The Spine, Spinal Column, and Vertebral Column are synonymous terms referring to the bony components housing the spinal cord.

- **Spinal Cord** = made of nervous tissue
- **Facet** = a small, smooth, flat surface on a bone
- **Facet Joint** = the articulation between the superior articular process of the vertebra below with the inferior articular process of the vertebra above

Clarification of Terms

Osteology

- Occipital Bone
- Temporal Bone
- Vertebral
- Intervertebral Disk
- Atlas
- Axis
- C7
Osteology…cont

Occipital Bone:

Temporal Bone:

Osteology continued

Parts of a Vertebra

Body
Neural Arch
Vertebral Foramen
Pedicle
Lamina
Transverse Process
Articular Process
Spinous Process
Typical Cervical Vertebrae

Osteology…cont

Vertebrae:
Osteology…cont

Intervertebral Disks:
- 23 disks located between vertebrae, starting between C2 and C3
- Function = absorb and transmit shock and maintain flexibility of the vertebral column
- Disks make up approx 25% of the total length of the vertebral column

(Continued from Lippert, p214-215)

Intervertebral Disks…cont:
- Annulus Fibrosus: outer portion of the disk consisting of several fibrocartilagenous rings that contain the nucleus pulposus
- Nucleus Pulposus: pulpy, gelatinous substance with high water content in the center of the disk

(Continued from Lippert, p215)

Atlas: Caudal aspect
Examples of Vertebrae

What can you palpate?
What can you NOT palpate?

Joint Structure

- **Atlanto-Occipital Joint** = articulation between condyles of occiput with atlas (C1)
- **Strong union that supports the weight of the head**
- **Atlantoaxial Joint** = articulation between atlas (C1) and axis (C2)

Lippert, p217
Articulations between C2 through S1 = all basically the same

Strong, weight bearing articulations occur anteriorly between the vertebral bodies

Posteriorly, there are 2 articulations (one on each side) called facet joints (formed by the articular processes of adjacent vertebrae)

Each facet joint = synovial joint with synovial membrane and capsular ligament

The direction the facets face largely determine the type and amount of motion possible at that part of the vertebral column

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Atlanto-Occipital Joint
- Flexion and extension, no rotation

Atlantoaxial Joint
- Rotation and some lateral flexion (aka sidebending)

Cervical Spine
- Flexion, extension, rotation, sidebending
- Retraction = combined head flexion on C1 and C2-C7 extension
- Protraction = combined head extension C1 and C2-C7 flexion

Thoracic Spine
- Facets in frontal plane
- Mostly rotation and lateral flexion
- Attachment of ribs contributes to lack of flexion and extension

Lumbar Spine
- Facets in sagittal plane
- Most flexion and extension of vertebral column occurs in lumbar spine

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Anterior longitudinal ligament
Attaches the bodies of the vertebrae on the anterior surface
- Prevents excessive hyper extension
- Thin superiorly and thick inferiorly to fuse the sacrum
- Found in the thoracic and lumbar regions deep to the aorta
Supporting Structures...cont

**Posterior longitudinal ligament**
Attaches to the bodies of the vertebrae on the posterior surfaces inside the vertebral foramen
Prevents excessive flexion
Thick superiorly to help support the skull and thin inferiorly
Contributes to instability and increased disk injury in the lumbar region.

Lippert, 218

Supporting Structures...cont

**Supraspinal ligament**
Extends from the 7th cervical vertebra distally to the sacrum posteriorly along the tips of the spinous processes

**Interspinous ligament**
Attaches successive spinous processes

**Nuchal ligament**
Interspinous ligament in the cervical spine

Lippert, 218

Supporting Structures...cont

**Ligamentum Flavum**
Connects adjacent laminae on the anterior surface

Lippert, 218
Recap 3 parts of spine

- **Lumbar:**
  - Most injured region of the human body
  - Absorbs the majority of our body weight plus any weight we carry
  - Center of gravity located just anterior to the vertebral body of S2
  - Most movement occurs between L4/5 and L5/S1, most disk herniations occur here as well

- **Thoracis:**
  - Much less motion than cervical and lumbar due to attachments to rib cage, the shape of vertebral bodies, and length of spinous processes

- **Cervical:**
  - Moves freely
  - Job is not weight distribution, but to support the head
  - Allows nervous tissue to enter vertebral canal and entrance/exit of major blood vessels in the skull

Muscles of the neck and trunk are numerous and can be divided into anterior and posterior muscles.

- The Quadratus Lumborum (QL) is the only exception (located laterally)
- Anterior muscles ________________ the spine
- Posterior muscles ________________ the spine

Cervical

- **Anterior**
  - Superficial:
    - Sternocleidomastoid (SCM)
  - Deep:
    - Longus colli and capitis
    - Rectus capitis anterior and lateralis

- **Posterior**
  - Superficial:
    - Splenius capitis and cervicis
  - Deep:
    - Supraoccipital muscles (rectus capitis posterior major and minor, obliquus capitis superior and inferior)
**Sternocleidomastoid**

- **Origin**
  - Sternal head: superior aspect of the manubrium of the sternum
  - Clavicular head: medial 1/3 of the clavicle

- **Insertion**
  - Mastoid process of the temporal bone

- **Innervation**
  - Spinal accessory n. (cranial n. XI)

- **Action**
  - **Bilateral**: Flexion of the head & neck
  - **Unilateral**: Contralateral rotation of the head and neck

