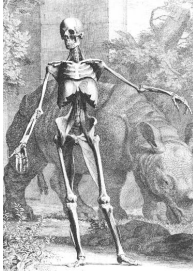
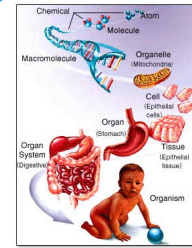


General Anatomy



The human body: Levels of organization

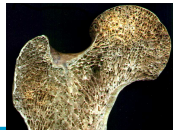
- Chemical
- Cellular
- Tissue
- Organ
 - Muscle
 - Bone
 - Heart
 - Etc.
- Organ system
 - Musculoskeletal
 - Central nervous
 - Etc.
- Organismal



Source: www.ashhe.com/biomechanics/2001_solidstatefolder_structures/bio/stand_01_1.htm

We deal with Biological material

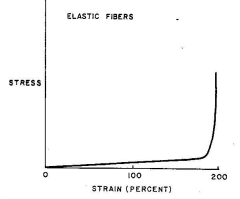
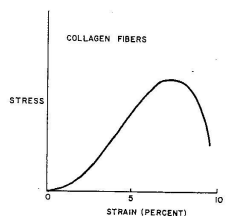
- Inhomogeneous
- An-isotropic
- Visco-elastic
 - Creep
 - Relaxation
 - Depending on rate of lengthening
 - Hysteresis
- Non-linear
- Living material
 - Adaptation to load
 - Damage repair
 - Ageing



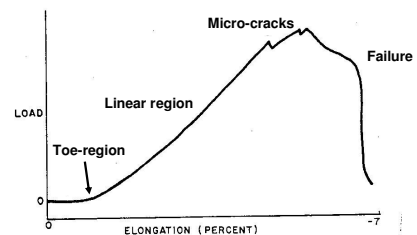
The musculoskeletal system: Basic building blocks

- Fibers:
 - Collagen (high stiffness)
 - Elastic (low stiffness)
- Substance: Proteins +
 - Bone: hydroxy-apatite (calcium-phosphate)
 - Cartilage: Proteoglycans
- Fluids:
 - Cartilage: Water
- Tensile strength: Fibers
- Compressive strength: Calcium

Collagen and elastic fibers

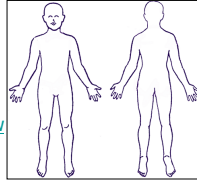


Stress-strain curve



The language of Anatomy: anatomical terms of location

- Directional – used in paired terms to describe **location** of body structures
 - Anterior v. posterior
 - Medial v. lateral
 - Superior v. inferior
 - Superficial v. deep
 - Proximal v. Distal
- [see Wikipedia for an overview](#)



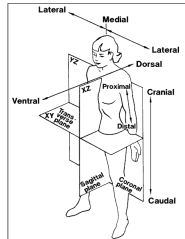
Study Table 1.1

Reference Point

Anterior – (ventral) Closer to the front surface of the body	Posterior – (dorsal) Closer to the rear surface of the body	Frontal Plane
Medial – Lying closer to the midline	Lateral – Lying further away from the midline	Sagittal Plane
Superior – (cranial) Closer to the head in relation to the entire body (More General)	Inferior – (caudal) Away from the head or towards the lower part of the body	Horizontal Plane
Superficial – Towards the surface	Deep – Away from the surface	Surface of body or organ
Proximal – Closer to the origin of a body part (More Specific)	Distal – Further away from the origin of a body part	Origin of a structure

The Anatomical Position

- Regional – names the specific body **areas**
 - Axial v. Appendicular
- Body planes – cut on a flat surface and lie at right angles to each other
 - Frontal = coronal
 - Separates into anterior and posterior
 - Transverse = horizontal
 - Separates into superior and inferior
 - Sagittal / Median
 - Any plane parallel to the median
 - Separates body into right and left
 - Parasagittal



Anatomical terms of motion

- Flexion - Extension
 - Plantar flexion - dorsiflexion
 - (hyperextension)
- Abduction - Adduction
- Pronation - Supination
- Endorotation - Exorotation
- Eversion - Inversion
- Circumduction
- Protraction - Retraction
- Elevation - Depression
- Circumduction
- Opposition

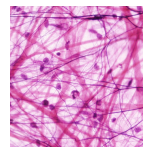
See handout, or:
[Wikipedia](#)

The musculoskeletal system: Connective tissue

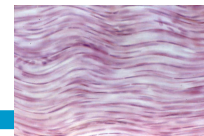
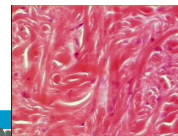
- 4 main types of CT:
 1. CT proper
 2. Cartilage
 3. Bone tissue
 4. Blood



1. CT Proper



- Two main types:
 - Loose CT
 - Adipose and reticular
 - Dense CT
 - Irregular and regular
- Mainly acts to resist tension

