

# PAST AND PRESENT



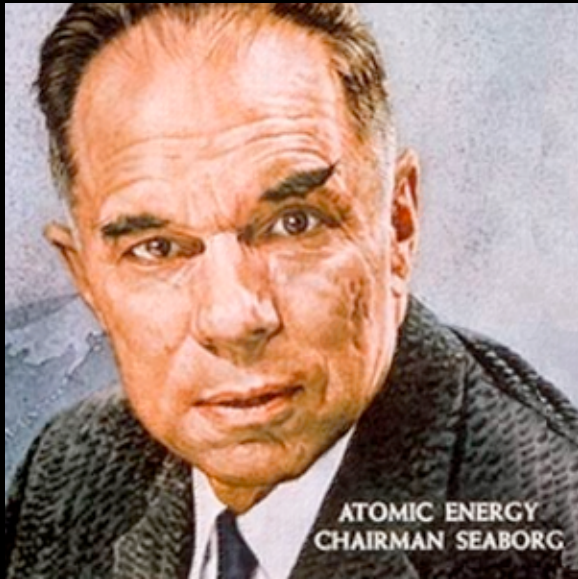
# ARRANGERS



# OF CHEMICAL ELEMENT SYSTEMS

**After de Chancourtois started the ball rolling with a *PERIODIC* periodic table, Meyer and Mendeleev, by reducing the arrangement to two dimensions, made them far more convenient for printing and distribution as well as for working.**

**Following Moseley's establishing technical accuracy to the sequence of elements, the icon of chemistry seemed settled, but other forms were to come...**



While creating the Atom Bomb, **Glenn Seaborg** demonstrated that the heavy elements form a "*transition series*" of elements like the lanthanide elements. During the period of his leading development of the atom bomb, made the first serious periodic table change since Moseley.

**As the periodic table became more and more crowded as Seaborg and crew discovered more post-uranium elements, he put all heavy elements together, below the rest of the Periodic Table, a move in which he took great pride - a Nobel Prize factor.**





Period	Group																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
I																	1 H 1.008	2 He 4.003	
II	3 Li 6.940	4 Be 9.02												5 B 10.82	6 C 12.010	7 N 14.008	8 O 16.000	9 F 19.00	10 Ne 20.183
III	11 Na 22.997	12 Mg 24.32												13 Al 26.97	14 Si 28.06	15 P 30.98	16 S 32.06	17 Cl 35.457	18 Ar 39.944
IV	19 K 39.098	20 Ca 40.08	21 Sc 45.10	22 Ti 47.90	23 V 50.95	24 Cr 52.01	25 Mn 54.93	26 Fe 55.85	27 Co 58.94	28 Ni 58.69	29 Cu 63.57	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.916	36 Kr 83.7	
V	37 Rb 85.48	38 Sr 87.63	39 Y 88.92	40 Zr 91.22	41 Nb 92.91	42 Mo 95.95	43 —	44 Ru 101.7	45 Rh 102.91	46 Pd 106.7	47 Ag 107.868	48 Cd 112.41	49 In 114.76	50 Sn 118.710	51 Sb 121.76	52 Te 127.61	53 I 126.92	54 Xe 131.3	
VI	55 Cs 132.91	56 Ba 137.33	57-71 Rare Earths	72 Hf 178.5	73 Ta 180.88	74 W 183.85	75 Re 186.31	76 Os 190.2	77 Ir 193.1	78 Pt 195.23	79 Au 196.967	80 Hg 200.59	81 Tl 204.39	82 Pb 207.2	83 Bi 209.0	84 Po 210	85 —	86 Rn 222	
VII	87 AcK 223	88 Ra 226.05	89 Ac 227	90 Th 232.04	91 Pa 231	92 U 238.03	93 —												

↑ Rare Earths.																	
VI	57 La 138.92	58 Ce 140.13	59 Pr 140.92	60 Nd 144.27	61 —	62 Sm 150.43	63 Eu 152.0	64 Gd 157.9	65 Tb 158.9	66 Dy 162.5	67 Ho 164.94	68 Er 167.2	69 Tm 169.4	70 Yb 173.04	71 Lu 174.99		

