Appendix 1

Description, Evoking and Reduction of Retained Primitive Reflexes
The following reflexes are the ones traditionally included in first-year pediatric or pediatric neurology exams. We think that these are the most important reflexes that need to be examined and integrated across age groups:

• Asymmetric tonic neck reflex
• Symmetric tonic neck flex
• Moro reflex
• Palmar grasp reflex
• Rooting and sucking reflex
• Snout reflex
• Babinski reflex
• Spinal Galant reflex

When we test these reflexes, we grade them on a scale of 0-4 based on clinical judgement (0=0 fully integrated; 1=25%; retained; 2= 50 % retained; 3=75%; 4=100% completely retained when Tested by 3 examiners.

The following is a detailed description of each reflex test. In testing reflexes in higher-functioning or older children, the ideal positions are standing, seated or supine, and on all fours. Since infants cannot stand and may not be able to kneel on all fours, we must work around that.

PALMAR GRASP REFLEX

Testing the palmar grasp reflex

Use the hard end of a small paintbrush to draw an X with firm pressure over the middle of the palm of the hand. What we are looking for is any contraction or withdrawal of the hand, fingers or even arm. In a small child, or if the reflex is strong, the whole hand may contract and grab the brush. Otherwise, you may see quick but clear contractions and a partial closure of the fingers. In some cases, the hand will contract and the whole arm may jump. All of these represent different levels of retained reflexes in the 0-4 scale.

Activating or stimulating the palmar grasp reflex

When testing for this reflex, do not forcibly hold the hand open as it is necessary to see and grade the reaction if one exists. When stimulating the reflex to ultimately integrate it, we need to keep the hand open. Wrap your fingers around the hand, holding the thumb and pinky down and opening the hand to expose the middle of the palm. This is necessary, especially for children who may naturally attempt to pull away or close their hand. Once the hand is open and exposed, make a firm, quick X with the middle of the palm. Repeat his 10 times on one hand and 20 times on the opposite hand that is connected to the hemisphere one desires to stimulate. For example, if there is a right hemisphere delay, start by stimulating the reflex 10 times on the right hand and 20 times on the left hand, two to three times a day.

ROOTING AND SUCKING REFLEX

Testing the rooting and sucking reflex

Taking the brush side of a paintbrush, start slightly below the cheekbone on one side and then, firmly pushing on the brush, draw a straight line down to the corner of the mouth, brush over both lips and touch the other corner of the mouth. Perform this three times on either side and grade the severity on the third attempt. Then, stroke the brush from the chin directly toward the mouth on the same side three times. Similarly, grade the severity on the third try. Finally, complete the same procedure from the cheek and from the chin to the corner of the mouth and over the lips on the opposite side, then grade its severity.

Grading the rooting and sucking reflex

During the test, examine for contractions around the mouth and cheek. The most severe level (4) is obtained if the child opens their mouth fully, turns toward the brush, and attempts to latch on and suck. There is often a consistent contraction of the lips that may look like a smile, but when it happens each time, it is clearly a reflex. There can be many variations; we have observed the whole face twitch on one side or the other. It can also be as subtle as a slight contraction of the bottom or top lip, which may be considered a 1 in severity. The reflex should not be present after infancy and any presence is an indication of delayed nervous system integration.

Stimulating the rooting and sucking reflex

Take the brush side of the paintbrush, starting slightly below the cheekbone on one side and then, while pushing firmly on the brush, draw a straight line down to the corner of the mouth, firmly brush over both lips and touch the other corner of the mouth. Do this five times from the cheek to the corner of the mouth, then five times from the chin to the mouth on the same side, with a total of 10 on each side, two to three times a day. Repeat on the opposite side.

THE SNOUT REFLEX

As described, we can test for this reflex on its own or along with the rooting reflex. Similarly, when stimulating the reflex to inhibit it, we can stimulate it separately or in conjunction with the rooting reflex.

Testing for the snout reflex

You will most likely need to hold the child's head still while testing for this reflex. Take the hard side of the paintbrush and hold it vertically to the child's mouth, brush side down.

