**1. Communication between CNS & PNS:**
afferent (sensory) pathway versus efferent (motor) pathway of information

**This will be VERY important to learn for nursing pharmacology!!**

*Much of this chapter is review of Ch 4 part 1:*
- Voluntary muscle movement
- Autonomic regulation of body under sympathetic & parasympathetic control.

1. Junction between CNS and PNS (cranial nerves & spinal nerves)
Part 1: Communication between CNS & PNS

Click [HERE](#) for blank PNS flow chart.

Click [HERE](#) for KEY PNS flow chart.
Visceral effectors = smooth muscle, cardiac muscle, and glands.

Influenced by E from postganglion neurons or E secreted by adrenal medulla into bloodstream.

Or ACh from postganglion neurons

NE = norepinephrine
E = epinephrine
Autonomic Control of Cardiac and Smooth Muscles:

Shut down peristalsis

And vasodilation of arteries to skeletal muscles

For ACh and its receptors:

<table>
<thead>
<tr>
<th>TABLE 6.4</th>
<th>Effects of Acetylcholine (ACh) in the PNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurons Releasing ACh</td>
<td>Location</td>
</tr>
<tr>
<td>Somatic (voluntary) motor neurons</td>
<td>Skeletal muscles</td>
</tr>
<tr>
<td>Parasympathetic (involuntary) motor neurons</td>
<td>Smooth muscles, gland</td>
</tr>
<tr>
<td>Parasympathetic (involuntary) motor neurons</td>
<td>Heart</td>
</tr>
</tbody>
</table>
**Wiki text**

My comments

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See **Clinical App ONLINE**:  
Beta blockers.

**B1 & B2 blocker = Propranolol**  
↓ HR and BP & bronchoconstrict  
good for hypertension BUT not people w/respiratory prob. (it will cause bronchoconstriction!)

**B1-specific blocker = Atenolol**  
↓ HR and BP  
no effect on bronchioles  
good for hypertension WITH respiratory problems (won’t cause bronchoconstriction)

**B1 agonist = Dobutamine**  
↑ HR and cardiac output  
good for heart failure patients

**B1 & B2 agonist = isoproterenol**  
↑ HR and cardiac output & Bronchodilate

**B2 agonist = Albuterol & Terbutaline**  
Bronchodilates  
good for people w/respiratory problems
**Review**

- Communication between CNS & PNS.

1. Sensory division of PNS (special senses, visceral senses, somatic senses)
2. Motor division of PNS
   - Somatic motor division
     = voluntary control skeletal muscles with ACh & nicotinic cholinergic receptors
   - Autonomic motor division
     - Sympathetic regulation (epinephrine & adrenergic receptors) can speed some things up and slow other things down.
     - Parasympathetic regulation (ACh and muscarinic cholinergic receptors) can slow some things down and speed other things up.

**Part 2: Junction between CNS (spinal cord) and PNS**

**Objectives:**

- Understand how the PNS communicates between the CNS, and the rest of the body.
- Know / Review:
  - 12 pairs cranial nerves
  - 11 cranial nerves are part of the PNS. *(Optic cranial nerve is part of the CNS)*
  - 31 pairs spinal nerves
Review of Cranial Nerves:

What is the mnemonic device for remembering the list of 12 pairs cranial nerves?

Oh__________ Very__________
Once__________ Good__________
One__________  Vacations_______
Takes__________ Are__________
The__________ Heavenly_______
Anatomy
Final__________

What is the mnemonic device for remembering which cranial nerves are sensory (S), motor (M), or both (B)?

Some__________ Says__________
Say__________ Big__________
Marry__________ Brains__________
Money__________ Matter__________
But__________ Most__________
My__________
Brother__________

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Pg 72 Wiki text
31 Pairs of Spinal Nerves in PNS

- **Sensory tracts** (axons) enter spinal cord at dorsal side.
- **Motor tracts** (axons) exit spinal cord at ventral side.

31 Pairs of Spinal Nerves divided into:

1. Cervical spinal nerves (C1-C8)
2. Thoracic spinal nerves (T1-T12)
3. Lumbar spinal nerves (L1-L5)
4. Sacral spinal nerves (S1-S5)
5. Coccygeal spinal nerve (Co1)

These spinal nerves branch out into dorsal & ventral rami, and form a nerve plexus.
Dorsal and ventral rami of remaining spinal nerves form 4 major nerve plexuses of the PNS: that carry efferent (motor) and sensory (afferent) info. pertaining to our limbs:

1. Cervical Plexus (C1–C4)
2. Brachial Plexus (C5–T1)
3. Lumbar Plexus (L1–L4)
4. Sacral Plexus (L5–S5)

4 major nerve plexuses of the PNS:

1. Cervical Plexus (C1–C4)
   - motor control of head, neck, and diaphragm muscles
   - sensation in head & neck
4 major nerve plexuses of the PNS:

1. **Cervical Plexus (C1 - C4)**
   - motor control of head & neck diaphragm muscles
   - sensation in head & neck

   **Phrenic nerve** of cervical plexus: C3, C4, & C5 has motor control of diaphragm!

   "The primary danger of a ‘broken neck’ is that the phrenic nerve may have been severed above C3, leading to paralysis, cessation of breathing and death…"

2. **Brachial Plexus (C5 – T1)**
   - motor control of muscles of shoulder & arm
   - sensory perception in skin of those areas

   1) **Musculocutaneous nerve** – motor control of anterior arm & forearm flexors.

   2) **Radial nerve** – motor control of posterior extensor muscles of the arm, forearm & hand.

   3) **Axillary nerve** – motor control of shoulder muscles.

   4) **Median nerve** – motor control of anterior flexor muscles in forearm & several muscles in lateral hand.

   5) **Ulnar nerve** – motor control of flexor carpi ulnaris muscle & intrinsic hand muscles.
3. **Lumbar plexus** (L1 – L4)
- Motor control of muscles in the lower abdomen and antero-medial thigh.
- Sensory perception of those areas.

1) **Femoral nerve** - Innervates the anterior thigh muscles, lower abdomen, buttocks.

2) **Obturator nerve** - Innervates medial thigh adductor muscles.

4. **Sacral plexus** (L4 – S5)
- Motor control of posterior thigh (hamstrings) and posterior leg.
- Sensation in those areas.

Leads to **sciatic nerve** - The largest nerve of the human body.

Ex. Of hamstrings = biceps femoris, semitendinosus, semimembranosus

- Sciatic damage leads to inability to extend hip and flex the knee — “sciatica”.
4. Sacral plexus (L4 – S5)
- Motor control of posterior thigh (hamstrings) and posterior leg.
- Sensation in those areas.

- Sciatic subdivides in the popliteal region:
  i) Common fibular nerve – motor control of lateral leg and foot dorsiflexors and inverters.
     - Damage leads to inability to dorsiflex the foot or “footdrop”.

  ii) Tibial nerve – motor control of posterior leg and foot plantar flexors.
     - Damage leads to inability to plantar flex and invert the foot –> “shuffling gait”
Review

▪ Organization of the PNS.

1) 12 pairs cranial nerves
2) 31 pairs spinal nerves (divided into 5 vertebral regions)

Paired spinal nerves give rise to 4 groups of nerve plexuses (cervical, brachial, lumbar, & sacral), which carry afferent sensory and efferent motor signals to body.