I'm not a bot

Nettorama en Boni behalen beiden een podiumplek als beste regionale supermarkt van Nederland! Nettorama wint het formule-onderzoek van de eerste editie van supermarktKOMPAS onder alle regionale supermarkten. Boni eindigt op plek 3. Lees meer The most common issues that affect bones are fractures and osteoporosis.Bone fracturesA bone fracture is the medical term for a broken bone. You can break a bone in a trauma like a fall, car accident or sports injury.Go to the emergency room (ER) right away if youve experienced trauma or think you have a broken bone. A healthcare provider needs to diagnose and treat bone fractures as soon as possible to make sure your bone heals properly.OsteoporosisOsteoporosis weakens bones, making them more susceptible to sudden and unexpected fractures. Many people dont know they have osteoporosis until after it causes them to break a bone. There usually arent obvious symptoms.Women and adults older than 65 have an increased risk of developing osteoporosis. Talk to a healthcare provider about a bone density test that can catch osteoporosis before it causes a fracture.What are common treatments for bones?Usually, your bones wont need treatment unless youve experienced a fracture or another injury. You might need treatment if youve been diagnosed with osteoporosis.Bone fracture treatmentHow your fracture is treated depends on which bone is broken and what caused it. Youll need some form of immobilization like a splint or cast. You might need surgery to realign (set) your bone to its correct position and secure it in place so it can heal.Osteoporosis treatmentTreatments for osteoporosis can include:Exercise.Vitamin and mineral supplements.Prescription medications.Exercise and taking supplements may be all youll need to prevent osteoporosis. Your provider will help you find a combination of treatments thats best for you and your bone health. By the end of this section, you will be able to:Describe the microscopic and gross anatomical structures of bonesIdentify the gross anatomical features of a boneDescribe the histology of bone tissue, including the function of bone cells and matrixCompare and contrast compact and spongy boneIdentify the structures that compose compact and spongy boneDescribe how bones are nourished and innervatedfunction?Bone tissue (osseous tissue) differs greatly from other tissues in the body. Bone is hard and many of its functions depend on that characteristic hardness. Later discussions in this chapter will show that bone is also dynamic in that its shape adjusts to accommodate stresses. This section will examine the gross anatomy of bone first and then move on to its histology. A long bone has two main regions: the diaphysis and the epiphysis (Figure 6.3.1). The diaphysis is the hollow, tubular shaft that runs between the proximal and distal ends of the bone. Inside the diaphysis is the medullary cavity, which is filled with yellow bone marrow in an adult. The outer walls of the diaphysis (cortex, cortical bone)are composed of dense and hard compact bone, a form of osseous tissue.Figure 6.3.1 Anatomy of a Long Bone: A typical long bone showing gross anatomical features.The wider section at each end of the bone is called the epiphysis (plural = epiphyses), which is filled internally with spongy bone, another type of osseous tissue. Red bone marrow fills the spaces between the spongy bone in some long bones. Each epiphysis meets the diaphysis at the metaphysis.During growth, the metaphysis contains the epiphyseal plate, thesite of long bone elongation described later in the chapter.When the bone stops growing in early adulthood (approximately 1821 years), the epiphyseal plate becomes an epiphyseal line seen in the figure.Lining the inside of the bone adjacent to the medullary cavity is a layer of bone cells called the endosteum (endo- = inside; osteo- = bone). These bone cells (described later) cause the bone to grow, repair, and remodel throughout life. On the outside of bones there is another layer of cells that grow, repair and remodel bone as well. These cells are part of the outer double layered structure called the periosteum (peri = around or surrounding). The cellular layer is adjacent to the cortical bone and is covered by an outer fibrous layer of dense irregular connective tissue (see Figure 6.3.4a). The periosteum also contains blood vessels, nerves, and lymphatic vessels that nourish compact bone. Tendons and ligaments attach to bones at the periosteum. The periosteum covers the entire outer surface except where the epiphyses meet other bones to form joints (Figure 6.3.2). In this region, the epiphyses are covered with articular cartilage, a thin layer of hyaline cartilage that reduces friction and acts as a shock absorber.Figure 6.32 Periosteum and Endosteum: The periosteum forms the outer surface of bone, and the endosteum lines the medullary cavity.Flat bones, like those of the cranium, consist