REFERENCE BONE SET: VERTEBRAE

TYPICAL CERVICAL VERTEBRAE
1. Vertebral body (blue-green)
2. Pedicle (orange)
3. Lamina (blue)
4. Spinous process (yellow)
5. Superior articular process (light pink)
6. Joint facet of superior articular process (white)
7. Inferior articular process (dark pink)
8. Joint facet of inferior articular process (white)
9. Transverse process (green)
10. Transverse foramen.
11. Vertebral foramen.

ATYPICAL CERVICAL VERTEBRAE: C1-C2-C7

Atlas (C1)
1. Anterior arch (grey-green). The lighter colored bump on its anterior surface is called the anterior tubercle. The white facet on its posterior surface joints with the dens of the axis (see below).
2. Posterior arch (blue). The lighter colored bump on its posterior surface is called the posterior tubercle.
3. Superior articular process (light pink)
4. Joint facet on superior articular process (white)
5. Inferior articular process (dark pink)
6. Joint facet on inferior articular process (white)
7. Transverse process (green)
8. Transverse foramen

Axis (C2)
3. Superior articular process (light pink)
4. Joint facet on superior articular process (white)
5. Inferior articular process (dark pink)
6. Joint facet on inferior articular process (white)
7. Transverse process (green)
8. Transverse foramen
9. Vertebral body (blue-green)
10. Dens or odontoid process (grey). The white facet joints with the facet on the back of the atlas' anterior arch.

Vertebra Prominens (C7)
3. Superior articular process (light pink)
4. Facet on superior articular process (white)
5. Inferior articular process (dark pink)
6. Joint facet on inferior articular process (white)
7. Transverse process (green)
8. Transverse foramen
9. Vertebral body (blue-green)
10. Lamina (blue)
11. Spinous process (yellow)
**TYPICAL THORACIC VERTEBRAE**
1. Vertebral body (blue-green)
2. Pedicle (orange)
3. Lamina (blue)
4. Spinous process (yellow)
5. Superior articular process (light pink)
6. Joint facet of superior articular process (white)
7. Inferior articular process (dark pink)
8. Joint facet of inferior articular process (white)
9. Transverse process (green)
10. Joint facet on transverse process (white). *This joints with the tubercle of a rib.*
12. Superior demifacet (white)
13. Inferior demifacet (white) *The demifacets often look more like little bumps than smooth surfaces. However, the superior and inferior demifacets of adjacent vertebrae form little cup-shaped structures that joint with the head of a rib.*
15. Vertebral foramen

**TYPICAL LUMBAR VERTEBRAE**
1. Vertebral body (blue-green)
2. Pedicle (orange)
3. Lamina (blue)
4. Spinous process (yellow)
5. Superior articular process (light pink)
6. Joint facet of superior articular process (white)
7. Inferior articular process (dark pink)
8. Joint facet of inferior articular process (white)
9. Transverse process (green) *Developmentally, these are really the equivalents of the thoracic ribs.*
14. Mammillary process (small bump on back of superior articular process) *Developmentally, this small bump on the back of the superior articular process is really the equivalent of the transverse processes of the other vertebrae.*
15. Vertebral foramen

**SACRUM AND COCCYX**

*Sacrum*
1. Body of vertebra S1 (blue-green)
2. Body of vertebra S2
3. Body of vertebra S3
4. Body of vertebra S4
5. Body of vertebra S5
6. Position of intervertebral discs (white)
7. Sacral promontory. *This is a special name given to the anterior edge of body of S1.*
8. Costal processes (gray) *Developmentally, the equivalent of the thoracic ribs.*
9. Transverse processes (green)
10. Ala. *A special name given to the fused costal and transverse processes on either side of the body of S1.*
11. Anterior sacral foramen
12. Auricular surface (white edged with dark grey). *It joints with a similar surface on the hip bone at the sacroiliac joint.*
13. Sacral tuberosity (light blue)
14. Lateral sacral crest (dark green). *This ridge of bone is formed by the fusion of the transverse processes.*
15. Posterior sacral foramen
16. Intermediate sacral crest (dark pink). *This poorly marked bony ridge is formed by the fused articular processes of the vertebrae.*
17. Joint facet on superior articular process of S1
18. Sacral cornua (dark pink). *A special name given to the inferior articular processes of S5.*
19. Fused laminae (blue)
20. Median sacral crest (yellow). *This bony ridge is formed by the fused spinous processes.*
25. Sacral canal. *A special name given to the vertebral canal in the sacral region.*

**Coccyx**
22. Body of vertebra Cx1 (blue-green)
23. Transverse process of vertebra Cx1 (green)

**ATYPICAL THORACIC AND LUMBAR VERTEBRAE**
(DO THIS DEMONSTRATION AFTER YOU HAVE EXAMINED THE TYPICAL THORACIC AND LUMBAR VERTEBRAE.)

**Note that:**

Vertebra T1 looks somewhat like C7 and vice-versa. Like the typical thoracic vertebrae, it has an inferior demifacet. But, unlike them, it does not have a superior demifacet. Instead it has a complete facet.

The articular processes of Vertebrae T9-T12 look progressively more and more like those of the lumbar vertebrae. Their transverse processes get smaller and, unlike the typical thoracic vertebrae, those of T10-T12 do not have joint facets. The bodies of T9 - T11 have only superior facets; no inferior facets or demifacets. The body of T12 has neither facets nor demifacets.

L5 looks similar to S1 and vice-versa.