Traditionally, to test for the reflex, you would press on the upper lip/philtrum area with the brush or your finger. However, it is most effective when the examiner presses firmly on the upper and bottom lip at the same time, holding for three to five seconds and waiting for a response (the closing of the mouth and puckering of the lips into the brush). If the reflex is present, the child will close and pucker up like a kiss. If the reflex is strongly present, one can press on the corner of the mouth and the lips will close and pucker. If the reflex is not present, there will be no movement of the face or lips (a 0 on grading scale, while full lip puckering would be a 4).

Activating or stimulating the snout reflex

As with most reflexes, the best way to activate and integrate the snout reflex is exactly the way we test for it. Take the brush handle and press it against both the upper and lower lips at the same time. Press firmly and watch for closing and contraction of the mouth with puckering of the lips. Hold for three seconds and release, then repeat 10 times. The point is to activate the reflex repeatedly, with higher repetition than when testing in order to integrate it.

Snout reflex stimulation

If the child is crying or not closing the mouth and the snout response is present, each time one stimulates the rooting reflex, one can simultaneously stimulate the snout response, addressing both at the same time. With each stroke, press harder on the corner of the mouth to close the mouth and then finish the rooting stimulation.

If this isn't closing the mouth enough as you stroke down, stimulate the snout by pressing on the philtrum and lower lip area. This should close the mouth, after which you can brush over the lips. If this is not required because the child or adult keeps their lips closed but both reflexes are present, press on the philtrum and lower lip together, 10 times, after you have activated the rooting reflex. Repeat two to three times a day.

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THE BABINSKI REFLEX

Typically, in normal child development, the Babinski reflex is the last primitive reflex to become integrated. As the brain and frontal lobe develop (from the top down through the pyramidal tract as we get to the lowest part of the brain stem), this reflex becomes inhibited. This occurs around 12 months, or the same time a child should take their first steps.

Testing for the Babinski reflex

With the hard side of a paintbrush, stroke up the outside of the foot toward stopping just under the ball of the foot. Maintain deep, firm pressure and a quick stroking motion from the base of the heel, aiming at an area roughly between the fourth and fifth toes. If the reflex is still present, the foot and big toe will extend upward, and the other toes will also extend and may flare apart. If the reflex is not present, it will be replaced by the plantar reflex and the toes will curl down with the same stroking movement.

Assessing asymmetry of the Babinski reflex

The Babinski reflex should be exhibited on both feet at the same time; however, it, more than almost any other reflex, is commonly retained on one foot more than the other. This marks an efficient way to assess the most immature hemisphere: the foot with the stronger Babinski reflex is typically on the contralateral side of the more immature brain. The only time this may not be the case is if the foot with the lower response does not feel the pressure of the stroking and/or on the side of lower tone. This is where experience can help with understanding and differentiating the reflex. Stroke with firm pressure three times on each foot. Sometimes, the toes may initially go down but reverse direction with the second or third stroke. This means the reflex is still present but partially integrated, which is why you need to conduct the test more than once. The reflex is graded by the strength of the foot and toes going backward and toes splaying.

Stimulating the Babinski reflex

With the hard side of a paintbrush, stroke up the outside of the foot stopping just under the ball of the foot. Maintain deep, firm pressure and a quick stroking motion from the base of the hill, aiming at an area roughly between the fourth and fifth toes. Repeat 10 times on one side and 20 times on the side of the stronger Babinski response or on the side contralateral to the more delayed hemisphere. Repeat two to three times a day until completely integrated.

TESTING FOR THE ASYMMETRIC TONIC NECK REFLEX (ATNR)

There are three position options to test for the ATNR: supine, on hands and knees, and standing. The preference is for the individual to be on all fours, although it may not always be possible, especially in infants. For all three test options, turn the head all the way in one direction until the examiner feels he or she has reached the end of the range of motion of the child’s head — and then turn it slightly more.

Testing in supine position

For infants or anyone with a severe brain injury who cannot get on their hands and knees, test for the ATNR in the supine position, with the patient laying on a table or the end of bed, face up. Turn the head in one direction all the way and then slightly more. Hold this position. If the reflex is still present, one will observe the arm and leg on the side of the head turn begin to straighten and possibly fully extend. On the contralateral side, the arm and leg will slowly bend or flex and may end up fully flexed. Then, bring the head to the neutral position and rotate it all the way in the opposite direction — and then slightly more. Hold for at least five seconds or until both arms and legs finish moving. Repeat three times on either side, grading the severity. One may need an assistant to hold the child flat so their whole body does not roll over to the side.