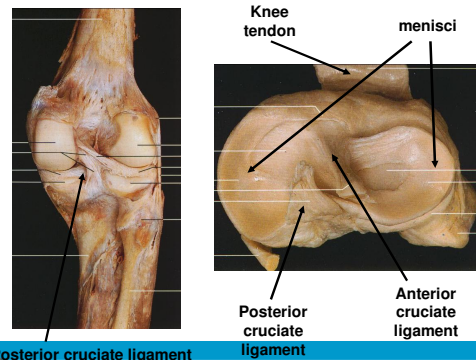


2. Cartilage

- Acts mainly to resist compression
- Firm, but flexible
- Consists of cells, separated by EM
- More present in embryo than in adult
- 80% water
- Avascular, NOT innervated
- Surrounded by perichondrium
 - Functions in growth/repair
 - Resists expansion during compression of cartilage
- Chondrocytes...the only cell!
 - Produce the cartilage
 - From Chondroblasts



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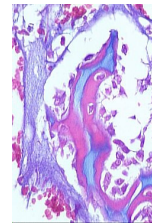
Location of Cartilage

- External ear
- Nose
- Articular cartilage
 - Covers end of bones
- Costal cartilage
 - Connects ribs to sternum
- Larynx
- Respiratory system
- Between vertebrae
- Pubic symphysis
- Form articular discs within moveable joints
 - Meniscus



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3. Bone Tissue



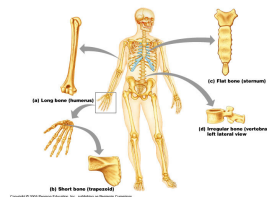
- Bone is an organ!
- Well vascularized
- Bone matrix contains:
 - Inorganic calcium salts
 - Enable to resist compression
 - Collagen fibers
 - Allow to withstand tension



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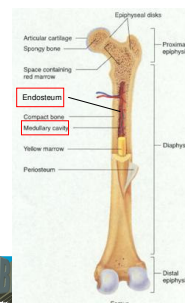
Classification of Bones

- Long
 - Femur
- Short
 - Sesamoid (kneecap)
- Flat
 - Ribs, cranial bones
- Irregular
 - Vertebrae, hip bones



TU Delft

Gross Anatomy of Long Bone



- Epiphysis
 - bone ends
- Diaphysis
 - shaft
- Epiphyseal line
 - Remnant of the growth plate
- Blood vessels
- Medullary cavity
- Membranes
- 2 layers of bone:
 - Compact
 - Spongy