**Labeled on T12**
1. Vertebral body (blue-green)
2. Pedicle (orange)
3. Lamina (blue)
4. Spinous process (yellow)
5. Superior articular process (light pink)
6. Joint facet on superior articular process (white)
7. Inferior articular process (dark pink)
8. Joint facet on inferior articular process (white)

**Labeled on T9**
9. Transverse process (green)
10. Joint facet on transverse process (white)

**Labeled on T1**
13. Inferior demifacet (white)
16. Superior facet (white)
REFERENCE BONE SET: SKULL

DEMONSTRATION SKULL 1 (Color-coded and Labeled)

Look at the front of the skull.
1a. Frontal bone: squama or squamous part (yellow)
1b. Frontal bone: nasal process. It joins with the nasal bones.
1c. Frontal bone: zygomatic process. It joints with the zygomatic bone.
1d. Frontal part: orbital plate. It forms the roof of the orbit.
2a. Zygomatic (purple)
2b. Zygomatic: frontal process. It joins with the frontal bone.
2c. Zygomatic: temporal process. It joins with the temporal bone.
2d. Zygomatic: maxillary process. It joins with the maxilla.
3a. Maxilla (red)
3b. Maxilla: frontal processs. It joins with the frontal bone.
3c. Maxilla: alveolar process. This "edge" carries the sockets for the upper teeth.
3d. Maxilla: zygomatic process. It joins with the zygomatic bone.
3e. Maxilla: orbital part. It forms most of the floor of the orbit.
4. Nasal bone (purple)
5a. Mandible: body (darker orange).
5b. Mandible: ramus (lighter orange)
5c. Mandible: angle
5d. Mandible: condylar process
5e. Mandible: coronoid process

Look in the orbit.
6. Lacrimal bone (green)
7a. Ethmoid: orbital plate (blue)
8a. Sphenoid: lesser wing (dark pink). It is pierced by a hole, the optic foramen.
8b. Sphenoid: orbital surface of the greater wing (lighter pink)

Look in the nasal cavity.
7b. Ethmoid: perpendicular plate (light blue)
7c. Ethmoid: middle nasal concha (dark blue)
9. Vomer (green)
10. Inferior nasal concha (dark blue)

Look at the lateral aspect of the skull.
8c. Sphenoid: lateral surface of greater wing (light pink)
8d. Sphenoid: pterygoid process (dark pink)
11. Parietal bone (dark green)
12a. Temporal bone: squama or squamous part (medium blue)
12b. Temporal bone: mastoid part (lighter blue)
12c. Temporal bone: tympanic part (very light blue)
12d. Temporal bone: zygomatic process (dark blue)
13. Occipital bone: squama or squamous part (light green)
14. Zygomatic arch

Look in the cranial cavity.
1a. Frontal bone: cranial surface of squama or squamous part (dark yellow)
1d. Frontal bone: cranial surface of orbital plate (light yellow)
1e. Frontal bone: crest
7d. Ethmoid: crista galli
7e. Ethmoid: cribiform plate
8a. Sphenoid: cranial surface of lesser wing (medium pink)
8b. Sphenoid: cranial surface of greater wing (light pink)
8d. Sphenoid: body (dark pink)  
8e. Sphenoid: hypophyseal fossa (red). The pituitary gland or hypophysis sits in this depression.  
8f. Sphenoid: dorsum sellae  
8g. Sphenoid: anterior clinoid process  
11. Parietal bone: cranial surface (dark green)  
12a. Temporal bone: cranial surface of squama (medium blue)  
12b. Temporal bone: cranial surface of mastoid part (light blue)  
12e. Temporal bone: petrous part (dark blue)  
12f. Groove left by sigmoid sinus  
13a. Occipital bone: basilar part or basioccipital (medium green)  
13b. Occipital bone: cranial surface of squama (light green)  
13c. Occipital bone: fossa for cerebellum  
13d. Occipital bone: internal occipital crest  
13e. Occipital bone: internal occipital protuberance  
13f. Occipital bone: groove for transverse sinus  
13h. Occipital bone: condyle. The condyles joint with the superior articular processes of the atlas, the first cervical vertebra.

**SKULL 2 (EXTERNAL, LABELED ONLY)**

1. Frontal bone: squamous part. *This part of the bone is called the squama or squamous part because it is more or less scale-like in shape.*  
2. Parietal bone  
3. Occipital bone: squamous part. See #1 above.  
4. Coronal suture. *It joins the parietal bones to the frontal bone.*  
5. Sagittal suture. *It joins the parietal bones to each other.*  
6. Lambdoidal suture. *It joins the the occipital to the parietal bones.*  
7. Sphenoid: greater wing  
8. Temporal bone: squamous part. See #1 above.  
9. Squamosal suture. *It joins the squama of the temporal bone to the parietal bone.*  
10. Temporal bone: mastoid process. *The process and the bone immediately around it form the mastoid part of the temporal bone and contains the mastoid air cells.*  
11. Temporal bone: external acoustic meatus. *This is the opening into the bony part of the “ear canal.” It leads to the tympanic membrane or “eardrum.” The bone immediately surrounding the meatus forms the tympanic part of the temporal.*  
12. Zygomatic arch  
13. Mandible: ramus  
14. Mandible: coronoid process  
15. Mandible: condylar process  
16. Mandible: mandibular notch  
17. Mandible: angle  
18. Mandible: body  
19. Temporal bone: styloid process  
20. Mandible: mental eminence. *This is the “chin.”*  
21. Maxilla  
22. Nasal bone

