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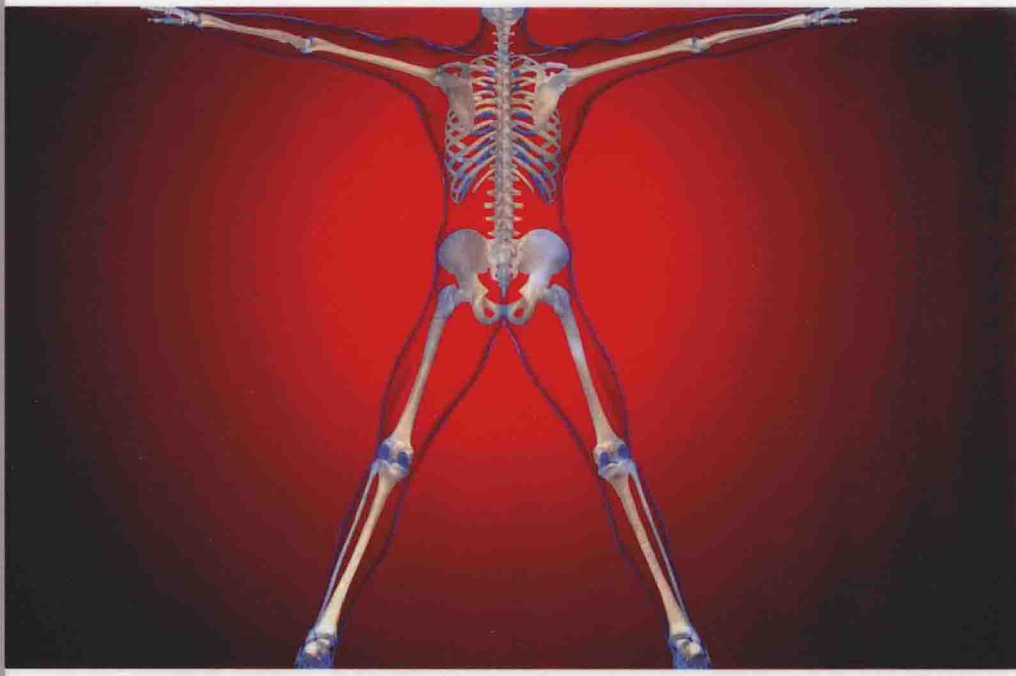

Orthopaedic Sports Medicine

Orthopedic Surgery, Sports Medicine, Human Musculoskeletal System

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Lambert M. Surhone,
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Orthopaedic Sports Medicine

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Orthopaedic sports medicine

Orthopaedic Sports Medicine is a subspecialty of orthopaedic medicine and sports medicine. The word orthopaedic derives from "ortho" which is the Greek root for "straight" and "pais" which is the greet root for child. During the early history of orthopaedic medicine, orthopaedists used braces, among other things, to make a child "straight." [1] Today, orthopaedists are making people of all ages "straight," including athletes from all different kinds of sports.

Subspecialty: Orthopaedic Sports Medicine

The phrase "sports medicine" is not specific to one career/profession. It instead, encompasses a group of professionals from various disciplines whose focus is the health of an athlete. Athletes can be all ages and play on all different levels (youth, high school, collegiate, recreational, and professional). [2]

Orthopaedic sports medicine is the investigation, preservation, and restoration by medical, surgical, and rehabilitative means to all structures of the musculoskeletal system affected by athletic activity. [3]

Orthopaedic Sports Medicine Specialist

Any Accredited Council for Graduate Medical Education (ACGME) residency trained orthopaedist can practice orthopaedic sports medicine. Their training specifically provides them with the skills to care for athletes' musculoskeletal needs.

What They Do

Orthopaedic sports medicine specialists…

- Condition and train athletes.
- Provide fitness advice relating to athletic performance.
- Give advice on athletic performance and the impact of dietary supplements, pharmaceuticals, and nutrition on athletes' short- and long-term health and performance.
- Coordinate medical care within athletic team settings, including other health care professionals, such as athletic trainers, physical therapists, and non-orthopaedic physicians.
- Conduct on-the-field evaluation and management of illnesses and injuries.

