ألجامعة المستنصرية /كلية الطب
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Development

- "Growing up" involves three major dynamic processes: Growth, Development, Sexual Maturation.
- **Growth** refers to an increase in physical size of the whole body or any of its parts. It is simply a quantitative change in the child's body. It can be measured in Kg, pounds, meters, inches.
- **Development** refers to a progressive increase in skill and capacity of function. It is a qualitative change in the child's functioning. It can be measured through observation.
- Parental concern regarding delays in fine and gross motor skills, language skills, and social/emotional development are often highly accurate and should always warrant further evaluation.

The Principles of Development

1. **Development is a continuous process from conception to maturity**. This means that development occurs in utero, and birth is merely an event in the course of development, though it signals the beginning of extraneous environmental factors.
2. **The sequence of development is the same in all children, but the rate of development varies from child to child**. For example, culture can influence the sequence of development; in general, a child must learn to sit before he can learn to walk. More than the sequence, the age at which children learn to sit and to walk varies considerably. There is a sequence of development within each developmental field, but the development in one field does not necessarily run parallel with that in another even in children with normal development, as often it depends on the dominant side of the brain. For instance, though the stages in the development in grasping and in locomotion (sitting and walking) are clearly delineated, development in one field may be more rapid than in another. A child with cerebral palsy involving mainly the lower limbs will be late in learning to walk, but if his intelligence is normal the development of manipulation will be average.
3. **Development is intimately related to the maturation of the nervous system.** For instance, no amount of practice can cause a child to walk until his nervous system is ready for it, but lack of opportunity to practice will impede it.

4. **Generalized mass activity is replaced by specific individual responses.** For instance, while the young infant wildly moves his trunk, arms and legs, and pants with excitement when he sees something interesting which he wants, the older infant merely smiles and reaches for it.
5. **Development is in the cephalocaudal direction.** The first step towards walking is the development of head control—of strength in the neck muscles. The infant can do much with his hands before he can walk. He can crawl, pulling himself forward with his hands, before he can creep, using hands and knees.
6. **Certain primitive reflexes, such as the grasp reflex and walking reflex, must be lost before the corresponding voluntary movement is acquired.**

Factors affecting development

1- Intelligence.
2- Environment.
3- Familial
4- Variation of CNS maturity.
5-Personality.
6- Prematurity.
7- Physical handicap: deafness → delay in speech
Blindness → delay in fine movement.

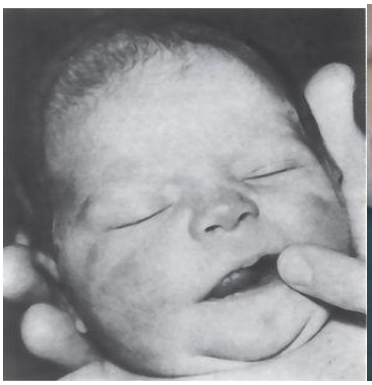
Primitive reflexes

- Primitive reflexes are involuntary motor responses originating in the **brainstem** present after birth in early child development that facilitate survival.
- These central nervous system motor responses are eventually inhibited by (4 to 6 months of age) as the brain matures and replaces them with voluntary motor activities but may return with the presence of neurological disease
- If an infant is very sleepy, irritable, or satiated after feeds, the primitive reflexes will be diminished and should be reevaluated when the infant is alert between feedings.
- The primitive reflexes should always be symmetrical and are considered abnormal if asymmetrical or absent at birth

Oral Reflexes: sucking, rooting, and snout reflexes

The **sucking reflex** is tested by introducing a finger or teat into the mouth, when vigorous sucking occurs.
The '**rooting**' or **'search'** reflex is present in normal full-term babies. When the Baby's cheek contacts the mother's breast or other part, he 'roots' for milk.

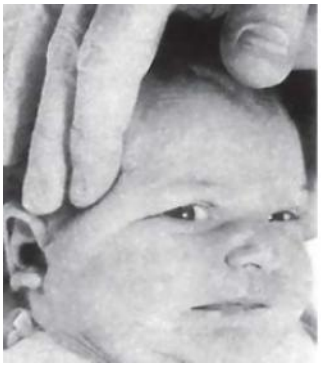
The **snout reflex** is present when the lips pucker in response to gentle pressure over the nasal philtrum.



