Spine & Thorax
Topographical Views

4.1 Anterior view

4.2 Posterior view

- Jugular notch
- Sternum
- Ribs
- Edge of the rib cage
- Rectus abdominis
- External oblique
- Umbilicus
- Iliac crest
- Inguinal ligament
- Spinous process of C-7
- Medial border of the scapula
- Erector spinae group
- Twelfth rib
- Iliac crest
- Sacrum
- Spinous processes of thoracic and lumbar vertebrae
- Posterior superior iliac spine (PSIS)
Exploring the Skin and Fascia

4.3 Partner prone

4.4 Partner side lying

4.5 Partner supine
Bones of the Spine and Thorax

- Cervical vertebrae (C-1 to C-7)
  - Atlas (C-1)
  - Axis (C-2)
  - Seventh cervical (C-7)
  - First thoracic (T-1)

- Thoracic vertebrae (T-1 to T-12)
  - Twelfth thoracic (T-12)
  - First lumbar (L-1)

- Lumbar vertebrae (L-1 to L-5)
  - Fifth lumbar (L-5)

- Sacrum
- Coccyx

4.6 Posterior view
Bony Landmarks

- Clavicle
- Jugular notch
- First rib
- Manubrium
- Sternal angle
- Sternum (body of)
- Xiphoid process
- Costal cartilage
- Costochondral joints
- Ribs
- Intervertebral discs
- Sacroiliac joint

4.7 Anterior view
Atlas (C-1)

Posterior tubercle
Anterior surface
Lamina Transverse process (TVP)

4.8 Lateral view

Superior facets
Transverse foramen
Groove for vertebral artery
Vertebral foramen

Articular facet for odontoid process
Transverse process (TVP)
Lamina

4.9 Superior view

Lateral view of vertebral column

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Axis (C-2)

- **Odontoid process (or dens)**
- **Vertebral foramen**
- **Spinous process**
- **Lamina**
- **Anterior surface**
- **Transverse process (TVP)**

4.10 Lateral view

4.11 Superior view

Lateral view of vertebral column
Cervical

4.12 Lateral view

4.13 Superior view

- Posterior tubercle
- Anterior tubercle
- Spinous process
- Transverse process
- Canal for spinal nerve

Lateral view of vertebral column
Thoracic

4.14 Lateral view

4.15 Superior view

Lateral view of vertebral column
Lumbar

4.16 Lateral view

4.17 Superior view

Lateral view of vertebral column
Bony Landmarks

4.21 Superior view of right rib

4.22 Superior view of right first rib

4.23 Superior view of right second rib

Groove for subclavian artery and vein

Head
Neck
Tubercle
**Bony Landmark Trails**

**Trail 1** "Midline Ridge" explores the spinous processes of the vertebrae and the spaces between them as they run down the middle of the back.

**Trail 2** "Crossing Paths" describes surrounding bony landmarks that intersect with specific spinous processes.

- C-7 and base of the neck
- T-2 and superior angle of the scapula
- T-7 and inferior angle of the scapula
- T-12 and the twelfth rib
- L-4 and top of the iliac crest

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**Bony Landmark Trails**

**Trail 3** “Nape Lane” locates the landmarks of the cervical vertebrae.

- a Spinous processes of the cervicals
- b Transverse processes of the cervicals
- c Lamina groove of the cervicals

**Trail 4** “Buried Boulevard” delves into the middle and low back regions to locate landmarks of the thoracic and lumbar vertebrae.

- a Spinous processes
- b Transverse processes
- c Lamina grooves

*Posterior view of cervical vertebrae*

*Superior view of lumbar vertebra*
Bony Landmark Trails

**Trail 5** “Breastbone Ridge” explores the sternum and its landmarks.

- a Jugular notch
- b Manubrium
- c Body of the sternum
- d Xiphoid process

**Trail 6** “One Bumpy Road” explores the ribs, the rib cage and the costal cartilage.
Trail 1 “Midline Ridge”

Spinous Processes of the Vertebrae

4.25 Posterior/lateral view, palpating the lumbar spinous processes

4.24 Lateral/posterior view, spine in neutral position
Trail 2 “Crossing Paths”
L-4 and Top of the Iliac Crest

T-12 and the Twelfth Rib
Trail 2 “Crossing Paths”

T-7 and Inferior Angle

T-2 and Superior Angle

C-7 and Base of the Neck
Trail 3 “Nape Lane”

Spinous Processes of the Cervicals
Trail 3 “Nape Lane”