What they Know

Orthopaedic sports medicine specialists have a knowledge of…

- Soft tissue biomechanics, injury healing, and repair.
- Treatment options, both surgical and non-surgical, as they relate to sports-specific injuries and competition.
- Principles and techniques of rehabilitation that enable the athlete to return to competition as quickly and safely as possible.
- Knowledge of athletic equipment and orthotic devices (braces, foot orthoses, etc.) and their use in prevention and management of athletic injuries.

Schooling

A person interested in becoming an orthopaedic sports medicine specialist must complete four years of medical school. After their undergraduate schooling is completed, training continues with a five year residency in orthopaedics. In order to sub-specialize, which is the case with an orthopaedic sports medicine, another two to four years of training is required. [4]

After they have finished their training and have graduated from an accredited residency, orthopaedic surgeons are eligible to become certified by the American Board of Orthopaedic Surgery (ABOS). Certification by the Board is required in order to practice. In addition, the orthopaedist who plans on specializing in sports medicine must complete certification in the sports medicine sub-specialty which is administered by the ABOS. [5] Education does not stop there; orthopaedists are required to take continuing education classes to maintain their license.

Careers

Orthopaedist specializing in sports medicine have various options of employment: from serving as a team's physician (high school, college, and professional), to running a private practice, to working in the academic setting.

According to a salary.com, the data they collected from HR reported data in August 2008 showed that an orthopaedic surgeon, on average, made about $396,343 a year not including bonuses and benefits. [6]

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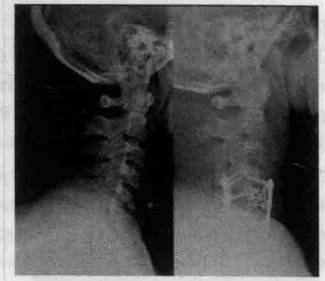
External links

- American Academy of Orthopedic Surgeons (http://www.aaos.org)
- American Orthopaedic Society for Sports Medicine (http://www.aossm.org)
- American Board of Othopaedic Surgery (https://www.abos.org/ModDefault.aspx)
- American College of Sports Medicine (https://www.acsm.org)
- American Journal of Sports Medicine (http://ajs.sagepub.com/)
- Arthroscopy Association of North America (http://www.aana.org)
- Arthroscopy: The Journal of Arthroscopic and Related Surgery (http://www.arthroscopyjournal.org)
- British Journal of Sports Medicine (http://bjsm.bmj.com/)
- Sports Health Journal (http://www.sportshealthjournal.org)
- Orthopedic Sports Medicine (http://www.itsaboutorthopedicmedicine.com)

Orthopedic surgery

Orthopedic surgery	
Intervention	
MeSH	D019637 [1]

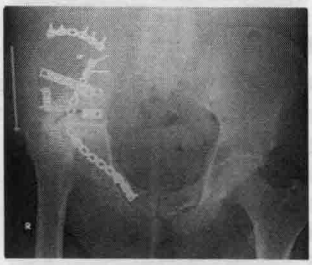
Orthopedic surgery or **orthopedics** (also spelled **orthopaedic surgery** and **orthopaedics** in Commonwealth countries and Ireland) is the branch of surgery concerned with conditions involving the musculoskeletal system. Orthopedic surgeons use both surgical and nonsurgical means to treat musculoskeletal trauma, sports injuries, degenerative diseases, infections, tumors, and congenital disorders.



This fracture of the lower cervical vertebrae, known as a "teardrop fracture", is one of the conditions treated by orthopedic surgeons and neurosurgeons.

Nicholas Andry coined the word "orthopaedics", derived from Greek words for *orthos* ("correct", "straight") and *paideion* ("child"), when he published *Orthopaedia: or the Art of Correcting and Preventing Deformities in Children* in 1741. Correction of spinal and bony deformities became the cornerstone of orthopaedic practice. Today, over 6 months of training is dedicated to the treatment of the pediatric population.

In the United States *orthopedics* is standard, although the majority of college, university and residency programs, and even the American Academy of Orthopaedic Surgeons, still use Andry's spelling. Elsewhere, usage is not uniform; in Canada, both spellings are acceptable; *orthopaedics* usually prevails in the rest of the Commonwealth, especially in Britain.



