PART 1----------

The History of the Periodic Table

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Democritus, Greek philosopher

Things are different from each other, and each can be reduced to very small parts of itself. - Ancient knowledge

In around 400 BC, Greek thinkers used the words 'element', and 'atom' to describe the differences and smallest parts of matter. These ideas survived for 2000 years. Aristotle's concepts, such as 'elements' of Earth, Fire, Air, and Water to explain the world, came and went.

Much later, Boyle, an experimenter like Galileo, lent important weight to the atomic theory of matter in the 1600s.

It was Lavoisier who wrote the first extensive list of elements - containing 33 elements. He distinguished between metals and non-metals, dividing the few elements known in the 1700's into four classes. Then, John Dalton made atoms even more convincing, suggesting that the mass of an atom was it's most important property.

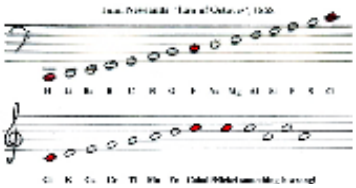
"The chemical elements are composed of... indivisible particles of matter, called atoms... atoms of the same element are identical in all respects, particularly weight." - Dalton

In the 1820's Jöns Jakob Berzelius developed a table of atomic weights, and introduced letters to symbolize elements, rather than the symbols originated by the early Greeks and following alchemists. Dobereiner noted that similar elements often had relative atomic masses, grouping elements in 'triads'.

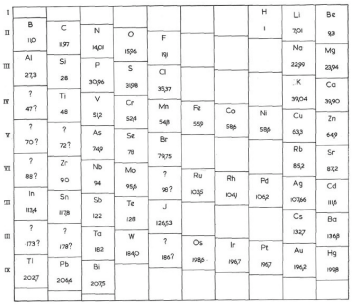
Stanislao Cannizaro determined atomic weights for the elements known in the 1860s, then a table was arranged by Newlands, with the elements given a numbers in series in order of their atomic weights, beginning with Hydrogen. This made evident that "The eighth element, starting from a given one, is a kind of repetition of the first", which Newlands called the Law of Octaves.

The first true periodic table was three

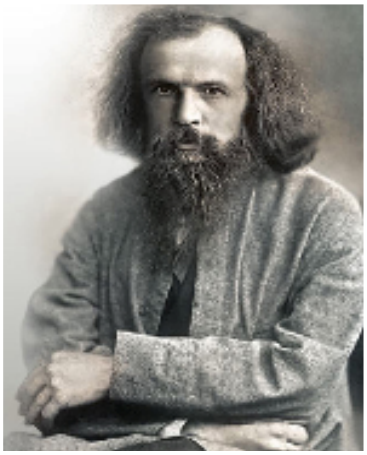
René Descartes, "Father of Modern Philosophy"



Newland's Octaves



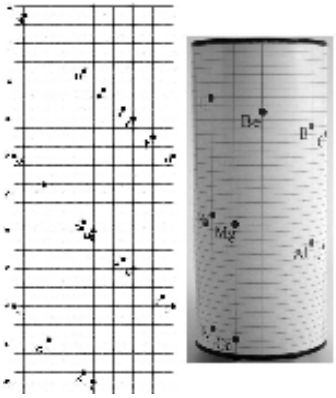
Lothar Meyer's 3-D



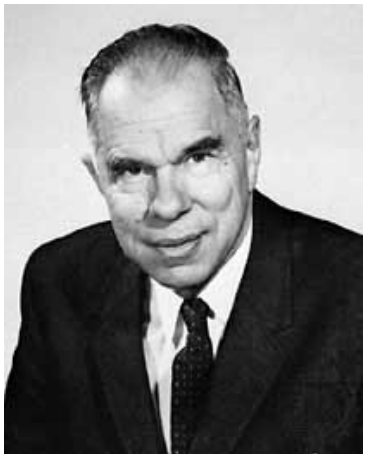
Dmitri Mendeleev

Alexandre-Émile Béguyer de Chancourtois

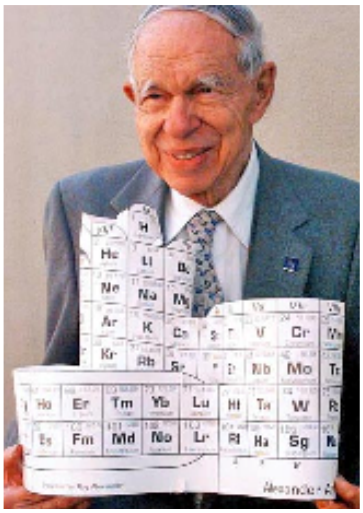
Model of the vis Tellurique in the British Museum of Natural History



Mark Leach's model of the telluric screw



Dr.Glenn T.Seaborg in 1968



Dr.Glenn T.Seaborg in 1997, with the Alexander Arrangement of Elements, which he referred to as his "favorite" periodic table.

dimensional.

Using element weights developed by Cannizarro, Alexandre-Émile Béguyer de Chancourtois created a fully-functioning periodic system on a cylinder, which he called the *vis Tellurique*. This dimensionality (a natural conclusion for him, as he worked to correct the relationships between world globes and maps) allowed the known elements to be placed in unbroken order of increasing weight of their atoms - the periodicity concept - which was then used by Newlands and Meyer.

The *vis Tellurique*, published a decade prior to the table of Dimitri Mendeleev, was little noticed by chemists. His paper describing his 3-D periodic table, was published by the French Academy of Sciences in 1862, but without the visual he had submitted, was poorly understood, and was little noticed for 11 years. It was re-introduced after Mendeleev's periodic table attracted attention among chemists.