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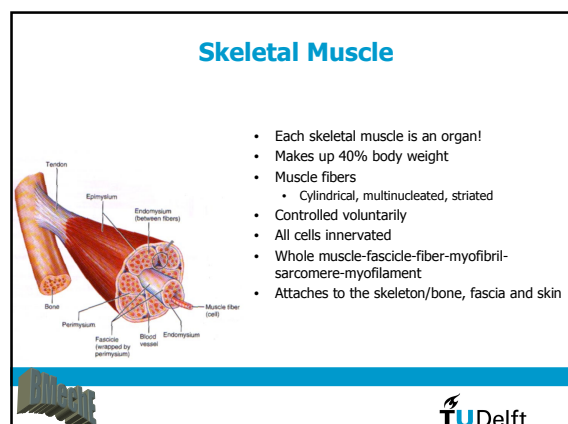
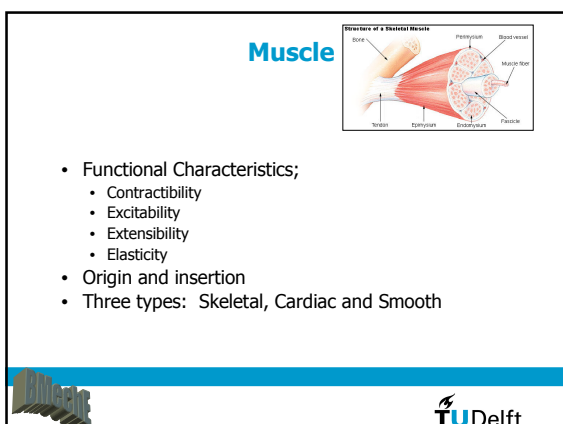
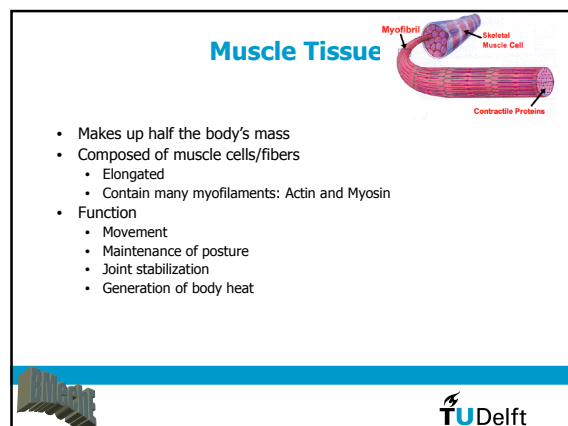
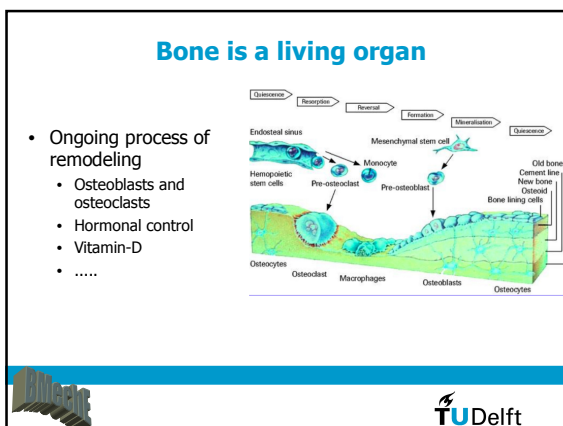
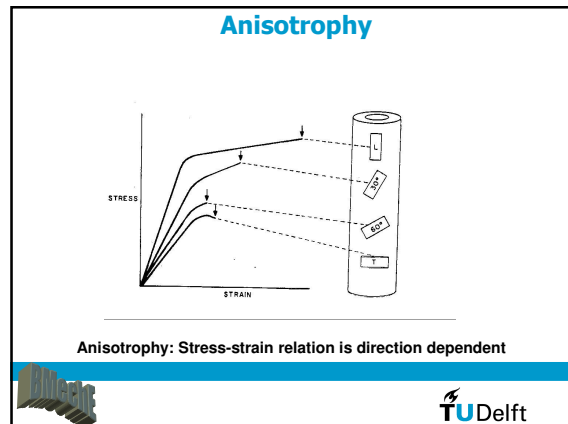
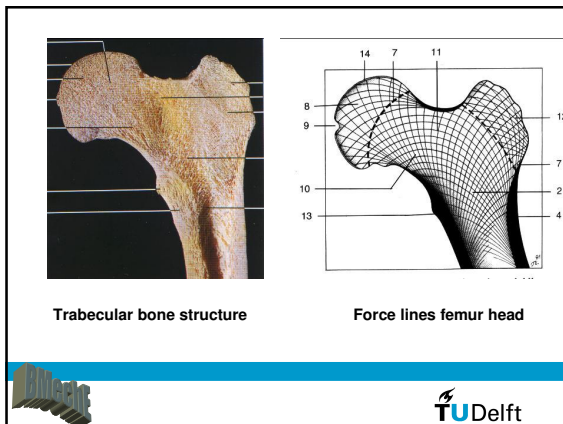
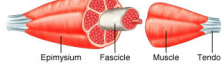
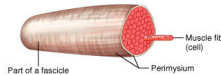
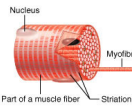
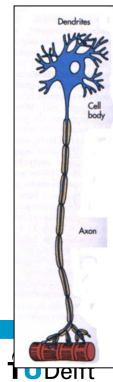


Table 10.1 Structure and Organizational Levels of Skeletal Muscle (1 of 2)			
Structure and organizational level	Description	Connective tissue wrappings	
Muscle (organ)	Consists of hundreds to thousands of muscle cells, plus connective tissue wrappings, blood vessels, and nerve fibers	Covered externally by the epimysium	
Fascicle (a portion of the muscle)	Discrete bundle of muscle cells, segregated from the rest of the muscle by a connective tissue sheath	Surrounded by a perimysium	
Muscle fiber (cell)	Elongated multinucleate cell; has a banded (striated) appearance	Surrounded by the endomysium	

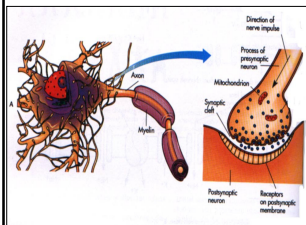
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Nervous Tissue

- Control!!!
- Main component of the brain, spinal cord, and nerves
- Regulates body functions
- 3 main cell types:
 1. Neurons:
 - Specialized nerve cells
 - Generate and conduct electrical impulses
 - Cell body, dendrite, axon
 2. Interneuron
 - Between motor and sensory neuron in CNS



Neuronal Anatomy



- Synapse
 - Cell junction where neurons communicate
- One direction!
- Presynaptic neuron
 - Synaptic vesicles fuses w/presynaptic membrane
 - Neurotransmitters released, diffuse across synaptic cleft, bind to postsynaptic membrane
 - Creates impulses (action potential) in that neuron
 - Cycle repeats