Section 2: History

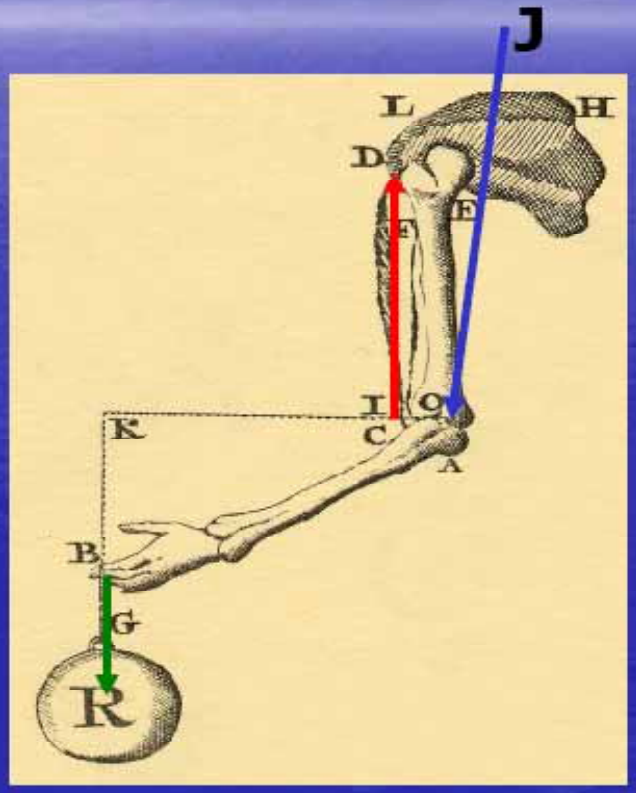
Biomechanics

- DaVinci (1452-1519): “Mechanical Science is the noblest and above all others the most useful, seeing that by means of it all animated bodies which have movements perform interactions…”
- Borelli (1608-1679): Founded “iatrophysyics” – physics applied to human motion, wrote “De Motu Animalium” (On the Motion of Animals)
- Newton (1642-1727)
- Hooke (1635-1703)

From: Ploeg

De Motu Animalium (1670) – The beginning of biomechanics

Giovanni Borelli
(1608-1679)



Taking moments about the muscle inserton site (C) gives Jx|IO|=Rx|RI|.
And since |IO|<<|RI| then J>>R. Therefore joint forces are massive!

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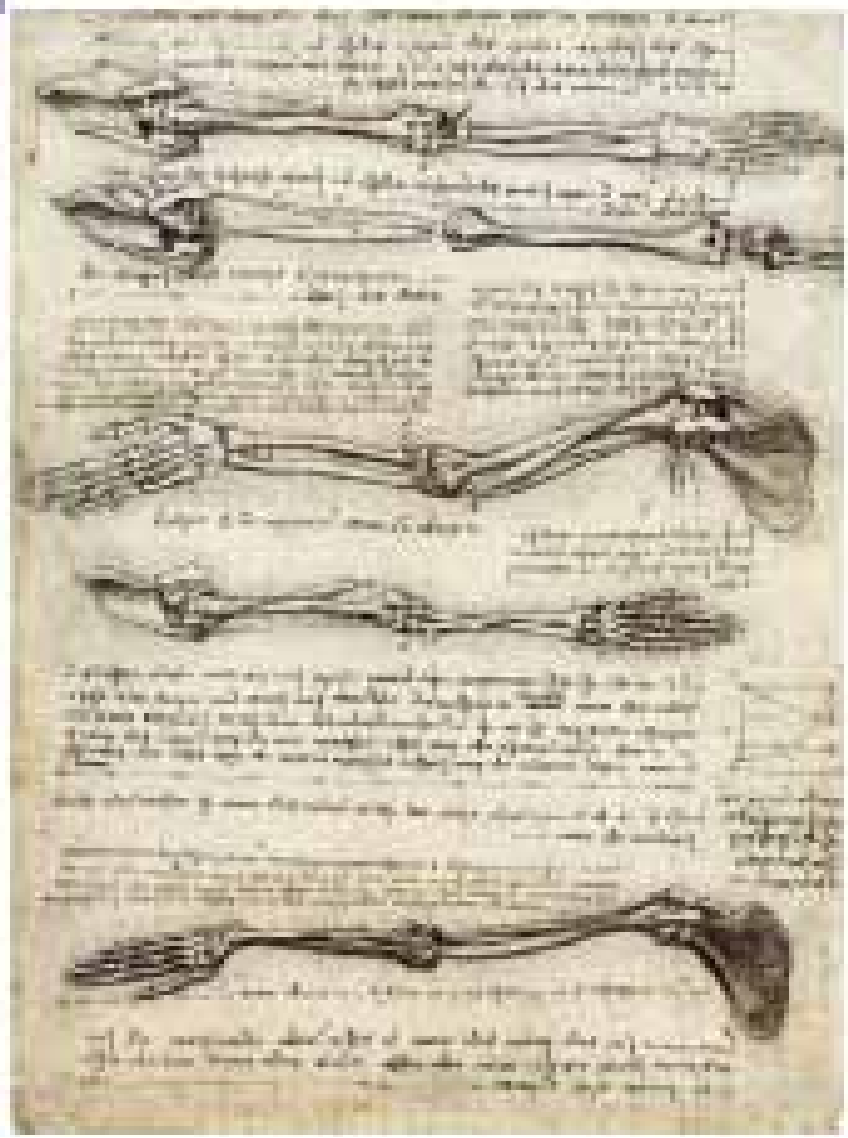