This image, taken in September 2006, shows extensive repair work to the right acetabulum 6 years after it was carried out (2000). Further damage to the joint is visible due to the onset of arthritis.

Training

In the United States, orthopedic surgeons have typically completed four years of undergraduate education and four years of medical school. Subsequently, these medical school graduates undergo residency training in orthopedic surgery. The five-year residency consists of one year of general surgery training followed by four years of training in orthopedic surgery.

Selection for residency training in orthopedic surgery is very competitive. Approximately 700 physicians complete orthopedic residency training per year the United States. About 10 percent of current orthopedic surgery residents are women; about 20 percent are members of minority groups. There are approximately 20,400 actively practicing orthopedic surgeons and residents in the United States.[2] According to the latest Occupational Outlook Handbook (2009–2010) published by the United States Department of Labor, between 3–4% of all practicing physicians are orthopedic surgeons.

Many orthopedic surgeons elect to do further training, or fellowships, after completing their residency training. Fellowship training in an orthopedic subspeciality is typically one year in duration (sometimes two) and sometimes has a research component involved with the clinical and operative training. Examples of orthopedic subspecialty

training in the United States are:

- Hand surgery
- Shoulder and elbow surgery
- Total joint reconstruction (arthroplasty)
- Pediatric orthopedics
- Foot and ankle surgery
- Spine surgery
- Musculoskeletal oncology
- Surgical sports medicine
- Orthopedic trauma

These specialty areas of medicine are not exclusive to orthopedic surgery. For example, hand surgery is practiced by some plastic surgeons and spine surgery is practiced by most neurosurgeons. Additionally, foot and ankle surgery is practiced by board-certified Doctors of Podiatric Medicine (D.P.M.) in the United States. Some family practice physicians practice sports medicine; however, their scope of practice is non-operative.

After completion of specialty residency/registrar training, an orthopedic surgeon is then eligible for board certification. Certification by the American Board of Orthopaedic Surgery means that the orthopedic surgeon has met the specified educational, evaluation, and examination requirements of the Board.[3] The process requires successful completion of a standardized written exam followed by an oral exam focused on the surgeon's clinical and surgical performance over a 6-month period. In Canada, the certifying organization is the Royal College of Physicians and Surgeons of Canada; in Australia and New Zealand it is the Royal Australasian College of Surgeons.

In the United States, specialists in hand surgery and sports medicine may obtain a Certificate of Added Qualifications (CAQ) in addition to their board certification by successfully completing a separate standardized examination. There is no additional certification process for the other subspecialties.

Practice

According to applications for board certification from 1999 to 2003, the top 25 most common procedures (in order) performed by orthopedic surgeons are as follows[4]:

1. Knee arthroscopy and meniscectomy
2. Shoulder arthroscopy and decompression
3. Carpal tunnel release
4. Knee arthroscopy and chondroplasty
5. Removal of support implant
6. Knee arthroscopy and anterior cruciate ligament reconstruction
7. Knee replacement
8. Repair of femoral neck fracture
9. Repair of trochanteric fracture
10. Debridement of skin/muscle/bone/fracture
11. Knee arthroscopy repair of both menisci
12. Hip replacement
13. Shoulder arthroscopy/distal clavicle excision
14. Repair of rotator cuff tendon
15. Repair fracture of radius (bone)/ulna
16. Laminectomy
17. Repair of ankle fracture (bimalleolar type)
18. Shoulder arthroscopy and debridement
19. Lumbar spinal fusion

20. Repair fracture of the distal part of radius
21. Low back intervertebral disc surgery
22. Incise finger tendon sheath
23. Repair of ankle fracture (fibula)
24. Repair of femoral shaft fracture
25. Repair of trochanteric fracture

A typical schedule for a practicing orthopedic surgeon involves 50–55 hours of work per week divided among clinic, surgery, various administrative duties and possibly teaching and/or research if in an academic setting. In 2009, the median salary for an orthopedic surgeon in the United States was $406,847.[5]

History

Jean-Andre Venel established the first orthopedic institute in 1780, which was the first hospital dedicated to the treatment of children's skeletal deformities. He is considered by some to be the father of orthopedics or the first true orthopedist in consideration of the establishment of his hospital and for his published methods.