of a layer of diplo (spongy bone), covered on either side by a layer of compact bone (Figure 6.3.3). The two layers of compact bone and the interior spongy bone work together to protect the internal organs. If the outer layer of a cranial bone fractures, the brain is still protected by the intact inner layer.Figure 6.3.3 Anatomy of a Flat Bone: This cross-section of a flat bone shows the spongy bone (diplo) covered on either side by a layer of compact bone.Bone MatrixOsseous tissue is a connective tissue and like all connective tissues contains relatively few cells and large amounts of extracellular matrix. By mass, osseous tissue matrix consists of 1/3rd collagen fibers and 2/3rds calcium phosphate salt. The collagen provides a scaffolding surface for inorganic salt crystals to adhere (see Figure 6.3.4a). These salt crystals form when calcium phosphate and calcium carbonate combine to create hydroxyapatite. Hydroxyapatite also incorporates other inorganic salts like magnesium hydroxide, fluoride, and sulfate as it crystallizes, or calcifies, on the collagen fibers. The hydroxyapatite crystals give bones their hardness and strength, while the collagen fibers give them a framework for calcification and gives the bone flexibility so that it can bend without being brittle. For example, if you removed all the organic matrix (collagen) from a bone, it would crumble and shatter readily (see Figure 6.3.4b, upper panel). Conversely, if you remove all the inorganic matrix (minerals) from bone and leave the collagen, the bone becomes overly flexible and cannot bear weight (see Figure 6.3.4b, lower panel).Figure 6.3.4a Calcified collagen fibers from bone (scanning electron micrograph, 10,000 X,By Sbertazzo Own work, CC BY-SA 3.0, 6.3.4b Contributions of the organic and inorganic matrices of bone. Image from Ammerman figure 6-5, PearsonBone CellsAlthough bone cells compose less than 2%of the bone mass, they are crucial to the function of bones. Four types of cells are found within bone tissue: osteoblasts, osteocytes, osteogenic cells, and osteoclasts (Figure 6.3.5).Figure 6.3.5 Bone Cells: Four types of cells are found within bone tissue. Osteogenic cells are undifferentiated and develop into osteoblasts. Osteoblasts deposit bone matrix. When osteoblasts get trapped within the calcified matrix, they become osteocytes. Osteoclasts develop from a different cell lineage and act to resorb bone.The osteoblast is the bone cell responsible for forming new bone and is found in the growing portions of bone, including theendosteum and the cellular layer of the periosteum. Osteoblasts, which do not divide, synthesize and secrete the collagen matrix and other proteins. As the secreted matrix surrounding the osteoblast calcifies, the osteoblast become trapped within it; as a result, it changes in structure and becomes an osteocyte, the primary cell of mature bone and the most common type of bone cell. Each osteocyte is located in a small cavity in the bone tissue called a lacuna (lacunae for plural).Osteocytes maintain the mineral concentration of the matrix via the secretion of enzymes. Like osteoblasts, osteocytes lack mitotic activity. They can communicate with each other and receive nutrients via long cytoplasmic processes that extend through canaliculi (singular = canaliculus), channels within the bone matrix. Osteocytes are connected to one another within the canaliculi via gap junctions.If osteoblasts and osteocytes are incapable of mitosis, then how are they replenished when old ones die? The answer lies in the properties of a third category of bone cellsthe osteogenic (osteoprogenitor) cell. These osteogenic cells are undifferentiated with high mitotic activity and they are the only bone cells that divide. Immature osteogenic cells are found in the cellularlayer of the periosteum and the endosteum. They differentiate and develop into osteoblasts.The dynamic nature of bone means that new tissue is constantly formed, and old, injured, or unnecessary bone is dissolved for repair or for calcium release. The cells responsible for bone resorption, or breakdown, are the osteoclasts. These multinucleated cells originate from monocytes and macrophages, two types of white blood cells, not from osteogenic cells. Osteoclasts are continually breaking down old bone while osteoblasts are continually forming new bone. The ongoing balance between osteoblasts and osteoclasts is responsible for the constant but subtle reshaping of bone. Table 6.3 reviews the bone cells, their functions, and locations.Bone Cells (Table 6.3)Cell typeFunctionLocationOsteogenic cellsDevelop into osteoblastsEndosteum, cellular layer of the periosteumOsteoblastsBone formationEndosteum, cellular layer of the periosteum, growing portions of boneOsteocytesMaintain mineral concentration of matrixEntrapped in matrixOsteoclastsBone resorptionEndosteum, cellular layer of the periosteum, at sites of old, injured, or unneeded bone