The Skeletal System

The function of the skeleton is to provide body shape and support, to protect vital organs (ribs, sternum, skull, vertebrae), act with muscles as levers to provide movement, provide storage for minerals (Ca and P). Also, within the red bone marrow, blood cells are produced. (p 158)

Bones are usually classified according to shape: (pp 157 – 158)

- long bones. These are longer than wide. They include the bones of the upper and lower arms and legs as well as of the feet, hands, fingers and toes.
- short bones. More or less cuboidal. They include the bones of the wrists and ankles.
- flat bones. These flattened bones include the sternum, scapulae, ribs and most skull bones.
- irregular bones. These oddly-shaped bones include the vertebrae and pelvis.
- sesamoid bones occur within tendons and are usually small and variable in number. Of the 206 named bones of the body, only the patellae are sesamoid bones.
- wormian or sutural bones. These are small bones that occur within the sutures of the skull. They are variable in size, number and position. None are named.

Bone Markings (p159)
Bones usually have many projections, depressions and holes. Projections that protrude out of bones are generally called processes of which we may refer to several types. These first processes are sites of muscle and ligament attachment:

- tuberosity – usually rounded, often roughened projection
- trochanter – large, blunt projection on femur
- tubercle – small rounded process
- crest – prominent ridge of bone
- line – narrow, less prominent ridge of bone
- epicondyle – a raised area on or above a condyle
- spine – sharper, more slender projection

Processes foming joints:

- head – rounded bony expansion at the end on a narrower neck
- facet – smooth, flat articular surface
- condyle – rounded articular process
- ramus – arm-like projection of bone

Depressions and openings:

- meatus – large canal-like passageway
- sinus – cavity within a bone filled with air and lined with mucous membrane
- fossa – depression in the bone, usually an articular surface
- groove – deeper furrow
- fissure – narrow, slit-like opening
- foramen – hole in the bone through which nerves and blood vessels pass

Structure of the Long Bone (pp160 – 161)
The long bone has a long shaft, or diaphysis, and two ends, usually enlarged, called the proximal and distal epiphysis. The diaphysis of the bone is smooth, hard compact bone. It surrounds a medullary cavity filled with fatty yellow bone marrow. On the very outside of the epiphysis is compact bone. Deeper it becomes cancellous or spongy bone. This looks like a sponge made of hard needle-like pieces called trabiculae. Within the spaces of the cancellous bone is found the red bone marrow where blood cells are produced.

The ends of a long bone are covered with a thin layer of cartilage, called articular cartilage, that prevents two bones from rubbing directly against each other. There is also a layer of cartilage between the epiphysis and the diaphysis called the epiphysial plate. After puberty this cartilage ossifies and becomes the epiphysial line. We will come back to this when bone growth is discussed. Except for the articular ends, the outside of the bone is covered with a tough, dense connective tissue covering called the periosteum. On the inside of the periosteum are two kinds of cells. Osteoblasts (bone-building) which remove calcium from the blood and deposit it in the bone, and osteoclasts (bone-destroying) which remove calcium from bone and

deposit it in the blood. Both the periosteum and the bone itself have many small openings (foramina) allowing for the passage of blood vessels and nerves. Internally the bone is covered with a thinner connective tissue membrane called the endosteum. This also contains osteoblasts and osteoclasts. (pp. 160 - 161)

Haversian System
Compact bone is made of structural units, each referred to as an osteon or the Haversian system. Running through the center of each osteon is the central canal where we find small blood vessels and nerve fibers. Surrounding the central canal are concentric rings called lamellae made mostly of extracellular matrix – calcium phosphate crystals and collagen. Where two lamellae come together there are found many small spaces called lacunae. It is within these that the mature bone cells, osteocytes, are found. Because of the thick, dense matrix, it is difficult for the blood to supply all of these osteocytes and so the osteocytes are connected to one another. They have long, cytoplasmic extensions running through tiny canals called canaliculi. (p 162)

Osteogenesis and Bone Growth (Long Bone) (pp 164 – 167)
Until the eighth week of gestation the embryonic skeleton is made of cartilage. At this time osteoblasts develop and form a bone collar around the diaphysis. The cartilage in the middle of the diaphysis then starts to deteriorate, cavitates and becomes ossified. The cavity (medullary cavity) continues to grow as secondary ossification centers appear in the proximal and distal epiphysis. This is the condition at about the time of birth. Ossification continues until the cartilage is found in two places – the ends of the bones (articular cartilage) and at the junction of the diaphysis and the epiphyses (epiphysial plates). During childhood the cartilage of the epiphysial plates continue to undergo mitosis (under the influence of growth hormone) pushing the epiphysis away from the diaphysis and thus elongating the bone. Sex hormones eventually cause the plate itself to ossify and growth is then complete. The remnants of the epiphysial plate appear as the epiphysial line in an adult bone.