1 H																	2 He	
3 Li	4 Be												5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg												13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	(43)	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
55 Cs	56 Ba	57-71 La-Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	(85)	86 Rn	
(87)	88 Ra	89 Ac	90 Th	91 Pa	92 U	(93)	(94)	(95)	(96)	(97)	(98)	(99)	(100)					

57 La	58 Ce	59 Pr	60 Nd	(61)	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	(106)								

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89 Ac	90 Th 232.04	91 Pa 231	92 U 238.03	93 Np 237	94 Pu	95	96							

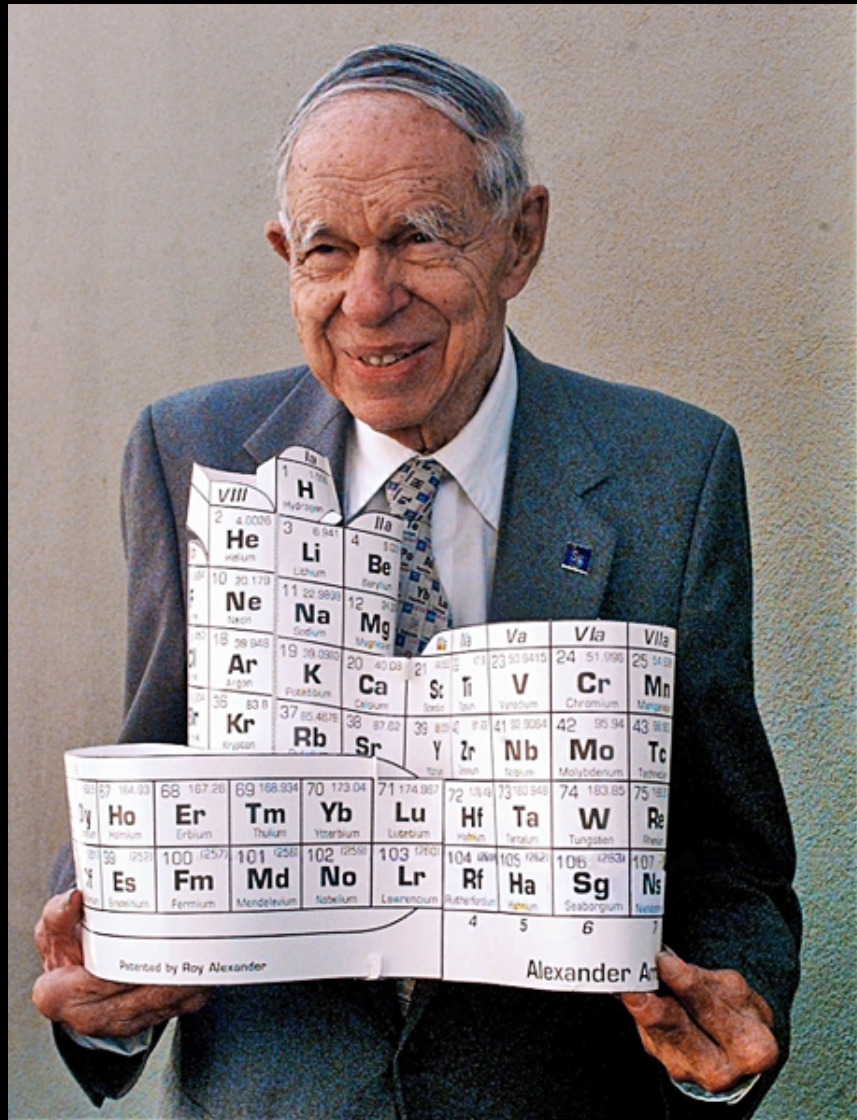
Before Seaborg's new transuranium elements, this 1942 table shows the **Actinides** being placed in the main body of the table, while **Lanthanides** remain outside.