Transverse Processes of the Cervicals

4.34 Lateral view, partner supine with head in neutral

4.35 Lateral view with head rotated away from the side you are palpating
Trail 3 “Nape Lane”

Transverse Process of C-1

Cervical Lamina Groove

4.36 Partner supine, anterior/lateral view with head rotated away from the side you are palpating

4.38 Lateral view, palpating in the lamina groove
Transverse Processes of the Thoracic and Lumbar Vertebrae

4.41 Partner prone, palpating the TVPs of the lumbar vertebrae

4.39 Partner prone, isolating the TVPs of the thoracic vertebrae
Trail 4 “Buried Boulevard”

Lamina Groove of the Thoracic Vertebrae

4.43 Lateral/superior view, accessing the lamina groove of the thoracic vertebrae. Muscles overlying the groove (below).
Trail 4 “Buried Boulevard”

Lamina Groove of the Lumbar Vertebrae

4.44 Lateral/superior view, accessing the lamina groove of the lumbar vertebrae. Muscles overlying the groove (left).
Trail 5 “Breastbone Ridge”

Jugular Notch
Manubrium and Sternum
Xiphoid Process

4.45 Partner supine, palpating the sternum, xiphoid process and edge of the rib cage
4.46 Partner supine, exploring the ribs
Trail 6 “One Bumpy Road”

First Rib

4.47 Superior view of thorax

4.48 Partner supine, palpating the first rib
Eleventh and Twelfth Ribs

4.49 Partner prone
Muscles of the Spine and Thorax

4.50 Posterior view, superficial muscles of the back. The deltoid, trapezius and latissimus dorsi are removed on the right side.
Muscles of the Spine and Thorax
Muscles of the Spine and Thorax

- Trapezius
- Sternocephaloid
- Infraspinatus
- Teres minor
- Teres major
- Latissimus dorsi (outline)
- Serratus posterior inferior
- Pectoralis minor
- Deltoid (outline)
- Serratus anterior
- External oblique
- Iliac crest
- Tensor fasciae latae
- Internal oblique
- Gluteus medius
- Gluteus maximus

4.52 Lateral view
Muscles of the Spine and Thorax

4.53 Posterior view, deep muscles of the back
Muscle Layers of the Posterior Neck

4.54 Posterior view of upper back and neck showing superficial layer of spinal muscles
Muscle Layers of the Posterior Neck

4.55 Posterior view of upper back and neck showing intermediate layer of spinal muscles
Muscle Layer of the Posterior Neck

Splenius capitis (cut)  Semispinalis capitis (cut)  Rectus capitis posterior minor
Rectus capitis posterior major
Longissimus capitis (cut)
Oblique capitis superior
Oblique capitis inferior
Vertebral artery

4.56 Posterior view of upper neck showing deepest layer of spinal muscles
Cross Section of the Neck

4.57 Cross section of the neck at the level of the fifth cervical vertebra
Cross Section of the Thorax

4.58 Cross section of the thorax at the level of the eighth thoracic vertebra
Cross Section of the Thorax

4.59 Cross section of the abdomen at the level of the third lumbar vertebra
Synergists – Muscles Working Together

Vertebral Column

**Flexion**
*(antagonists on extension)*
- Rectus abdominis
- External oblique (bilaterally)
- Internal oblique (bilaterally)
- Psoas major (with the origin fixed)
- Iliacus (with the origin fixed)

**Extension**
*(antagonists on flexion)*
- Longissimus (bilaterally)
- Iliocostalis (bilaterally)
- Multifidi (bilaterally)
- Rotatores (bilaterally)*
- Semispinalis capitis
- Spinalis (bilaterally)
- Quadratus lumborum (assists)
- Interspinalis*
- Intertransversarii (bilaterally)*
- Latissimus dorsi (assists, when arm is fixed)*
Vertebral Column

**Rotation**
(all unilaterally)
External oblique (to the opposite side)
Internal oblique (to the same side)
Multifidi (to the opposite side)
Rotatores (to the opposite side)

Anterior/lateral view

Posterior view of rotatores

Posterior view of multifidi
Vertebral Column

**Lateral Flexion**
*(unilaterally to the same side)*
- Iliocostalis
- External oblique
- Internal oblique
- Longissimus
- Quadratus lumborum
- Psoas major (assists)*
- Intertransversarii*
- Spinalis
- Latissimus dorsi (assists)

