EXAMINATION
PEDIATRIC PHYSICAL THERAPY

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- Examination begins as soon as the family and child **enter** the examination room
- **Reaction to separation** from the parents
- Apparent **visual and auditory** awareness;
- **Temperament** (calm or hyperactive, compliant, or difficult)
- **spontaneous exploration and interest in toys**, games, or books in the room; style, concentration, attention span
- **distractibility** during play
- level and manner of motor activities
- **Vocabulary, complexity of language**, and quality of speech; and interaction with parents or examiner (appropriate, shy, or demanding).
- Observations of the parents' response and their way of **handling** the child's behavior are also revealing.

- For infants and young children, the examiner must create an **atmosphere of trust.**
- Friendly advances during history-taking or while the child is at play allay **initial fears and anxiety**.
- Most, if not all, of the examination can be accomplished with the child in the **parent's lap** if the child remains fearful
- **Developmental testing** by offering toys for grasping
- As the parent gradually undresses the child, **gentle touch and tickling or funny sounds with a smile** help to maintain relaxation and to facilitate hands-on examination

- The **actual hands-on examination**, consisting of bodily handling and manipulation, is the last stage; anxiety-provoking or painful tests are deferred to the END
- With **anxious children**, performance of gross motor activities, such as sitting, crawling, standing, or walking, also can be conducted through the parents.
- Range of motion, deep tendon reflexes, or primitive reflexes that need **physical manipulation** should be examined after evaluation of active mobility

STEPS

- INSPECTION
- PALPATION
- ORGAN SYSTEMS
- NEUROMUSCULAR SYSTEM
- MUSCULOSKELETAL SYSTEMS
- SENSORY EXAMINATION
- FUNCTIONAL EVALUATION
- INFORMING INTERVIEW

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INSPECTION

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General appearance and special features may help to establish a diagnostic entity.

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- **Dysmorphic facial features, epicanthal folds, increased intercanthal distance, external ear anomalies, and malformations of the toes or fingers suggest a prenatal disorder,**

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Down syndrome

- **Hairy patches, dimples, or other skin lesions over the spine are frequent signs of……??**
- **small sinus, dermal tract, or pylonidal cyst in the gluteal crease**

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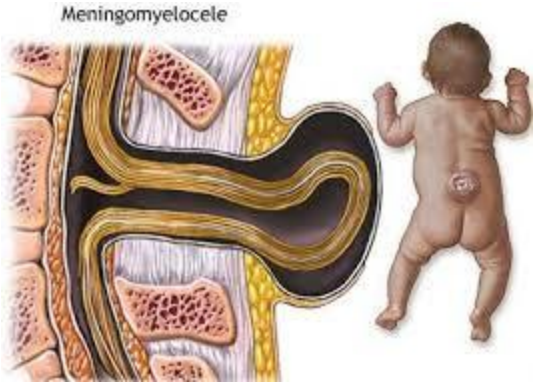
- **small sinus, dermal tract, or pylonydal cyst in the gluteal crease**

Spina bifida



- **Blue sclerae are a sign of --------????**

- **Blue sclerae are a sign of --------????**

Osteogenesis imperfecta

Asymmetric facial and palpebral fissures and pupils may indicate……

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Asymmetric facial and palpebral fissures and pupils may indicate facial palsy or Horner's syndrome

facial palsy or Horner's syndrome

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- craniofacial asymmetry and vertical strabismus develop in torticollis

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- Dolichocephaly is typical in premature infants

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- A bald spot or area of short, thinning hair over the posterior skull is a sign of weak neck muscles, most likely associated with **generalized weakness**

- Extraocular, facial, and tongue muscle weakness may represent cranial nerve dysfunction, myopathy, or other neurologic disease.

- Involuntary eye movements and nystagmus are noted in cerebellar or other CNS disorders.

- The skin should be inspected for telangiectasias, nevi, or other lesions. Cafe-au-lait spots or pigmented skin areas are seen in neurofibromatosis.

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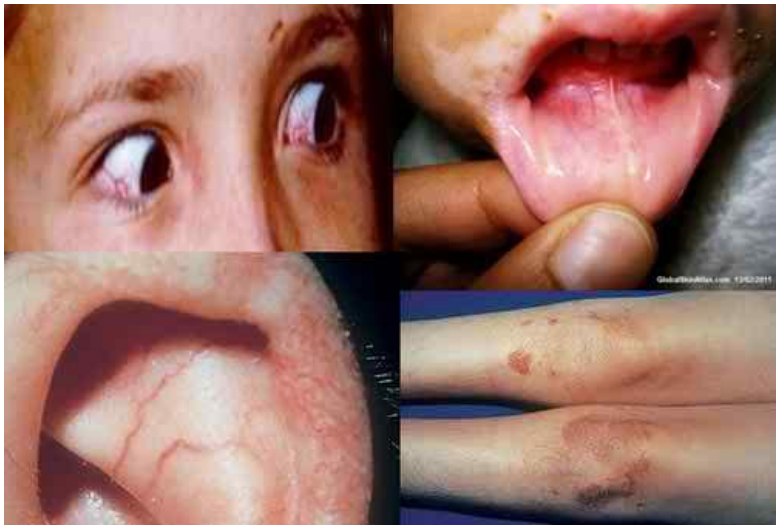
- In children with ataxia, telangiectasias are usually present over the flexor surface of the knees and elbows



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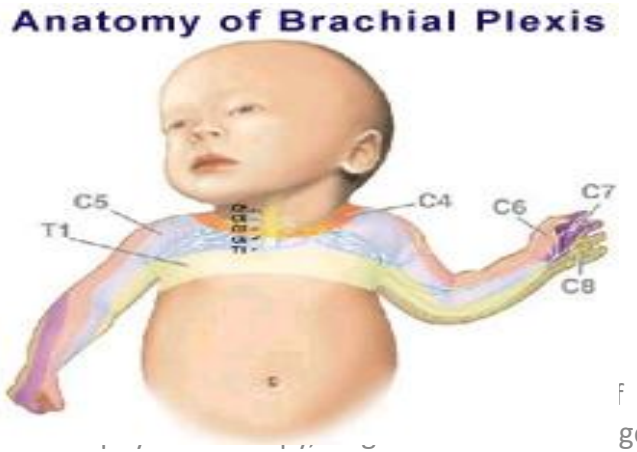
- Foot deformities, varus or valgus deformity, or claw toes lead to **abnormal weight distribution** and callus formation consistent with the **pathologic posture**.
- Calluses over the dorsum of the feet and knees, “housemaid’s knee,” develop in older children whose preferred mode of locomotion is crawling.

- **Anterior axillary and upper chest muscle atrophy may represent absent pectoralis muscle or wasting due to an old brachial plexus injury.**



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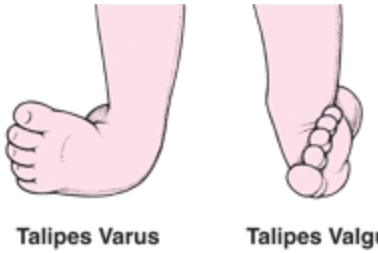
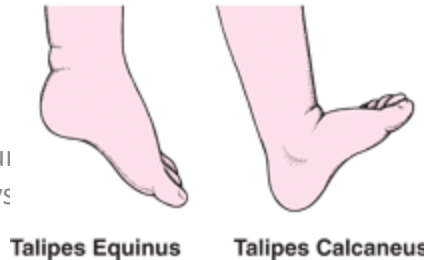
- **Congenital clubfeet or multiple joint deformities are manifestations of prenatal muscle weakness due to spina bifida, arthrogryposis, or myotonic dystrophy, or may be idiopathic**





Hypertrophy of the calf muscles is an early sign of????