Eye reflexes: Blink reflexes, The doll's eye response

Blink reflexes. When the infant is awake Various stimuli will provoke blinking, a bright light suddenly shone into the eyes, a puff of air upon the sensitive cornea or a sudden loud noise will produce immediate blinking of the eyes, and this continues to be present throughout life

The doll's eye response. This is so named because there is a delay in the movement of the eyes after the head has been turned. If the head is turned slowly to the right or left, the eyes do not normally move with the head. The reflex is always present in the first 10 days, disappearing thereafter as fixation develops. It would be asymmetrical in abducens paralysis. The reflex may persist beyond the first few days in abnormal babies

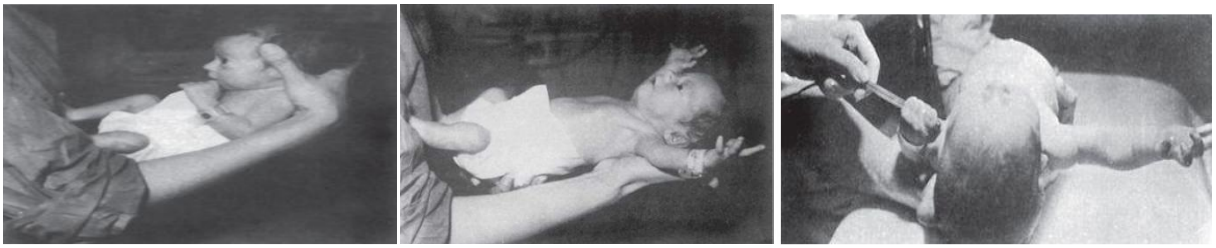


Moro reflex:

The Moro reflex is a vestibular reflex that is present at birth, peaks in the first month of life and begins to disappear by 2 months of age but can be noted till 6 months of age. stimuli are given to muscles of neck. It can be elicited in several ways. The head is supported in the palm of the examiner 2 cm above the table, then suddenly released. The reflex consists of abduction & extension of arms, opening of the hands,

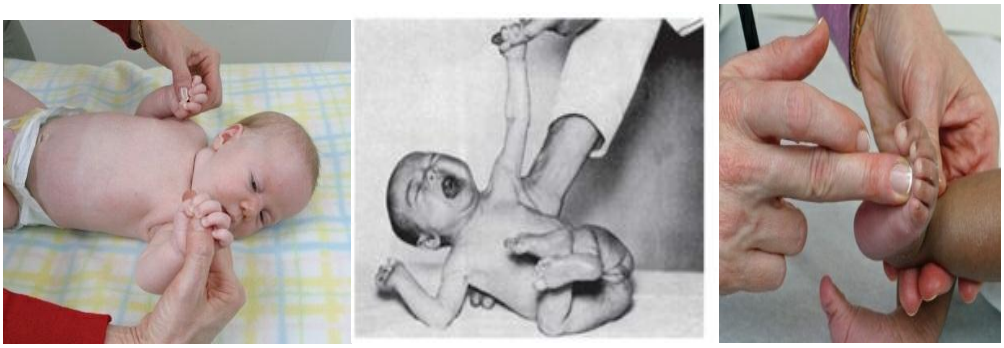
then adduction & flexion of the arms. The reflex may be accompanied by crying. When eliciting the response, the head should be in the midline, and the hands should be open. The reflex is less extensive in hypertonia; the full movement of the arm is prevented by the increased muscle tone. In severe hypertonia, the reflex cannot be elicited at all: in less severe hypertonia there is little movement of the arms, and the hands may fail to open.

- Established by 28 weeks of fetal life
- Disappears by 4-6 months after birth
- Decreased in: hypotonia
- Asymmetrical: in Erb's palsy, fracture of clavicle or humerus and spastic hemiplegia. It is inhibited on one side if the hand is holding an object.