Posterior view

Posterior/lateral view
**Elevation/Expansion**
*(involved with inhalation)*
- Anterior scalene (bilaterally)
- Middle scalene (bilaterally)
- Posterior scalene (bilaterally)
- Sternocleidomastoid (assists)
- External intercostals (assists)
- Serratus posterior superior*
- Pectoralis major
  *(all fibers may assist if arm is fixed)*
- Pectoralis minor (if scapula is fixed)*
- Serratus anterior (if scapula is fixed)*
- Subclavius (first rib)*

**Depression/Collapse**
*(involved with exhalation)*
- Internal intercostals (assists)
- Serratus posterior inferior*
Erector Spinae Group

*Spinalis*
*Longissimus*
*Iliocostalis*
Erector Spinae Group

Unilaterally:
- Laterally flex vertebral column to the same side

Bilaterally:
- Extend the vertebral column

Common tendon (thoracolumbar aponeurosis) that attaches to the posterior surface of sacrum, iliac crest, spinous processes of the lumbar and last two thoracic vertebrae

Various attachments at the posterior ribs, spinous and transverse processes of thoracic and cervical vertebrae and mastoid process of temporal bone

Spinal

Branches of the Erector Spinae Group

Spinalis

- Spinous processes of the upper lumbar and lower thoracic vertebrae (thoracis)
- Ligamentum nuchae, spinous process of C-7 (cervicis)

- Spinous processes of upper thoracic (thoracis)
  - Spinous processes of cervicalis, except C-1 (cervicis)
Erector Spinae Group

**Longissimus**

0. Common tendon *(thoracis)*
   Transverse processes of upper five thoracic vertebrae *(cervicis and capitis)*

1. Lower nine ribs and transverse processes of thoracic vertebrae *(thoracis)*
   Transverse processes of cervical vertebrae *(cervicis)*
   Mastoid process of temporal bone *(capitis)*
Erector Spinae Group

**Iliocostalis**

0. Common tendon (*lumborum*)
   - Posterior surface of ribs 1-12 (*thoracis and cervicis*)

1. Transverse processes of lumbar vertebrae 1-3 and posterior surface of ribs 6-12 (*lumborum*)
   - Posterior surface of ribs 1-6 (*thoracis*)
   - Transverse processes of lower cervical (*cervicis*)

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*4.65 Posterior view*

*4.67 Branches of the iliocostalis*
Erector Spinae Group

4.68 Partner prone, palpating the lower erectors while your partner raises his feet

4.70 Partner prone, strumming your thumbs across the fibers of the spinalis

4.69 Partner prone, palpating the upper erectors while your partner extends his spine
Transversospinalis Group

*Multifidi*

*Rotatores*

*Semispinalis Capitis*

4.71 Posterior view

4.72 Posterior view with the multifidi on the left and the rotatores on the right
Transversospinalis Group

**Multifidi and Rotatores**

**A** Unilaterally:
- **Rotate** the vertebral column to the opposite side

**Bilaterally:**
- **Extend** the vertebral column

**O** Multifidi:
- Sacrum and transverse processes of lumbar through cervical vertebrae

**Rotatores:**
- Transverse processes of lumbar through cervical vertebrae

**I** Spinous processes of lumbar vertebrae through second cervical vertebra
- *(Multifidi span two to four vertebrae)*
  - *(Rotatores span one to two vertebrae)*

**N** Spinal

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4.73 Posterior view, showing origins and insertions of the upper multifidi

4.74 Posterior view, showing origins and insertions of the upper rotatores
Semispinalis Capitis

A **Extend** the vertebral column and head

O Transverse processes of C-4 to T-5

I Between the superior and inferior nuchal lines of the occiput

N Cervical

4.75 Posterior view, showing origin and insertion of the semispinalis capitis
Transversospinalis Group

Spinous processes

Multifidi

TVPs

4.76 Posterior view, partner prone
4.77 Partner prone, posterior view with superficial muscles removed. Accessing the rotatores by directing your fingers toward the vertebrae.