Orthopedic implants to repair fractures to the radius and ulna. Note the visible break in the ulna. (right forearm)

Antonius Mathysen, a Dutch military surgeon, invented the plaster of Paris cast in 1851. Many developments in orthopedic surgery resulted from experiences during wartime. On the battlefields of the Middle Ages the injured were treated with bandages soaked in horses' blood which dried to form a stiff, but unsanitary, splint. Traction and splinting developed during World War I. The use of intramedullary rods to treat fractures of the femur and tibia was pioneered by Gerhard Küntscher of Germany. This made a noticeable difference to the speed of recovery of injured German soldiers during World War II and led to more widespread adoption of intramedullary fixation of fractures in the rest of the world. However, traction was the standard method of treating thigh bone fractures until the late 1970s when the Harborview Medical Center in Seattle group popularized intramedullary fixation without opening up the fracture. External fixation of fractures was refined by American surgeons during the Vietnam War but a major contribution was made by Gavril Abramovich Ilizarov in the USSR. He was sent, without much orthopedic training, to look after injured Russian soldiers in Siberia in the 1950s. With no equipment he was confronted with crippling conditions of unhealed, infected, and malaligned fractures. With the help of the local bicycle shop he devised ring external fixators tensioned like the spokes of a bicycle. With this equipment he achieved healing, realignment and lengthening to a degree unheard of elsewhere. His Ilizarov apparatus is still used today as one of the distraction osteogenesis methods.

Ruth Jackson became the first female Board-certified Orthopaedic Surgeon in the U.S in 1937. Orthopaedics continues to be a male-dominated field. In 2006, 12.4% of orthopaedics residents were women.[6]

David L. MacIntosh pioneered the first successful surgery for the management of the torn anterior cruciate ligament (ACL) of the knee. This common and serious injury in skiers, field athletes, and dancers invariably brought an end to their athletics due to permanent joint instability. Working with injured football players, Dr MacIntosh devised a way to re-route viable ligament from adjacent structures to preserve the strong and complex mechanics of the knee joint and restore stability. The subsequent development of ACL reconstruction surgery has allowed numerous athletes to

return to the demands of sports at all levels.

Modern orthopedic surgery and musculoskeletal research has sought to make surgery less invasive and to make implanted components better and more durable.

Arthroscopy

The use of arthroscopic techniques has been particularly important for injured patients. Arthroscopy was pioneered in the early 1950s by Dr. Masaki Watanabe of Japan to perform minimally invasive cartilage surgery and reconstructions of torn ligaments. Arthroscopy helped patients recover from the surgery in a matter of days, rather than the weeks to months required by conventional, 'open' surgery. Knee arthroscopy is one of the most common operations performed by orthopedic surgeons today and is often combined with meniscectomy or chondroplasty. The majority of orthopedic procedures are now performed arthroscopically.

Arthroplasty

The modern total hip replacement was pioneered by Sir John Charnley in England in the 1960s.[7] He found that joint surfaces could be replaced by metal or high density polyethylene implants cemented to the bone with methyl methacrylate bone cement. Since Charnley, there have been continuous improvements in the design and technique of joint replacement (arthroplasty) with many contributors, including W. H. Harris, the son of R. I. Harris, whose team at Harvard pioneered uncemented arthroplasty techniques with the bone bonding directly to the implant.

Knee replacements using similar technology were started by McIntosh in rheumatoid arthritis patients and later by Gunston and Marmor for osteoarthritis in the 1970s developed by Dr John Insall in New York utilizing a fixed bearing system, and by Dr Frederick Buechel and Dr Michael Pappas utilizing a mobile bearing system.[8]

Uni-compartmental knee replacement, in which only one weight-bearing surface of an arthritic knee is replaced, is an alternative to a total knee replacement in a select patient population.

Joint replacements are available for other joints on a limited basis, most notably shoulder, elbow, wrist, ankle, spine, and fingers.

In recent years, surface replacement of joints, in particular the hip joint, have become more popular amongst younger and more active patients. This type of operation delays the need for the more traditional and less bone-conserving total hip replacement, but carries significant risks of early failure from fracture and bone death.