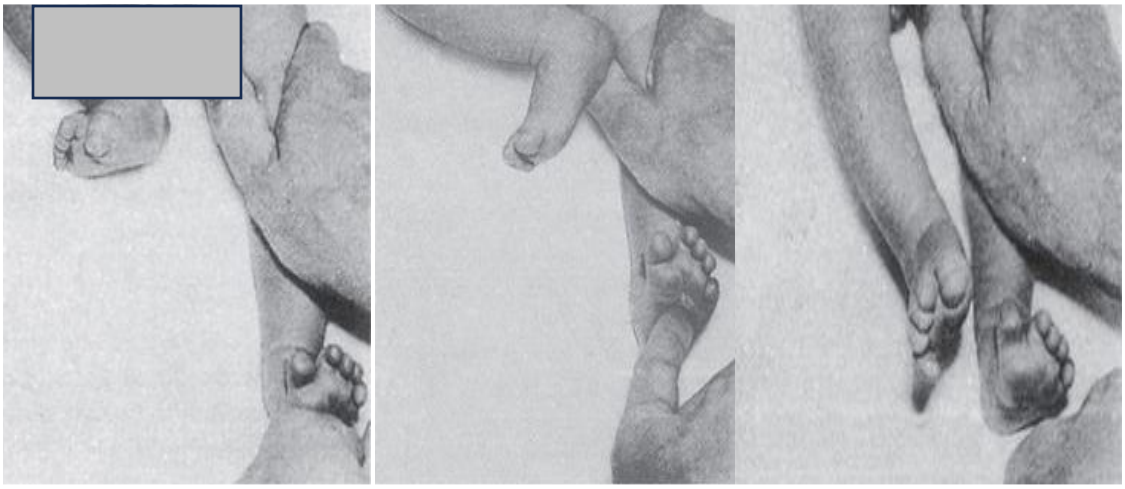


Startle reflex: This is frequently confused with the Moro reflex. In the startle reflex, obtained by a sudden loud noise or by tapping the sternum, the elbow is flexed (not extended, as in the Moro reflex), and the hand remains

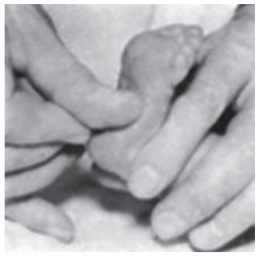
Grasp reflex: The grasp reflex is elicited by introducing a finger or other suitable object into the palm from the ulnar side. In full term baby the grasp is so tight that you can lift the baby off the couch. There is a corresponding planter grasp reflex. It begins at 32 weeks and premature baby up to 36 wks. has weak grasp reflex. Palmar grasp disappears at 4-6 months of age, persistence of this reflex in spastic cerebral palsy. Plantar grasp reflex disappears at 9-12 months, time at which gait is expected to occur.



The crossed extension reflex is obtained by holding one leg extended at the knee and applying firm pressure to the sole or stroking it on the same side. The free leg flexes, adducts and then extends, giving the impression of attempting to push away the stimulating agent. It is not normally obtained after the first month. It may be obtained in the preterm baby, but the adduction component of the reflex does not appear until the 37th week of gestation.



The plantar response. The reflex is tested by the finger—and never by a key or other instrument. The stimulating finger should not be taken across the sole of the foot, for that would elicit the plantar grasp reflex: the stimulus should be applied to the distal half of the outer side of the foot



Hip Reflexes:

Limp placement reflex: the infant held vertically by the trunk, the tibia brought up against the edge of the table, the baby steps up the table. It appears in full term baby, disappearing in 6 weeks. It is absence in brain damage

Walking (stepping) reflex: feet are pressed against the surface of the table with the infant held vertically, the baby makes walking movements. It lasts for 1-2 months, but more if the neck remains extended (for several months). The reflux is not well developed until 40 weeks of fetal life.

Asymmetrical tonic neck reflex: The baby lying awake at rest in supine position, the head is turned to one side→ the arm &leg on the same side is extended & the contralateral knee is flexed. It occurs spontaneously in 7 weeks baby. Disappear in 2-3months Persist in spastic child.

The Galant reflex (trunk incurvation):
obtained by placing the baby in ventral suspension, then stroking the skin on one side of the back. The baby's trunk and hips should swing towards the side of the stimulus. This reflex is absent in transverse spinal cord lesions or injuries.

Lateral propping: In sitting, the arm extends on the side to which the child falls as a saving mechanism. It appears at age of 6-8 months, fully developed at age of 10-11 months and never disappears. Asymmetric lateral propping can be an early sign of hemiparesis; the baby will prop on one side but on the paretic side he will not extend the arm to catch himself with the infant sitting

Parachute reflex: When suspended face down, the arms extend as though to save themselves. It is the last of the postural reflexes to develop. It usually appears at 8 to 9 months of age. Asymmetry of the reflex is abnormal and may indicate paresis in the non-extended extremity.

