Spinal Nerves

- Thirty-one pairs of mixed nerves arise from the spinal cord and supply all parts of the body except the head

- They are named according to their point of issue
  - 8 cervical (C_1-C_8) (Only 7 cervical vertebrae!)
  - 12 thoracic (T_1-T_{12})
  - 5 Lumbar (L_1-L_5)
  - 5 Sacral (S_1-S_5)
  - 1 Coccygeal (C_0)
Spinal Nerves

Cervical nerves: exit superior to the vertebrae
   C8 emerges inferior to C7 (between C7 and T1)
T,L,S, and coccygeal all exit inferior to the same numbered vertebrae
Spinal Nerves: Roots

- Ventral roots: motor (efferent) fibers
- Dorsal roots: sensory (afferent) fibers
- They unite to form a spinal nerve before emerging from the vertebral column via an intervertebral foramina
- After emerging from foramina, spinal nerve divides into small dorsal, ventral rami and meningeal branch (that re-enters the vertebral column)
Innervation of Specific Body Regions

- Spinal nerve rami supply the entire somatic region of the body from the neck down
  - Dorsal rami supply the posterior body trunk
  - Ventral rami supply the anterior body trunk and limbs and are thicker than dorsal rami

- Roots: each root is either sensory *or* motor (medial)
- Rami: each rami is sensory *and* motor (lateral)
Ventral Rami

- Except for T2-T12…
- All ventral rami branch and join one another lateral to the vertebral column forming the nerve plexuses (which primarily serve the limbs)
- Only ventral rami form plexuses
- Extreme branching of nerves results in each muscle being supplied by more than one spinal nerve
- The strategy is to offset damage via redundant innervation and prevent paralysis
Spinal Nerve Innervation: Back, Anterolateral Thorax, and Abdominal Wall

- The back is innervated by dorsal rami via several branches
- The thorax is innervated by ventral rami T₁-T₁₂ as intercostal nerves
- Intercostal nerves supply muscles of the ribs, anterolateral thorax, and abdominal wall. Intercostal groove is inferior…
Cervical Plexus

- The cervical plexus is formed by ventral rami of \( C_1 \)-\( C_4 \) and is located deep to the sternocleidomastoid muscle.
- Most branches are cutaneous nerves of the neck, ear, back of head, and shoulders.
- The most important nerve of this plexus is the phrenic nerve which innervates the diaphragm.
Brachial Plexus and Upper Limb

- Gives rise to nerves that innervate the upper limbs
- Can palpate it!!
- Formed by C5-C8 and T1 (C4 and T2 may also contribute to this plexus)
Brachial Plexus

- There are four major branches of this plexus
  - Roots – five ventral rami (C₅-T₁)
  - Trunks – upper, middle, and lower, which form divisions
  - Divisions – anterior and posterior serve the front and back of the limb
  - Cords – lateral, medial, and posterior fiber bundles
Brachial Plexus

Key:
- = Roots
- = Trunks
= Anterior division
= Posterior division

Roots:

Posterior divisions:
- Lateral
- Medial

Cords:
- Axillary
- Musculocutaneous
- Radial
- Median
- Ulnar

(a)

Dorsal scapular
Nerve to subclavius
Suprascapular

Upper
Middle
Lower

Trunks

T1

Long thoracic
Medial pectoral
Lateral pectoral
Upper subscapular
Lower subscapular
Thoracodorsal
Medial cutaneous nerves of the arm and forearm

Figure 13.9a
Brachial Plexus: Nerves

- Axillary – innervates the deltoid and teres minor

- Musculocutaneous – sends fibers to the biceps brachii and brachialis

- Median – branches to most of the flexor muscles of arm

- Ulnar – supplies the flexor carpi ulnaris and part of the flexor digitorum profundus

- Radial – innervates essentially all extensor muscles
Brachial Plexus: Distribution of Nerves

![Image of the brachial plexus showing the distribution of nerves]

- Trunks
- Humerus
- Radial nerve
- Musculo-cutaneous nerve
- Ulna
- Radius
- Ulnar nerve
- Median nerve
- Radial nerve (superficial branch)
- Dorsal branch of ulnar nerve
- Superficial branch of ulnar nerve
- Digital branch of ulnar nerve
- Muscular branch
- Digital branch
- Median nerve

Figure 13.9c
Lumbar Plexus and Lower Limb

- Arises from L₁-L₄
- Lies within the psoas major muscle
- Major branches descend and innervate the anterior and medial thigh
- Femoral nerve: anterior thigh muscles (quads), skin of anterior thigh, surface of leg from knee to foot
- Obturator nerve: adductor muscles
Sacral Plexus

- Arises from L₄-S₄ and serves the buttock, lower limb, pelvic structures, and the perineum
- The major nerve is the sciatic, the longest and thickest nerve of the body
- The sciatic is actually composed of two nerves: the tibial and the common fibular (peroneal) nerves
- Supplies entire lower limb (except antero-medial thigh)
- Tibial nerve: calf muscles and skin, sole of foot
  - Sural nerve: posterolateral leg skin
  - Medial/lateral plantar nerves: foot
- Fibular nerve: knee joint, skin of lateral calf, dorsum of foot, muscles of anterolateral leg
- Superior/inferior gluteal nerves: gluteal muscles and tensor fascia latae
- Pudendal nerve: skin of perineum (ano-genital region)
Sacral Plexus

Figure 13.11

Key:
- Blue = Ventral rami

(a) Superior gluteal
Lumbosacral trunk
Inferior gluteal
Common fibular
Tibial
Posterior femoral cutaneous
Pudendal
Sciatic

Ventral rami:
- Superior gluteal
- Inferior gluteal
- Pudendal
- Sciatic
- Posterior femoral cutaneous
- Common fibular
- Tibial
- Sural
- Deep fibular
- Superficial fibular

(b) Plantar branches
Innervation of the Skin: Dermatomes

- A dermatome is the area of skin innervated by the cutaneous branches of a single spinal nerve
- All spinal nerves except C₁ participate in dermatomes
- Lumbar (anterior) vs. Sacral (posterior)
- Cervical (limbs) vs. Thoracic (trunk)

Innervation of Joints:

- Question: Which nerves serve which synovial joints?
- Answer: Nerves obey Hilton’s Law which is…
Don’t go changing, baby!”
Dermatomes

- Actually, Hilton’s Law states,
  - “Any nerve serving a muscle that produces movement at a joint also innervates the joint and the skin over the joint.”
KU Game Week!!

- Saturday 1 pm
- Saturday 3 pm