One of the main problems with joint replacements is wear of the bearing surfaces of components. This can lead to damage to surrounding bone and contribute to eventual failure of the implant. Use of alternative bearing surfaces has increased in recent years, particularly in younger patients, in an attempt to improve the wear characteristics of joint replacement components. These include ceramics and all-metal implants (as opposed to the original metal-on-plastic). The plastic (actually ultra high-molecular-weight polyethylene) can also be altered in ways that may improve wear characteristics.

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External links

- American Academy of Orthopaedic Surgeons (http://www.aaos.org/)
- American Osteopathic Academy of Orthopedics (http://www.aoao.org/)
- Arthroscopy Association of North America (http://www.aana.org/)
- American Orthopaedic Society for Sports Medicine (http://www.sportsmed.org)
- Wheeless' Textbook of Orthopaedics (http://www.wheelessonline.com/ortho/2136)
- The International Society of Orthopaedic Surgery and Traumatology (http://www.sicot.org/)
- The Journal of Bone and Joint Surgery, American Volume (http://www.jbjs.org/)
- The Journal of Bone and Joint Surgery, British Volume (http://www.jbjs.org.uk/)
- Arthroscopy: The Journal of Arthroscopic and Related Surgery (http://www.arthroscopyjournal.org/)

Sports medicine

Sports medicine is an area of health and special services that apply medical and scientific knowledge to prevent, recognize, manage, and rehabilitate injuries related to sport, exercise, or recreational activity.

Domains

1. Prevention
2. Clinical education & diagnostic
3. Immediate care
4. Treatment, rehab & reconditioning
5. Organizations & admin
6. Professional responsibility (education & counseling)

Sports Medicine Team

Certified Athletic Trainer (ATC) The ATC is a highly skilled professional specializing in the health care of physical activity. They are responsible for care & prevention of athletic injury. Without an ATC, the coaching staff is responsible for it's duties. The ATC serves as a liaison between the team physician, coach, parent & athlete. Responsibilities include:

1. First aid care
2. Initiate treatment plan/ protocol
3. Design & implementation of rehab protocols
4. Applying protective/supportive techniques that allow the athlete to regain physically active lifestyle
5. Inventory and purchasing of supplies
6. Completing medical/accidental record form

Team Physician

Promotes the success of the AT program, "cornerstone" of the medical team, available for emergencies.

Duties

1. Supervising pre-participation physical & medical history
2. Clearing of players for return to play after injury
3. Work with ATC & SAT's in further development of AT program

Athletes

Duties

1. Maintain good physical condition
2. Selecting, fitting, and maintaining protective equipment
3. Play by the rules
4. Follow the instruction of the coaches and the ATC

Parents Can assist by keeping the child healthy, if kept updated on the injury Should be informed of recommended treatment at home for injury or if they are hurt

Officials Duties

1. enforcing fair rules
2. Monitoring playing conditions

3. Cooperating with ATC & physician when injury occur & when environmental hazards exist

Coaches

Duties

1. Plan practice including: conditioning & training of the athlete & teach techniques /rules of sport
2. Selecting ,fitting & maintaining protective things
3. Supervision of practice/ game facilities
4. Update education by attending clinics that review rule changes, skill development, CPR/FA

ATS's (athletic training students) Duties

1. Assisted by the ATC to develop skills in immediate care of injury, preventative techniques and basic treatment protocol
2. Maintain clean athletic training facility
3. Inventory control: keeping track of supplies and equipment
4. Packing FA kits
5. Preparing H20, inj ice &take to fields
6. Taping, wrapping, change dressings, minor treatment, FA procedures

Sports Medicine Organizations

American College of Sports Medicine (ACSM)

Founded in 1954, the American College of Sports Medicine is the largest and most prominent sports medicine and exercise science organization in the world. ACSM has more than 20,000 International, National and Regional Chapter members. Since its founding ACSM members have applied their knowledge, training and dedication in sports medicine and exercise science to promote healthier lifestyles for people around the globe.

