EXAMINATION OF THE BACK

GAIT
- Stance phase (heel strike → mid-stance → toe-off)
- Swing phase, stride length
- Smoothness, symmetry, ability to turn quickly
- Antalgic gait (identify point at which pain occurs)
- Trendelenberg gait (weak hip abductors)
- Transition from sitting to standing (useful to find source of pain)

INSPECTION
Ensure adequate exposure while preserving patient's modesty
- Swelling
- Erythema
- Atrophy
  - Sternocleidomastoid, shoulder girdle, chest wall, intercostals
  - Paraspinals, gluteal muscles
  - Abdominal obesity or muscle laxity
- Deformities
  - Posture and alignment: expect 4 normal curvatures
    - Cervical lordosis
    - Thoracic kyphosis
      - Increased in ankylosing spondylitis (AS) and fractures from osteoporosis
    - Lumbar lordosis
      - Increased in flexion contracture of hip
      - Flattened in AS
    - Sacrococcygeal kyphosis
  - Scoliosis (asymmetric shoulder height)
    - Adam's Forward Bend Test
      - Patient bends forward with knees in full extension
      - Inspect from behind, scapula will be elevated on the side of convexity
- Skin
  - Scars or skin changes
  - Sinus or hair tuft in keeping with spina bifida

PALPATION
- Systematic approach from the occiput down (stabilize the patient - don't push over!)
- Assess for muscle bulk/tenderness and bony tenderness
- Spinous processes and interspinous ligaments
  - C7: bony prominence at base of neck
  - T3: corresponds to spine of scapula
  - T7: corresponds to angle of scapula
  - L3-L4: corresponds to iliac crests (useful for landmarking lumbar puncture)
  - S2: posterior superior iliac spine

Evidence-Based Medicine: Scoliosis

Adam's Forward Bend Test
Sensitivity 92%, Specificity 60%
Diagnostic Value: Ruling out thoracic spine curvature
- Space between ribs and iliac crest (normal is 4 fingers, decreased in kyphosis)

**RANGE OF MOVEMENT**

- **Cervical Spine**
  - Flexion
    - Chin should touch chest
  - Extension (look up)
    - Chin should pass level of ear
  - Lateral flexion
    - Ear to shoulder
  - Rotation
    - Normal ≥ 70° to each side (can estimate but best to measure with a goniometer)

- **Thoracolumbar Spine**
  - Chest expansion (see "Special Tests")
  - Flexion (touch toes while keeping knees straight)
    - Finger to Floor distance
      - Not specific - can be limited by hip, tight hamstrings, abdominal obesity, etc. May be useful as a tracking measurement.
      - Observe rhythm: lumbar lordosis should transition to a kyphosis
    - Modified Schober’s test (see "Special Tests")
  - Extension (ensure legs are kept straight)
    - Best done with patient against a surface (e.g., bed) while leaning backwards
  - Lateral Flexion
    - Finger-fibula distance (normal 0 cm) on each side
    - Measure finger-floor before and after bending to side (normal > 10 cm)
    - Useful in following patient over time
  - Rotation (patient sitting, arms crossed across chest)
    - May apply overpressure while observing for pain

**SPECIAL TESTS**

- **Occiput-to-Wall** (cervical or thoracic kyphosis)
  - Patient stands with back to wall, nose and ear must be at same horizontal level to ensure patient is not hyperextending neck
  - Occiput-to-wall should be 0 cm
  - Increased in abnormal cervical or thoracic kyphosis (e.g., ankylosing spondylitis, thoracic fractures in osteoporosis)

- **Chest expansion**
  - Quick screen
    - Hands on back at 10th rib level; thumbs should move apart 4 cm with inspiration
    - Measure at level of xiphisternum: normal ≥ 4 cm
    - May be reduced in thoracic scoliosis, ankylosing spondylitis, or COPD

**Evidence-Based Medicine: Vertebral Fractures**

- **Occiput-wall distance of >4.0 cm:**
  - Sensitivity 41%, Specificity 92%
  - Diagnostic Value: Ruling in thoracic vertebral fracture