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Hypertrophy of the calf muscles is an early sign of ????

Duchenne muscular dystrophy.

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- **Flaring of the ribs, or bellshaped chest, suggests ineffective intercostal muscle function in children with motor unit disease or high spinal cord dysfunction.**
- **In scoliosis, the thoracic cage is asymmetric.**

STEPS

EXAMINATION

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- PALPATION
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- NEUROMUSCULAR SYSTEM

HISTORY

- MUSCULOSKELETAL SYSTEMS
- SENSORY EXAMINATION
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PALPATION

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- Pseudomotor paralysis in **spinal cord injury** eliminates sweating below the level of the lesion, and compensatory excessive perspiration occurs above the level of the lesion with high environmental temperature

- **Vasomotor dysfunction** with **coldness** to touch and **paleness or slight cyanosis** of the skin may be present in severe upper motor neuron impairment.
- It is seen in the lower extremities of some children with **cerebral palsy**

- Tone and bulk are reduced in lower motor neuron paralysis; in longstanding denervation, the muscle tissue feels less resilient and fibrotic

- The **pseudohypertrophic calf** muscles in Duchenne muscular dystrophy have a typical **rubbery** and hard consistency.

- fibrotic nodule is usually palpable in the sternocleidomastoid muscle in congenital torticollis

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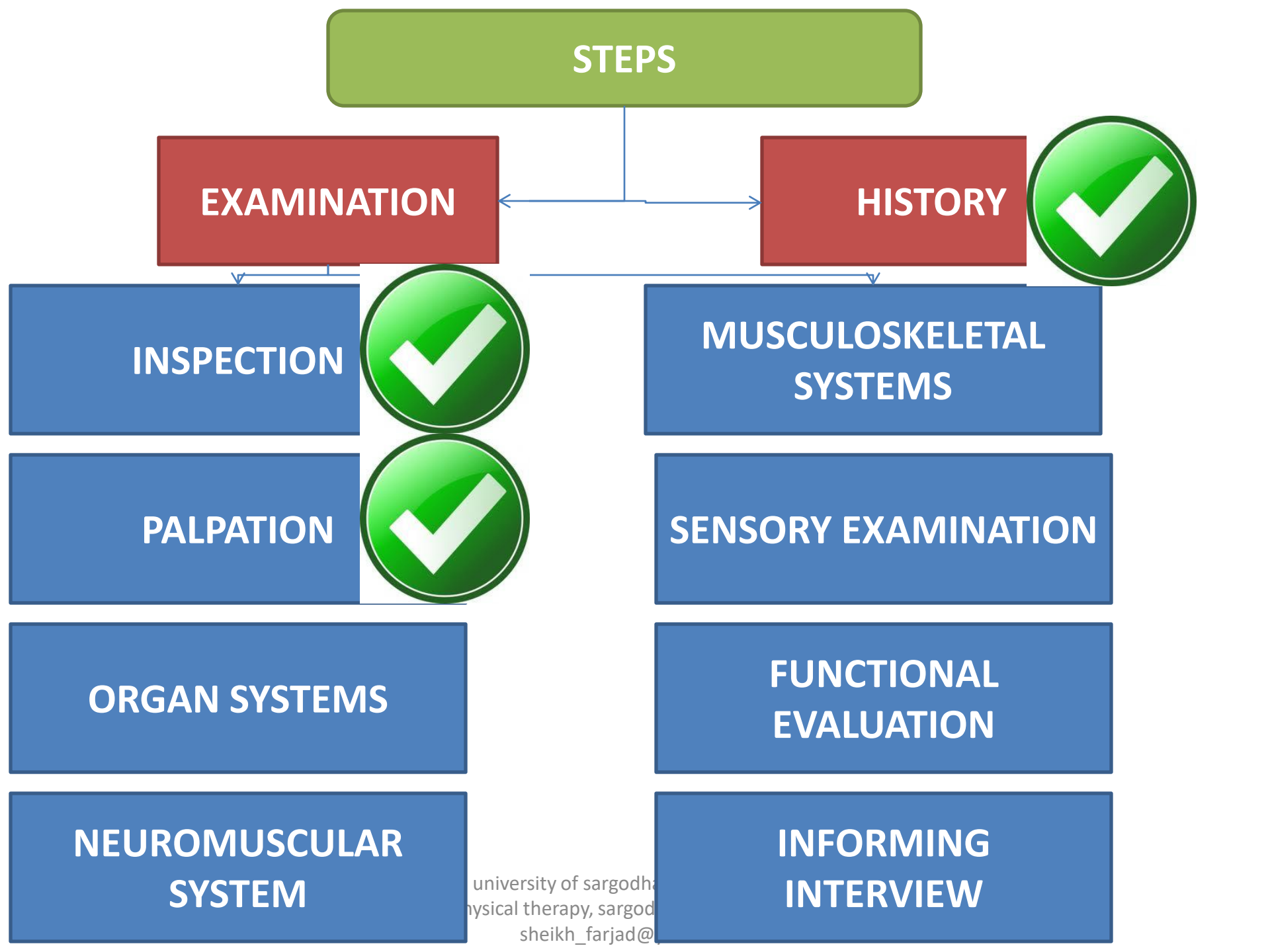

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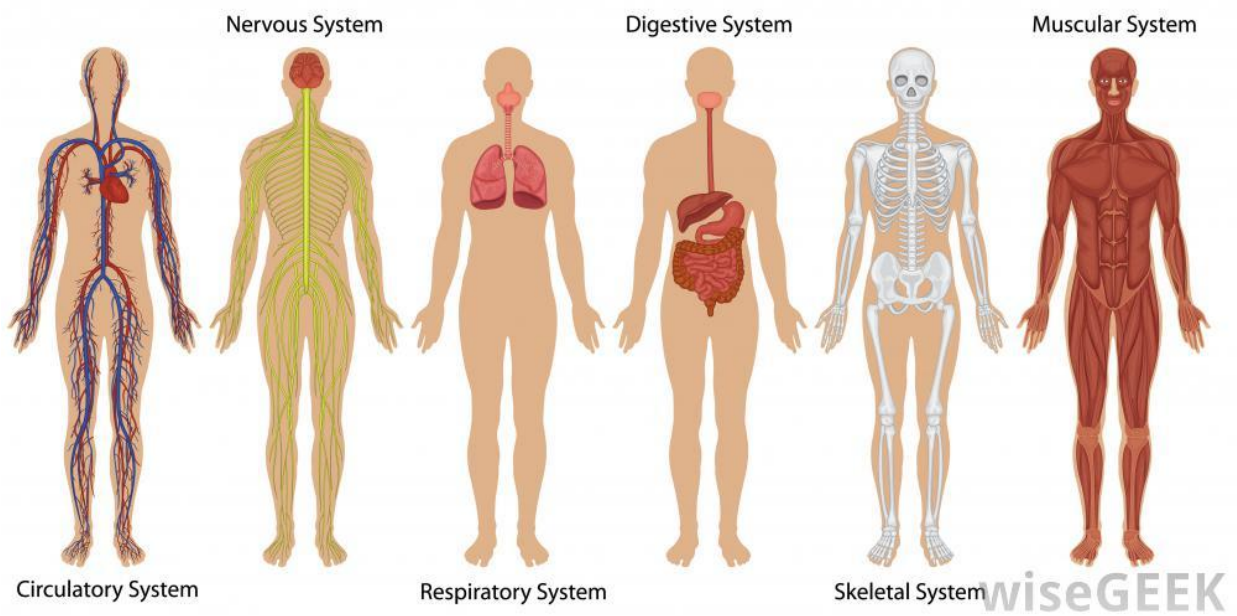
ORGAN SYSTEM



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- Vital signs, including blood pressure and heart rate, are obtained in all patients
- In **myopathies** and collagen diseases, cardiac auscultation should be performed because of the possibility of associated **heart disease**.
- In a child with developmental delay, the presence of a heart murmur may suggest an undiagnosed syndrome.
- **Blood pressure monitoring** is particularly important in **spinal cord injury, neurogenic bladder, Guillain-Barré syndrome, and residual poliomyelitis, as well as in children receiving stimulant medications**.

