Unit 4: Body

a. the physical frame or structure of man;
b. the whole material organism viewed as an organic entity.

(1) How do living creatures work?
(2) Science and the ethics of research
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See: http://www.bodyworlds.com
Aristotle: Matter vs. Form

Actual vs. Potential

Photo courtesy of davidjthomas on Flickr.

Photo courtesy of mattfoster on Flickr.

Photo courtesy of davidjthomas on Flickr.
Johann Blumenbach

*bildungstrieb*

“formative pressure”

Photos of the developmental stages of a duck, from embryo to duckling, removed due to copyright restrictions.
Studies of Hydra: Regeneration

Photo of a hydra removed due to copyright restrictions.
Johannes Muller, Professor of Physiology
University of Berlin, 1833-1858

Vitalism and “Romantic Science”
Organic Life beneath the shoreless waves
Was born and nurs’d in Ocean’s pearly caves
First forms minute, unseen by spheric glass,
Move on the mud, or pierce the watery mass;
These, as successive generations bloom,
New powers acquire, and larger limbs assume;
Whence countless groups of vegetation spring,
And breathing realms of fin, and feet, and wing.
-- Erasmus Darwin, 1803

Romanticism and Spontaneous Generation
Lazzaro Spallanzani
(1729-1799)

Experiments on
Spontaneous Generation

Diagram of spontaneous generation experiments removed due to copyright restrictions.
Early Microscopy: Robert Hooke and Anton van Leeuwenhoek
Theodor Schwann: Cell Theory

Microscopic Researches into Accordance in the Structure and Growth of Animals and Plants (1839)
Berlin Physical Society, 1845
“there are no force in organisms other than physicochemical forces”

Rudolf Virchow, Cellular Pathology
Images of sodium, potassium, magnesium, and iodine removed due to copyright restrictions.
Michael Faraday

Image of benzene experiments due to copyright restrictions.
Friedrich Wöhler, 1828

Ammonium Cyanate → Urea

Image of a German stamp commemorating Friedrich Wöhler removed due to copyright restrictions.
Hermann Helmholtz
Animal Heat, Vitalism, and Perpetual Motion

“The animal body therefore does not differ from the steam-engine as regards the manner in which it obtains heat and force”
Louis Pasteur

Disproof of Spontaneous Generation
Fermentation: Wine, Beer, and Microbes

Yeast

Photo courtesy of tessawatson on Flickr.

Photo courtesy of ChristmasStockImages.com.
Diseases of Silkworms: Bacteria
Koch’s Technology: Petri Dishes and Pure Cultures

Photo of a petri dish culture removed due to copyright restrictions.
Koch’s Postulates

- Pathogen found in all victims
- Can be isolated and grown in pure culture
- Causes disease when infected into healthy animal
- Can be re-isolated from the new victims
Robert Koch, 1882

*Mycobacterium tuberculosis*

Koch’s Egypt Expedition: *Vibrio cholerae*, 1883

Photo courtesy of AJC1 on Flickr.
Max von Pettenkofer:
Testing the etiology of cholera

“Even if I be mistaken, and this experiment that I am making imperils my life, I shall look death quietly in the face, for what I am doing is no frivolous or cowardly act of suicide, but I shall die in the service of science as a soldier perishes on the field of honor.” -- 1892