Bone Remodeling (p 168 and 170)
Osteoblasts and osteoclasts are continuously causing the deposition and resorption of bone. This is a lifelong process. One of the controls of these processes is mechanical stress on the bone the bone responds by building up those areas where the stress occurs. For example, the attachment sites of muscle tendons will enlarge if those tendons continuously pull on the bone there. Over long periods of time the shape of the bone can actually change. Orthodontists use this to advantage by continually applying stress to one side of a tooth with braces. The bony socket of the jaw changes shape as bone is compressed on one side and tension is applied to the other. Braces for spine curvatures work in much the same way.

Bone Fractures
Fractures may be classified in a number of ways but here are some important types:
- simple – the bone end does not penetrate the skin
- compound – the bone end penetrates through the skin
- compression – bone is crushed
- depression - bone is pressed inward
- spiral – break may continue around bone when twisting forces are applied
- greenstick – incomplete break, more common in children who have a higher proportion of collagen.
- comminuted - bone fragments into three or more pieces

Bone Diseases
Osteoporosis. This is a reduction in bone mass most commonly seen in the elderly. Most common in postmenopausal women, it is often a consideration in hormone (estrogen) replacement therapy.

Rickets. A calcium insufficiency caused by a Vitamin D deficiency and lack of sunlight. Children's bones are stunted and malformed.

Osteogenesis imperfecta. Brittle bone disease caused by inadequate or improperly manufactured collagen in the bones making them susceptible to fracture. In extreme cases ribs may fracture upon breathing deeply.

Osteomyelitis. A bacterial infection causing an inflammation of the bone and bone marrow.
Osteosarcoma. A type of bone cancer usually found in teens and young adults. It grows aggressively and metastasizes frequently.

Paget's Disease (Osteitis deformans). Excessive bone deposition usually in leg bones, skull, pelvis and spine. New bone however is softer and more susceptible to breaks. Usually occurs in middle aged people and is of unknown etiology.

The Skeleton

The axial skeleton (skull, vertebral column and bony thorax) will be considered first. The skull is composed of 22 bones. (pp 203 – 216) Eight of these make up the cranium that protects the brain. Joints between the flat bones of the skull are called sutures because of their appearance and within these may be found small wormian bones.

- Frontal Bone. The frontal bone is an unpaired bone of the anterior skull. The supraorbital margins are a thickened part of the frontal bone that underlie the eyebrows and form the superior part of the orbit.
- Parietal Bones. The right and left parietal bones articulate with the frontal bone forming the coronal suture. The two parietals join together to form the sagittal suture.
- Occipital Bone. The occipital bone (unpaired) articulates with the posterior ends of the parietals forming the lambdoid suture. On the inferior side of the occipital is a large opening, the foramen magnum, through which the spinal cord leaves the skull and descends through the vertebral column. On either side of the foramen magnum are the R & L occipital condyles which articulate with the first cervical vertebra.
- Temporal Bones. The parietal bones articulate laterally with the R & L temporal bones forming the squamous suture. The important bone markings include the external auditory meatus where the ear canal enters the skull, the mastoid process (a large blunt part of the bone that can be felt directly behind the ear) and the styloid process (a pointed process that serve as an attachment site for muscles of the tongue and neck). The zygomatic process of the temporal bone projects anteriorly and articulates with the temporal process of the zygomatic bone. On the inferior surface of the zygomatic process is the mandibular fossa which articulates with the mandible forming the temporomandibular joint.
- Sphenoid Bone. In approximately the middle of the skull is sphenoid bone which articulates with all other bones of the cranium. The greater and lesser wings of the sphenoid give it a butterfly-like shape. The posterior, superior surface bears the sella turcica (Turk's saddle) which encloses the pituitary gland. There are a number of canals, fissures and foramena in the sphenoid that allow for the passage of nerves to and from the brain.
- Ethmoid Bone. The oddly shaped ethmoid lies anterior to the sphenoid and posterior to the nasal bones. On the superior surface is the cribriform plate forming part of the upper nasal cavity. This plate is perforated with dozens of small olfactory foramina with allow branches of the olfactory nerve to enter the nasal cavity. Projecting superiorly from the cribriform plate late is the crista galli (cock's comb). The outermost covering of the brain is attached to it and thus it helps secure the brain in place. Projecting inferiorly from the cribriform plate is the perpendicular plate that forms the superior part of the nasal septum.
- Mandible. The mandible is an unpaired bone that forms the lower jaw. It is the only moveable bone in the skull. Anteriorly is the body of the mandible and forms the chin. On the superior surface of the body is the alveolar margin containing the bony sockets for the bottom teeth.The posterior mandible consists of the R & L mandibular rami which project superiorly at an angle (mandibular angle). Each ramus bears two processes – the anterior coronoid process to which is attached the temporalis muscle and the posterior mandibular condyle which articulates with the mandibular fossa of the temporal bone. Between the mandibular condyle and the coronoid process is the mandibular notch.
- Maxillae. The two maxillary bones form the upper jaw. The alveolar margin contains the bony sockets for the upper teeth. The inferior medial part forms the anterior portion of the hard palate.
- Inferior Nasal Conchae. From the part of the maxillae forming the lateral wall of the nasal cavity, the two curved inferior nasal conchae project medially.