Pediatric Vital Sign Normal Ranges

Age Group	Respiratory Rate	Heart Rate	Systolic Blood Pressure	Weight in kilos	Weight in pounds
Newborn	30 - 50	120 - 160	50 - 70	2 - 3	4.5 - 7
Infant (1-12 months)	20 - 30	80 - 140	70 - 100	4 - 10	9 - 22
Toddler (1-3 yrs.)	20 - 30	80 - 130	80 - 110	10 - 14	22 - 31
Preschooler (3-5 yrs.)	20 - 30	80 - 120	80 - 110	14 - 18	31 - 40
School Age (6-12 yrs.)	20 - 30	70 - 110	80 - 120	20 - 42	41 - 92
Adolescent (13+ yrs.)	12 - 20	55 - 105	110 - 120	>50	>110

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- In disabilities that cause ineffective ventilation and involve the risk of minor aspirations, auscultation of the lungs must be a routine procedure.
- Myopathies, thoracic spinal cord dysfunction due to injury or malformation, severe spastic quadriparetic cerebral palsy, and any disability with oral motor dysfunction are such indications

- **Abdominal and rectal examinations are essential in children with neurogenic bladder**

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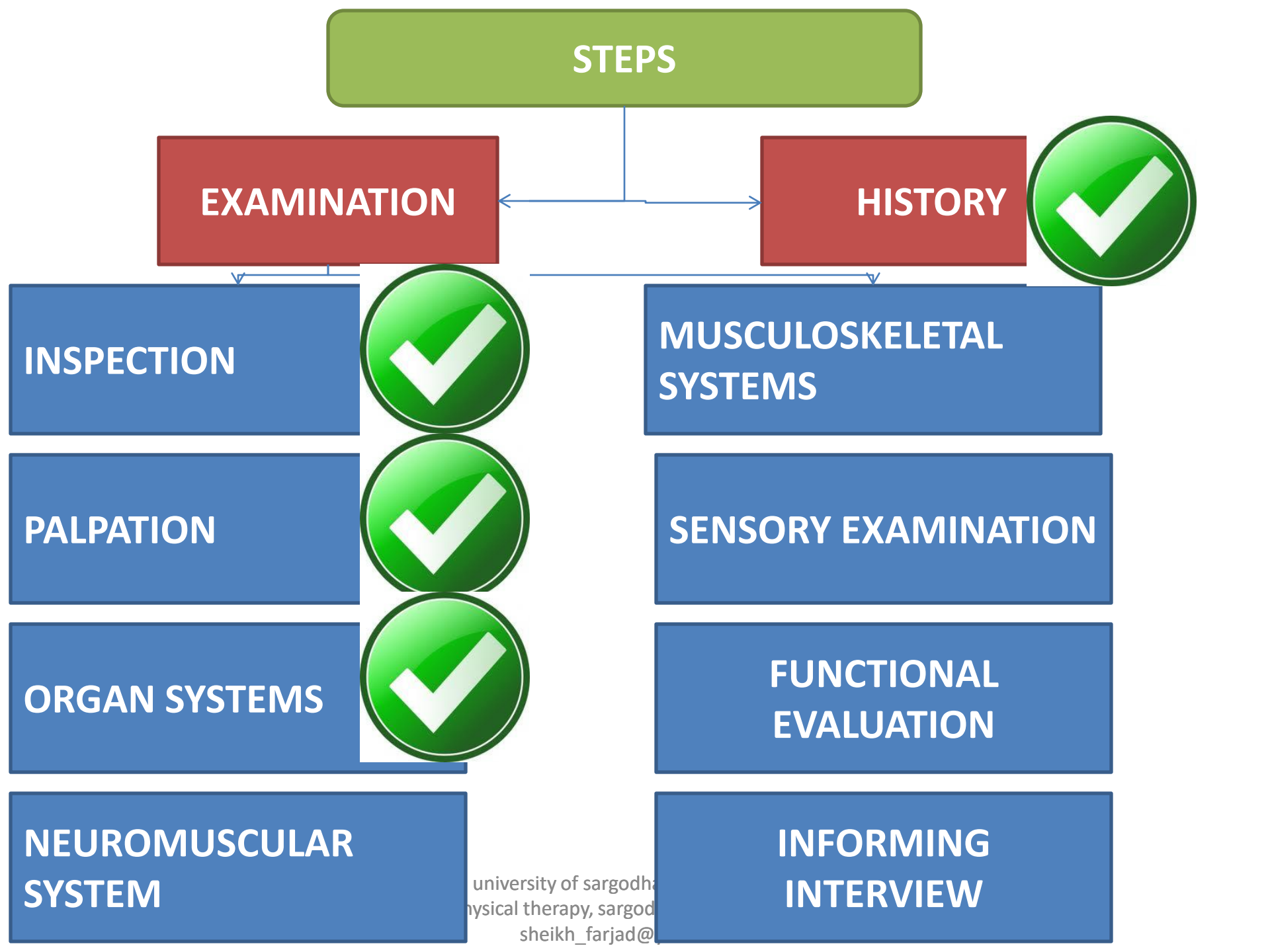

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HISTORY

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NEUROMUSCULAR SYSTEM

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NEUROMUSCULAR SYSTEM

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Reflex testing

Tone

Active movements

Strength

Coordination

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Reflex testing

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Reflex:	Suck-Swallow
Seen:	Around 28 weeks' gestation until 5 months of age.
How to elicit:	Place child supine with head in the midline. Place a finger or nipple into the infant's mouth. Press down on tongue. Best if done before infant is fed.
Response:	Rhythmical sucking movements.
Reflex:	Rooting
Seen:	Around 28 weeks' gestation until 6 months of age.
How to elicit:	Place child supine with head in the midline. Using your finger, stroke the peri-oral skin at the corner of the mouth, moving laterally toward the cheek.
Response:	After stimulation, there is head turning and mouth opening toward the stimulated side. Best if done before infant is fed.

Reflex:	Galant
Seen:	Around 32 weeks' gestation until 2 months of age.
How to elicit:	Hold the infant in prone position with one hand and gently stroke along the paravertebral line from the thoracic to lumbar region.
Response:	Concavity toward the stimulated side. Look for symmetrical response on right and left.
Reflex:	Positive Support
Seen:	Around 35 weeks' gestation until 1 to 2 months of age.
How to elicit:	Support infant in the vertical position with examiner's hands under the arms and around the chest. Allow the infant's feet to make contact with the tabletop or other flat surface.
Response:	Simultaneous contraction of flexor and extensor muscles in the legs so as to bear weight through the lower extremities. The child supports only a minimal amount of body weight.