**Structures 23 and 25 - 29 are located inside the left orbit.**

23. Zygomatic bone: orbital surface. *This surface of the zygomatic makes up the front half of the lateral wall of the orbit.*  
24. Zygomatic bone  
25. Maxilla: orbital surface  
26. Sphenoid: greater wing, orbital surface
27. Ethmoid: orbital plate. This rectangular plate forms much of the medial wall of the orbit and covers the ethmoidal air cells, air spaces located in the main mass of the ethmoid.
29. Lacrimal bone and lacrimal fossa. The lacrimal bone is the small, delicate bone anterior to the orbital plate of the ethmoid. The depression in it is the lacrimal fossa. In life, it contains the lacrimal sac, which collects tears.
30. Supraorbital foramen. On some skulls this is a notch, not a hole.

**Structures 31–33 are located inside the nasal cavity.**

31. Inferior nasal concha
32. Nasal septum: perpendicular plate of ethmoid. This plate of bone projects down from the body of the ethmoid and forms the upper part of the bony nasal septum.
33. Nasal septum: vomer. This triangular bone sits in the floor of the nasal cavity, joints with the perpendicular plate of the ethmoid, and forms the lower part of the nasal septum. In life, the triangular gap between the vomer and the perpendicular plate is filled with a triangular plate of cartilage that extends into the fleshy part of the nose.

**Structures 34–37 are located in the right orbit.**

34. Inferior orbital fissure
35. Superior orbital fissure. This is a gap between the greater and lesser wings of the sphenoid.
36. Optic foramen. This hole is located in the lesser wing of the sphenoid.
37. Nasolacrimal canal
38. Infraorbital foramen
39. Mental foramen
40. Maxilla: zygomatic process. It joints with the zygomatic bone.
41. Maxilla: frontal process. It joints with the frontal bone.
42. Zygomatic bone: frontal process. It joints with the frontal bone.
43. Frontal bone: zygomatic process. It joints with the zygomatic bone.
44. Zygomatic bone: temporal process. It joints with the temporal bone.
45. Temporal bone: zygomatic process. It joints with the temporal process of the zygomatic bone. Together, the two processes form the zygomatic arch.
46. Pterygomaxillary fissure. This is the small slit between the pterygoid process (47) and the maxilla. It leads to the pterygomaxillary fossa.
47. Sphenoid: pterygoid process

**Look on the base of the skull near the small supporting block of wood for #48.**

48. Occipital condyle
49. Superior and inferior temporal lines. These two lines are poorly marked on this skull. They are caused by the attachments of a large fan-shaped muscle, the Temporalis, and the connective tissue covering it, the temporalis fascia. The lines begin at the back edge of the zygomatic process of the frontal bone, arch across the parietal bones and then curve down and forward to end at the mastoid process.
50. External occipital protuberance. This bump can be palpated (‘felt’) on the back of the skull.
51. Superior nuchal line. These lines, arching laterally from the external occipital protuberance, are caused by the attachments of neck muscles.
52. Sutural bone. Sutural bones are small bones "trapped" between sutures. They are not uncommon.
SKULL 3 (BASAL ASPECT, LABELED ONLY)

1. Incisive foramen
2. Greater and lesser palatine foramina
3. Foramen ovale
4. Foramen spinosum
5. Foramen lacerum
6. Carotid canal
7. Jugular fossa and foramen
8. Stylo mastoid foramen
9. Foramen magnum
10. Hypoglossal canal. *The pin runs from the foramen magnum through the canal.*
11. Hard palate: palatine process of maxilla
12. Hard palate: horizontal process of palatine bone
13. Pterygoid process: medial lamina
14. Pterygoid process: lateral lamina. *The depression between the two laminae is the pterygoid fossa.*
15. Vomer. *It separates the two large posterior openings (choanae) of the nasal cavity.*
16. Occipital bone: basilar part or basioccipital
17. The carotid canal runs forward through this part of the temporal bone.
18. Styloid process. *Most of this delicate process has been broken off.*
19. Mastoid process. *The large groove medial to the process is called the mastoid notch.*
20. Occipital condyle
21. Occipital bone: squamous part or squama
22. External occipital protuberance.
23. Mandible: body
24. Mandible: fossa for attachment of Digastricus muscle
25. Mandible: mental spines.
26. Mandible: fossa for submandibular salivary gland
27. Mandible: angle
28. Mandible: condylar process. *The process consists of a knuckle-shaped head and a neck that connects the head to the rest of the ramus of the mandible. The head joints with the mandibular fossa of the temporal bone, forming the jaw joint.*
29. Zygomatic arch
30. Middle nasal concha (part of the ethmoid bone)
31. Zygomatic bone (base of the greater wing)
32. Inferior orbital fissure

SKULL 4 (DISSECTED, LABELED ONLY)

This skull has been partly dissected to show certain structures, indicated by **bold** type. It has also been painted to indicate the openings for nerves (yellow), arteries (red) and veins (blue). The structures indicated by "*italics*" pass through or occupy skull openings or depressions.

