


**Lecture 29**  
**Rise of Science in the 17<sup>th</sup> and 18<sup>th</sup> Century**

**New Systems of Philosophy and Experimental Science**



*The scientific revolution in this period was responsible for advances from supernaturalism to secularism, from theology to science, from hope of heaven and fears of hell to plans for the enlargement of knowledge and the improvement of human life*

Will and Ariel Durant, The story of civilization

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**17<sup>th</sup> Century Beginnings**

**Fusion of theoretical and applied sciences**

**Development of new scientific instruments:**  
barometer, air pump, sextant

**Technology allowed humans to move outside visual world**

**Astronomy via the telescope invented by Jannssen, a Dutch spectacle maker in 1590**

**Discoveries in the heavens by Galilei Galileo (1564–1642)**

**Biology via the microscope**

**Science became an important force in Western Civilization**

**Science Societies: Royal Society of London founded 1662**

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 <p><b>Francis Bacon</b> 1561–1626 (English)</p>	 <p><b>Thomas Hobbes</b> 1588–1679 (English)</p>	 <p><b>Gottfried Leibnitz</b> 1647–1716 (German)</p>
 <p><b>Rene Descartes</b> 1596–1650 (French)</p>	 <p><b>Baruch Spinoza</b> 1632–1677 (Dutch)</p>	 <p><b>Isaac Newton</b> 1642–1727 (English)</p>

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**The Plant Sciences**  
**Microscopy**  
**Robert Hooke (1634–1703)**  
English experimental physicist with wide interest in science  
Motion of heavenly bodies regarded as a problem, discovers universal gravitation, feuds with Newton.  
Examines a wide range of materials with microscope  
Discovers the cell.  
Recognizes that plant tissues are “*all perforated and porous, much like a honeycomb*” Gave the name cells to these pores,  
Referred to cell walls as *interstitia*, but not considered a constituent part of the cell, “*for in several of these vegetables whilst green, I have with my microscope plainly enough discovered these cells filled with juices, and by degrees sweating them out.*”  
Publishes results in *Micrographia* (1665)

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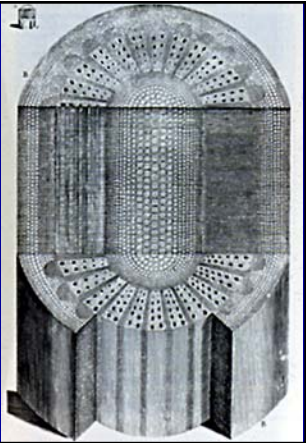
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*The Anatomy of Plants 1682*



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**Anton Van Leeuwenhoek (1632–1723)**



Dutch microscopist; Father of Scientific Microscopy  
Constructs 400 microscopes, bequests 26 to Royal Society of London  
Refers to animacules (little animals)  
Extended Malpighi’s demonstration of blood capillaries, later describe blood corpuscles  
Life cycle of aphids  
Stem structures in monocots and dicots  
Polyembryony in citrus  
Male spermatozoa  
First drawing of bacteria

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**Marcello Malpighi (1629–1684)**



Italian physician, anatomist, physiologist, microscopist.

First to utilize microscope to study animal and plant structure and histology (tissues structure)

Layers of tissues in leaves and young shoots found to be continuous with those of the main stem

Distinguishes fibers, tubes and other constituents of wood

First to understand the food function of leaves

Observes stomata, nodules in legume roots

Relates ovule to seed and carpel to fruit

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**Nehemiah Grew (1642–1712)**



English physician, anatomist, and physiologist

Co-founder of plant anatomy with Malpighi

Secretary of Royal Society of London

Compares plant and animal tissue in essay before Royal Society (1671, 1672, 1674)

Tissue histology, describes parenchyma

Note that pollen is bee-bread

Observes scattered vascular bundles in monocots.

Resin ducts in pine

Extracts chlorophyll using oil as a solvent

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**Plant Classification**



**Joseph Pitton de Tournefort (1656–1708)** suggests flowers and fruits as basis of classification, although he failed to understand sexuality in plants, began study of plant systematics beyond genera.