American College of Sports Medicine [1]

American Medical Society for Sports Medicine (AMSSM)

Founded in 1991, AMSSM is a multi-disciplinary organization of physicians whose members are dedicated to education, research, collaboration and fellowship within the field of Sports Medicine. It now comprises over 1500 Sports Medicine Physicians whose goal is to provide a link between the rapidly expanding core of knowledge related to sports medicine and its application to patients in a clinical setting. American Medical Society for Sports Medicine

National Athletic Trainers' Association(NATA)

Founded in the year 1950

The mission of the National Athletic Trainers' Association is to enhance the quality of health care provided by certified athletic trainers and to advance the athletic training profession.

National Athletic Trainers' Association

American Medical Association(AMA)

Recognized Athletic Training(AT) as an allied health profession in 1990

American Medical Association

American Osteopathic Academy of Sports Medicine (AOASM) http://aoasm.org/

Common Sports Injuries

Concussion- caused by severe head trauma where the brain moves violently within the skull so that brain cells all fire at once, much like a seizure

Muscle Cramps- a sudden tight, intense pain caused by a muscle locked in spasm. Muscle cramps are also recognized as an involuntary and forcibly contracted muscle that does not relax

ACL Sprains- The anterior cruciate ligament (ACL) is a ligament involved in knee stabilization. An ACL rupture can occur when the foot is planted and the knee twists to change direction.

Ankle Sprain- The ligaments that hold the ankle bones in place can easily be overstretched.

Shin Splints- The tissue that attaches the muscles of your lower leg to the shin bone may be pulling away from the bone, or it may be inflamed from overuse. [2]

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[2] Common Sports Injuries." Common Sports Injuries. Union Memorial Hospital. Web. 10 Dec. 2009. <http://www.unionmemorial.org/npt.cfm?id=878>.

Human musculoskeletal system

A **musculoskeletal system** (also known as the **locomotor system**) is an organ system that gives animals (including humans) the ability to move using the muscular and skeletal systems. The musculoskeletal system provides form, support, stability, and movement to the body.

It is made up of the body's bones (the skeleton), muscles, cartilage,[1] tendons, ligaments, joints, and other connective tissue that supports and binds tissues and organs together. The musculoskeletal system's primary functions include supporting the body, allowing motion, and protecting vital organs.[2] The skeletal portion of the system serves as the main storage system for calcium and phosphorus and contains critical components of the hematopoietic system.[3]

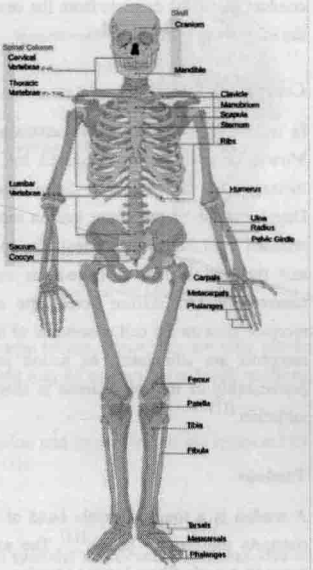
This system describes how bones are connected to other bones and muscle fibers via connective tissue such as tendons and ligaments. The bones provide the stability to a body in analogy to iron rods in concrete construction. Muscles keep bones in place and also play a role in movement of the bones. To allow motion, different bones are connected by joints. Cartilage prevents the bone ends from rubbing directly on to each other. Muscles contract (bunch up) to move the bone attached at the joint.

There are, however, diseases and disorders that may adversely affect the function and overall effectiveness of the system. These diseases can be difficult to diagnose due to the close relation of the musculoskeletal system to other internal systems. The musculoskeletal system refers to the system having its muscles attached to an internal skeletal system and is necessary for humans to move to a more favorable position. Complex issues and injuries involving the musculoskeletal system are usually handled by a physiatrist (specialist in Physical Medicine and Rehabilitation) or an orthopaedic surgeon.