Most bones contain compact and spongy osseous tissue, but their distribution and concentration vary based on the bones overall function. Although compact and spongy bone are made of the same matrix materials and cells, they are different in how they are organized. Compact bone is dense so that it can withstand compressive forces, while spongy bone (also called cancellous bone) has open spaces and is supportive, but also lightweight and can be readily remodeled to accommodate changing body needs. Compact bone is the denser, stronger of the two types of osseous tissue (Figure 6.3.6). It makes up the outer cortex of all bones and is in immediate contact with the periosteum. In long bones, as you move from the outer cortical compact bone to the inner medullary cavity, the bone transitions to spongy bone.Figure 6.3.6 Diagram of Compact Bone: (a) This cross-sectional view of compact bone shows several osteons, the basic structural unit of compact bone. (b) In this micrograph of the osteon, you can see the concentric lamellae around the central canals. LM 40. (Micrograph provided by the Regents of University of Michigan Medical School 2012)Figure 6.3.7 OsteonIf you look at compact bone under the microscope, you will observe a highly organized arrangement of concentric circles that look like tree trunks. Each group of concentric circles (each tree) makes up the microscopic structural unit of compact bone called an osteon (this is also called aHaversian system). Each ring of the osteon is made of collagen and calcified matrix and is called a lamella (plural = lamellae). The collagen fibers of adjacent lamallae run at perpendicular angles to each other, allowing osteons to resist twisting forces in multiple directions (see figure 6.34a). Running down the center of each osteon is the central canal, or Haversian canal, which contains blood vessels, nerves, and lymphatic vessels. These vessels and nerves branch off at right angles through a perforating canal, also known as Volkmanns canals, to extend to the periosteum and endosteum. The endosteum also lines each central canal, allowing osteons to be removed, remodeled and rebuilt over time.The osteocytes are trapped within their lacuane, found at the borders of adjacent lamellae. As described earlier, canaliculi connect with the canaliculi of other lacunae and eventually with the central canal. This system allows nutrients to be transported to the osteocytes and wastes to be removed from them despite the impervious calcified matrix. Like compact bone, spongy bone, also known as cancellous bone, contains osteocytes housed in lacunae, but they are not arranged in concentric circles. Instead, the lacunae and osteocytes are found in a lattice-like network of matrix spikes called trabeculae (singular = trabecula) (Figure 6.3.8). The trabeculae are covered by the endosteum, which can readily remodel them. The trabeculae may appear to be a random network, but each trabecula forms along lines of stress to direct forces out to the more solid compact bone providingstrength to the bone. Spongy bone provides balance to the dense and heavy compact bone by making bones lighter so that muscles can move them more easily. In addition, the spaces in some spongy bones contain red bone marrow, protected by the trabeculae, where hematopoiesis occurs.Figure 6.3.8 Diagram of Spongy Bone: Spongy bone is composed of trabeculae that contain the osteocytes. Red marrow fills the spaces in some bones.Aging and theSkeletal System: Pagets DiseasePagets disease usually occurs in adults over age 40. It is a disorder of the bone remodeling process that begins with overactive osteoclasts. This means more bone is resorbed than is laid down. The osteoblasts try to compensate but the new bone they lay down is weak and brittle and therefore prone to fracture.While some people with Pagets disease have no symptoms, others experience pain, bone fractures, and bone deformities (Figure 6.3.9). Bones of the pelvis, skull, spine, and legs are the most commonly affected. When occurring in the skull, Pagets disease can cause headaches and hearing loss.Figure 6.3.9 Pagets Disease: Normal leg bones are relatively straight, but those affected by Pagets disease are porous and curved.What causes the osteoclasts to become overactive? The answer is still unknown, but hereditary factors seem to play a role. Some scientists believe Pagets disease is due to an as-yet-unidentified virus.Pagets disease is diagnosed via imaging studies and lab tests. X-rays may show bone deformities or areas of bone resorption. Bone scans are also useful. In these studies, a dye containing a radioactive ion is injected into the body. Areas of bone resorption have an affinity for the ion, so they will light up on the scan if the ions are absorbed. In addition, blood levels of an enzyme called alkaline phosphatase are typically elevated in people with Pagets disease. Bisphosphonates, drugs that decrease the