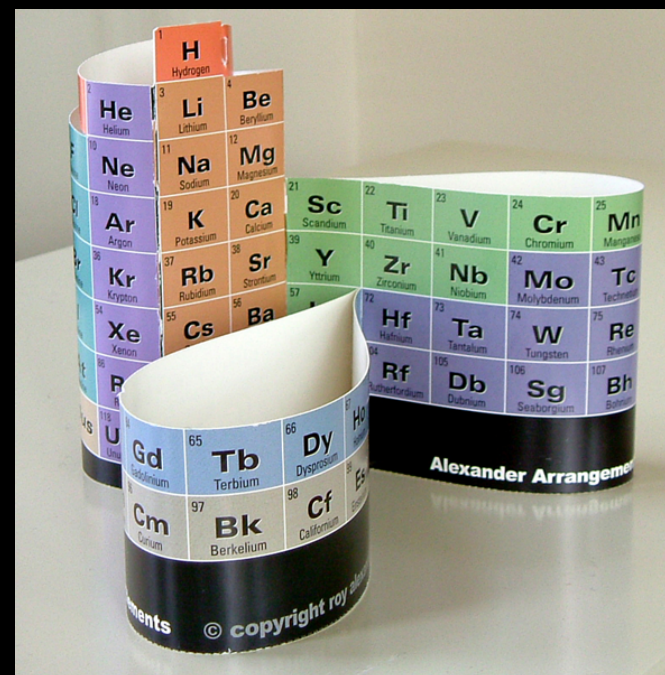
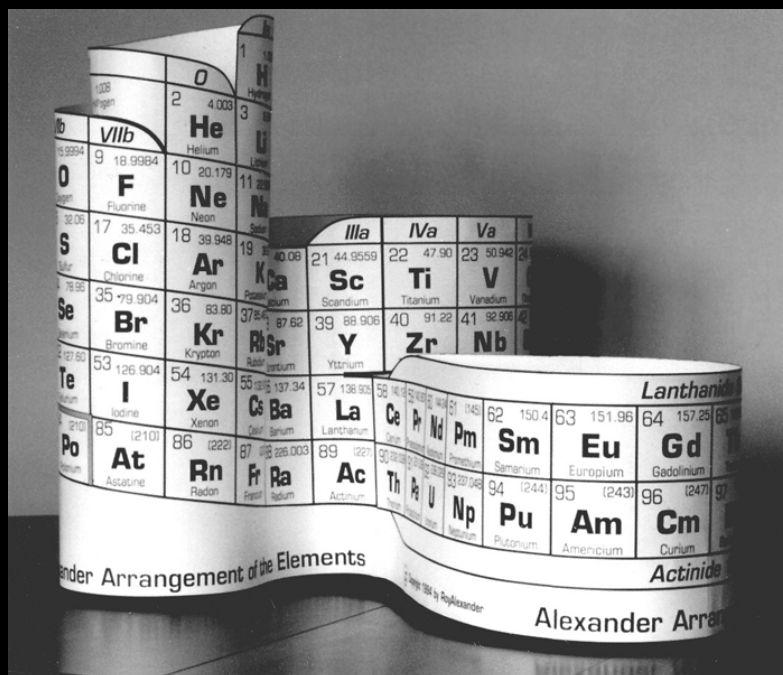




Dr. Seaborg, to be photographed with his favorite periodic table, chose this **3D model** showing the f- and d-blocks looping out from the main group, which he had informed the designer was “correct”.