Subsystems

Skeletal

The Skeletal System serves many important functions; it provides the shape and form for our bodies in addition to supporting, protecting, allowing bodily movement, producing blood for the body, and storing minerals.[4] The number of bones in the human skeletal system is a controversial topic. Humans are born with about 300 to 350 bones, however, many bones fuse together between birth and maturity. As a result an average adult skeleton consists of 206 bones. The number of bones varies according to the method used to derive the count. While some consider certain structures to be a single bone with multiple parts, others may see it as a single part with multiple bones.[5] There are five general classifications of bones. These are Long bones, Short bones, Flat bones, Irregular bones, and Sesamoid bones. The human skeleton is composed of both fused and individual bones supported by ligaments, tendons, muscles and cartilage. It is a complex structure with two distinct divisions. These are the axial skeleton and the appendicular skeleton.[6]



Front view of a skeleton of an adult human

Function

The Skeletal System serves as a framework for tissues and organs to attach themselves to. This system acts as a protective structure for vital organs. Major examples of this are the brain being protected by the skull and the lungs being protected by the rib cage.

Located in long bones are two distinctions of bone marrow (yellow and red). The yellow marrow has fatty connective tissue and is found in the marrow cavity. During starvation, the body uses the fat in yellow marrow for energy.[7] The red marrow of some bones is an important site for blood cell production, approximately 2.6 million red blood cells per second in order to replace existing cells that have been destroyed by the liver.[4] Here all erythrocytes, platelets, and most leukocytes form in adults. From the red marrow, erythrocytes, platelets, and leukocytes migrate to the blood to do their special tasks.

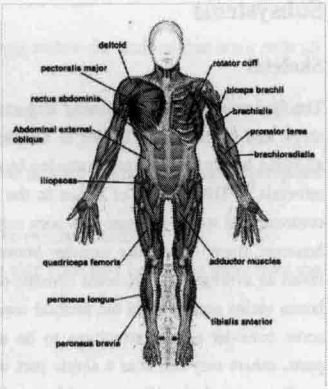
Another function of bones is the storage of certain minerals. Calcium and phosphorus are among the main minerals being stored. The importance of this storage "device" helps to regulate mineral balance in the bloodstream. When the fluctuation of minerals is high, these minerals are stored in bone; when it is low it will be withdrawn from the bone.

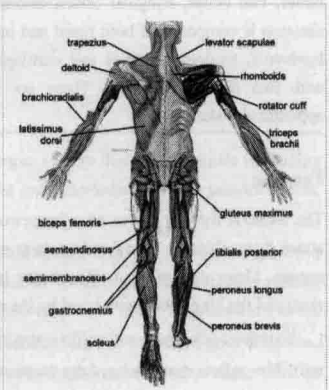
Muscular

Types of muscle and their appearance

There are three types of muscles—cardiac, skeletal, and smooth. Smooth muscles are used to control the flow of substances within the lumens of hollow organs, and are not consciously controlled. Skeletal and cardiac muscles have striations that are visible under a microscope due to the components within their cells. Only skeletal and smooth muscles are part of the musculoskeletal system and only the skeletal muscles can move the body. Cardiac muscles are found in the heart and

are used only to circulate blood; like the smooth muscles, these muscles are not under conscious control. Skeletal muscles are attached to bones and arranged in opposing groups around joints.[8] Muscles are innervated, to communicate nervous energy to,[9] by nerves, which conduct electrical currents from the central nervous system and cause the muscles to contract.[10]





Contraction initiation

In mammals, when a muscle contracts, a series of reactions occur. Muscle contraction is stimulated by the motor neuron sending a message to the muscles from the somatic nervous system. Depolarization of the motor neuron results in neurotransmitters being released from the nerve terminal. The space between the nerve terminal and the muscle cell is called the neuromuscular junction. These neurotransmitters diffuse across the synapse and bind to specific receptor sites on the cell membrane of the muscle fiber. When enough receptors are stimulated, an action potential is generated and the permeability of the sarcolemma is altered. This process is known as initiation.[11]

Tendons

A tendon is a tough, flexible band of fibrous connective tissue that connects muscles to bones.[12] The extra-cellular connective tissue between muscle fibers binds to tendons at the distal & proximal ends, and the tendon binds to the periosteum of individual bones at the muscle's origin & insertion. As muscles contract, tendons transmit the forces to the rigid bones, pulling on them and causing movement. Tendons can stretch substantially, allowing them to function as springs during locomotion, thereby saving energy.

Joints, ligaments, and bursae