Reflex:	Spontaneous Stepping
Seen:	Around 27 weeks' gestation until 2 months of age.
How to elicit:	Support the infant in the vertical position with examiner's hands under the arms and around the chest. With the infant's feet touching the table surface, incline the infant forward and gently move the infant forward.
Response:	The infant will make alternating, rhythmic, and coordinated stepping movements.
Reflex:	Moro
Seen:	Around 28 weeks' gestation until 4 months of age.
How to elicit:	Place the infant supine, with head in the midline, arms on chest. The head is gently lifted but not the infant's body. Allow the infant's head to drop backward, quickly supporting the head so it does not bang against the surface.
Response:	Abduction of the arms with extension of the elbows, wrists and fingers, followed by subsequent adduction of the arms at the shoulders and flexion at the elbows.

Reflex:	Startle
Seen:	Around 28 weeks' gestation until 5 months of age.
How to elicit:	Make a sudden, loud noise or tap the sternum.
Response:	The infant will startle. Will move the arms similar to a Moro but the elbows remain flexed and the hands closed.

Reflex:	Plantar Grasp
Seen:	Around 28 weeks' gestation until 9 months of age.
How to elicit:	Place the infant supine with head in midline and legs relaxed. Apply a firm pressure against the metatarsal heads, or directly below the toes.
Response:	Plantar flexion of all toes.

Reflex:	Tonic Labyrinthine
Seen:	At birth until 6 months of age.
How to elicit:	Place infant prone or supine. Observe the infant's muscle tone and posture in prone and supine.
Response:	In prone, flexor muscle tone dominates. In supine, extensor muscle tone dominates.

Reflex:	Asymmetrical Tonic Neck (ANTR)
Seen:	At birth until 6 months of age.
How to elicit:	Place the infant supine with head in midline. Have the infant follow an object from one side to the other, or turn her head slowly to one side, and hold in this position
Response:	The infant's arm and leg on the jaw side extend while the arm and leg on skull side flex.
Reflex:	Palmar Grasp
Seen:	At birth until 6 months of age.
How to elicit:	Place the index finger of the examiner into the hands of the infant and gently press against the palmar surface.
Response:	The infant's fingers will flex around the examiner's index finger.
Reflex:	Landau
Seen:	Around 4 to 5 months until 1 to 2 years.
How to elicit:	Examiner supports the infant prone, horizontally in the air.
Response:	The infant's head and hips extend in sequence.

- Reflex testing
- Tone
- Active movements
- Strength
- Coordination

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Tone

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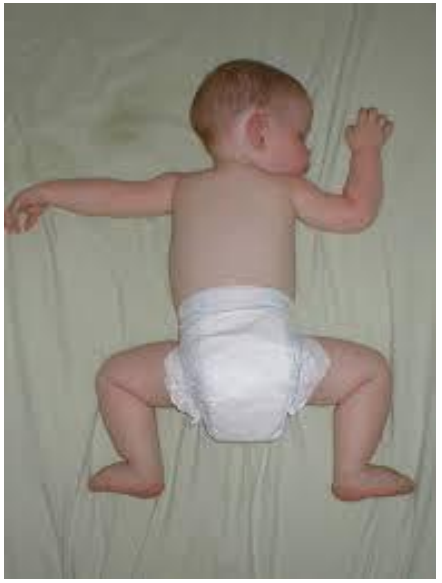

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Muscle Tone

- **Resistance to passive movement**
- **Muscle tone is most easily shown as movement of an extremity but certainly includes the trunk, neck, back and the shoulder, and pelvic girdles**
- **Two types of tone:**
  - **Phasic tone: passive resistance to movement of the extremities (appendicular structures)**
  - **Postural tone: passive resistance to movement of the axial muscles (neck, back, trunk)**

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Discrepancy between phasic tone and postural tone

- There may be a discrepancy between **phasic tone and postural tone** in a given patient
- Example: The 3 or 4 months old infant who has suffered an hypoxic-ischemic insult at birth who now has poor **head and trunk control (postural hypotonia**)
- but is beginning to become stiff (hypertonic) in the extremities (phasic tone)
- and will eventually develop increased reflexes and tone (spasticity) in the appendicular and axial muscles

SUPERA SEGMENTAL AND SEGMENTAL INFLUENCE

- **The neurologic inputs that influence muscle tone are divided into 2 major categories**
- **supraspinal or suprasegmental structures and motor unit or segmental structures.**

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Supraspinal influences

Represent those inputs from the CNS

- **This influence is exerted on the axial and appendicular muscles but is most easily appreciated in the appendicular portion of the motor system.**
- **The cerebellum normally is a powerful facilitator of tone and damage to it produces decreased tone**
- **Midline cerebellum damage may relate most to axial hypotonia and lateral cerebellar damage to appendicular hypotonia**

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MOTOR UNIT OR SEGMENTAL STRUCTURES INFLUENCE

- Related to tone from the reflex loop and its components
- The reflex loop is influenced by discrete supraspinal inputs as well as diffuse cerebral inputs such as level of consciousness, anxiety etc

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- More discrete lesions of the motor unit may affect either the **afferent or efferent limb of the reflex arc** or the muscle itself.
- These lesions almost always result in the loss of the **myotatic reflexes**
- Lesions of the **neuromuscular junction** may also be associated with hypotonia and weakness but may have preserved reflexes
- Peripheral lesions that might increase tone include visceral pain

- In the first few months of life, **flexor tone** predominates.
- Hypotonia or hypertonicity signals neurologic abnormalities
- **Increased tone is** the symptom of corticospinal or basal ganglion damage

- Myopathy, cerebellar dysfunction, and lower motor neuron lesions due to anterior horn disease, neuropathy, or spina bifida all can result in **Hypotonia.**

•Hypotonic stage usually precedes the appearance of increased tone in perinatal anoxic brain damage
• This stage of hypotonicity tends to last longer in dyskinetic cerebral palsy than in spastic types

LOCALIZATION OF LESION

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LOCALIZATION OF LESION

- **Localization into 2 large groups:**
- **Supraspinal conditions** (the brain, brainstem, and cervical spinal junction): central hypotonia
- **Segmental conditions** (anterior horn cell, peripheral nerve, neuromuscular junction, and muscle): motor unit hypotonia

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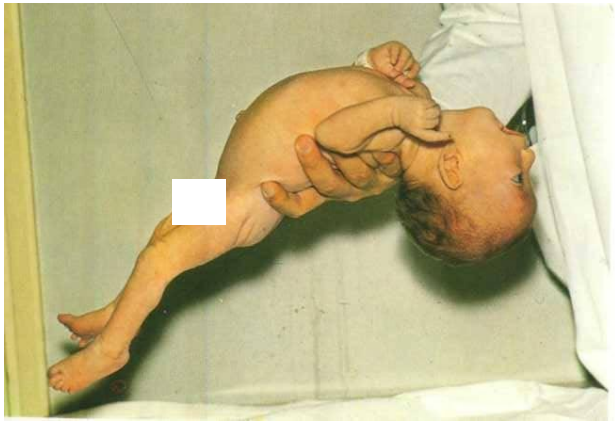
- On passive motion of hypotonic muscles or extremities, no resistance is felt. The infant with generalized hypotonia is **limp and floppy with handling**