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**Rudolph Camerarius (1665–1721)**

Professor Botanic Gardens at Tübingen, 1688

Through study of dioecious and monoecious plants explains function of pollen and egg; considered apices with pollen as male, first modern understanding of plant sexuality



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**Babylonian pollinating date palm**

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**Carolus Linnaeus (Carl Von Linne)**  
1707–1778



Swedish botanist and physicians  
Curator of the gardens of the University of Lund at age 23  
Traveled in Lapland, Holland, England and France  
1741 Head of Botany of the University of Upsula  
Father of Taxonomy

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Established groups of organism that depended upon structural or morphological similarities and differences.

Basic taxonomic criteria for groupings were based on morphology of reproductive parts, parts least apt to be influenced by environment.

However, his system was artificial and is not longer being used; depended on no. of stamens and carpels as a method of grouping plants.

Credited with establishment of binomial nomenclature.

*Systema Naturae* 1735, *Fundamenta Botanica* 1736

*Genera Plantarum* 1737, *Classes Plantarum* 1738, *Philosophia Botanica* 1751

Named more than 1300 different plants (and as many or more animals); many names still used.

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### Hybridizing



Joseph Gottlieb Koelreuter (1733–1806)

First systematic experiments on plant hybridization using tobacco (*Nicotiana paniculata* × *N. rustica*)

He demonstrated that hybrids resemble both parents.

Experimentally verified the genetic contribution of pollen

First observed hybrid vigor (heterosis)

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### Plant Physiology


Joachim Jung (1587–1657) argued that plants have no soul; studies absorption by roots

M. Malpighi and N. Grew, established leaves as producers of food

J.B. van Helmont (1527–1644)

Infamous experiments with wrong conclusions.

Assumes carbon fixation from air and oxygen and hydrogen from water.



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# History of Horticulture: Lecture 29

**Stephen Hales (1671–1761)**



English physician, chemist, inventor, and country vicar

Studies physiology on foundation of Grew's anatomical work

First to use quantitative results: studies movement of sap, root pressure, transpiration, flow of nutrients by girdling

Contended plants draw some parts of the nourishment from air and that leaves absorb light

*Statical Essays, Vegetable Staticks* (1727)

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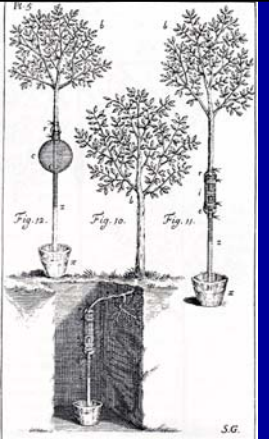
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Experiments, to find out the force with which trees imbibe moisture



Source: Hales, *Vegetable Staticks*, 1727.

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**Joseph Priestly (1733–1804)**



Proved that oxygen (dephlogisticated air) is produced by plants

Discovers photosynthesis and respiration

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**Era of Botanical Exploration**

**Hans Sloan (1660–1750)**

Collected 800 species from West Indies.

**James Cunningham**, sent to China in 1698 to investigate flora

**George Eberhard Rumph (Rumphius) 1628–1702**, known as “Pliny of the Indies,” explores Moluccas, describes 1700 species, stationed on small island of Amboina

*Herbarium Amboinense 1741–1755*

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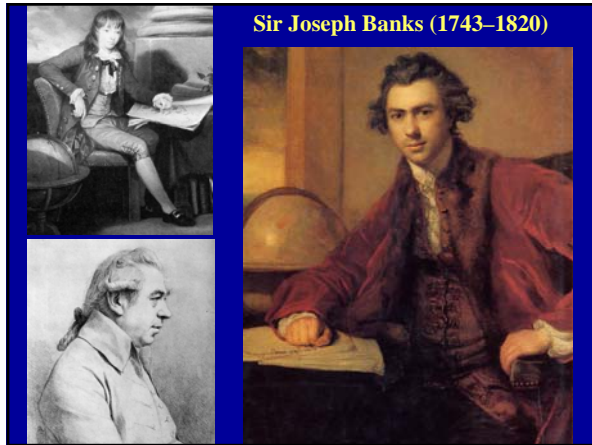
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**Sir Joseph Banks (1743–1820)**

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**Wealthy English landowner**

**President Royal Society for 42 years; dictator of English Botany**

**Explored Newfoundland, Brazil, New Zealand, and Australia**

**Plant explorer sailing with Captain Cook in the Endeavor at age of 25**

**Unpaid director of Kew Gardens**

**Considered greatest Englishman of his time by foreign scientists**

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