Development milestones

• **Developmental milestones:** the acquisition of important developmental skills.
• **The median age** is the age when half of the standard population of children achieve that level; it serves as a guide to when stages of development are likely to be reached but does not tell us if the child's skills are outside the normal range.
• **Limit ages** are the age by which they should have been achieved. Limit ages are usually 2 standard deviations (SD) from the mean. They are more useful as a guide to whether a child's development is normal than the median ages. Failure to meet

them gives guidance for action regarding more detailed assessment, investigation or intervention.

Variation in the pattern of development

There is variation in the pattern of development between children. Taking motor development as an example, normal motor development is the progression from immobility to walking, but not all children do so in the same way. While most achieve mobility by crawling (83%), some bottom-shuffle and others crawl with their abdomen on the floor, so-called commando crawling (creeping). A very few just stand up and walk. The locomotor pattern (crawling, creeping, shuffling, just standing up) determines the age of sitting, standing and walking.

The limit age of 18 months for walking applies predominantly to children who have had crawling as their early mobility pattern. Children who bottom-shuffle or Commando-crawls tend to walk later than crawlers, so that within those not walking at 18 months there will be some children who demonstrate a locomotor variant pattern, with their developmental progress still.

Adjusting for prematurity

If a child has been born preterm, this should be allowed for when assessing developmental age by calculating it from the expected date of delivery. Thus, the anticipated developmental skills of a 9-month-old baby (chronological age) born 3 months early at 28 weeks' gestation are more like those of a 6-month-old baby (corrected age). Correction is not required after about 2 years of age when the number of weeks early the child was born no longer represents a significant proportion of the child's life.

Gross motor	**Limit age**
Head control	4 months
Sits unsupported	9 months
Stand independently	12 months
Walk independently	18 months

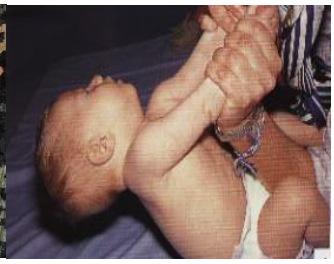
Vision and fine motor	**Limit age**
Fixes and follows visually	3 months
Reaches for objects	6 months
Transfers	9 months
Pincer grip	12 months

Hearing, speech and Language	**Limit ages**
Polysyllabic babble	7 months
Consonant babble	10 months
Saying 6 words with meaning	18 m
Joins words	2 years
3-word sentences	2.5 years

Social behavior	**Limit ages**
Smiles	8 weeks
Fear of strangers	10 months
Feeds self/spoon	18 months
Symbolic play	2–2.5 years
Interactive play	3–3.5 years

Neonatal period:
• prone: flexed attitude, turn face from side to side, head sags on ventral suspension
• supine: flexed, a little stiff.
• visual: may fixate on light in line of vision, doll ‘s eye movement of eye on turning the body
• reflexes: (Moro, stepping, walking, grasp) are active.
• social: visual preference for human face.

[1month]:
• prone: legs more extended, hold chin up, turn head, head lifted momentarily to plane of body on ventral suspension.
• supine: tonic neck posture predominates, head lags on pulling to sitting position.
• visual: follow moving objects, watch people.
• social: begins to smile, body movement in cadence with voice of others in social contact.

tonic neck posture Head lag

2months:
• prone: raises head slightly further, head sustained in plane of body on ventral suspension.
• supine: tonic neck posture, head lags on pulling to sitting position.
• visual: follow moving objects 180 degrees
• social: smile on social contact, listen to voice& coos.