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- In hypotonia related to motor unit disease or lower motor neuron lesion, deep tendon reflexes are diminished or absent.
- In contrast, transient hypotonic phase of central nervous system damage

Measures of muscle tone

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Measures of muscle tone

The pull to sit maneuver

- It is performed by grasping the supine infant's hands and gently pulling them to a sitting position. The normal newborn will have a head lag, but, by about 2 months of age, this should be minimal if still present at all

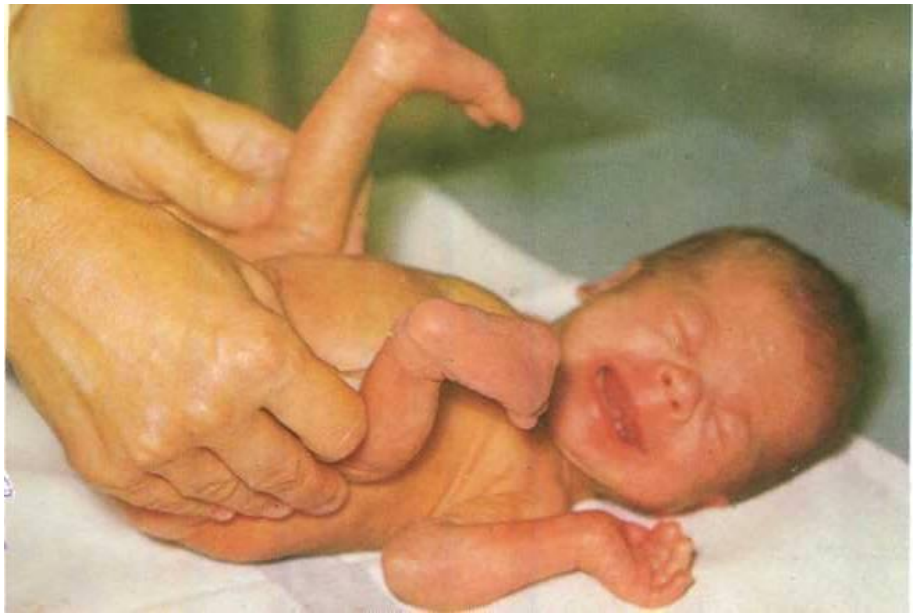
- Premature infants will have lower tone than term infants, and term infants will have lower tone than post term infants normally

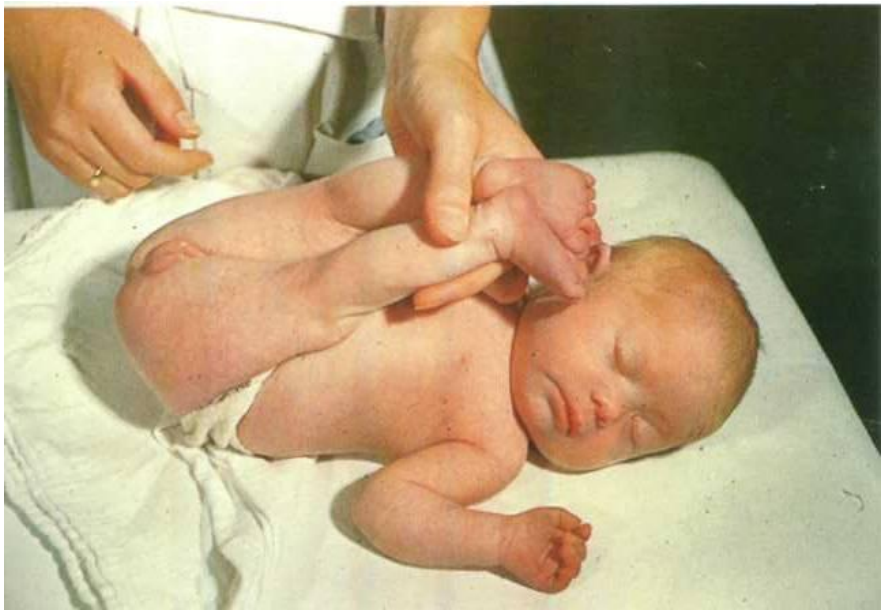
- The "pull to sit" maneuver tests axial tone of the neck and back and appendicular tone of the shoulder and arms and also tests strength to some extent

The Scarf sign

- It is performed by grasping the supine infant's hand and pulling it across the chest as far as it will go without significant resistance
- Normally, the elbow can be brought to the midline of the baby's chin and chest. In the hypotonic infant, the elbow can easily be brought well beyond the midline before encountering resistance. This test measures the appendicular tone in the shoulder

The *'heel-to-ear'* manoeuvre





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The shoulder suspension test

- It is performed by picking the infant up holding them under the arms
- The hypotonic infant tends to slip through the examiners hands, and the maneuver is a test of appendicular tone but can also give some indication of head control (axial) as well as strength because the normal infant provides some resistance in the shoulders when being lifted



The ventral suspension test

- The infant is lifted off the table by 1 hand under the chest and abdomen
- The position the infant assumes is quite dependent on the gestational age and state of alertness
- Normally, the term infant will keep the arms and legs flexed some and is able to lift the head above the horizontal, although not indefinitely
- The premature infant will just drape over the hand, and the postmature infant would be able to keep the arms and legs flexed and the head above horizontal indefinitely
- In older children (eg, 2 to 4 months old), this maneuver is also a reasonably good measure of strength

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Clinical Evaluation

- **There is no substitute for experience**
- Examine the patient on 2 or more occasions
- The second important feature to determine is the presence or absence of myotatic reflexes
- Most hypotonic individuals will have depressed reflexes

Localization of hypotonia

- **Supraspinal or suprasegmental conditions**
  - central hypotonia
  - conditions that affect the brain and brainstem, either diffusely or focally
  - myotatic reflexes are preserved
- **Segmental or motor unit conditions**
  - Effects the motor unit
  - reflexes are usually lost completely

Table 1 Localization in the Floppy Infant

Origin of Hypotonia	Structural Localization	Clinical Pathological Conditions
Supraspinal/suprasegmental hypotonia (preserved DTR)	Brain	Systemic illness (sepsis, CHF, HIE)
	Brainstem	Syndromic hypotonia
		Cerebral dysgenesis
		Grossly normal brain
	Craniovertebral junction	Spinal cord injury
Segmental or motor unit hypotonia (DTR depressed or lost)	Anterior horn cell	Spinal muscular atrophy
	Peripheral nerve	HMSN
	Neuromuscular junction	Myasthenia gravis, congenital myasthenic syndromes, botulism
	Muscle	Congenital myopathies, metabolic myopathies, neonatal presentation of muscular dystrophy

DTR = myotatic reflexes (deep tendon reflexes); CHF = congestive heart failure; HIE = hypoxic ischemic encephalopathy; HMSN = hereditary motor sensory neuropathy.

- Spastic hypertonicity and related postures are influenced by position in space and the effect of gravity.
- The child should be examined in supine, prone, and vertical positions to elicit typical postures.
- Examples include increased scissoring, extension, and plantar flexion of the legs when a child with spastic cerebral palsy is suddenly lifted into vertical suspension

- Resistance to both slow and fast stretching of muscle should be tested to differentiate **rigidity from spasticity**

- Reflex testing
- Tone
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Active movements

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- In infants and young children, a number of developmental **reflexes** to examine active movements and strength

- The Moro reflex includes shoulder abduction followed by forward flexion of the arm

- Eliciting palmar or plantar grasp reflexes demonstrates **finger or toe flexor function**

- **Asymmetric responses** in the upper extremities may suggest **Erb's or Klumpke's paralysis or hemiplegia**

- Unilateral or bilateral absence of protective extension response is likewise suggestive of weakness in the respective extremity.