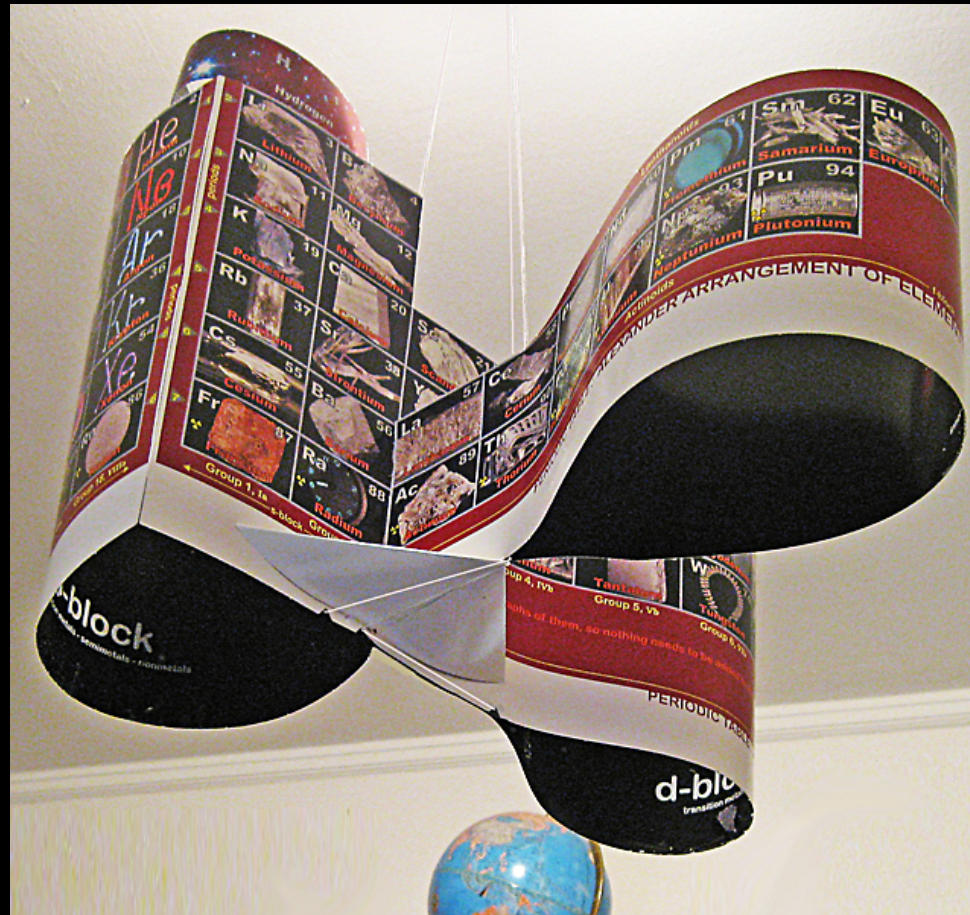
It was one of several three-dimensional tables that **Roy Alexander** had designed in hopes of improving chemistry education.