**Look at the external surface of the skull.**
1. Frontal bone: *frontal sinus* (unopened)
2. Frontal bone: *frontal sinus* (opened)
3. Frontal bone: *supraorbital foramen* > Supraorbital nerve
4. Ethmoid bone: *ethmoidal air cells.* *These air spaces are part of the paranasal sinuses. They are connected to the nasal cavity.*
5. Maxilla: *infraorbital groove and canal* > Infraorbital nerve, artery, vein.
6. Nasolacrimal canal > *Nasolacrimal duct.*
7. Maxilla: *infraorbital foramen* > Infraorbital nerve, artery, and vein
8. Bony part of nasal septum: *vomer*
9. Bony part of nasal septum: **ethmoid**: **perpendicular plate.** The nasal septum is the wall that divides the nasal cavity into right and left chambers. The posterior part of the septum is composed of the vomer below and the perpendicular plate of the ethmoid above. The anterior part of the septum, a triangular plate of cartilage, was removed with the fleshy part of the nose.

10. **Inferior nasal concha.** There are three conchae ("sea shells") on each side of the nasal cavity. The inferior nasal concha is the largest. It is a separate bone that joins with the maxilla. The smaller middle nasal concha (just above the inferior concha) and the smallest superior nasal concha (barely visible just above and posterior to the middle concha) are parts of the ethmoid.

11. **Right Nasal bone**

12. **Lacrimal bone and fossa** > **Lacrimal sac.**

13. **Ethmoid**: **orbital plate.** This part of the ethmoid forms much of the medial wall of the orbit and covers the ethmoidal air cells.

14. **Lesser wing of sphenoid**: **Optic foramen** > **Optic nerve**, **Ophthalmic artery**.

15. **Sphenoid**: **Superior orbital fissure** > **Oculomotor**, **Trochlear**, **Abducens**, and **Ophthalmic nerves**.

16. **Sphenoid**: **greater wing** (orbital surface). The greater wing has three surfaces: one visible in the orbit; one in the temporal fossa of the skull; and one in the middle fossa of the cranial cavity.

17. **Inferior orbital fissure** > **Maxillary nerve**, **Infraorbital artery and vein**.

18. **Zygomatic bone**

19. **Maxilla**

20. **Maxillary sinus.** This air space is the largest of the paranasal sinuses. It opens into the nasal cavity below the middle nasal concha.

21. **Mandible**: **coronoid process**

22. **Mandible**: **ramus**

23. **Mandible**: **body**

24. **Mandible**: **mental foramen** > **Mental nerve**, **artery**, and **vein**.

25. **Mandible**: **mental eminence** ("chin")

26. **Mental artery and vein**

27. **Inferior alveolar artery.** This artery enters the mandible through the mandibular foramen (on the inner surface of the ramus of the mandible) and runs forward through the body of the mandible supplying sensory branches to all the lower teeth and giving off the mental artery.

28. **Zygomatic arch.** The arch is formed by the zygomatic process of the temporal bone and the temporal process of the zygomatic.

29. **Temporal bone**: **squamous part.** The temporal bone is divided into squamous, tympanic, mastoid, and petrous parts. The squamous part is shaped like a large scale. It is joined to the parietal by the squamosal suture and to the greater wing of the sphenoid by the sphenosquamosal suture.

30. **Sphenoid**: **greater wing**

31. **Parietal bone**

32. **Frontal bone**

33. **Temporal bone**: **external acoustic meatus.** This is the opening into the bony part of the "ear canal." It leads to the tympanic membrane (= ear drum).

34. **Temporal bone**: **mastoid air cells and tympanic antrum.** The mastoid air cells are air spaces in the mastoid process. Unlike the other air cells and sinuses in the skull, they do not empty into the nasal cavity.

35. **Temporal bone**: **styloid process**

   **Look inside the cranial cavity.**

36. **Ethmoid**: **crista galli**

37. **Ethmoid**: **cribriform plate.** The olfactory nerves (cranial nerves I) run in small bundles through the holes of the cribriform plate on either side of the crista galli to leave the nasal cavity and enter the cranial cavity. The yellow band over the left side of the plate represents the position of the olfactory bulb and tract, parts of the olfactory system of the brain.

38. **Frontal bone**: **orbital plate.** These parts of the frontal bone form the roofs of the orbits and most of the floor of the anterior cranial fossa.

39. **Sphenoid**: **lesser wing.** The lesser wings form the back part of the floor of the anterior cranial fossa.
40. Position of optic chiasma (yellow band). As the optic nerves exit from the optic foramina and enter the cranial cavity, the nerve fibers carrying information from the medial half of each retina cross over to the opposite side (i.e., the fibers from the medial half of the right eye cross to the left side and the fibers from the medial half of the left eye cross to the right side). The crossing-over forms a nervous structure called the optic chiasma (= "crossing over").