Name – Protective extension(PE)
Onset – arms, 4-6 months; legs , 6-9 months.
Integrated – persists
Stimulus – Displace center of gravity outside the base of support
Response – Arms or legs extend and abduct to support and to protect the body against falling

Parachute Reflex

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- A **four month old** infant elevates the head and trunk on extended arms in the prone position. **Scapular winging during this activity is a sign of a weak serratus anterior muscle**

- Young children often adopt **substitutions movements** to cope with weakness of particular muscles.
- With weakness of the deltoid, they may flying the arm forward by momentum or substitute the long head of the biceps for shoulder flexion.

- **Combat crawl** is a usual way of crawling in **lower extremity paralysis**.
- **Deformities around a joint** reflect an **imbalance of strength in muscles** acting on the joint.
- The deformity or deviation is in the direction of over-pull.
- Such imbalance may be spastic or paralytic.

- Reflex testing
- Tone
- Active movements
- Strength
- Coordination

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Strength

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- Visual observation during performance of **functional activities** to detect muscle weakness should consider the **child's age** and the **achievements expected** for the child's developmental stage.
- Walking on tiptoes, squatting and rising without using the arms for assistance, and straight sitting up from the supine position without rolling to the prone position or to the side are mastered by children around **three years of age**

- The standard technique of manual muscle testing can be used after school age, **except** in children who have serious behavioral problems or mental retardation
- The customary grading system of scores from **0–5 or zero to normal is used.**
- A wide range of normal variations in growth patterns should be considered in judging good versus normal strength
- Because children are adept in using substitution movements, the examiner must pay special attention and adhere to **precise technical conduct of testing** individual muscles

- **Side-to-side comparison** may detect even mild neurologic weakness, although disuse atrophy or mild bilateral neurologic weakness may escape detection.
- **Quantitative strength determination** with comparison of both sides is helpful to demonstrate unilateral disuse atrophy in such strong muscles as the **quadriceps.**

- Testing of strength in upper motor neuron lesions requires the well-known considerations for position in space and orientation of head and major joints, which may affect recruitment of motor units and produce synergistic movement patterns.

- Reflex testing
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- Active movements
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Coordination

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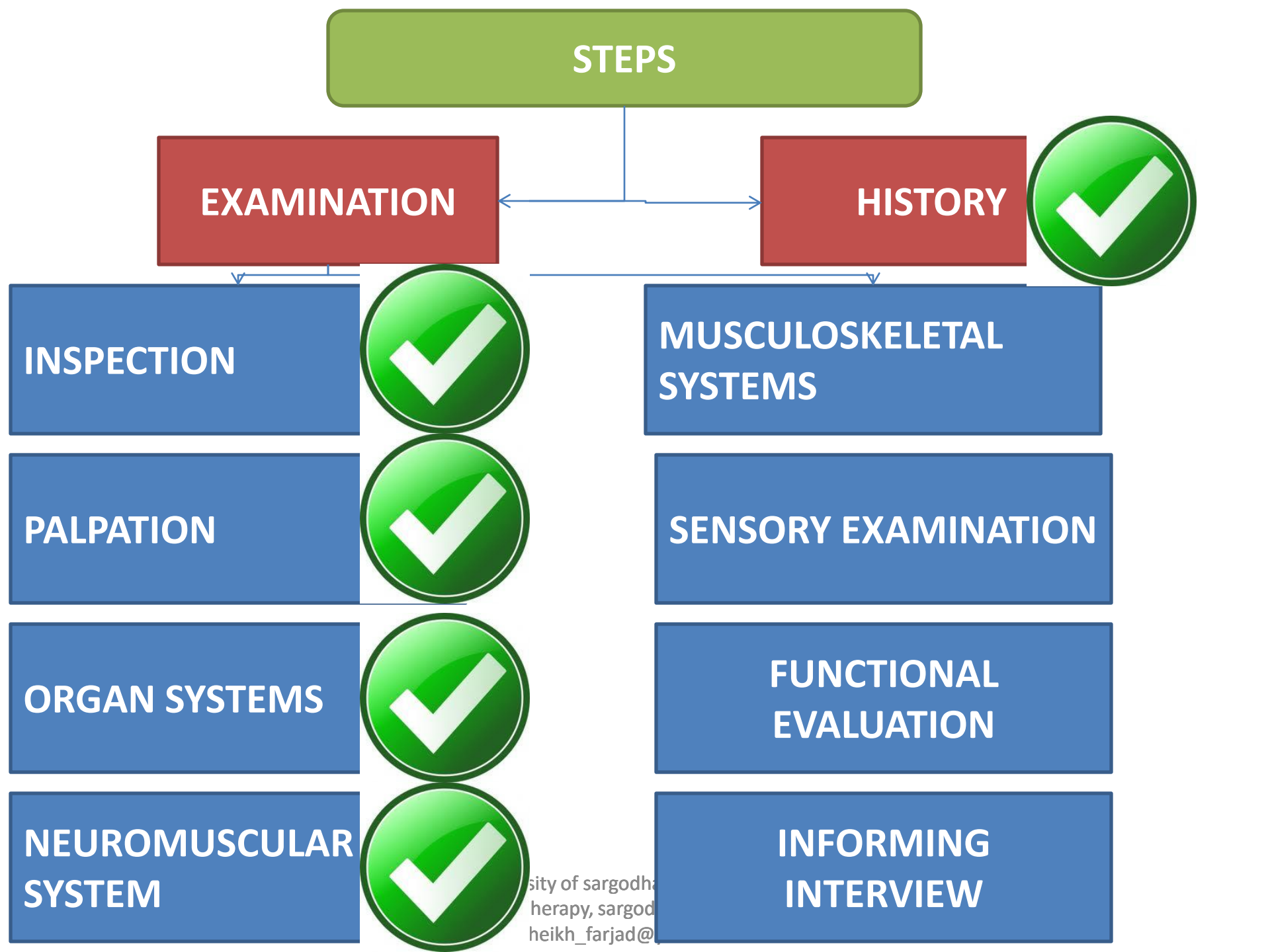
- A common sign of central movement disorders is impaired coordination.
- Proprioceptive sensory loss or parietal lobe syndrome may contribute to **incoordination**.
- Movement abnormalities associated with cerebellar dysfunction, basal ganglion disease, dyskinetic disorders, or spastic incoordination present with specific distinguishing signs
- Detection of coordination deficit is based mostly on observation of **gross and fine motor function in children less than two to three years of age**.