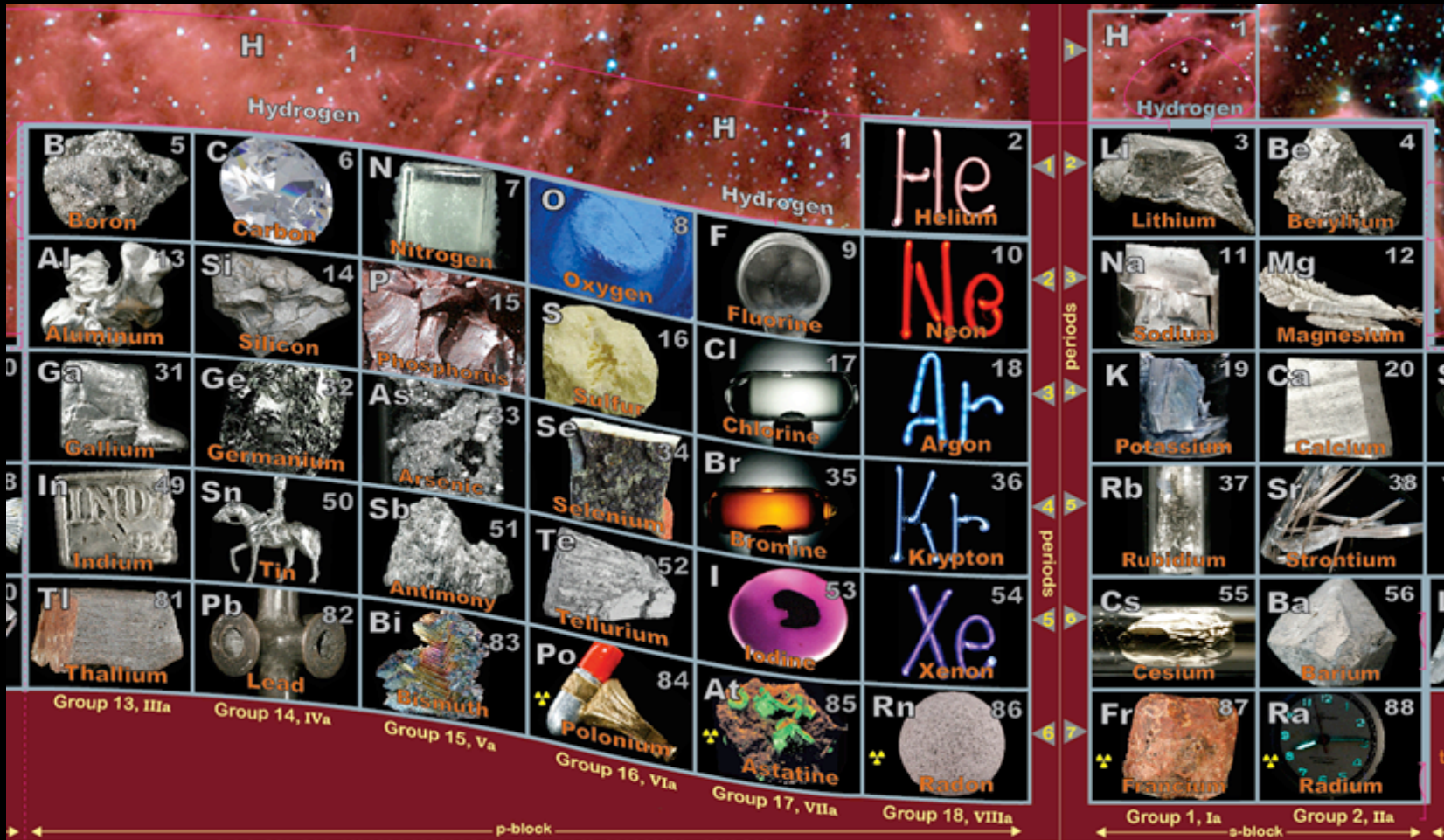


A science museum exhibit designer, he had, in 1965, used the Periodic Law to resolve his long held conviction that the standard table was “*just wrong*”, applying three dimensions to fix the dozen breaks in the atomic numbers and between the periods.