activity of osteoclasts, are often used in the treatment of Pagets disease. The spongy bone and medullary cavity receive nourishment from arteries that pass through the compact bone. The arteries enter through the nutrient foramen (plural = foramina), small openings in the diaphysis (Figure 6.3.10). The osteocytes in spongy bone are nourished by blood vessels of the periosteum that penetrate spongy bone and blood that circulates in the marrow cavities. As the blood passes through the marrow cavities, it is collected by veins, which then pass out of the bone through the foramina.In addition to the blood vessels, nerves follow the same paths into the bone where they tend to concentrate in the more metabolically active regions of the bone. The nerves sense pain, and it appears the nerves also play roles in regulating blood supplies and in bone growth, hence their concentrations in metabolically active sites of the bone.Figure 6.3.10 Diagram of Blood and Nerve Supply to Bone: Blood vessels and nerves enter the bone through the nutrient foramen.Watch this video to see the microscopic features of a bone. A hollow medullary cavity filled with yellow marrow runs the length of the diaphysis of a long bone. The walls of the diaphysis are compact bone. The epiphyses, which are wider sections at each end of a long bone, are filled with spongy bone and red marrow. The epiphyseal plate, a layer of hyaline cartilage, is replaced by osseous tissue as the organ grows in length. The medullary cavity has a delicate membranous lining called the endosteum. The outer surface of bone, except in regions covered with articular cartilage, is covered with a fibrous membrane called the periosteum. Flat bones consist of two layers of compact bone surrounding a layer of spongy bone. Bone markings depend on the function and location of bones. Articulations are places where two bones meet. Projections stick out from the surface of the bone and provide attachment points for tendons and ligaments. Holes are openings or depressions in the bones.Bone matrix consists of collagen fibers and organic ground substance, primarily hydroxyapatite formed from calcium salts. Osteogenic cells develop into osteoblasts. Osteoblasts are cells that make new bone. They become osteocytes, the cells of mature bone, when they get trapped in the matrix. Osteoclasts engage in bone resorption. Compact bone is dense and composed of osteons, while spongy bone is less dense and made up of trabeculae. Blood vessels and nerves enter the bone through the nutrient foramina to nourish and innervate bones. articular cartilagethin layer of cartilage covering an epiphysis; reduces friction and acts as a shock absorberarticulationwhere two bone surfaces meetcanaliculi(singular = canaliculus) channels within the bone matrix that house one of an osteocytes many cytoplasmic extensions that it uses to communicate and receive nutrientscentral canallongitudinal channel in the center of each osteon; contains blood vessels, nerves, and lymphatic vessels; also known as the Haversian canalcompact bonedense osseous tissue that can withstand compressive forcesdiaphysistubular shaft that runs between the proximal and distal ends of a long bonediplolayer of spongy bone, that is sandwiched between two the layers of compact bone found in flat bonesendosteumdelicate membranous lining of a bones medullary cavityepiphyseal plate(also, growth plate) sheet of hyaline cartilage in the metaphysis of an immature bone; replaced by bone tissue as the organ grows in lengthepiphysiswide section at each end of a long bone; filled with spongy bone and red marrowholeopening or depression in a bonelacunae(singular = lacuna) spaces in a bone that house an osteocytemedullary cavityhollow region of the diaphysis; filled with yellow marrownutrient foramensmall opening in the middle of the external surface of the diaphysis, through which an artery enters the bone to provide nourishmentosteoblastcell responsible for forming new boneosteoclastcell responsible for resorbing boneosteocyteprimary cell in mature bone; responsible for maintaining the matrixosteogenic cellundifferentiated cell with high mitotic activity; the only bone cells that divide; they differentiate and develop into osteoblastsosteon(also, Haversian system) basic structural unit of compact bone; made of concentric layers of calcified matrixperforating canal(also, Volkmanns canal) channel that branches off from the central canal and houses vessels and nerves that extend to the periosteum and endosteumperiosteumfibrous membrane covering the outer surface of bone and continuous with ligamentsprojectionbone markings where part of the surface sticks out above the rest of the surface, where tendons and ligaments attachspongy bone(also, cancellous bone) trabeculated osseous tissue that supports shifts in weight distributiontrabeculae(singular = trabecula) spikes or sections of the lattice-like matrix in spongy bone