts of central nervous system maturity, knowing that by 3½ years of age the postural should be developed and there shouldn't be any sign of primitive reflexes left.

All right. So that was our overview and now I'm going to ask you some questions specific to autism and I'd like to know, some of our children have hypersensitivity to some things but have hyposensitivity to other things. So what parts of the brain operating abnormally could cause hypersensitivities to some things but hyposensitivity to others?

Well, it could be the specific part of the brain that processes that type of sensory information—in the sensory part of the cortex or the pathways between the sensory organ and the cortex. It could be the thalamus which is the part of the brain through which all sensory information with the exception of smell is filtered on its way up to higher centers in the brain. If there is a dysfunction at the level of the thalamus, it may be letting too much information up to the cortex for one thing and perhaps not enough for another. And then lower still we have something called the reticular activating system which is like a net-like structure that goes from the brain stem right up towards the cortex. And the reticular activating system operates like a gating system for arousal and allowing information from lower centers up to higher centers. One theory in ADHD is that the gates are actually closed, too far closed, not open enough. The outcome is that the child maintains, retains, too much excitation and arousal within the body and it cannot let it go up to the cortex for the cortex to analyze, deal with it, and decide what to discard. So we could also be seeing that there was too much or too little information being allowed through the reticular activating system. The two filtering systems, the RAS and/or the thalamus are not doing their job properly or that there could be a problem even higher up in the brain itself.

Would that hold true with say a child who was hypersensitive to light touch but hyposensitive to deep pressure?

Again, there are different types of touch receptors—those that actually process deep pressure are slightly different from those that process light touch. So you could be looking at different types of receptors within the same overall sensory system.

Lack of balance between those, because generally speaking within touch we have one system that allows the information *in* and one that is defensive and will shut it *out*. These two systems should actually be mutually exclusive, so if the defensive system comes into play, then we cannot feel or allow anymore touch information in until that defense mechanism has been released. Equally, if we've opened up to allow information in, we are no longer able to protect ourselves. It could be that in some way those two different types of receptors are not working in balance.

Okay. So is autism characterized by abnormal sensory thresholds?

Well, it certainly appears to be. Nearly all of the literature actually looks at the different types of sensory processing abnormalities whether they're hyper, hypo, or whether they've got general interference like "white sound" in processing certain types of sensory information.

Yes. I actually had read something about a woman who was on the spectrum who said that when she walked down a hallway it was like she was in a discothèque so I assume that means that colors or lights have different frequencies?

Yes, and somewhere the system is not integrating those into a coherent pattern like the little girl Georgie in the book *Sound of a Miracle*. Her mother talked about that when Georgie had been through auditory integrative training, some of her hearing sensitivity had improved and her mother asked her, "Well, what about the other perceptual distortions you used to have like the visual distortion of things breaking up and things moving?" I think her answer was paraphrased badly but something along the lines, "I still have those, but now I'm not bombarded by sound. I'm able to compensate or cope to some degree with the fact that my visual world sometimes plays tricks on me."

What a good observation. There was a boy whose occupational therapist said that he didn't have any one of this senses that could comfort the other, that could be kind of – I don't know how to describe this – I'll say a platform because you used that word, but all of the different senses, proprioceptive and vestibular, vision, auditory, etc. – none of them were calm. None of them were operating correctly so that one could be an anchor to comfort another one when it was being worked on.

Yes, because I know that a lot of sensory integration intervention aims at modulating one sensory system with another so that if you over-stimulate say the vestibular system, in theory you should be able to calm it down by giving oral motor stimulation or deep proprioceptive stimulation. By the sounds of it, in that particular child it would have been very difficult to know how and where to start a sensory integration program because that theory wasn't going to work for him.

Well, would reflex rehabilitation likely help in that situation?

I don't know.

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Okay, how many of the autistic symptoms or behaviors are caused by retained primitive or immature postural reflexes or by sensory based issues?

I think it's where every child with autism is an individual. Although we talk about characteristics of the autistic spectrum and that many children within that spectrum share problems and symptoms in common, the way that those symptoms are put together are usually as individual as the child.

This is one of the reasons why it's so difficult to find any *one* solution to the problem of autism. Some of the common symptoms in autistic spectrum disorders can be related to immature reflexes, but equally we have children with reflex abnormalities who don't belong on the autistic spectrum either, so we cannot say that reflexes are a diagnostic sign of autism. They can be there in many other conditions. My feeling is that until a universal cause of autism is discovered, it's going to be very difficult to say that there is a universal solution such as reflex integration programs for children with autism.

I think really the key to success is in looking at the profile of the individual child, saying, "What have we got in this child? Do we have abnormal reflexes?" Yes—well that gives us one clue. Do we have abnormal sensory processing problems? If so, which ones seem to be the most important developmentally; which one do we deal with first? And are there biomedical, biochemical problems—in which case the biochemistry needs to be dealt with as well if we're going to make lasting changes with the work we're doing with the nervous system. At that stage the way that we would work with the child is as individual as the child with his presenting problems.