Testing in tabletop position (on all fours)

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If the patient can be on their hands and knees, test from this position, also called a tabletop position. Their shoulders should be fully over their arms and hands, with hands flat and pointing forward. If the hands veer to the side, it is a sign of ATNR or symmetric tonic neck reflex. Standing or kneeling facing their head, the examiner should place hands on either side of the patient's head, firmly cupping the ears. Maintain a firm, stable grip if the child is fighting and trying to pull away. If the child is aggressive, a parent or therapist may need to hold their child still or keep the hands down while the other turns the head. Turn the head to the end of the range of motion and then slightly more. Observe if the elbow on the side of head turn extends slightly, and if the opposite elbow bends or significantly shakes. If the reflex is fully retained, the elbow will bend fully and that side of the body will collapse, ensure that the head remains still and prevent the child from falling over through a slight upward pressure. Turn the head back to the center and repeat on the contralateral side. Complete three times on both sides and grade the severity level. If the child or adult has elbows hyperextended elbows when resting on their hands and knees, unlock their elbows by flexing them slightly before turning the head.

Stimulating the ATNR

Whether in the supine or tabletop position, the reflex should be activated repeatedly until it becomes fully integrated.

Stimulating the ATNR in the supine position

Activate the reflex the same way one tested for it. Turn the head from side to side, allowing the reflex to fully activate, and repeat on the other side. Repeat 10 times on both sides, two to three times a day, until the reflex is fully inhibited or integrated.

Stimulating the ATNR on all fours

In the tabletop position, turn the head from side to side all the way, then slightly further to fully activate the reflex. Repeat on the other side. Repeat 10 times on both sides, two to three times a day, until the reflex is integrated. Testing for this reflex, and the symmetric tonic neck reflex, depends on how much the examiner turns or bends the head. The examiner may turn the head 90 percent of the full rotation and not see any bending of the elbow. Even at the full range of motion, one may not see it; it may only emerge when the examiner proceeds slightly beyond what feels like the end of the range of motion. Understandably, many parents are afraid to turn the head this far, but unless the child has a congenital spine issue or Chiari malformation, there is not pain associated with the procedure. In fact, a full neck rotation is healthy.

SYMMETRIC TONIC NECK REFLEX

Testing and stimulating the symmetric tonic neck reflex (STNR) are similar to testing and stimulating the ATNR and should be completed immediately following the ATNR.

In testing in the supine position (infants or anyone who cannot get on all fours), the individual should lay face up on the end of the table or bed, with their head hanging slightly over the top so it can fully extend. The examiner should fully flex the patient's head until it is touches or nearly touches the chest and hold the position for approximately five seconds.

With the head fully flexed forward, check if both arms bend at the elbow and both legs extend. Bring the head back to a neutral position and then extend it fully backwards. In this position, the arms will both extend, and the legs will flex if the reflex is present. The degree to which the arms and legs bend and extend is the extent to which the reflex is retained. Repeat at least third times and grade its severity on the third time.

Testing in the tabletop position

If the individual can get onto their hands and knees, it is best to test from this position. The main difference is in the placement of the examiner's hands. When testing and stimulating this reflex, the examiner must

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move quickly, especially if the individual is pulling away or attempting to resist. The examiner may need a parent or adult to hold the body still and/or the hands down. Immediately after testing the ATNR, continue to hold the head but the examiner should switch the position of his or her hands. If the examiner is right-handed, instead of standing or kneeling in front of the patient, move slightly to the right side of their head. Place two or three fingers on the examiner's left hand under the patient's chin and the right hand on the back of the top of the head, as if palming a ball. The examiner should not place the full hand under the chin as when the patient's head is flexed, the hand may block the full flexion and that may compress the neck, which can be uncomfortable to the patient.

Flex the head fully downward. If the reflex is present, both of the elbows will bend and the legs may extend a bit, rocking the individual forward. With the examiner's bottom hand, apply a slight upward pressure to prevent the patient from completely collapsing, so their head may touch the ground or floor.