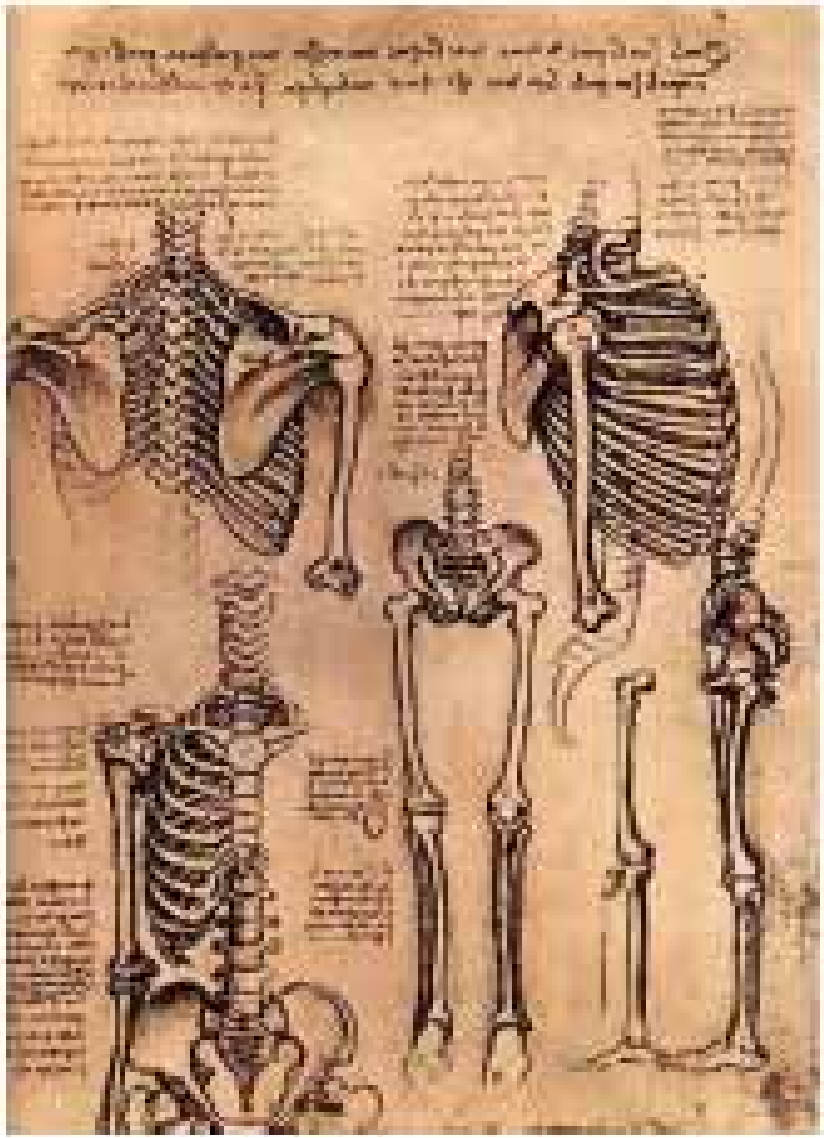

www.visi.com/~reuteler/leonardo.html

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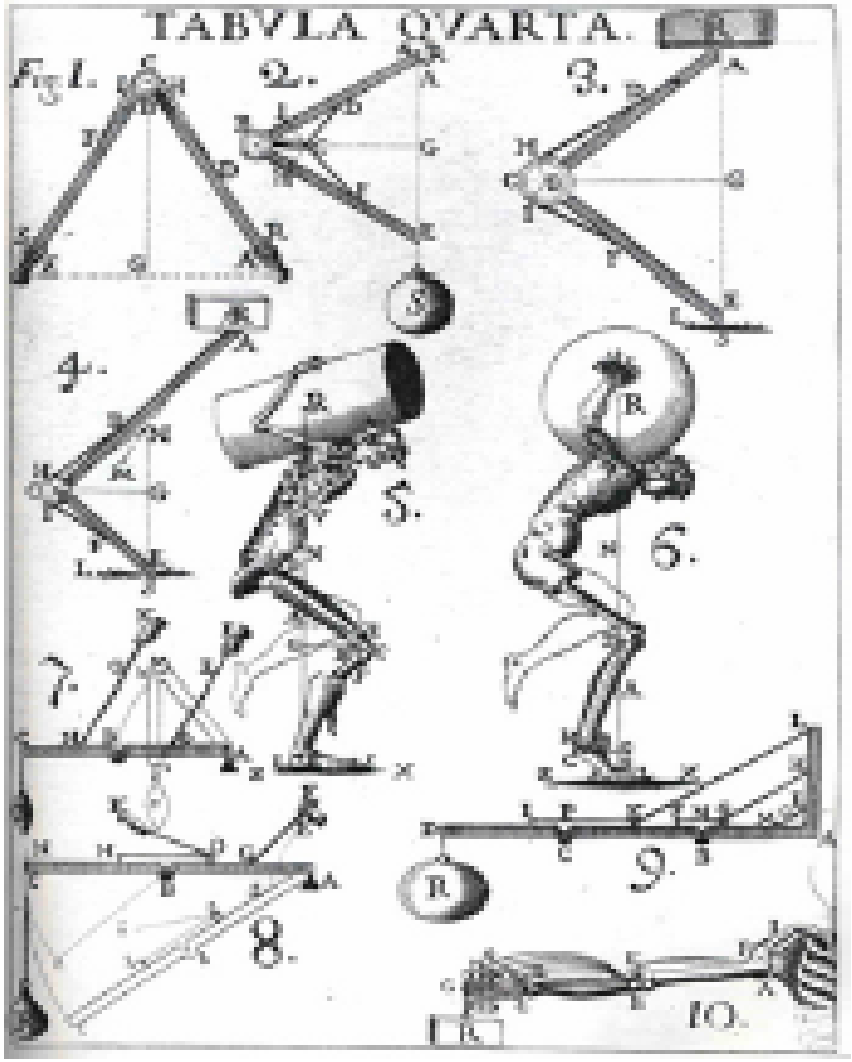


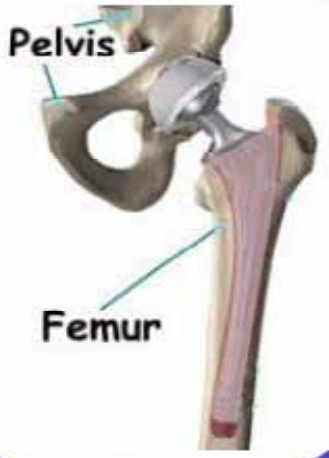
Fig. 1 describes the conjunction of two levers (or bones), IFS and HDR, at pivot point C.
Fig. 2 shows how elastic bands (muscles) attached externally to the levers (at D and F) and to the pivot (B) might bring the levers closer to each other.
Fig. 3 shows the elastic bands attached externally to the levers so that they can be "expanded".
Fig. 4 is a sketch of a twin-lever system, in which the levers are of unequal length.
Fig. 5&6 demonstrate the muscle and bone configurations in two humans carrying different loads.
Fig. 7&8 are studies of pulley arrangements.
Fig. 9&10 demonstrate the actions of muscles that enable a human to hold a weight with an extended arm.

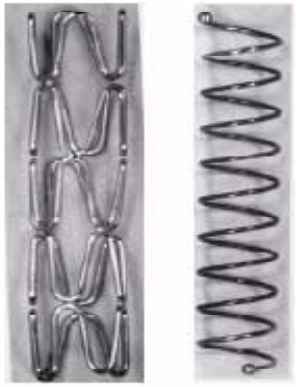
education.umn.edu/.../motorlab/borelli.htm

From: Ploeg

Mechanical Engineering of Implants

- Hip prosthesis
- Shoulder prostheses
- Cardiovascular stents
- Middle ear prostheses





From: Prendergast

Areas of Specialization

- **Developmental biomechanics**
  - Studies movement patterns and how they change across the lifespan and varying disabilities.
- **Biomechanics of exercise**
  - To maximize the benefits of exercise and reduce the chances of injury.
- **Rehabilitation mechanics**
  - Study of the movement patterns of people who are injured or who have a disability.
- **Equipment design**
  - Increases in performance through the change of equipment.

From: Nierengarten

Sample Research Questions

- How do running motions change as children develop?
- How do forces summate to produce maximum power in the tennis serve
- How can athletic shoes be designed to reduce injuries on artificial turf?
- What is the best body position for swimming the butterfly stroke?

From: Nierengarten

Instruments

- Computers
  - Simulation
- Cinematography
- Stroboscopy
- Videography

- Anthropometry
- Timing devices
- Electrogoniometry
- Electromyography
- Dynamography
- Telemetry

From: Nierengarten