V*ery good, treating them as an individual. Okay. And wow, that just underscores the need for more resources to rehabilitate all of the children, to be able to treat them and respect them and rehabilitate them as individuals according to their unique needs. Now, an INPP provider in America had mentioned to me that without correcting the underlying reflex dysfunctions, that the other therapies wouldn't necessarily stick as well, say vision therapy. They might stick for a little while but then revert. And that reminds me of something that, you know, you just said. Does that sound about right?*

Yes, I mean, if possible, we have a number of developmental optometrists in this country who know the work that we do and if they recognize the child has a lot of reflex issues when they first see them, they will sometimes suggest that they do the INPP program first and maybe six to ten months into the INPP program, if there are still problems with the eyes that are not responding to the reflex work, then that's the time to start bringing up optometric intervention as well. In an ideal world, that is the way that I would see that it should be done. One of the problems I know that we see, and I imagine parents find too, that there is very, very poor communication between professional bodies working in their own particular fields. Children and families tend to be passed from pediatrician to occupational therapist, speech and language pathologists to educational psychologists, to special needs teacher at seven or eight years. Each professional has done the best they can within their own professional domain but a child may have seen numerous specialists for assessment before anyone really starts to take the lid off and say, "Have we got common underlying factors here, which should be dealt with in a much more holistic and physical way?" and "Should we not all be working together on this rather than this poor child being passed from pillar to post?"

You've got it. That's a wonderful statement and it really underscores the need again for optimizing the child's precious rehabilitation time. About the stimming behaviors, behaviors that we call self-stimulatory, are an autistic child's stimming behaviors attempts to compensate for aberrations in how our sensory information is to be processed?

It certainly seems to be the most logical explanation. One of the problems is, if the behaviors are continuous self-stimulation behaviors, then that behavior is not actually resolving the problem—it's simply putting a temporary lid on it. Effective therapy would use the self-stimulation as a clue as to what type of intervention needs to be used; clearly that behavior needs to be adapted in some way to make it more effective in correcting as far as is possible the underlying problem.

Yes, we always want to get at the underlying problem. Now, what do you think about modes of therapy where they want to I'll say suppress but sort of phase out that self-stimulatory behavior and then, conversely, I also heard someone say well, if you try to suppress it, another one will just pop up. Well, that makes sense that another one will pop up if they're doing it for what is to the child a very, very valid physiological reason. So getting at the root cause would definitely be the thing to do as soon as possible, but what do you think about the ones where they try to phase out that behavior?

I think again it does depend on what the behavior is and if the behavior is totally inappropriate or if it's harmful—physically harmful to the child or to somebody else. Then something clearly has to be done to modify it in some way. But really again it's asking the question what is it doing for the child?

If I see a child who continues to spin themselves for example—when you're spinning yourself, in effect it cuts out or shuts out information from other external senses so that it's a form of self defense against too much external stimulation. Now you could say that it's trying to provide stimulation for the balance mechanism and you need to then ask, "What other type of vestibular stimulation could we provide that might do the job better and might replace it?" Or, if the child is doing it to cut out other sensory information, "Can we find a way of reducing the hypersensitivity to some of the other sensory information so that this shutting out mechanism isn't required anymore?"

Very good. Would that be something like humming?

Yes. Funny I was thinking about this when I knew we were going to be doing this interview and I wondered, in children who hum, could it be the acoustic stapedius reflex is only working when they voice themselves and is not working when outside noises are coming in? Therefore, by humming and making

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a noise themselves, they're able to cut out too much external auditory stimuli. They're using it as a cover-up.

Now I'm going to go off on a tangent here for a moment and I know that you are very interested in using music with children and we're not really going to go in depth with that in this particular interview, but are singing and talking processed in two different parts of the brain?

Yes. Singing has initially a much more right hemisphere involvement in it. Music in the child who has not had musical training tends to be predominantly a right hemisphere function. Once there is formal musical training then you start to get more left hemisphere involvement. So you can have children who can sing and who can memorize things to tunes but if you ask them to just memorize words without the tune, which is more of a left brain function, they can't do it. They need the right-brain support in order to do it. So if you had a particular problem or damage to one side of the brain or other, you could have a child who could talk but couldn't sing or conversely they might be able to sing but they wouldn't be able to talk.

If the child learns things from singing will they retain it and be able to talk about it later?

I think it would have to be linked to something. It's like if you think of information as being like a coat that you're wearing when you come into somebody's house, You then need to hang that coat on a hook somewhere in order to be able to find it when it's time to go home; so that it's linking information to something already known.