41. Optic foramen > Optic nerve
42. Sphenoid: hypophyseal fossa > hypophysis (pituitary gland). In life, the hypophysis or pituitary gland occupies this depression on the top of the body of the sphenoid.
43. Sphenoid: dorsum sellae. The dorsum sellae is literally the "back of the (turkish) saddle." Early anatomists thought the top of the sphenoid looked like a Turkish saddle, in Latin, sella turcica. This is the back of the saddle. The hypophyseal fossa is its seat.
44. Sphenoid: Foramen rotundum > Maxillary nerve.
45. Sphenoid: Foramen ovale > Mandibular nerve.
46. Sphenoid: Foramen spinosum > Middle meningeal artery and vein (blue and red)
47. Temporal bone: petrous part: inner ear. The petrous (= "rocky" because it is very dense) part of the temporal houses the inner ear. Here the bone has been dissected away to expose one part of the inner ear. The green structures are parts of the three semicircular canals, inner ear structures concerned with equilibrium.
48. Temporal bone: petrous part: internal acoustic meatus and canal > Facial nerve, Statoacoustic nerve, Internal auditory artery. The meatus is the opening or entrance into the canal.
49. Temporal bone: petrous part: inner ear: location of cochlea. The bone has been dissected away to expose the part of the inner ear that contains the cochlea, a snail shell-shaped structure that converts sound waves to nerve impulses.
50. Internal carotid artery (red band). The red band marks the intracranial course of the internal carotid artery, a major artery to the brain. The artery enters the carotid canal on the base of the skull (not visible), turns forward to run through the canal in the petrous temporal, exits from the canal just above the foramen lacerum, then turns up to run along the side of the sella turcica. It ends by giving off branches to the brain and the orbit.
51. Inferior petrosal sinus. The blue-grey bands in the cranium represent dural sinuses. These are blood channels located within the dura, the outer connective tissue covering of the brain.
52. Basioccipital sinus. The basilar part of the occipital bone or basioccipital is the rectangular part of the occipital bone that runs up from the front edge of the foramen magnum to join the body of the sphenoid. This dural sinus gets its name from its location on the basioccipital.
53. Hypoglossal canal > Hypoglossal nerve.
54. Jugular foramen > origin of Internal jugular vein. The jugular foramen is a large gap between the petrous temporal and the occipital bone. The internal jugular vein, which drains most of the cranial cavity and much of the face and neck, begins at the foramen on the base of the skull.
55. Sigmoid sinus. This dural sinus is actually a continuation of the transverse sinus (see below). It gets its name from its resemblance to a flattened out "S." It ends at the jugular foramen.
56. Transverse sinus.
57. Confluence of the sinuses. This is the point where several sinuses meet.
58. Occipital bone. These two depressions (the right one is not labelled) are occupied by the cerebellum of the brain.
60. Superior petrosal sinus. This dural sinus runs along the upper edge of the petrous temporal.
61. Cavernous sinus. This dural sinus surrounds the hypophyseal fossa.
62. Sphenoparietal sinus. This dural sinus is named for its course along the parietal bone and the back edge of the lesser wing of the sphenoid.
63. Sphenoid: greater wing
64. Foramen magnum > spinal cord
65. Temporal bone: mastoid process
66. Mandible: condylar process
MANDIBLE (COLOR-CODED AND LABELED)

Look at the external surface.
1. Ramus (flesh colored)
2. Angle
3. Coronoid process (dark orange)
4. Condylar process: neck (dark orange)
5. Condylar process: condyle or head (dark orange)
6. Body (dark pink-orange)
7. Mental eminence (dark orange)
8. Mental foramen (hole beside the label)

Look at the internal surface.
9. Lingula (dark orange projection)
10. Mandibular foramen. This is the entrance to the mandibular canal. It is partly covered by the lingula.
11. Mylohyoid line (dark orange). This line is caused by the attachment of the mylohyoid muscle.
12. Fossa for the submandibular salivary gland (light yellow-orange)
13. Fossa for the sublingual salivary gland (light yellow-orange)
14. Mental spines (aka = genial or gonial tubercles) (dark orange projections). These little bony projections are caused by muscle attachments.
16. Mylohyoid groove (dark orange). This groove is caused by the mylohyoid nerve.

HYOID (COLOR-CODED AND LABELED)
This delicate U-shaped bone is located in the neck, just below the mandible and above the larynx (voice box). It is held in place by muscles and ligaments.
1. Body (dark blue)
2. Greater cornu (medium blue)
3. Lesser cornu (light blue projection)
REFERENCE BONE SET: UPPER LIMB

LEFT SCAPULA (COLOR-CODED AND LABELED)

Because of its triangular shape, the scapula has three defined borders and three angles.

Look at the anterior or costal surface. This is the surface that lies next to the ribs.
1. Subscapular fossa (yellow)
2. Medial or vertebral border (blue)
3. Lateral or axillary border (light green)
4. Superior border (dark green)
5. Superior angle
6. Inferior angle
7. Lateral angle (light blue). It does not look like an angle because of the glenoid cavity (see #10)
8. Coracoid process (pink). This particular scapula does not have one, but there is usually a scapular notch, a slight concavity on the superior border near the base of the coracoid process.
9. Infraglenoid tubercle (dark blue)
10. Glenoid cavity (white). This is the "socket" for the head of the humerus at the shoulder joint.
11. Supraglenoid tubercle (dark blue)

Look at the posterior surface.
12. Spine of the scapula (grey)
13. Acromion process (light blue)
14. Joint facet for acromioclavicular joint, the joint between the acromion and the clavicle.
15. Supraspinous fossa
16. Infraspinous fossa

RIGHT CLAVICLE (COLOR-CODED AND LABELED)

Before beginning, identify the following:
Superior surface: shades of green
Inferior surface: shades of grey
Posterior surface: blue

1. Medial or sternal end
2. Articular surface for sternoclavicular joint (white)
3. Lateral or acromial end
4. Articular surface for acromioclavicular joint (white)
5. Anterosuperior surface (medium green)
6. Attachment area for Deltoid muscle (light green)
7. Attachment area for Trapezius muscle (dark green)
8. Anterior border
9. Attachment area: Pectoralis major muscle (light blue)
10. Conoid tubercle (black)
11. Trapezoid line (light grey)
12. Subclavian groove: a depression for Subclavius muscle (black)
13. Costal tuberosity: an attachment area for costoclavicular ligament
14. Articular facet for joint with first costal cartilage
15. Posterior (cervical) surface (blue)
LEFT HUMERUS (COLOR-CODED AND LABELED)