- Nasal Bones. The two small nasal bones fuse medially forming the bridge of the nose. The nasals together with the maxillae form the entrance to the nasal cavity. These bones also support the nasal cartilages.
- Zygomatic Bones. The R & L zygomatics (cheekbones) form the lateral inferior part of the orbit. The temporal process of the zygomatic articulates with zygomatic process of the temporal bone forming the zygomatic arch.
- Lacrimal Bones. Within the medial orbit are the two smallest bones of the skull, the R & L lacrimal bones. Each contains a groove that, with the maxillae, forms the lacrimal fossa . This houses the lacrimal sac, part of the structure that allows tears to drain from the eye into the nasal cavity.
- Pallatine Bones. The R & L L-shaped palatines have a horizontal plate that articulates with the maxillae and forms the posterior part of the hard palate. The perpendicular plates form part of the posterior nasal cavity.
- Vomer. The unpaired vomer forms the lower part of the nasal septum.

Hyoid. The Hyoid bone lies inferior to the mandible in the anterior neck. It is the only bone of the body that does not articulate with another bone . It serves as an attachment site for muscles of the neck and larynx.

Paranasal sinuses
Five bones of the skull – frontal, ethmoid, sphenoid and R & L maxillae have air-filled spaces lined with mucous membrane. These sinuses lighten the skull, enhance the resonance of the voice and warm and humidify inspired air. (p 216)

Vertebral Column
The vertebral column (spine) is composed of 33 bones though some of these are fused. (pp 219 - 226) It is divided into 5 regions: Cervical (7), Thoracic (12), Lumbar (5), Sacrum (5 fused), Coccyx (4 fused). In a sagittal view the cervical and lumbar regions are slightly concave while the thoracic and sacrum-coccyx regions are slightly concave. The spine is supported by ligaments and back muscles. The bones of the cervical, thoracic and lumbar regions are separated by intervertebral discs that cusion the bones and allow for some flexibility. A herniated or prolapsed disc occurs when the fibrous outer collar of the disc ruptures and allows some of the inner pulpy material to protrude. This may put pressure on the spinal nerves that exit the spinal cord between vertebrae.

Each vertebra is composed of an anterior centrum or body and a vertebral arch posteriorly that encloses a space, the vertebral foramen, through which the spinal cord passes. Projecting from the arch is a posterior spinous process (the spinous processes are the bumps you feel as you run your hand down a spine) and two lateral transverse processes.