4.78 Partner prone, posterior/lateral view with superficial muscles removed. Palpating into the lamina groove on opposite side of the body with the thumbs sliding away from the vertebrae.
Splenumis Capitis and Cervicis

**A** Unilaterally:
- **Rotate** the head and neck to the same side
- **Laterally flex** the head and neck

**Bilaterally:**
- **Extend** the head and neck

**O** Capitis: Inferior one-half of ligamentum nuchae and spinous processes of C-7 to T-4
- Cervicis: Spinous processes of T-3 to T-6

**I** Capitis: Mastoid process and lateral portion of superior nuchal line
- Cervicis: Transverse processes of C-1 to C-3

**N** Cervical

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Splenius Capitis and Cervicis

4.81 Lateral view

4.82 Lateral view
Splenius Capitis

Both Splenii Muscles

4.83 Partner prone, locating splenius capitis

4.84 Partner supine, with head rotated 45° to the right, away from the side you are palpating
Suboccipitals

Rectus Capitis Posterior Major
Rectus Capitis Posterior Minor
Oblique Capitis Superior

Rock and tilt the head back into extension

Rectus Capitis Posterior Major
Oblique Capitis Inferior

Rotate the head to the same side

Oblique Capitis Superior

Laterally flex the head to the same side
Suboccipitals

Rectus Capitis Posterior Major

- **O**: Spinous process of the axis (C-2)
- **I**: Inferior nuchal line of the occiput
- **N**: Suboccipital

Rectus Capitis Posterior Minor

- **O**: Tubercle of the posterior arch of the atlas (C-1)
- **I**: Inferior nuchal line of the occiput
- **N**: Suboccipital
Suboccipitals

Oblique Capitis Superior

O  Transverse process of the atlas (C-1)
I  Between the nuchal lines of the occiput
N  Suboccipital

Oblique Capitis Inferior

O  Spinous process of the axis (C-2)
I  Transverse process of the atlas (C-1)
N  Suboccipital

4.87 Oblique capitis superior

4.88 Oblique capitis inferior
Suboccipitals

4.89 Partner supine, curling the fingers under the occiput

4.90 Partner prone, sinking your thumb medially, just lateral to the edge of the trapezius
Quadratus Lumborum

A Unilaterally:
   Laterally tilt (elevate) the pelvis
   Laterally flex the vertebral column
to the same side

Bilaterally:
   Assist to extend the vertebral column
   Fix the last rib during forced inhalation and exhalation

O Posterior iliac crest

I Last rib and transverse processes of first through fourth lumbar vertebrae

N Lumbar plexus T12, L1, 2, 3

4.91 Posterior view, erector spinae group removed on right side

4.92 Anterior view
Quadratus Lumborum

4.93 Origin and insertion

4.94 Partner prone, laying your fingers along the corners of the quadratus lumborum
**Quadratus Lumborum**

*4.95 Partner prone, accessing the quadratus lumborum*

*4.96 Anterior/lateral view, partner side lying*
**Abdominals**

*Rectus Abdominis*
*External Oblique*
*Internal Oblique*
*Transverse Abdominis*

**4.97 Anterior view**
Abdominals

Rectus Abdominis

- **A** Flex the vertebral column
- **Tilt** pelvis posteriorly
- **O** Pubic crest, pubic symphysis
- **I** Cartilage of fifth, sixth and seventh ribs and xiphoid process
- **N** T5, 6, T7-11, T12, ventral rami

4.98 Anterior view of rectus abdominis

4.99 Anterior view showing origin and insertion
Abdominals

External Oblique

Unilaterally:
- Laterally flex vertebral column to the same side
- Rotate vertebral column to the opposite side

Bilaterally:
- Flex the vertebral column
- Compress abdominal contents

O: External surfaces of fifth to twelfth ribs

I: Anterior part of the iliac crest, abdominal aponeurosis to linea alba

N: (T5, 6), T7-11, T12

4.100 Lateral view of external oblique

4.101 Lateral view showing origin and insertion
Abdominals

Internal Oblique

**Unilaterally:**
- *Laterally flex* vertebral column to the same side
- *Rotate* vertebral column to the same side

**Bilaterally:**
- *Flex* the vertebral column
- *Compress* abdominal contents

- Lateral inguinal ligament, iliac crest and thoracolumbar fascia
- Internal surface of lower three ribs, abdominal aponeurosis to linea alba
- T7, 8, T9-12, L1, iliohypogastric and ilioinguinal, ventral rami
Abdominals

Transverse Abdominis

A Compress abdominal contents

O Lateral inguinal ligament, iliac crest, thoracolumbar fascia and internal surface of lower six ribs

I Abdominal aponeurosis to linea alba

N T7-12, L1, iliohypogastric and ilioinguinal, ventral divisions

4.104 Anterior view of transverse abdominis (both obliques cut and reflected)

4.105
Rectus Abdominis

External Oblique (left side)