Look at the proximal end.
1. Head (grey + white). The white area was covered with joint cartilage and articulated with the glenoid cavity of the scapula.
2. Anatomical neck (light green)
3. Lesser tubercle (dark orange)
4. Crest of lesser tubercle (orange and blue). This is also called the medial lip of the intertubercular groove. It is continuous distally with the medial border (18).
5. Greater tubercle (dark grey-blue)
6. Crest of the greater tubercle (dark blue). This is also called the lateral lip of the intertubercular groove. It ends distally in the deltoid tuberosity (7).
7. Deltoid tuberosity. This is the roughened insertion of the Deltoid muscle.
8. Intertubercular groove (light green)

Look at the distal end.
9. Medial epicondyle (dark grey)
10. Trochlea (yellow + white). The white area was covered with joint cartilage and articulated with the trochlear notch of the ulna.
11. Capitulum (green + white). The white area was covered with joint cartilage and articulated with the head of the radius.
12. Lateral epicondyle (pink)
13. Coronoid fossa (green)
14. Radial fossa (dark blue-grey)
15. Olecranon fossa (light blue-green)

Look at the shaft.
16. Anterior surface (light blue-grey). The rounded ridge that the label is on divides the anterior surface into anteromedial and anterolateral parts.
17. Posterior surface (dark green)
18. Medial border (light orange). Proximally, it begins at the crest of the lesser tubercle. Distally, it ends at the medial epicondyle. The flared part above the epicondyle is called the medial supracondylar crest.
19. Lateral border (dark pink). Proximally, it begins at the greater tubercle. Distally, it ends at the lateral epicondyle. The flared part above the epicondyle is called the lateral supracondylar crest.

RIGHT RADIUS (COLOR-CODED AND LABELLED)

Look at the proximal end.
1. Head (grey + white)
2. Head: fovea (white). This depression was covered with joint cartilage and articulated with the capitulum of the humerus.
3. Head: articular surface for ulna (white). This part of the head was covered with joint cartilage and articulated with the radial notch of the ulna.
4. Neck (light green)
5. Tuberosity of the radius = radial tuberosity (yellow)

Look at the distal end.
6. Styloid process (light green)
7. Dorsal tubercle (dark blue)
8. Ulnar notch (white). This surface was covered with joint cartilage and articulated with the head of the ulna.
**ANATOMY 25**  KEYS: REFERENCE BONE SET  GUTHRIE

*Tilt the demonstration so you can see the two white areas on the distal end of the bone. This is called the carpal articular surface, it joints with two carpal bones to form the wrist joint.*

9. Articular surface for the lunate. *It was covered with joint cartilage.*
10. Articular surface for the scaphoid. *It was covered with joint cartilage.*

**Look at the shaft.**
11. Lateral surface (blue-grey).
12. Posterior surface (grey-green). *The posterior border between the posterior and lateral surfaces is poorly marked.*
13. Anterior surface (light blue).
14. Anterior border (pink)
15. Interosseous crest = medial border (orange)

**ULNA (COLOR-CODED AND LABELED)**

1. Olecranon process (bright blue). *This is the “point” of your elbow.*
2. Coronoid process (bright green)
3. Trochlear notch (white). *This surface joints with the trochlea of the humerus.*
4. Radial notch (white). *This surface joints with the head of the radius.*
5. Tuberosity of the ulna (ulnar tuberosity). *The Brachialis muscle inserts in this roughened area.*
6. Anterior surface (blue-grey)
7. Posterior surface (blue-green)
8. Medial surface (green-yellow)
9. Interosseous border. *The interosseous membrane, connecting the shafts of the ulna and the radius, attached to this sharp crest of bone.*
10. Posterior border. *This border begins at the inferior end of the V-shaped area on the back of the olecranon and ends at the styloid process.*
11. Anterior border. *This border begins at the medial edge of the coronoid process and ends at the styloid process.*
12. Head (dark green + white). *The white articular surface joints with the ulnar notch of the radius.*
13. Styloid process (pink)

**RIGHT HAND (COLOR-CODED AND LABELED)**

Articular surfaces are white

**Carpal (wrist) Bones**
1. Trapezium (brown)
2. Scaphoid (navicular) (light-green)
3. Lunate (blue)
4. Triquetral (dark green)
5. Pisiform (light green)
6. Hamate (light brown)
7. Capitate (medium green)
8. Trapezoid (blue-green)
9. Hamulus (little hook) of the hamate

**Metacarpals and Phalanges**
10. Metacarpal I (green yellow)
11. Metacarpal II
12. Metacarpal III
13. Metacarpal IV
14. Metacarpal V
15. Proximal phalanges (ochre)
16. Middle phalanges (yellow)
17. Distal phalanges (light green)
   A. Base of metacarpal
   B. Head of metacarpal
   C. Base of phalanx
   D. Head of phalanx
   E. Condyles on head of metacarpal
REFERENCE BONE SET: LOWER LIMB

RIGHT HIP BONE, COLOR-CODED AND LABELED

The hip bone or os coxae is composed of three fused bones: ilium, ischium, and pubis.

Look at the external surface.