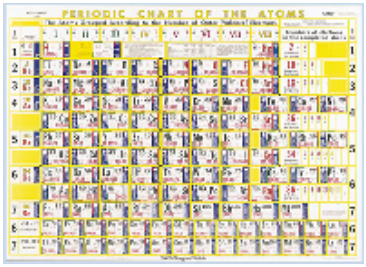
In 1869, Lothar Meyer compiled a periodic table of 56 elements based on the periodicity of properties such as molar volume when arranged in order of atomic weight, and formed one of his tables as a cylinder far less complex than de Chancourtois'. Both Meyer and Mendeleev constructed periodic tables independently that are credited as being the basis of the modern table. Meyer was more impressed by the periodicity of physical properties, while Mendeleev was more interested in the chemical properties.

In the same year as Meyer, Mendeleev also published his periodic table & law in 1869. However, he also forecast the properties of missing elements, and chemists began to appreciate it when, soon after, the discovery of elements predicted by gaps in his table took place. **Mendeleev is almost universally thought of as the sole originator of the periodic table.**

"...if all the elements be arranged in order of their atomic weights a periodic repetition of properties is obtained." - the Periodic Law, as stated by Mendeleev

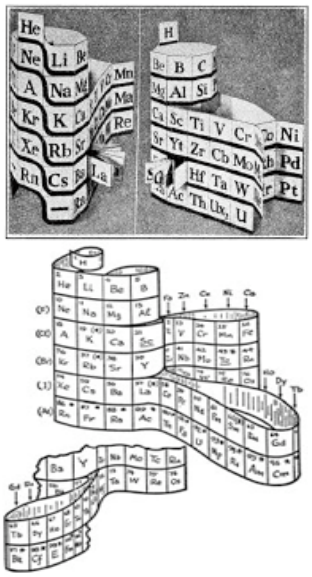
The periodic law, however, appears to have been independently formulated by at least six people within one decade - de Chancourtois, Newlands, Lothar Meyer, Mendeleev, Hinrichs, and Odling. Periodic tables have always been related to the way

The first Mendeleev "System of Elements"



Hubbard's "Chart of the Atoms"

The DeskTopper version of the



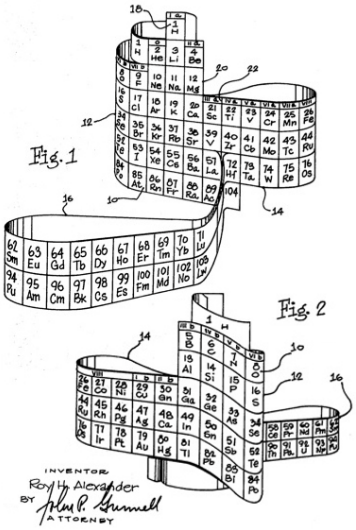
Courtines' and Gamov's 3-D periodic tables

scientists thought about the shape and structure of the atom, and the relationships between elements, so have changed accordingly over time.

While charts were mainly developed flat, for obvious convenience, W. Jensen says "Mendeleev was quite flexible when it came to graphical representation" of an element system, and decried the "leaps, breaks in continuity" of element system representations. 1894 Ramsay isolated Argon, and in the next year discovered helium. He went on to discover neon, krypton and xenon, and added a group to the periodic table to be called the Noble Gases - elements least likely to associate with others.

Later, the table was reordered by Mosely according to atomic numbers (nuclear charge) rather than by weight, thereby modifying the Periodic Law. The Periodic Law revealed important analogies among the 94 naturally occurring elements, and stimulated renewed interest in Inorganic Chemistry in the nineteenth century. This has carried into the present with the creation of artificially produced, short lived elements of `atom smashers' and supercolliders of high energy physics.

"Alexander Arrangement of Elements"



AAE Patent Drawings

Harry D. Hubbard, of the United States National Bureau of Standards, modernized Mendeleev's periodic table, and his first work was published in 1924. This was known as the "Periodic Chart of the Atoms".

Into the 1930s the heaviest elements were being put up in the body of the periodic table, and Glenn Seaborg "plucked those out" while working with Fermi in Chicago, naming them the Actinide series, which later permitted proper placement of subsequently 'created' elements - the Transactinides, changing the periodic table yet again. These elements were shown separate from the main body of the table.

Several scientists independently revived the Chancourtois 3-D periodic table concept in the 20th Century. Some have started with a ribbon of elements in atomic number sequence and wrapped it in a spiral to vertically align elements with similar properties, which establishes the 'periodic' nature of the table. Others may have merely wrapped the plane of the flat table - after ramping the element rows – escalator-like – in the p-block - and let the post Emile/Lothar/Dmitri element blocks loop to allow a perfect atomic number sequence. Some may have been seeking to resolve technical questions, and others, like Courtines, Gamov and Alexander, aiming for a better educational tool.

When Seaborg was shown the 1965 Alexander Arrangement in 1997, he said that it was 'correct', and later told a photographer that it was his 'favorite' periodic table. This arrangement retains the separate Lanthanide and Actinide series, but re-integrates them at the same time, a possibility only by using all three dimensions to produce a gap-free table.

The periodic table has been improved continuously over the last century and a half, built on the shoulders of many creative scientists.

The newer versions improve the educational possibilities by making possible element number continuity, easing both use & understanding of the immense correlative power of the periodic chart in teaching, learning, and working with chemistry.