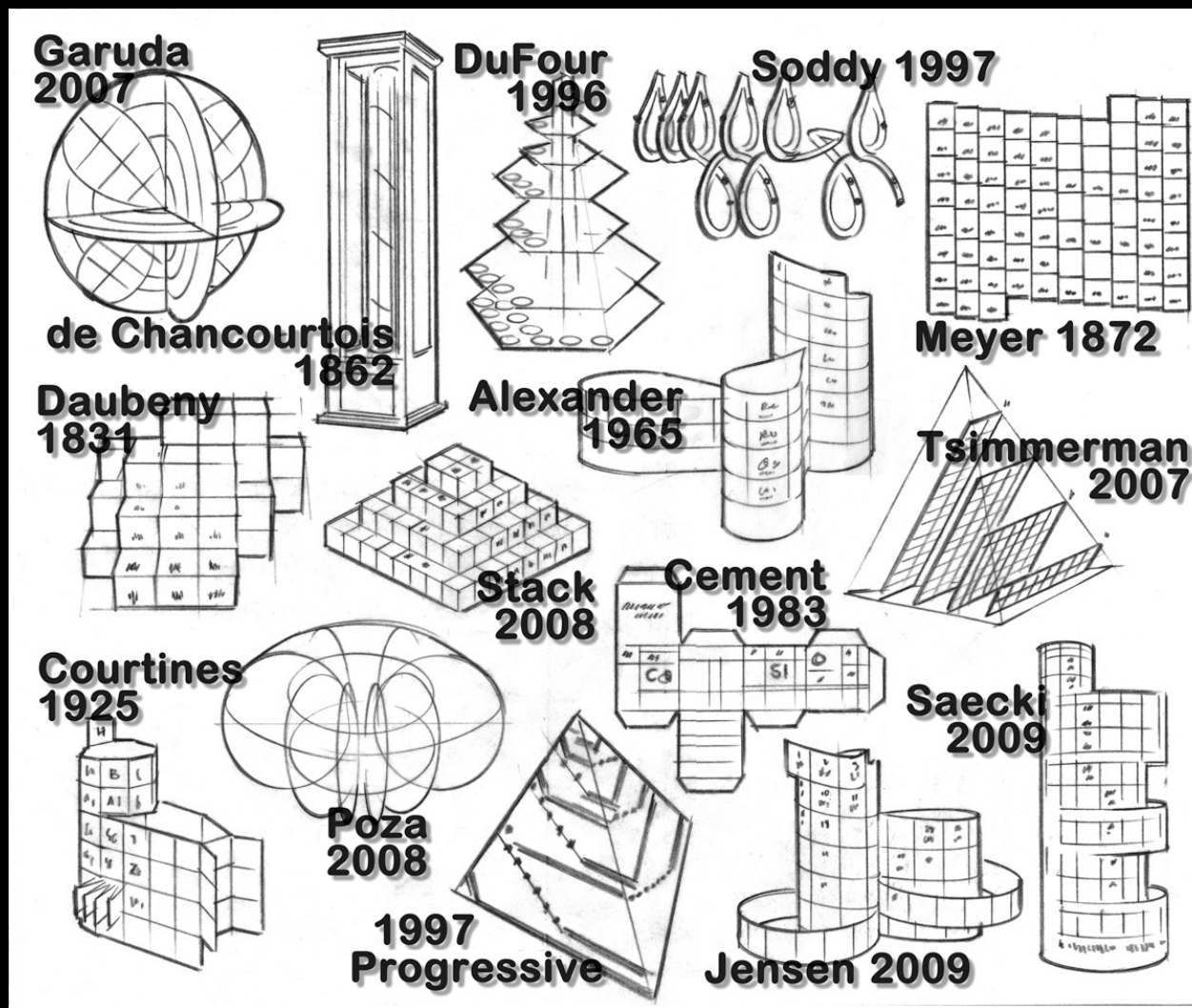




This latest **Alexander Arrangement of Elements** has photos of element simple substances, and thus is forever complete at element 94.

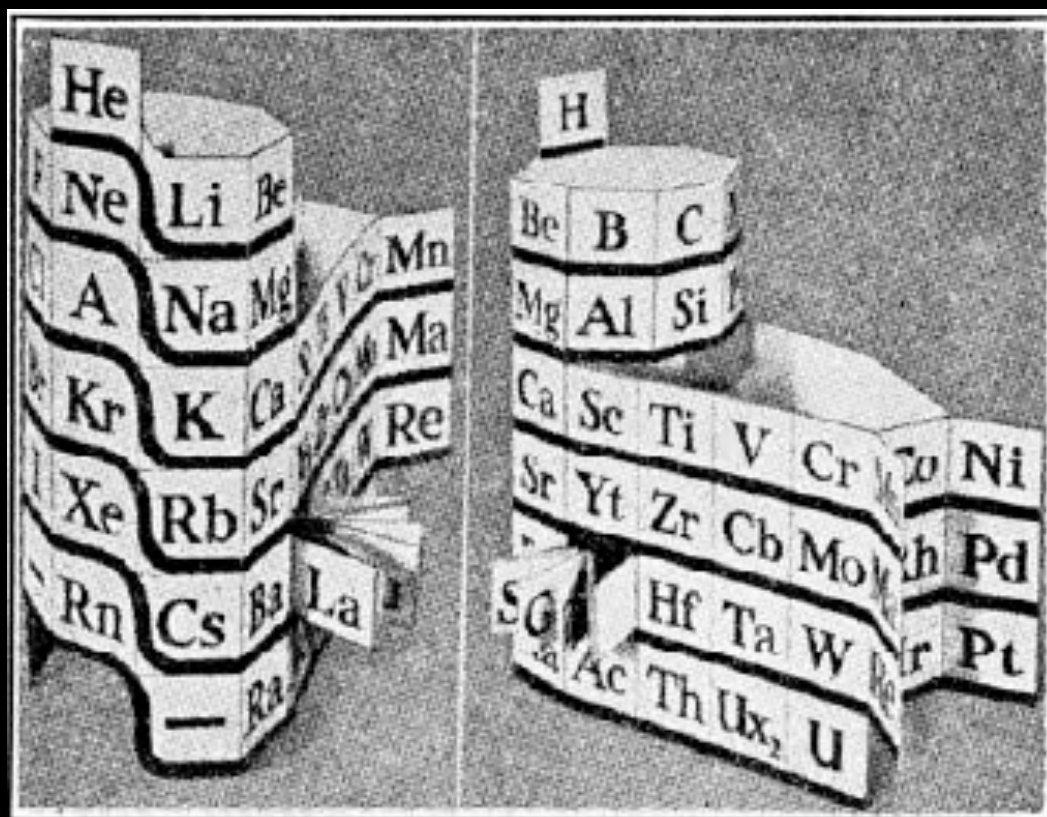


This downslant in the s-block was all that was needed to bring continuity to every element and period - without changing the property columns.