The whole head and body may collapse as the elbows reflexively bend, therefore ensure that control of and hold up the head is maintained. Push up with the examiner's bottom hand to a neutral position and extend the head backwards as far as it can go. If the reflex is present, both arms will extend and both legs will flex, making the patient sit back on their heel slightly. Repeat three times and grade the severity on the third try.

Activating the reflex to inhibit

Activate the reflex the same way that it has been tested. Immediately after testing the ATNR reflex in the supine or tabletop position, move the head up or down to activate the STNR.

Stimulating/activating in the tabletop position

With the individual on all fours, the examiner should position his or her hands with two or three fingers on the chin and the opposite hand on the back of the patient's head. Flex the head forward fully. Push to the end of the range of motion and then, once again, slightly more.

If the reflex is present, the elbows will both bend and the legs may extend a bit, rocking the individual forward. With your bottom hand, the examiner should apply slight pressure upward to prevent the patient from completely collapsing, so their head may not touch the ground or floor. The whole head and body may collapse as the elbows reflexively bend, so again, make sure to maintain control of the head and hold it up from completely collapsing. Push up with your bottom hand to a neutral position and then extend the head all the way back as far as it can go. Repeat 10 times, two to three times a day.

SPINAL GALANT REFLEX

Testing the spinal Galant reflex

The spinal Galant reflex can be tested from almost any position. The child can sit in or lay across the parent's lap, lay on their stomach or even lay on their side. But the most common position is the tabletop position, with the child on their hands and knees as with the ATNR and STNR.

Take the hard side of a paintbrush, and, starting along the spine about one inch to the side and below the level of the scapula, stroke down with a deep, firm, quick stroke from the top to the base of the lower back. Alternate from side to side and repeat a minimum of three times on each side. If the reflex is present, the child will flex their back toward the side of stimulus. Start toward the middle of the spine as described and then, with each stroke, proceed more laterally toward the side of the child. The strongest response is usually evoked from the most lateral position.

Stimulating/activating the spinal Galant reflex

The examiner can activate the reflex the same way that it was tested, but with 10 strokes on one side and 10 on the other. With the child in the tabletop position or over the parent's lap, take the hard side of a

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paintbrush, and, starting along the spine about one inch to the side and below the level of the scapula, stroke down with a deep, firm, quick stroke to the base of the lower back. Alternate from side to side, with a minimum of three times on each side. Start toward the middle of the spine as described and then, with each stroke, proceed more laterally toward the side of the child. The examiner must alternate sides for each stroke. The examiner may notice more of a response on one side, but we recommend activating the reflex equally. Repeat 10 times on each side, two to three times a day.

MORO REFLEX

Testing the Moro reflex

A number of ways can be employed to test this reflex in young children or low-functioning individuals. First, the child should lay in a supine, face-up position with arms at their side and legs flat. The examiner will lift their head up completely into flexion, then quickly thrust it down toward the table, only about two to three inches.

This simulates falling backward, which is what activates the reflex in small children or adults if the Moro reflex is still active. This procedure should be repeated three times and the examiner should observe whether the hands, arms, or legs fly up or off the table. The response can range from the fingers and hands extending slightly, to the entire body jumping. One may also observe an immediate increase in pulse rate and face flushing.

To test the auditory stimulation response, the examiner should clap loudly over their head of the individual three times to observe if they jump. The examiner may need one parent to hold the child flat on the table. Repeat both procedures three times and grade the severity on the last one.

Stimulating and activating the Moro reflex to integrate it

Lay the person in a supine, face-up position, with their arms at their sides and legs flat. Lift the head up all the way into flexion, then quickly thrust it down toward the table, only two to three inches. This simulates if someone was falling backward, which is what activates the reflex in small children, or adults if the Moro reflex is still active. Repeat three times and watch if the hands, arms or legs fly up or off the table. It can range from the fingers and hands extending slightly to the entire body jumping.

Stimulating with sound

To activate the sound part of the Moro reflex, clap loudly over or behind the patient's head 10 times.

Stimulating the visual part of the reflex

Move a finger quickly toward the individual as though you will poke them in the eye and repeat 10 times. Complete 10 repetitions of each positive stimulus two to three times a day until the reflex is fully inhibited.

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