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**Scalenes**

- **Origin**
  - Ant. Scalene: transverse processes of C3-C7
  - Middle Scalene: transverse processes of C2-C7
  - Posterior Scalene: transverse processes of C5-C7

- **Insertion**
  - Ant. Scalene: 1st rib
  - Middle Scalene: 1st rib
  - Posterior Scalene: external surface of the 2nd rib

- **Innervation**
  - Ventral rami (C3-C7)

- **Action**
  - **Bilateral**: Flexion of the neck, assist with inspiration by elevating ribs 1 & 2
  - **Unilateral**: Lateral flexion
### Myology…cont

**Cervical**
- **Anterior**
  - Deep:
    - Longus colli = flexes neck
    - Longus capitis = flexes head
    - Rectus capitis anterior = flexes head
    - Rectus capitis lateralis = laterally bends head

**Posterior Neck**
- **Superficial (Erector Spinae)**
  - Splenius capitis & cervicis = bilaterally extends head and neck, unilaterally = rotates and laterally bends the face to same side
  - Erector spinae = extensors which bring the head back from a flexed position
- **Deep**
  - Suboccipital muscles (rectus capitis posterior major and minor, obliquus capitis superior and inferior)
  - * = extend the head and * also lateral bend and rotate to the same side

**Neck:**
- **Posterior:**
  - Superficial:
    - Splenius capitis and cervicis
Neck:
Posteriors:
Deep:
Suboccipital Muscles

Trunk
Anterior
Superficial to Deep:
- Rectus Abdominis
- External Oblique
- Internal Oblique
- Transverse Abdominis

Posterior
- Erector Spinae
- Deep
- Transverse spinal muscles

Lateral
- Deep
- Quadratus Lumborum

Suboccipital Muscles
**Rectus Abdominis**

- **Origin**: Crest of the pubis
- **Insertion**: Xiphoid process and cartilages of ribs 5-7
- **Innervation**: Intercostal n. (T7-T12)
- **Action**: Flexion of the trunk, posterior pelvic tilt, increases intra-abdominal and intrathoracic pressure

“tidbits” pregnancy? tendinous inscriptions?

Lippert, p223

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**External Oblique**

- **Origin**: Lateral side of ribs 4-12
- **Insertion**: Iliac crest and linea alba
- **Innervation**: Intercostal nerves (T8-T12)
- **Action**: **Bilateral**: Flexion of the trunk, posterior pelvic tilt, increased intra-abdominal and intra-thoracic pressure  
  **Unilateral**: Rotation of the trunk to the contralateral side, ipsilateral lateral flexion of the trunk

Lippert, p223

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**Strengthening Rectus Abdominis**

- **Crunch**: To hold the ankles/feet down or not?

Lippert, p222-223

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7/28/2013
**Strengthening External Oblique**

*When you do a crunch on a diagonal and bring your right shoulder toward your left knee, which external oblique is responsible for this motion? The right or left?*

**Internal Oblique**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Iliac crest, inguinal ligament &amp; thoracolumbar fascia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Ribs 9-12, linea alba</td>
</tr>
<tr>
<td>Innervation</td>
<td>Intercostal n. (T8-T12)</td>
</tr>
<tr>
<td>Action</td>
<td><strong>Bilateral</strong>: flexion of the trunk, posterior pelvic tilt, increases intra-abdominal and intra-thoracic pressure. <strong>Unilateral</strong>: ipsilateral lateral flexion of the trunk, rotation of the trunk to the ipsilateral side</td>
</tr>
</tbody>
</table>

Lippert, p223

**Strengthening Internal Oblique**

*When you do a crunch on a diagonal and bring your right shoulder toward your left knee, which internal oblique is responsible for this motion? The right or left?*
## Transverse Abdominis

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>iliac crest, thoracolumbar fascia cartilages of ribs 6-12, &amp; inguinal ligament</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
<td>Linea alba</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Intercostal n. (T7-T12)</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Increases intra-abdominal pressure, increases tension in thoracolumbar fascia</td>
</tr>
</tbody>
</table>

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## Strengthening Transverse Abdominis

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## Myology…cont

- **Trunk: Posterior; Superficial; Erector Spinae**
  - 3 muscles make up the erector spinae
  - Medially = *spinalis*
    - Attaches spinous process to spinous process
    - Action = extension
  - Intermediate = *longissimus*
    - Attaches transverse process to transverse process
    - Action = extension and lateral bending
  - Laterally = *ilio-costalis*
    - Attaches transverse process to rib or rib to rib
    - Action = extension and lateral bending
Trunk: Posterior: Deep: Transverse Spinal Muscle Group
- 3 muscles make up the Transverse Spinal Group
- They attach from transverse to spinous process
- Action = extension and rotation to the opposite side
  - Most superficial = semispinalis (tend to span ≥ 5 vertebrae)
  - Intermediate = multifidus (tend to span 2-4 vertebrae)
  - Deepest = rotatores (span 1 vertebrae)
  - (All run the entire vertebral column in layers)

Myology…cont

Trunk: Posterior: Deep: Transverse Spinal Muscle Group

Myology…cont

Trunk: Lateral: Deep: Quadratus Lumborum
Quadratus Lumborum

- Reversal of Muscle Action
  - When the insertion moves toward the origin, what movement occurs?

  - When the origin moves toward the insertion, what movement occurs?

  - Which is open chain and which is closed chain?

References