There are 7 cervical (neck) vertebrae. C2 through C6 usually have a spinous process that is bifed (forked). The vertebral foramen is relatively large in this region as the spinal cord is at its widest diameter here and tends to taper as it descends. All of the cervical vertebrae have transverse foramina in their transverse processes. (Through these the vertebral arteries pass to supply the head.) Three cervical vertebrae deserve special consideration. C1, or the atlas, articulates with the occipital bone forming the atlanto-occipital joint. The occipital condyles rest on the superior articular facets of C1 and allow the condyles to rock back and forth making a “yes” motion. There is virtually no centrum on C1 and the spinous process is poorly developed. C2, the axis, has on its centrum a superiorly projecting process called the dens. This fits into C1 allowing the atlas to rotate around the dens in a “no” motion. C7 is referred to as the vertebra prominans. It can be easily felt as it has the largest spinous process in the cervical region and this provides us with a good landmark.

There are 12 thoracic vertebrae each of which articulates with a R & L rib. The centrum is roughly heart-shaped and many of the spinous processes are deflected downward. There is no flexion or extension of the thoracic spine but there is rotation.

The 5 lumbar vertebrae have relatively small vertebral foramina and large centra – the weight of the upper body must be supported by these. The large spinous processes allow the attachment of large back muscles. There is some flexion but no rotation of the lumbar spine.

The sacrum, consisting of five fused vertebrae, articulates with L5. The broad alae articulate with the pelvis forming the sacroiliac joints. The medial sacral crest is formed on the dorsal side by the fusion of the spinous processes. The vertebral canal continues as the sacral canal. The sacral foramina allow the passage of blood vessels and nerves.

The coccyx, "tailbone" is formed by the fusion of usually 4 bones. Most of the markings on typical vertebrae are no longer distinguishable.

Abnormal Curvatures of the Spine
Although there are natural convexities and concavities of the spine, it should be vertically straight along the midlide of the body. A lateral curvature of the spine, C-shaped or even S-shaped, is called scoliosis. It may be treated with braces or surgically in childhood. An exaggerated curvature or the thoracic spine is called kyphosis and gives the person a hunchback appearance. Lordosis is an exaggerated curvature of the lumbar spine.

Sternum and Ribs
The sternum (p 226), or breastbone, is a flat bone that lies on the midline of the thorax protecting the heart. Superiorly it articulates with the R & L clavicles to form the jugular notch. The sternum is composed of 3 parts: the superior manubrium, the middle corpus, or body, and the small inferior xyphoid process.

There are 12 pairs of ribs articulating posteriorly with vertebrae T1 – T12. Anteriorly, ribs 1 through 7 articulate with the sternum via an individual costal cartilage. These are called the true ribs. Ribs 8, 9 and 10 have costal cartilages that articulate with the costal cartilages of rib 7. These last 3 together with ribs 11 and 12 are called false ribs. Ribs 11 and 12 have no anterior articulation. These false ribs are also called floating ribs. The ribs form what is referred to as the thoracic cage. While protecting the thoracic organs, it allows for expansion to accommodate inhalation.

The appendicular skeleton articulates with the axial skeleton appending the upper and lower limbs. (pp 228 – 237)

- Clavicles. The R & L clavicles, or collarbones, are S-shaped and articulate medially with the manubrium of the sternum and laterally with the acromion process of the scapula.
- Scapula. The R & L scapulae, or shoulder blades, have a number of important markings. The lateral and medial borders edge the broad, flat part of the bone. On the posterior side is the spine of the scapula, a sharp ridge of bone that more or less runs laterally and ends with the acromion process. Two large processes, the acromion process (posterior) and the coracoid process (anterior) are located on the anterior, lateral scapula and provide for the attachment of many muscles and ligaments including those that stabilize the ball and socket arm joint. These two processes partially enclose the glenoid fossa of the scapula which articulates directly with the head of the humerus forming the glenohumeral joint.
- Humerus. The large bone of the upper arm, the humerus, has, at its proximal end, the hemispherical head. Just distal to the head are the greater and lesser tubercles. Below the head the humerus constricts at the surgical neck. About midway along the length of the humerus is the deltoid tuberosity to which attaches the deltoid muscle. At the distal end are condyles on which are the medial and lateral epicondyles. Between them on the anterior side is the trochlea (which articulates with the ulna) and the capitulum (which articulates with the radius). Immediately superior to the trochlea on the anterior side is a depression called the coronoid fossa. Opposite, on the posterior side, is a deeper depression called the olecranon fossa.
- Ulna. The ulna is the slightly longer of the two bones of the forearm. At its proximal end are the superior olecranon process and below this is the coronoid process. The two are separated by the trochlear notch and together they form a C-shaped structure resembling an adjustable wrench. (Don't confuse the coronoid process of the ulna with the coronoid process of the mandible or the coracoid process of the scapula.) The trochlear notch slides around the trochlea of the humerus when the arm is flexed at the elbow. The olecranon process fits into the olecranon fossa and the coronoid process fits into the coronoid fossa. At the distal end is the head of the ulna bearing a styloid process.

