BIOCHEMISTRY and GENETICS:

BIOCHEMISTRY: Initially evolved from the controversy of Vitalists versus mechanists:

<table>
<thead>
<tr>
<th></th>
<th>matter</th>
<th>natural laws</th>
<th>organic matter origins?</th>
<th>Heated?</th>
<th>spont. gen?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitalists:</td>
<td>organic qualitatively</td>
<td>involves “anima”,</td>
<td>Organic only in life.</td>
<td>inorganic melts</td>
<td>No, God</td>
</tr>
<tr>
<td></td>
<td>different from inorganic</td>
<td>different laws apply</td>
<td>Not made from inorganic</td>
<td>organic “cooks”</td>
<td>created once</td>
</tr>
<tr>
<td>Mechanists:</td>
<td>all matter the same</td>
<td>all laws of nature apply</td>
<td>interconvertable</td>
<td>should be same</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Friedrich Wohler 1828  
Showed urea, an organic molecule, could be formed from ammonium cyanate (NH₄OCN), an inorganic salt. Thus, laws of chemistry and physics apply to biology, **vitalism** incorrect at least on several points.

Louis Pasteur 1880s  
Showed that fermentation not spontaneous, yeast turns sugar to alcohol.

Eduard Buchner 1897  
Prepared yeast extracts (ferments) and conducted fermentation *in vitro*. Agents in extracts causing fermentation called *enzymes*. Again, vitalism wrong, fermentation *could* occur outside living cells.

Embden, Meyerhof, Warburg and Krebs 1920s & 30s  
Elucidation of biochemical glycolytic pathways by Germans: Glycolysis = Embden-Meyerhof pathway  
ATP recognized as energy storage molecule.

Melvin Calvin 1940s-50s  
Pioneered use of radiotrace technology

The Svedberg 1925-30  
Developed ultracentrifuge, allowed cellular fractionation

GENETICS:

Gregor Mendel 1866  
Studies peas, proposed  
Eq Seg: 1a. Paired hereditary factors (now called *genes*...)  
1b. These factors segregate equally during gametogenesis  
Ind Ast 2. Two or more pairs *assort independent* of each other  
Unappreciated for 35 years

Friedrich Miescher 1869  
Isolated DNA from human pus then salmon sperm.  
(He was 75 yrs ahead of time.)

Walther Flemming 1870s  
Saw thread-like structures termed *chromosomes* (colored bodies) in dividing cells, process = *mitosis* (thread process).

Wilhelm Roux 1883  
Suggested chromosomes might carry genetic information

Correns, von Tschemark, & de Vries 1900: simultaneously rediscovered Mendel's work.

Walter Sutton 1903  
Proposed chromosome theory of heredity: *Flemming's threads = Mendel's factors*.

Thomas Hunt Morgan 1910-1920  
Used *Drosophila* to show Sutton correct.

Robert Feulgen 1914  
Developed DNA stain, showed component in chromosomes, most thought couldn’t be genetic material: possessed only 4 bases.

Avery, MacLeod and McCarty 1944  
Showed DNA could transform bacteria

Hershey and Chase 1952  
Phage inject DNA, not protein.

James Watson, Francis Crick 1953  
Elucidated the structure of DNA.