- **Rib-pelvis distance of <2 finger breadths:**
  - Sensitivity 88%, Specificity 46%
  - Diagnostic Value: Ruling out lumbar vertebral fractures
- **Modified Schober's Test***(restricted lumbar flexion)*
  - Place mark in midline between Dimples of Venus, then mark 10 cm above and 5 cm below
  - Patient then bends forward trying to touch floor (knees straight)
  - Normal ≥ 5 cm increase

- **Straight Leg Raise** *(for sciatic nerve root irritation: L4, L5, S1, S2)*
  - With patient lying supine, passively raise straight leg (knee extended)
  - Pain radiating down the back of the leg into the foot is a positive test (usually between 30-70°)
  - Pain in thigh only may be due to hamstring muscles.
  - If positive test, slowly lower leg just until the pain stops, then dorsiflex ankle
  - Return of pain is a positive Lasegue's sign

- **Crossed Straight Leg Raise** *(sciatic nerve root irritation)*
  - With patient lying supine, passively raise asymptomatic leg (with knee extended)
  - Pain radiating down the symptomatic leg is a positive test (good specificity for sciatica, but poor sensitivity)

- **Femoral Nerve Stretch** *(for femoral nerve root irritation: L2, L3, L4)*
  - With patient lying prone, passively flex knee and extend hip lifting thigh off bed
  - Positive if the patient experiences pain in the anterior thigh

**Evidence-Based Medicine: Lumbar Disc Herniation**

**Straight Leg Raise**
- Sensitivity 91%, Specificity 32%
- Diagnostic Value: Ruling out lumbar disc herniation

**Crossed Straight Leg Raise**
- Sensitivity 32%, Specificity 98%
- Diagnostic Value: Ruling in lumbar disc herniation

**Evidence-Based Medicine: Nerve Impingement**

**Femoral Nerve Stretch**
- Sensitivity 50%, Specificity 100%
- Diagnostic Value: Ruling in mid-lumbar nerve impingement
- **Sacroiliac Joints**
  - **FABER Test**
    - With patient supine:
      - Flex,
      - ABduct,
      - Externally Rotate one hip (by placing heel on the opposite knee)
    - Then push down on knee, while stabilizing the opposite hemipelvis
    - Lower back or sacroiliac joint pain is a positive test
  - **Gaenslen’s Test**
    - Patient lies supine at the edge of bed with one leg hanging off bed, while using his/her hands to bring the other knee to the chest
    - Pain in back or buttock is a positive test

**NEUROLOGIC EXAM**
- **Tone**
  - Hip, knee, ankle
  - Look for ankle clonus
- **Power**

<table>
<thead>
<tr>
<th>Nerve Root</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1, L2, L3</td>
<td>Hip flexion</td>
</tr>
<tr>
<td>S1, S2</td>
<td>Hip extension</td>
</tr>
<tr>
<td>L2, L3, L4</td>
<td>Knee extension</td>
</tr>
<tr>
<td>L5, S1, S2</td>
<td>Knee flexion</td>
</tr>
<tr>
<td>L4, L5</td>
<td>Ankle dorsiflexion</td>
</tr>
<tr>
<td>S1, S2</td>
<td>Ankle plantar flexion</td>
</tr>
<tr>
<td>L5, S1</td>
<td>Great toe dorsiflexion</td>
</tr>
</tbody>
</table>

- **Reflexes**
  - Patellar: L2-L4 (mainly L4)
  - Achilles: S1-S2 (mainly S1)
  - Plantar response (upgoing toes with upper motor neuron lesion)
- **Dermatomes of lower limb**

<table>
<thead>
<tr>
<th>Nerve Root</th>
<th>Area of sensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Groin</td>
</tr>
<tr>
<td>L2</td>
<td>Just below L1</td>
</tr>
<tr>
<td>L3</td>
<td>Medial aspect of knee</td>
</tr>
<tr>
<td>L4</td>
<td>Lateral aspect of knee</td>
</tr>
<tr>
<td>L5</td>
<td>Dorsum of foot</td>
</tr>
<tr>
<td>S1</td>
<td>Lateral border of foot</td>
</tr>
</tbody>
</table>