

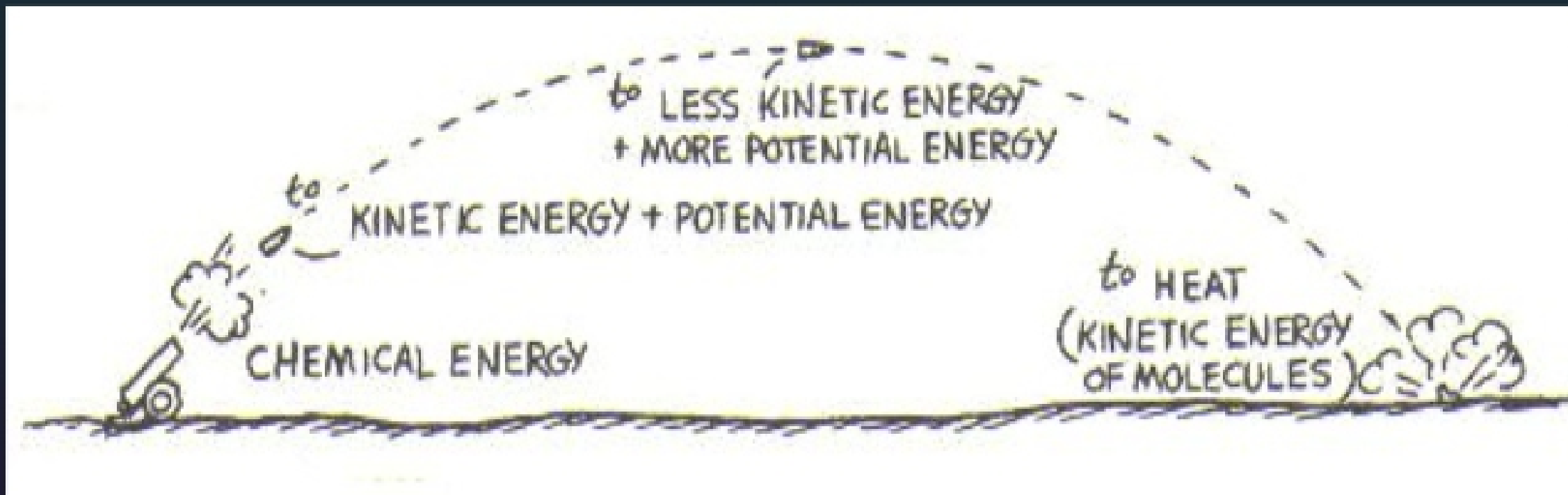
# HERMANN von HELMHOLTZ (1821-1894)

- Next generation of German physiologists
- Helmholtz - Student of Müller's
- But rejected Müller's **vitalism** in favor of **materialism**.
- Wanted to take down Kant's naturalism
  - (i.e. that scientific conclusions can be deduced from philosophy in opposition to observation of physical world)
  - Helmholtz said naturalism reduces science to speculation.



# HERMANN von HELMHOLTZ and the Case of the Animal Heat

- Where does the heat you give off come from?
- **Conservation of Energy:** energy is never created or destroyed within a given system, just transformed.
  - Helmholtz's mathematics proved all body heat can be accounted for by physiological chemical processes
  - First serious blow Helmholtz struck to the vitalist position



# HERMANN von HELMHOLTZ and the Case of the Teltale Frog Leg

- **Rate of Nerve Conduction:** second blow to the vitalist position.
  - Müller: nerve conduction is a vital force, and would be near light speed and thus unmeasurable.
    - Helmholtz invented the myograph to measure muscle movement, stimulated frog motor nerves at different distances from the muscle, then measured the contractions
    - Measured the amount of time between the stimulation of the nerve and the muscle contraction.
      - About 90 feet per second.
    - Stimulated men on the toe and on the thigh and measured the difference in time between stimulation and the pushing of a button.
      - Between 165 and 330 feet per second.