- Radius. The head of the radius at the proximal end bears a slight concavity which articulates with the capitulum of the humerus. Just inferior to the neck is the radial tuberosity to which attaches the biceps of the upper arm. The distal end of the radius also bears a styloid process.
- Carpals. Distally the radius and ulna articulate with the carpal bones which form two rows of four short bones. In the proximal row (lateral to medial) are the scaphoid, the lunate, the triquetral and the pisiform. In the distal row (lateral to medial) are the trapezium, the trapezoid, the capitate and the hammate.
- Metacarpals. Articulating with the distal row of the carpals are the bones of the palm, the metacarpals. They are numbered 1 through 5 beginning with the thumb, or pollex.
- Phalanges. The digits have small long bones called phalanges. The pollex has two and digits 2 through 4 have three each. A proximal phalanx articulates with each of the metacarpals. These are followed by the middle and distal phalanges. The pollex only has a proximal and a distal phalanx.

The lower limbs are appended to the pelvis. As mentioned, the pelvic bones, or os coxae, articulate with the sacrum. The two pelvic bones are actually made up of three fused bones: the ilium, the ischium and the pubis. (pp 237 – 245)

- Ilium. Each ilium has a large flaring superior part of the bone (your hips) called the ala. The superior margin of the ala is the iliac crest which anteriorly ends with the anterior superior iliac spine and posteriorly with the posterior superior iliac spine. Below each of these processes is another protuberance – the anterior and posterior inferior iliac spines. Just below the posterior inferior iliac spine is a large indentation called the greater sciatic notch through which the sciatic nerve passes to enter the leg. Anteriorly the ilium is fused with the pubis to form the pelvic brim. This brim separates the false pelvis (above the brim) from the true pelvis (below the brim).
- Pubis. The two pubic bones are joined medially at a cartilaginous joint called the pubic symphysis. Lateral and inferior to the symphysis are the superior and inferior rami of the pubis. These two arms, together with the ischium form a large opening, the obdurator foramen. Despite its size, only a few small nerves and blood vessels pass through here. Most is closed by a fibrous membrane.
- Ischium. The inferior surface of the ischium is a rough, thick area called the ischial tuberosity, the attachment site for a number of muscles. The ischial tuberostities bear the weight of the body when you are sitting. Superior to the tuberosities and projecting somewhat medially are the ischial spines. These are important landmarks in determining the degree of descent of the fetus during childbirth.

All three bones of the pelvis come together laterally to form the acetabulum. This is the socket that receives the head of the femur.

Differences in the male and female pelvis

One of the few ways of distinguishing the male from the female skeleton is by examining the pelvis. (p 240) Some of the differences include: The ♂ coccyx is deflected anteriorly to a greater degree; the ♀ acetabula are smaller and farther apart; ♂ pelvic outlet is narrower; the pubic arch (the angle formed by the inferior pubic rami) is more acute in the ♂ - about 60° in the ♂and about 90° in the ♀.

- Femur. The femur is the largest single bone of the body. The head of the femur has a small central pit, the fovea capitis. From this, a small ligament, the ligamentum teres, connects to the acetabulum. Below the head is the neck which is angled to the shaft. The neck may be a particularly weak point in the elderly. A fracture of the femoral neck is often referred to as a broken hip. Where the neck and shaft join is found the greater and lesser trochanters, muscle attachment sites for muscles of the leg and buttocks. On the posterior surface, below the trochnters, is a roughened area called the gluteal tuberosity. This blends into a vertical ridge of bone called the linea aspera. Distally the femur broadens into the medial and lateral condyles on the sides of which are the medial and lateral epicondyles. Posteriorly is found the intercondyler notch through which pass important blood vessels.
- Patella. The patell is a sesamoid bone found within a large tendon and it protects the knee.
- Tibia. The tibia is the second largest bone of the body. Its medial and lateral condyles articulate with the corresponding condyles of the femur. Just below the condyles on the anterior surface is the tibial tuberosity where the patellar tendon attaches. Also on the anterior surface is the sharp anterior crest ("shin bone"). Distally on the tibia is the medial malleolus, the medial protuberance of the ankle. Almost all the weight of the lower leg is borne by the tibia.

