

Big Chem Historical Introduction

NATURAL PHILOSOPHY-- Old name for Science (Greek for “*Love of Knowledge*”).

THALES OF MILETUS (600 BC)-- First Natural Philosopher we know of who hypothesized on the makeup of matter.

I. Water is the universal element.

Evidences: Heating substances ---> water.

ie. leaf, wood, paper, chalk, minerals (the water of hydration).

When the Heat's On-- You Sweat!

II. The Water Cycle-- shows how water interacts everywhere.

III. Concluded: “Nature follows a pattern of laws.”

DEMOCRITUS (400 BC)-- First Atomic Hypothesis.

Atomos: Greek for “*uncuttable*”.

Chop up a piece of matter until you reach the atomos.

Properties of atoms:

Indestructible.

Changeable, however, into different forms.

An infinite number of kinds so there are an infinite number of elements.

Hard substances have rough, prickly atoms that stick together.

Liquids have round, smooth atoms that slide over one other.

Smell is caused by atoms interacting with the nose-- rough atoms hurt (stink), etc.

Sleep is caused by atoms escaping the brain.

Death-- too many escaped or didn't return.

The heart is the center of anger.

The brain is the center of thought.

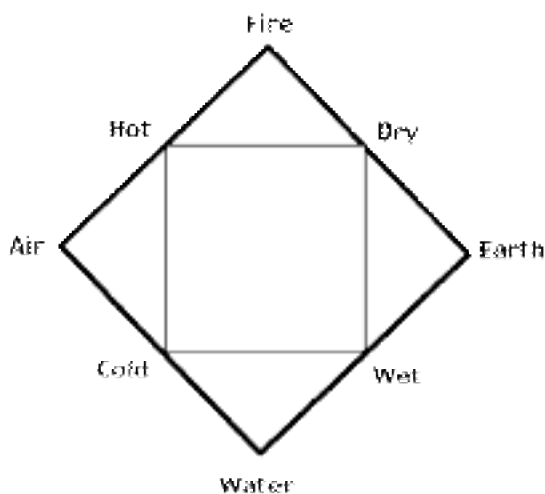
The liver is the center of desire.

“Nothing exists but atoms and space, all else is opinion”.

EMPEDOCLESE (400 BC)-- The Four Element Hypothesis:

Primary Matter-- Fire, Water, Earth, Air.

The Four Qualities-- Wet, Dry, Warm, Cold.



The Four Elements
are brought
together by
Love
and separated
by
Hate

The Modern Terms
are
Endothermic Energy
and
Exothermic Energy

Sample formulas:

Human flesh-- equal quantities of the Four Elements.

Bones-- 1/2 Fire, 1/4 Earth, 1/4 Water.

ARISTOTLE (300 BC)-- (student of Plato, teacher of Alexander The Great and many others).

Known as “*The Master of Those Who Know*”, his influence was so great that it was said that he held back science for 2000 years. In future generations one could prove an argument by using the Latin statement, “*IPSE DIXIT*” (“He himself said it”).

ARISTOTLE’S BIG ACTIONS:

- Established the world's greatest library (university) at Alexandria. It lasted 700 years!
- Preserved much knowledge of the ancient world.
- Established the Science of Biology.
- Supported the Four Element Hypothesis. This was one reason it lasted so long.

ARISTOTLE’S “*FUNDAMENTAL OBSERVATIONS*”:

- Objects fall at accelerations proportional to their weights.
- Air is levity (it rises).
- Nature abhors a vacuum.
- Spontaneous Generation of Life (dead meat changes into living flies. This was still being disputed in the 19th century).
- Even today Aristotle is frequently quoted!

FRIAR ROGER BACON (1200)-- The “Crazy Monk” of Oxford University.

Said, “*Experimentation in Science is Necessary* ”.
Developed a formula for gunpowder and used it to stop a student demonstration.

ALCHEMY (ancient-1600's)-- The forerunner to Big Chem.

Alchemists objectives--

- To make precious metals... cheaply.
- To make gold out of base metals.
- To produce formulae for making gold and silver.
- To make elixirs (cure-alls), love potions, and poisons. An alchemist produced the potion that made Romeo's Juliette appear dead for three days.
- Sought the “*PHILOSOPHER’S STONE*” for power and great longevity. It would certainly help in the making of gold!
- Sought the “*UNIVERSAL SOLVENT*” which would dissolve all. (That, too, should help to make gold).
- Worked in great mystery and sorcery.

Accomplishments:

- Discovered many new substances (elements and compounds).
- Invented laboratory equipment:
 - Test tubes
 - Distilleries
 - Reaction furnaces
 - The Retort-- neat!
- Developed many lab techniques for experimenting, assaying, metallurgy.

Not all alchemists were bad, but their general reputation was extremely sinister. It was not safe to be an alchemist as he might be burned for sorcery or hanged for the general good of the public.

To call a chemist an alchemist is an insult. (Like calling a doctor a quack).

ROBERT BOYLE (1661)--

Defined *ELEMENT* in modern terms-- a form of matter that cannot be further simplified.

Shot down the *Four Element Hypothesis* showing that there are many elements (92 found in nature).

Changed “*Alchemy*” to “*Chemistry*”.

SIR FRANCIS BACON (1600)-- “The Father of Science”.

Wrote the *NOVUM ORGANUM* in which he presents *THE SCIENTIFIC METHOD* :

1. Collect Reliable Data (No *Ipse Dixit*).
2. Classify the Data.
3. Generalize, experiment.
4. Make Hypothesis or Theory.
5. Try to prove it by further experimentation.

JOHN DALTON (1800)-- “Father of Modern Chemistry”.

The *MODERN ATOMIC THEORY* (compare to Democritus').

1. Elements are composed of atoms.
2. Atoms are indestructible (chemically correct).
3. All atoms of an element are identical (chemically correct).
4. In orderly fashion, the atoms combine to form molecules. (Dalton’s Law).
5. The atoms are not changed in the process of forming molecules.

LAVOISIER (1800)--

Discovered the true nature of burning:

It was not the liberation of a mysterious negative weight substance called “*caloric*”, but the chemical addition of oxygen to the fuel. He burned a diamond in oxygen and obtained only carbon dioxide as a product, thus proving that burning is rapid oxidation and that a diamond is pure carbon.

Introduced quantitative measurements into chemical experimentation, and for accurate, consistent results he helped invent the super simple-- *Metric System*.

At an early age, Lavoisier was guillotined during the French Revolution because he was a nobleman and tax collector for the king. His short chemical career had already gained him greatness in the scientific world. The French call him, “*The Father of Modern Chemistry*”.

MENDELEEV (1869)--

Invented the first Periodic Table for classifying elements.

Found that the Elements could be classified by their reoccurring chemical properties.

Used his Periodic Table to predict the existence of undiscovered elements and to determine their properties. As result, many new elements were quickly found. His predictions had been correct!

MODERN CHEMISTRY-- A multitude of people doing new things rapidly! We shall meet many of them this year.