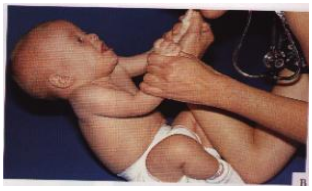
(3 months):
• prone: lifts head & chest, arm extended, head above plane of body on ventral suspension.
• supine: tonic neck posture predominates, reach towards & misses objects, wave at a toy.
• sitting: head lags partially compensated on pull to sitting position, early head control with bobbing, back is rounded

• reflexes: typical Moro reflex disappears, make defensive movement or selective withdrawal reactions
• social: sustained social contact, listen to music, say aah- ngah

Wave at toy

(4months) :

• prone: lifts head on chest, head is approximately in vertical axis, legs are extended.
• supine: symmetric posture predominates, hands in midline, reach & grasp objects & bring them to mouth.
• sitting: no head lag on pull to sitting position, head is steady tipped forwards, enjoy sitting with full trunk support
• standing: when held erect push with feet
• adaptive: see pellet, but makes no move to it.
• social: laugh aloud, displeasure when social contact is broken &excited at sight of food.



Head control

7 months:

• Prone: roll over, crawl or creep.
• Supine: lift head, roll over, squirming movement
• Sitting: sits briefly with support of pelvis, lean forward
• Standing: support most of weight, bounce actively.
• Adaptive: reach out & grasp large object, transfer objects from hand to hand.
• Language: polysyllabic vowel sounds.
• Social: prefer mother, enjoy looking at mirror. Respond to change in social & emotional contact.

(10 months):

• sitting: sit alone indefinitely without support.
• standing: pull to standing position, walk holding furniture.

• motor: creep, crawl.
• adaptive: grasp object with thumb & forefinger, pick pellet with assisted pincer movement, attempt to retrieve dropped objects, release object grasped by others uncovers hidden toy.
• social: respond to sound of name play peekaboo, wave bye-bye.
• language: mama, baba (repetitive constant sounds).


walk holding furniture


play peekaboo

(1 year):
• motor: walk with one hand held(48wk), rises independently, takes several steps.
• adaptive: pick up pellet with unassisted pincer movement of forefinger & thumb, request to gesture.
• language: few words beside mama, baba.
• social: play simple ball game. Makes postural adjustment to dressing

At 15 months:
• motor: walk alone, crawl upstairs.
• adaptive: make tower of 3 cubes, insert pellet in a bottle, make a line.
• language: jargon, follow simple commands, name familiar objects، respond to his name.
• social: indicate some desire or need by pointing hugs parents.

At 18 months:
• motor: run stiffly, sit on small chair, walk upstairs with one hand held, explore drawers & waste baskets.
• adaptive: make a tower of 4 cubes, scribble, imitate vertical stroke, dumps pellet from bottle.
• language: 10 words, name pictures, identify one or more parts of the body.
• social: feeds self, seek help when in a trouble, complain when wet or soiled, kisses parents with pucker

At 24 months:
• Motor: runs well, walk up & downstairs with one step at a time, opens doors, jumps.

• Adaptive: tower of 7 cubes, circular scribbling, imitate horizontal stroke, folds paper once imitatively, handle spoon well.
• social: tell immediate experience, help to undress, listen to stories with pictures.
• language: Puts 3 words together (subject, verb, object) ،well, developed, questioning, expressing, sing nursery rhyme

At 30 months:
• Motor: goes upstairs on alternating feet.
• Adaptive: tower of 9 cubes, make vertical & horizontal strokes but generally will not join them to make a cross, imitates circular stroke, forming closed figures.
• Language: knows full name, refers to self by pronoun (I).
• Social: helps put things away, pretends in play.

At 3 years:
• Motor: rides tricycle, stands momentarily on one foot.
• Adaptive: tower of 10 cubes, imitates construction of bridge of 3 cubes, copies a circle, imitates a cross.
• Language: knows age & sex, counts **3** objects correctly, repeats 3 numbers or a sentence of 6 syllables, most of speech intelligible to strangers
• Social: plays simple games (in parallel with other children), helps in dressing (unbuttons clothing & puts on shoes), washes hands.

4 years:
• motor: hops on one foot, throws ball overhand, uses scissors to cut out pictures, climbs well.
• adaptive: copies bridge from model, imitates construction of gate of 5 cubes, copies cross & square, draws a man with 2-4 parts besides head, name longer of 2 lines.
• language: Counts **4** pennies accurately, tells a story
• social: plays with several children with beginning of social interaction and role playing, goes to toilet alone.

(5 years):
• Motors: skips.
• Adaptive: draws triangle from copy, names heavier of 2 weights.
• Language: names 4 colors, repeats sentence of 10 syllables, counts **10** pennies correctly.
• social: dresses & undresses, ask questions about meaning of words, domestic role playing.