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You are teaching medical students how to perform a neurologic examination in a newborn. The discussion focuses on the evolution of primitive reflexes through gestational development and infancy.

Of the following, the EARLIEST primitive reflex to appear during human gestation is the

- |   |                          |
|---|--------------------------|
| 1 | crossed extension reflex |
| 2 | Moro reflex              |
| 3 | palmar grasp reflex      |
| 4 | rooting reflex           |
| 5 | tonic neck reflex        |

You selected **3**, the correct answer is **3**.

Primitive neonatal reflexes, also called primary integrated reflexes, are transitory developmental phenomena that appear according to a [predictable timetable](#) during gestation and disappear during infancy. The most frequently elicited reflexes are: Moro reflex; palmar and plantar grasp reflex; placing and stepping reflex; rooting, sucking, and swallowing reflex; tonic neck reflex; and crossed extension reflex. Others include Galant's trunk incurvation reflex, finger extension reflex, and head traction reflex. These highly stereotypical patterns of automatic movement are elicited by specific sensory stimuli and controlled by subcortical neuronal pathways. Some of the reflexes can be elicited as early as during the 25th week of gestation; most are fully present at birth in term neonates. These reflexes become difficult to elicit after the first half of infancy when cortical inhibition emerges and voluntary muscle activity replaces the reflex movements. Delayed appearance of the reflexes during gestation and persistence of the reflexes beyond the anticipated age for their disappearance are indicators of potential central nervous system dysfunction.

The palmar grasp reflex is one of the earliest primitive neonatal reflexes to appear during human gestation. The reflex is elicited by stroking with a finger the palmar surface of the infant's hand, which results in flexion of the fingers in a grasping motion. This reflex can be elicited, albeit weakly, as early as at 26 weeks of gestational age, is stronger at 32 weeks, and is strong enough to allow the examiner to lift the infant from the bed at 37 weeks. The palmar grasp reflex begins to fade at 2 months of age and disappears by 4 months with the development of a voluntary grasp.

To elicit the crossed extension reflex, one leg is held firmly in extension and the sole of the foot is rubbed. The reflex is observed in the opposite (free) leg in three successive phases: initial flexion (withdrawal), subsequent extension and fanning of the toes, and, in its fully developed form, adduction of the free leg toward the stimulated side as if to push away the stimulus. This reflex is absent at 26 weeks of gestational age, can be elicited in its partial form (only flexion) at 30 weeks, and is complete at 34 weeks. The crossed extension reflex disappears by about 2 months of age.

The Moro reflex can be elicited by startling the infant. The most effective and reproducible method for startling is to create a sensation of falling by sudden dropping of the head in relation to the trunk. With the infant held in supine position, the head is allowed to fall a few centimeters, rapidly but gently, in the examiner's hands. The reflex is observed in two successive phases. The infant's first response is a spreading motion in which the arms are abducted and extended with hands opened. The spreading motion is followed by a clutching motion in which the arms are adducted and flexed over the trunk with fists closed, often

accompanied by an audible cry. The Moro reflex is absent at 26 weeks of gestational age, can be elicited in its partial form (only spreading motion) at 30 weeks, is complete but variable (spreading with or without clutching motion) at 34 weeks, and is fully developed at 38 weeks. The reflex begins to fade at 2 months of age and disappears by 4 months.

In addition to being an index of gestational maturation, the Moro reflex can be useful in other clinical settings. An absent or depressed Moro reflex often accompanies severe illness, especially kernicterus and general depression of the central nervous system or a disorder of motor function. An exaggerated Moro reflex may be a manifestation of narcotic withdrawal or moderately severe hypoxic-ischemic encephalopathy. An asymmetric Moro reflex is seen with brachial plexus palsy and with trauma to the clavicle, humerus, or shoulder joint.

The rooting reflex is elicited by stroking with a finger the upper or lower lip or either corner of the infant's mouth, which results in the infant turning the head, searching for the finger, and attempting to suck. Sucking tends to reinforce the rooting; a recent feeding tends to suppress it. The rooting reflex tests the integrity of the sensory pathways of the trigeminal nerve and of the motor pathways of the trigeminal, facial, and hypoglossal nerves. This reflex is absent at 26 weeks of gestational age, can be elicited with long latency at 30 weeks, and is fully developed at 34 weeks. The reflex disappears by 4 months of age.

To elicit the tonic neck reflex, the infant is placed in a supine position with the head in the midline, and the head is turned slowly to one side. This maneuver results in extension of the arm on the side to which the head is turned and flexion of the arm on the opposite side. The lower limbs respond similarly, but less strikingly. Ultimately, the infant assumes a "fencing" posture. The tonic neck reflex is one of the latest primitive neonatal reflexes to appear during human gestation. It appears at 35 weeks of gestational age, is most prominent at 2 months after birth, and disappears by 6 months of age.

#### References:

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#### Content Specifications:

Know the normal integrated (primitive) reflexes that are present in the newborn infant, such as Moro, tonic neck, rooting, and grasping

Know the normal pattern of development of primitive (primary or integrated) reflexes in premature and term infants and through infancy (e.g. grasp, asymmetric tonic neck reflex, tonic labyrinthine)

