

Biomechanics Introduction

Mechanics:

- science which describes and predicts the conditions of rest or motion of bodies under the action of forces

Biomechanics:

- science which describes and predicts the conditions of rest or motion of **biological systems** under the action of forces

Subdivisions of Biomechanics

Biomechanics of Rigid Bodies

- Statics
- Dynamics
 - Kinematics
 - Kinetics
 - Direct dynamics
 - Inverse dynamics

Biomechanics of Deformable Bodies

Biomechanics of Fluids

Anthropometrics

- Body segment parameters

Electromyography

Biomechanics of Rigid Bodies

Rigid body:

- body which cannot be deformed, stretched or compressed. A body whose particles occupy fixed positions with respect to each other. Body segment parameters are constants for each subject.

Statics:

- branch of mechanics concerned with bodies at rest or in constant linear motion

Dynamics:

- branch of mechanics concerned with bodies in motion

Kinematics:

- branch of dynamics concerned with describing the state of motion of bodies without regard to the causes of the motion

Kinetics:

- branch of dynamics concerned with causes of motion and the action of forces (work, power, energy, impulse, ...)

Direct dynamics:

- ▶ calculation of kinematics from forces applied to bodies

Inverse dynamics:

- ▶ calculation of forces and moments from kinematics of bodies and their inertial properties

Important Figures and Events in Biomechanics

Euclid	c.450-380 BCE	wrote postulates which contained existing knowledge of geometry and algebra
Aristotle	384-322 BCE	developed the scientific method, wrote many books on philosophy of science and nature
Archimedes	c.287-212 BCE	developed many mechanical principles especially in hydraulics
Leonardo da Vinci	1452-1519	investigated anatomy, applied mechanics
Galileo Galilei	1564-1642	developed principles relating to gravity, projectile motion
Giovanni Alfonso Borelli	1608-1679	considered first biomechanist, applied mechanics to study of human motion
Isaac Newton	1643-1727	defined gravity, Laws of Motion, calculus many other physical principles, founder of modern science
Leonard Euler	1646-1716	extended Second Law for rigid body rotations
Emil DuBois-Reymond	1818-1896	studied electrical phenomenon in animal muscles, developed field of electrophysiology
Weber brothers	1836	computed first body segment parameters for human motion analysis
E.Muybridge & E.-J.Marey	1880s	developed first motion picture cameras
Braüne & Fischer	1889	extended Weber bros. work
A.V.Hill	1886-1977	described relationship between muscle force and velocity of contraction using thermodynamics
W.O.Fenn & H.Elftman	1929-1942	developed inverse dynamics and mechanical energy and power analyses of human motions
W. Dempster	1955	developed tables of body segment parameters and linked-segment biomechanical analysis
John V. Basmajian	1960s	developed field of electromyographic kinesiology
ISB	1973	International Society of Biomechanics
CSB	1974	Canadian Society for Biomechanics holds first conference in Edmonton