- Fibula. The head of the fibula articulates with the tibia (not with the femur). The distal end is enlarged and forms the lateral maleolus.
- Tarsal Bones. There are 7 tarsal bones. The tibia rests on the talus which in turn rests on the calcaneus, or heel bone. The calcaneus is the largest of the tarsal bones. The calcaneal tendon, more often called the Achille's tendon, attaches certain muscles of the calf to the posterior surface of the calcaneus. The cuboid and navicular bones articulate ateriorly with the talus and calcaneus. Anterior to the cuboid and navicular are the 3 remaining tarsals – the medial, the intermediate and the lateral cuneiform bones. These last three, together with the cuboid, articulate with the 5 metatarsals of the foot. The proximal phalanges of the toes articulate with the metatarsals. The arrangement of phalanges in the toes is similar to that in the fingers. The big toe (1st digit), or hallux, has only a proximal and a distal phalanx. The four remaining digits (2 – 5) have proximal, middle and distal phalanges.

Joints

There are several ways to classify joints but we will examine just three basic types: (pp 253 – 257)

- Fibrous joints are joined by fibrous tissue such as the dense connective tissue found in the sutures of the skull. Sometimes these joints connect bones with a small ligament. Fibrous joints are immovable (or slightly movable, at best).
- Cartilaginous joints occur where two bones are joined by cartilage. The articulation of the ribs with the manubrium and the pubic symphysis are examples. These joints are also immovable or very slightly movable.
- Synovial joints are those in which the articulating bones are separated by a fluid-filled joint cavity. There is substantial freedom of movement in these joints. The joints of the limbs are examples.

The articulation of two (or more) bones within the synovial cavity has thin layers of articular cartilage on the ends of the opposing bones. The cavity itself contains lubricating synovial fluid and is enclosed by a two-layered joint capsule – the inner synovial membrane lining the cavity and the outer fibrous capsule which is actually a continuation of the periostea of the articulating bones. Reinforcing ligaments also connect the ends of the bones. These are usually found outside the capsule but sometimes may be found within, such as the anterior and posterior cruciate ligaments of the knee. Some of the larger joints have fatty pads between the fibrous capsule and the membrane. A few, such as the tibiofemoral joints, have cartilaginous discs, or menisci, within the joint which minimize wear and tear on bones under a lot of pressure. Examples of menisci are the semilunar cartilages of the knee. (p 266)

Around the synovial joint are found bursae, small, flat, fibrous sacs with a little fluid that reduce friction between structures. An elongated bursa that wraps around a tendon to prevent it from rubbing against a structure is called a tendon sheath. Ligaments connecting bones stabilize the joint and prevent excessive movement. Synovial joints may be further classified according to the type of movement permitted by the joint. Ball (heads of femurs and humeri) and socket (acetabula and glenoid fossa) joints and hinge joins (elbow) are two types among others.

Joint Injuries and Conditions (pp 272 – 275)

Sprains occur when a ligament is stretched or torn. Because dense connective tissue is poorly vascularized, sprains heal slowly. Surgical repair is sometimes required.

Torn cartilage frequently requires surgical removal of the damaged tissue. Again, cartilage is avascular and rarely repairs itself.

Bursitis and tendonitis (usually the inflammation of the tendon sheath) are inflammations often treated with steroidal drugs.

Arthritis describes inflamed joints. Among the more common kinds are:

- Osteoarthritis involves the breakdown of the articular cartilage. This may be the result of years of compression and normal wear and tear exposing the opposing bone ends. This is a chronic, degenerative condition.

- Rheumatoid arthritis, more common in women than men, is an autoimmune disease, i.e. antibodies attack its own tissues. This disease is often disabling and disfiguring. Sometimes scar tissue forms between the bones which later ossifies fusing the bones together resulting in immobility.
- Gout, or gouty arthritis, occurs when uric acid, normally soluble in the blood, crystallizes in a joint causing a painful inflammatory response. More common in males, it often occurs in the big toe but may occur in other synovial joints as well.

Luxations are dislocations that occur when the bones are forced out of alignment and must be returned to their former positions. Luxations are often accompanied by inflammation and immobilization.