All right. Now have there been any studies of autistic children who prior to diagnosis showed movement patterns or postures that are different from other children?

Yes. There is a man called Philip Teitelbaum based at a university in Florida somewhere, where he and his colleagues have actually used videotape of assessments of children learning to walk, who were *later* diagnosed with autism, and the researchers were able to pick out abnormalities in motor movement during the first year of life just by looking at those children on videotape without knowing in advance which children were autistic and which children were not. Their observations suggest that early movement patterns may indicate that there are going to be later problems.

All right. So also we need to discuss what parents can do to find out which reflex issues, if any, need help in their child?

The simplest way of doing it is to access our screening questionnaire which you can find on our Web site; Anybody can download it for free.

The Questionnaire has questions on basic aspects of early development. If the child scores more than seven "yes" answers to being late in certain things or there being problems with certain things such as, birth or difficulties in the pregnancy, family history, and so on, a high score gives a good indication that there probably will be reflex related issues if it was followed through further. However, the questionnaire is only an *initial* screening stage. The next step is to follow it through with assessment.

Within the medical services, Occupational Therapists and Physiotherapists, particularly OTs trained in sensory integration, are very familiar or should be familiar with primitive and postural reflexes. That would be one way of accessing some sort of a assessment to find out whether reflexes are part and parcel of the problem.

Well, should you specifically ask your occupational therapist, are you familiar with the Moro reflex, or other reflexes, primitive reflexes?

It would be better to ask in more general terms, are you familiar with the role of postural reflexes in later developmental disorders?

Okay. All right. And how would the OT be able to differentiate for example whether auditory hypersensitivity was due to a residual Moro reflex or a sensory processing problem?

I cannot answer for Occupational Therapists and I'm not so up on how Occupational Therapists work in the U.S. I know that here in the U.K. that they're like gold. I see families that have waited two or three years to actually get an appointment with an Occupational Therapist.

Oh, my.

So I – it's often actually a case of whether the Occupational Therapist has got time to dedicate to, assessing an individual child on reflexes in addition to the regular assessment they would carry out on such a child. It's often down to matters of practicality I'm afraid. When we see children at INPP it's a different matter – our work is centered around the reflexes

At the initial consultation we will spend an hour going through more details during the questionnaire which also has a section on auditory processing. We use Paul Madaule's screening questionnaire from the Listening Centre in Canada.

The Listening Centre, okay.

We use our own neurological questionnaire plus a very basic nutritional questionnaire, and we will look at the three sections—neurological, auditory and nutritional - and we will decide after we've discussed with the family *all* the history, which of those three areas we feel is the most urgent. It is on the basis of the Initial Consultation that we'll decide whether to do an assessment for reflexes first or suggest that this child goes to a biomedical consultant who will try and stabilize the biochemistry first.

Oh, good.

If there was absolutely no speech at all in a child say seven or eight years of age, I would probably decide at that point that the hearing side was the most important and we would suggest auditory integrative training or the Tomatis method, quite an

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intensive method of sound therapy. If the child's speech and language is not too bad but there are a lot of coordination problems and some speech and language difficulties, then we would probably say that the neurological side was the priority and we would layer in an auditory program, probably a more specific one such as Johansen Sound Therapy at a later stage when it is appropriate.

Okay, so these things can complement each other? You've mentioned a developmental optometrist earlier; I've heard of behavioral optometry; you've mentioned listening therapies such as from the Listening Centre or Tomatis. I've also heard that craniosacral therapy can complement a program of rehabilitating reflexes, so it's holistic. Do these different programs complement each other, but you want to go in the right order?

Yes, we'll tend not to use all together all at the same time because then it's very difficult to evaluate. If you're getting change either in the right direction or you're getting regression, what is actually causing this? If at first meeting a child there seems to be a clear structural problem in posture, it would suggest we're looking at a skeletal or structural problem, we're looking at alignments, we've perhaps got one shoulder and one hip higher than the other, or we've got severe restriction of movement when we try to rotate or flex and extend the head. In those cases we might suggest craniosacral therapy, cranio-osteopathy or chiropractic work—first to work with the skeletal system, and ease that up, then, we can start to address reflex problems using functional exercises. This is because if you've got a structural problem, blockage, it doesn't matter how much functional work you do, the function is going to be limited by the structural blockage.

Wow, what a good point. Okay. All right. So how then do the parents go about remedying the reflex dysfunctions? How do they find a provider, what research do they do?

That's again a million-dollar question, because the practitioners who've been trained by us at INPP are still few and far between and scattered on different parts of the globe.

We have quite a few in the UK; there's a large number in Germany; there's a few in the Netherlands, Italy, Spain and the Scandinavian countries. We have now started training courses in the United States. The first official course started in Maryland this year and then we've also had a handful who've come over to the UK and trained with us from the U.S., Australia, and New Zealand. You can find the names of the key person in each country by going in to our Website. Click on the contact name for your country, and the contact can then send you a list of people nearest your area.