Ilium (shades of green). The ilium has two main parts: a body and the large fan-shaped part called the ala. Structures 1-7 are all parts of the ala.
1. Ilium: gluteal fossa (dark green). The gluteal or buttoc muscles attach to this large depressed area.
2. Ilium: crest = iliac crest (light green)
3. Ilium: anterior superior iliac spine (blue-green)
4. Ilium: anterior inferior iliac spine (blue-green)
5. Ilium: posterior superior iliac spine (blue-green)
6. Ilium: posterior inferior iliac spine (blue-green). The iliac crest and spines are sites of muscle or ligament attachments.
7. Ilium: tubercle of the crest of the ilium (blue-green)
8. Ilium: body of the ilium (light green)

Ischium (shades of grey).
9. Ischium: body (light grey)
10. Ischium: spine = ischial spine (dark grey)
11. Ischium: tuberosity = ischial tuberosity (dark grey)
12. Ischium: ramus = ischial ramus (light grey). This is the rectangular bar running forward from the tuberosity.
The ischial spine, tuberosity, and ramus are sites of muscle or ligament attachments.

Pubis (shades of blue)
13. Pubis: superior ramus
14. Pubis: inferior ramus. The combined inferior pubic ramus and ischial ramus are sometimes called the ischiopubic ramus.
15. Pubis: tubercle = pubic tubercle. The small bump beside the label.
17. Pubis: pecten pubis. The sharp line running along the superior pubic ramus towards the pubic tubercle.

Acetabulum. The socket for the hip joint is called the acetabulum. It is formed by parts of the ilium, ischium, and pubis. It is divided into an articular part that contacts the head of the femur and a non-articular part.
18. Acetabulum: articular surface (white). It is also called the lunate surface because it resembles a crescent moon.
19. Acetabulum: non-articular part (green-grey-blue). This depressed area in the floor of the acetabulum is also called the acetabular fossa.

Obturator Foramen
21. Obturator foramen. The hole bounded by the acetabulum and the rami of the pubis and the ischium. In life, it is almost completely closed by a sheet of connective tissue, the obturator membrane.
Look at the internal surface.
22. Ilium: iliac fossa (medium green)
23. Ilium: auricular surface (white). It joins with a similar surface on the sacrum at the sacroiliac joint.
24. Ilium: tuberosity = iliac tuberosity (dark green)
25. Ilium: arcuate line. The bony ridge running forward from the auricular surface. It joins the pecten pubis. Together, the two lines form the iliopectineal line.
26. Iliopubic eminence. This bump marks the junction of the ilium and the pubis.
27. Greater sciatic notch. The concave border between the auricular surface and posterior inferior iliac spine, superiorly, and the ischial spine, inferiorly.
29. Articular surface for pubic symphysis (white). The two pubic bones joint at this surface.

LEFT FEMUR (COLOR-CODED AND LABELLED)

Look at the proximal end.
1. Head: articular surface of head (white). The head fits into the acetabulum of the hip bone, forming the hip joint.
2. Fovea of the head (dark blue). The round ligament of the femur attaches at the fovea. Its other end is anchored to the acetabular floor.
3. Head: non-articular part (grey)
4. Neck (green)
5. Greater trochanter (dark grey-blue)
6. Lesser trochanter (orange)
7. Intertrochanteric line (light grey)
8. Intertrochanteric crest (light grey)

The trochanters, line and crest are sites of muscle and ligament attachments.

Look at the distal end.
9. Medial condyle (yellow)
10. Lateral condyle (green)
11. Medial epicondyle (grey)
12. Lateral epicondyle (orange). The epicondyles are sites of ligament attachments.
13. Patellar articular surface. This surface joints with the patella (knee cap) at the knee joint.
14. Medial condyle: articular surface (white). This surface joints with the medial condyle of the tibia at the knee joint.
15. Lateral condyle: articular surface (white). This surface joints with the lateral condyle of the tibia at the knee joint.
17. Intercondylar fossa or notch. The depression between the condyles.

Look at the shaft.
18. Anterior surface (light blue). Notice that this surface is very smooth. It is almost entirely covered by large thigh muscles in life.
19. Posterior surface (grey-green)
20. Lateral surface (blue-green)
21. Linea aspera. This "rough line" is a major attachment site for many of the thigh muscles.
22. Linea aspera: medial lip (green)
23. Linea aspera: lateral lip (yellow)
24. Popliteal surface (lighter grey triangular area). *This surface underlies the hollow at the back of the knee.*
25. Gluteal tuberosity (proximal end of lateral lip of linea aspera)
26. Pectineal line. *This line is caused by the Pectineus muscle.*
27. Proximal end of medial lip of the linea aspera

**RIGHT PATELLA (COLOR-CODED AND LABELED)**

The patella is the kneecap.

*Look at the anterior surface.*
1. Anterior surface (medium blue). *This is the surface you can feel through the skin.*
2. Base (light blue) *This is the proximal end of the bone.*
3. Apex (dark blue) *This is the distal end of the bone.*

*Look at the posterior surface.*
4. Articular surface for medial femoral condyle (white)
5. Articular surface for lateral femoral condyle (white). *Notice that it is much larger than the medial articular surface.*
6. The grey ridge joints with the groove in the patellar articular surface of the femur.