- Around **three years of age**, the child can walk along a **straight line**, unsteadily placing one foot in front of the other.
- In comparison, facility at **tandem walking** at **five years of age** is a good illustration of continuing refinement of motor skills with age
- Clumsiness of handwriting and drawing, difficulties in physical education or sports, and other subtle signs may be present


STEPS
EXAMINATION
HISTORY
INSPECTION
MUSCULOSKELETAL SYSTEMS
PALPATION
SENSORY EXAMINATION
ORGAN SYSTEMS
FUNCTIONAL EVALUATION
NEUROMUSCULAR SYSTEM
INFORMING INTERVIEW

MUSCULOSKELETAL SYSTEMS

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INSPECTION

PALPATION
BONE/SOFT TISSUES

ACTIVE/PASSIVE
ROM

GAIT

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ACTIVE/PASIVE ROM

- Full-term infants may lack as much as **25 degrees** of elbow extension because of **predominant flexor tone**.
- In contrast, joint hyperextensibility and hypotonia allow **increased passive motion** in preterm infants.
- The **scarf sign** is a good illustration of excessive joint mobility in premature babies

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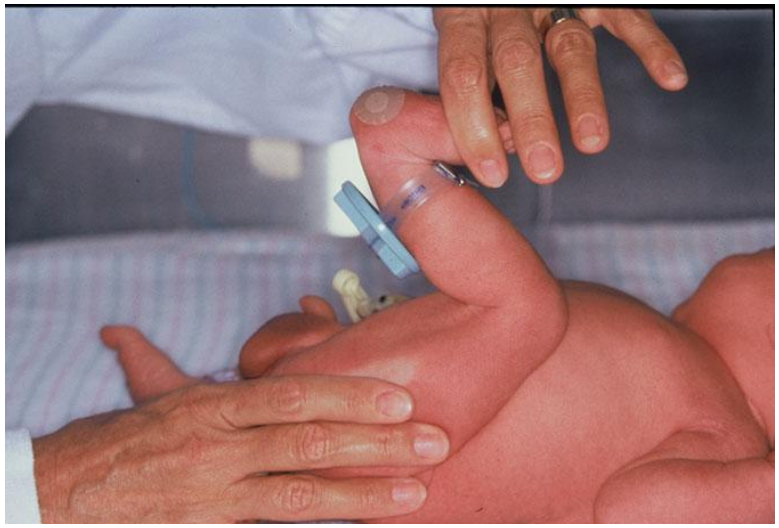
- Full-term neonates have incomplete hip extension with an average **limitation of 30 degrees** as a result of early flexor tone predominance
- The limitation **decreases to less than 10 degrees by three to six months**

- At birth and during early infancy, **hip external rotation** exceeds internal rotation
- With the resolution of **early hip flexion attitude**, **internal rotation gradually increases**.
- Differences between bilateral hip abduction, apparent shortening of one leg, and asymmetric gluteal and upper thigh skin folds are highly suggestive of **congenital or acquired hip dysplasia or dislocation**
- Femoral **inclination is 160 degrees**, and the angle of **anteversion is 60 degrees**. Respective **adult** measurements of **125 and 10 to 20** degrees develop postnatally and are accelerated by weight bearing

- The **popliteal angle is 180 degrees** in the **hypotonic preterm** infant, compared with **90 degrees in full-term neonates**.



GAIT

- asymmetric stride length and stance phase in **hemiparesis;**
- toe walking and scissoring with lower extremity **spasticity;**
- crouch posture and gait in **diplegic cerebral palsy**;
- Trendelenburg's gait in motor unit diseases and **hip dislocation;**
- gastrocnemius limp with lack of push-off in L4–L5 weakness due to **spina bifida**;
- gait deviations associated with involuntary movements, such as **ataxia, tremor, or dyskinesias, in dysfunction of the central nervous system**.

INSPECTION

PALPATION
BONE/SOFT TISSUES

ACTIVE/PASIVE
ROM

GAIT

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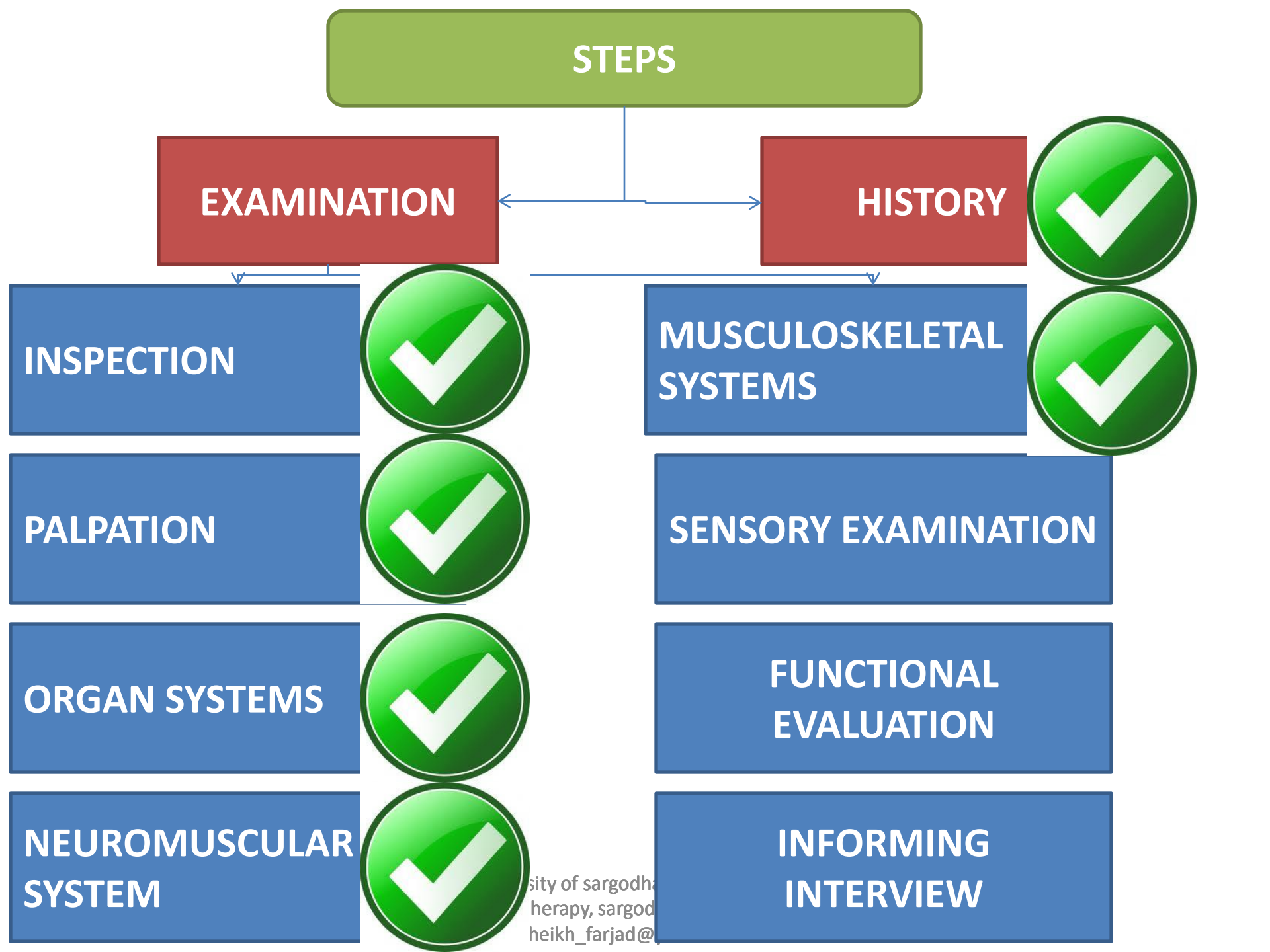
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FUNCTIONAL EVALUATION