4.106 Palpating rectus abdominis while your partner flexes his trunk

4.107 Accessing the external oblique while your partner rotates his trunk toward the opposite side
Diaphragm

**A** Draw down the central tendon of the diaphragm

Increase the volume of the thoracic cavity during inhalation

**O** Costal attachment:
Inner surface of lower six ribs

Lumbar attachment:
Upper two or three lumbar vertebrae

Sternal attachment:
Inner part of xiphoid process

**I** Central tendon

**N** Phrenic C3, 4, 5

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4.108 Lateral view of thorax showing diaphragm in position of exhalation
Diaphragm

Vena cava foramen
Esophageal hiatus
Abdominal aorta
Lumbar vertebra
Diaphragm
Central tendon
Psoas major
Quadratus lumborum

4.109 Inferior view of the diaphragm
Diaphragm

4.110 Partner supine, palpating the diaphragm

4.111 Partner side lying, fingers curling around the ribs to access the diaphragm
**Intercostals**

**A** *External Intercostals:*
Draw the ribs superiorly (increasing the space of the thoracic cavity) to assist with **inhalation**

*Internal Intercostals:*
Draw the ribs inferiorly (decreasing the space of the thoracic cavity) to assist with **exhalation**

- O Inferior border of the rib above
- I Superior border of the rib below
- N Thoracic

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**4.112 Anterior view of rib cage**

**4.113 Partner supine**

Cross section of palpating intercostals
Serratus Posterior Superior and Inferior

**Serratus Posterior Superior**

- **A** Elevate the ribs during inhalation
- **O** Spinous processes of C-7 to T-3
- **I** Posterior surface of second through fifth ribs
- **N** T1, 2, 3, 4

**Serratus Posterior Inferior**

- **A** Depress the ribs during exhalation
- **O** Spinous processes of T-12 to L-3
- **I** Posterior surface of ninth through twelfth ribs
- **N** T9, 10, 11, (12)

4.114 Posterior view with origins and insertions shown on left side
Serratus Posterior Superior

4.115 Partner prone, palpating serratus posterior superior

Serratus Posterior Inferior

4.116 Partner prone, palpating serratus posterior inferior
Intertraversarii

A Unilaterally:
Laterally flex the vertebral column to the same side

Bilaterally:
Extend the vertebral column

O and I
Cervical:
Spanning the transverse processes of vertebrae C-2 to C-7

Lumbar:
Spanning the transverse processes of vertebrae L-1 to L-5

N Spinal

4.117 Posterior views of vertebral column showing cervical and lumbar intertransversarii
Interspinalis

A **Extend** the vertebral column

O and I

*Cervical:*
Spanning the spinous processes of C-2 to T-3

*Lumbar:*
Spanning the spinous processes of T-12 to L-5

N **Spinal**

4.118 Posterior views of vertebral column showing cervical and lumbar interspinalis
Other Structures of the Spine and Thorax

Ligamentum Nuchae

4.119 Posterior/lateral view with muscles and tissue removed from right side

4.120 Partner supine, palpating the ligamentum nuchae
Supraspinous Ligament

Abdominal Aorta
Thoracolumbar Aponeurosis

4.123 Posterior view of lower thorax and pelvis

Spinous process of T-9
Latissimus dorsi
Thoracolumbar aponeurosis
Iliac crest
Sacrum (deep)

4.124 Partner prone, exploring the aponeurosis

Gluteus maximus
Latissimus dorsi
Craniovertebral Joints

Atlantooccipital and Atlantoaxial Joints

4.125 Anterior view of upper cervical vertebrae, cross section along coronal plane

4.126 Posterior view of axis, atlas and occiput, with posterior portion of bones removed
Craniovertebral Joints

Atlantooccipital and Atlantoaxial Joints

4.127 Superior view of atlas (C-1)

4.128 Lateral view, cross section along the sagittal plane
Intervertebral Joints

4.130 Posterior view of vertebral bodies

4.131 Anterior view of vertebrae’s lamina and pedicle

- Body of vertebra
- Pedicle (cut)
- Posterior longitudinal ligament
- Posterior surface of vertebral body
- Intervertebral disc
- Transverse process
- Pedicle (cut)
- Ligamentum flavum
- Superior articular process
- Lamina
- Inferior articular facet
Costovertebral Joints

4.132 Superior view of thoracic vertebra, left side of illustration cut in cross section

4.133 Lateral/posterior view
Sternocostal Joints

- Interclavicular ligament
- Articular disc
- Costoclavicular ligament
- Sternocostal joints (articular cavities)
- Costal cartilages
- Xiphoid process

4.134 Anterior view, right side of illustration shown in coronal cross section