Okay, so those are at www.inpp.org.uk. And Sally, in addition to the people listed on your Website, are there say behavior optometrists and other practitioners who are familiar with primitive reflexes, etc.?

There are Behavioral Optometrists who've done shortened courses, not with us. They have done training with other people in recognizing reflexes. They're certainly familiar with what the reflexes do but I don't honestly know how much they know about the remedial side of it.

Okay. All right. I assume that there is contact information on your Website?

Yes.

Okay. So you mentioned earlier about determining the level at which physical remediation should be targeted. Do you just want to reiterate that now for us?

In an ideal world it should start from the point of developmental capability in the child. By looking at reflexes, you know at what age a reflex should be inhibited—if the reflex is still there, it is telling you that some related skills are at the level of a child at four months, six months, nine months or whatever. The earliest level of dysfunction determines at what developmental level remediation should begin. You start from *the child's point of competency*.

All right. And in wrapping up, let's just confirm, how do we know that intervention addressing reflexes is helpful in general and helpful to children with autism in particular? Have there been any studies such as in schools?

We haven't heard of studies on autism in particular in relation to reflex integration programs, but we have carried out studies in schools using the INPP School's program.

The INPP School's program is a more general program than the individual clinical program. INPP runs courses for teachers over one day and during which time we give them a shortened test battery that takes them about ten or fifteen minutes to administer. They are then given a series of developmental exercises which should be used in blocks of four or six exercises at a time. Teachers would take a whole class of children through a group of four exercises for a period of six to eight weeks. Provided every child in the class has been able to do those exercises competently for at least three or four weeks, they'll then move the class on to the next block and the next block and so on.

The school's program is run over the course of one academic year. We have carried out a number of studies using this program in schools in Northern Ireland, the UK and in Germany really trying to answer three key questions:

Is neurological dysfunction a significant factor in children in mainstream schools who are underachieving? (This is where the test battery the teachers have will pick up children who've got three reflexes and a couple of balance and coordination problems.)

The study found the answer to the above question to be "Yes"—up to 48% of children at five to six years of age, (because children in the UK go to school earlier here), and 35% of children from seven to nine years of age still have some traces of abnormal reflexes that shouldn't be there after the first year of life.

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The second question the research tried to answer was: Does neurological dysfunction respond to a specific program of daily developmental exercises?

The answer was a resounding yes.

We had one group doing the exercises, another comparison group not doing the exercises and at one school they had a third group who were doing general physical exercises for the same time period every day. At the school where they had three groups, they found that the children who did general exercises made *twice* as much improvement as the children who did none, but only *half* as much as the children who did the INPP exercises.

Wow.

In other words, some movement is beneficial. Whatever you do, if they have *daily* movements, it's a much cheaper way of helping boost education than lots of other things. If you use *specific* movements, then it seems to be better still.

So specific –

And the third question was: Is there a cross-over from change in neurological status into improvements in reading, writing, spelling, and drawing?

The answer was "Yes.", There were significant improvements in the draw-a-person test, compared to controls. The Draw a Person test is a measure of nonverbal performance. There were improvements in reading and spelling in those children who fulfilled the criteria of having *both reflex dysfunction of more than twenty-five percent together with a reading age below their chronological age when they started* the program. When they had both underachievement and high reflex scores were present. Children made statistically greater improvements in reading and spelling compared to those children who didn't do the exercises. (Published "Child care in practice". Volume 11/4. 415-432)

Okay. So you did survey schools in Northern Ireland, the United Kingdom, and Germany and you looked at children who had up to forty-eight percent abnormal reflexes in children five to six years old and thirty-five percent in children seven to nine years old –

That's in some mainstream schools. These are children who would be assumed to be achieving their level of potential and wouldn't normally be investigated.

Okay, and then you looked at whether they responded to daily exercises that were specific, some general movement, or none at all, and you looked at whether the children's reading and writing and spelling and drawing improved and you did find a statistically significant correlation in underachieving students whose reflexes were decreased by twenty-five percent and reading was below par and they did improve. Is that a correct summary?

Yes, that's absolutely right.

And, Sally, what's your most important take-home message for parents today?

I think to never give up, probably. To be realistic, to have realistic expectations, but never to give up believing that tomorrow can in some way be better than today.

All right. Very good. And I want to thank you for bringing this vital information to our attention and for explaining these critical aspects of development and remediation that are so often overlooked.

It has been a pleasure and thank you so much for being such an interested interviewer.

Well, you're welcome. We want to be able to help the children and families.

So Sally Goddard Blythe's books can be ordered through the INPP Web site at www.inpp.org.uk or through the Developmental Delay Resources Website at www.devdelay.org.

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