**LEFT TIBIA (COLOR-CODED AND LABELED)**

*Look at the proximal end.*
1. Medial Condyle (dark brown)
2. Lateral Condyle (light brown)
3. Articular surface of medial condyle (white). *This surface joints with the medial condyle of the femur.*
4. Articular surface of lateral condyle (white). *This surface joints with the lateral condyle of the femur.*
5. Intercondylar eminence (medial and lateral intercondylar tubercles) (light brown)
6. Attachment area: anterior end of medial meniscus (medium grey)
7. Attachment area: anterior end of lateral meniscus (dark grey)
   *The menisci (plural of meniscus) are two crescent shaped pieces of cartilage that attached to the rims of the condyles in life.*
8. Attachment area: anterior cruciate ligament (light grey). *There are two cruciate (= “crossed”) ligaments. They connect the tibia and the femur.*
9. Attachment area: posterior end of medial meniscus (medium blue)
10. Attachment area: posterior end of lateral meniscus (light blue)
11. Attachment area: posterior cruciate ligament (dark blue)
12. Articular surface: proximal tibiofibular joint. *This area joints with the head of the fibula.*
13. Tibial tuberosity (yellow-brown) *This is the “bump” just below the knee joint. The patellar ligament, a continuation of the tendon of the Quadriceps muscle of the thigh, attaches to it.*

*Look at the distal end.*
14. Medial Malleolus (light yellow) *This is the “bump” on the medial side of the ankle.*
15. Fibular notch: area for distal tibiofibular joint (blue-green). *The distal end of the fibula joints with the tibia here.*
16. Talar articular surface (white). *This surface joints with the top and sides of the talus or “ankle bone” of the foot.*
17. Attachment site: anterior tibiotalar ligament (yellow-green). *The tibiotalar ligaments, anterior and posterior, connect the tibia and the talus.*
18. Malleolar groove (blue and yellow). *This shallow groove is caused by the tendons of leg muscles that curve around the bone as they enter the foot.*
Look at the shaft.
19. Anteromedial surface (dark yellow). This surface is subcutaneous; i.e., it is covered only with skin and can be easily palpated (= felt with your fingers).
20. Anterolateral surface (dark green). This surface is covered with muscles in life and cannot be easily palpated.
21. Posterior surface (dark blue)
22. Anterior border. This is the sharp ridge of bone running down the front of your leg. You can trace it from the tibial tuberosity to the medial malleolus.
23. Interosseous crest. This ridge gets its name from a large sheet of connective tissue, the interosseous membrane, that connects it to a similar crest on the fibula.
24. Medial border
25. Soleal line (light green). This line is caused by the Soleus muscle.
26. Nutrient foramen. A major artery to the tibia enters the bone at this point.

RIGHT FIBULA (COLOR-CODED AND LABELED)

Look at the proximal end.
1. Head (expanded part of dark brown)
2. Neck (constricted part of dark brown)
3. Articular surface for proximal tibiofibular joint (white). This area joins with the facet on the undersurface of the lateral condyle of the tibia.
4. Apex (styloid process) (grey). This small projection is caused by the pull of the tendon of the Biceps femoris muscle.

Look at the distal end.
5. Lateral malleolus (blue-green). This is the "bump" on the lateral side of the ankle.
6. Articular surface for talofibular joint (white). This surface joins with the side of the talus at the ankle joint.
7. Surface for distal tibiofibular joint. This area joins with the distal end of the tibia.
8. Malleolar fossa: attachment site for posterior talofibular ligament (light green). The ligament helps to bind the talus and the fibula together.

Look at the shaft.
9. Medial surface (yellow)
10. Lateral surface (blue)
11. Posterior surface (green)
   a. Posteromedial part
   b. Posterolateral part
12. Anterior border
13. Interosseous crest. This crest is connected to the interosseous crest of the tibia by the interosseous membrane, a large sheet of connective tissue.
14. Posterior border
15. Medial crest (crista medialis). This ridge of bone, caused by muscles, divides the posterior surface into medial and lateral parts.
LEFT FOOT (COLOR-CODED AND LABELED)

Visible joint surfaces are colored white.

**Tarsal Bones.** Collectively, these seven bones are called the tarsus (= ankle).

1. Calcaneus (“heel bone”) (grey)
2. Talus (“ankle bone”) (yellow)
   a. Joint surface for articulation with talar articular surface of tibia.
   b. Joint surface for articulation with lateral malleolus of fibula
   c. Joint surface for articulation with medial malleolus of tibia.
3. Navicular (“boat shaped”) (dull green)
4. Cuboid (bright green)
5. Medial cuneiform (orange)
6. Intermediate cuneiform (pink)
7. Lateral cuneiform (blue)

**Metatarsals** (light green). Metatarsal means “beyond the tarsal.” They are numbered from I-V (Roman numerals) or 1-5 (Arabic numerals), starting medially with the metatarsal of the big toe or hallux.

8a. Metatarsal I or 1
8b. Metatarsal II or 2
8c. Metatarsal III or 3
8d. Metatarsal IV or 4
8e. Metatarsal V or 5

Each metatarsal has a proximal end, called the base, and a distal end called the head. The bases joint with the tarsals and with each other. The heads carry condyles (knuckle-shaped processes) which joint with the proximal phalanges. The base, head and condyles are labeled only on Metatarsal 1.

  g. base
  h. head
  i. condyle

**Phalanges** (shades of brown). The phalanges are the “toe bones.” A phalanx (the singular of phalanges) is a rectangular military formation used by ancient Macedonians, Greeks and Romans. The hallux or big toe contains two phalanges: proximal and distal. Toes 2-5 contain three: proximal, middle and distal. However, it is not unusual for the middle phalanx to be absent in the little toe. Like the metatarsals, the proximal end of each phalanx is called the base and the distal end, the head.

9. Proximal phalanges (dark brown)
10. Middle phalanges (medium) brown
11. Distal phalanges (light brown). Note their expanded distal ends, which form platforms to support the nails.