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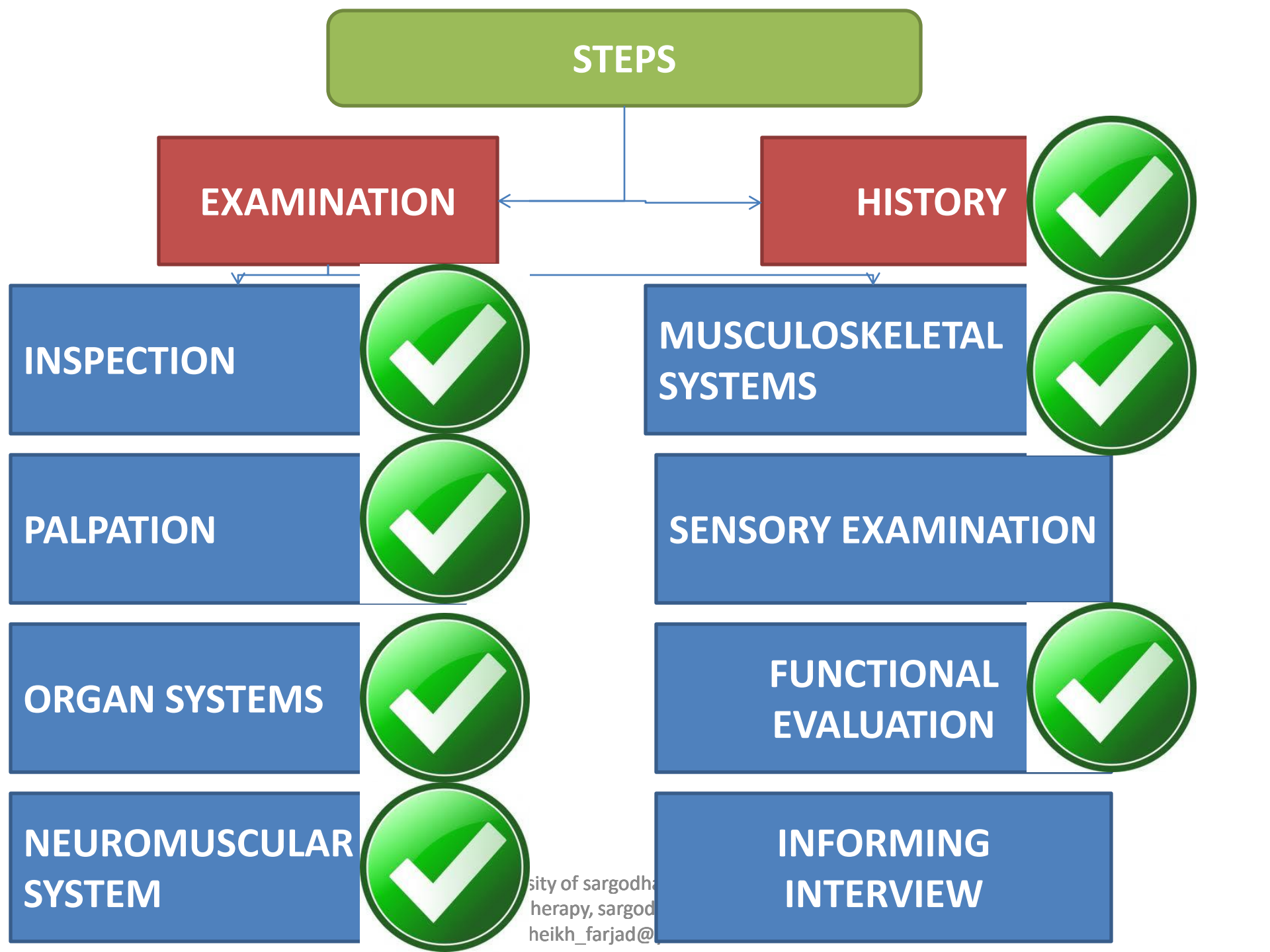
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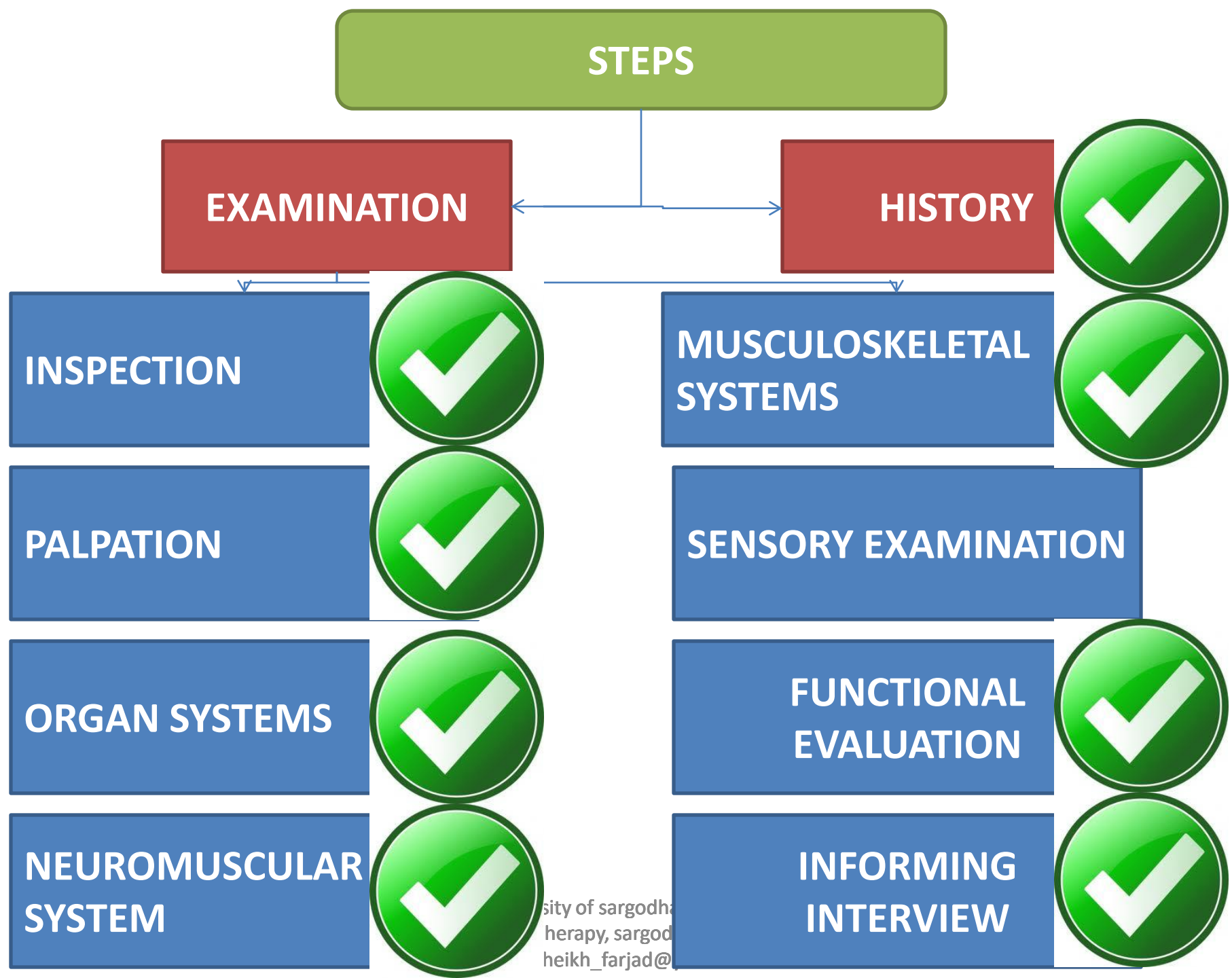
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Best of luck

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ENOUGH FOR TODAY
THANK YOU CLASS
ANY QUESTION????

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