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# A Brief and Selective Overview of Human Anatomy and Physiology

UNIV 197K-01

The Limits of Human Performance

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## Definitions

- Anatomy – Study of the structure of body parts and their relationship to one another
  - macroscopic ("gross" anatomy)
  - microscopic
  - developmental
- Physiology – Study of the function of the structural machinery of the body
- Structure and function are intimately related
  - form (structure) follows function





## Anatomy

- Gross anatomy
  - regional – focus on a specific region
  - systemic – focus on a specific system
  - surface – internal structures relative to skin
- Microscopic anatomy
  - cytology – focus on cells
  - histology – focus on tissues
- Developmental anatomy
  - embryology – changes before birth
  - lifespan development – changes throughout life





## Physiology

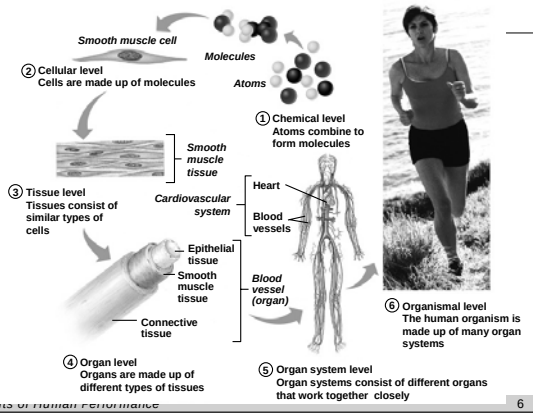
- Considers function across a range of scales from sub-cellular to whole organisms
- Requires knowledge of chemistry and physics
- Physiology has given rise to many closely-related fields:
  - biochemistry
  - biophysics
  - paleobiology
  - biomechanics
  - pharmacology

## Levels of Organization

- Chemical – atoms combine to form molecules
- Cell – cells are made up of molecules
- Tissue – consist of similar types of cells
- Organ – made up of different types of tissues
- Organ System – consists of different organs working closely together
- Organism – all the organ systems functioning together





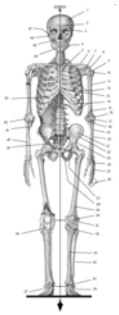







## Selected Organ Systems

- Skeletal System
  - Consists of bones, cartilage, & ligaments
  - Bones articulate at the joints
  - Protects and supports organs
  - Provides a store of minerals; site of blood cell formation
  - Provides the lever system that muscle act upon to effect movement



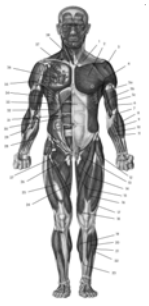






## Selected Organ Systems

- Muscular System
  - Consists of muscles & tendons
  - Major source of heat production
  - Provides for maintenance of posture
  - Represent the motors that power movement of the body
    - locomotion
    - activities of daily living
    - sports participation



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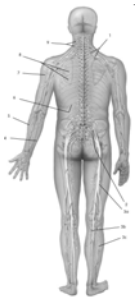
## Selected Organ Systems

- Nervous System
  - Consists of brain, spinal cord, and nerves
  - Receives sensory information about the body and environment
  - Provides motor commands to the muscles
  - Plays major role in learning and controlling movements







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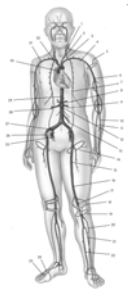
## Selected Organ Systems

- Cardiovascular System
  - Consists of heart and blood vessels
  - Heart pumps the blood, which is transported by the vessels throughout the body
  - Delivers $O_2$ and nutrients to muscle
  - Removes $CO_2$ and by-products from muscle







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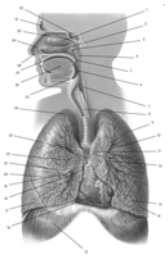
## Selected Organ Systems

- Respiratory System
  - Consists of nasal cavity, pharynx, trachea, bronchi, and lungs
  - Supplies blood with $O_2$, removes $CO_2$
  - Works closely with cardiovascular system







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## Integrative Study of Biology

- Science in general, and biology in particular, have been dominated by reductionism
  - explanations have been sought at increasingly smaller scales
- The integrative approach focuses on the interactions or integration of the many "parts" that make up the living organism
  - the whole organism is more than the sum of its parts (synergy)
  - the body is a complex dynamical system; can't just study the parts in isolation

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## Movement Science

- The scientific study of human movement; part of the broader field of Kinesiology
- Major areas:
  - biomechanics
  - exercise physiology
  - motor control and learning
  - exercise and sport psychology
- Scientific underpinnings: biology, physics, chemistry, psychology, mathematics



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## Biomechanics

- The science concerned with internal and external forces acting on the human body, and the effects produced by those forces
- Some major topics
  - kinematics – description of movement
  - kinetics – causes of movement
  - mechanics of muscle
  - mechanisms of injuries



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## Exercise Physiology

- Study of the functional changes brought about by a single bout or repeated bouts of exercise, often with the objective of improving function
- Some major topics
  - energy sources for movement
  - cardiopulmonary function
  - neuromuscular function
  - environmental factors / erogenic aids



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## Motor Control and Learning

- Study of the processes that lead to skilled human movement, and the manner in which these processes develop during skill acquisition
- Some major topics
  - conduction of neural signals
  - control versus coordination
  - speed/accuracy trade-off
  - optimal practice methods/structure

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## Exercise and Sport Psychology

- Study of the effects of exercise on psychological well being, determinants of adherence to exercise, and traits that lead to success in athletics
- Some major topics
  - effects of physical activity on emotional status
  - effects of personality and motivation on physical activity choices and performance
  - effects of stress on performance



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## Up Next ...

- Factors that determine and limit human strength