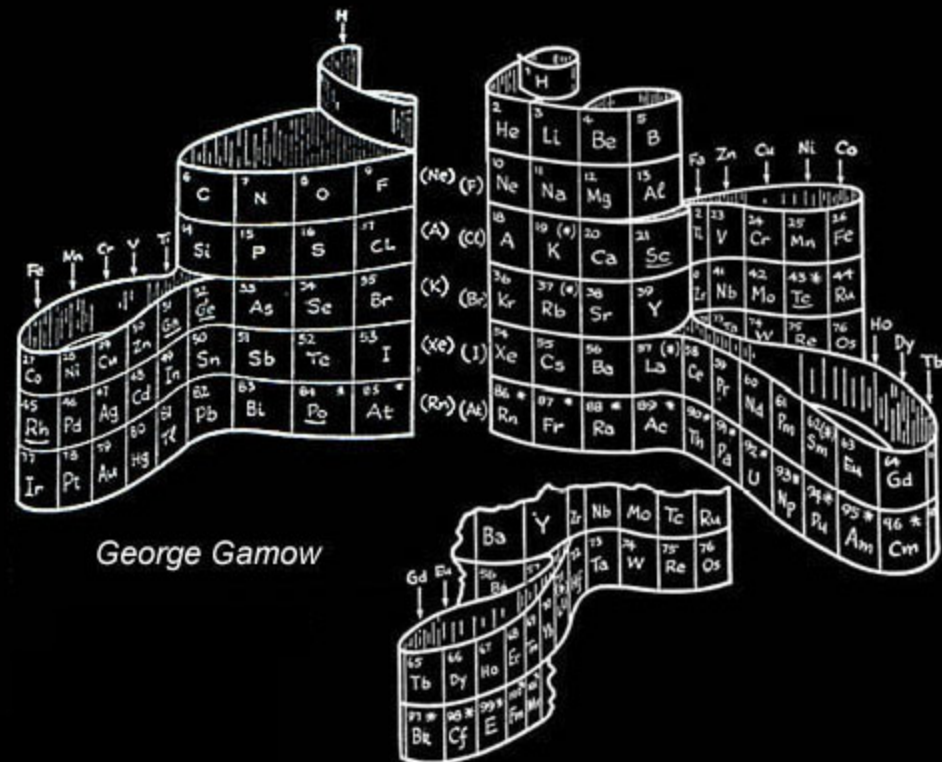
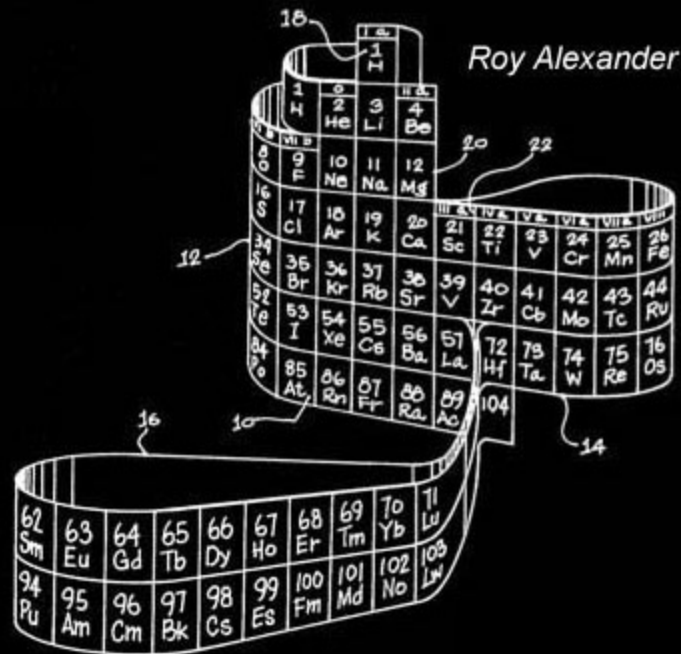


Many other creative 3D periodic tables have been published since de Chancourtois'.





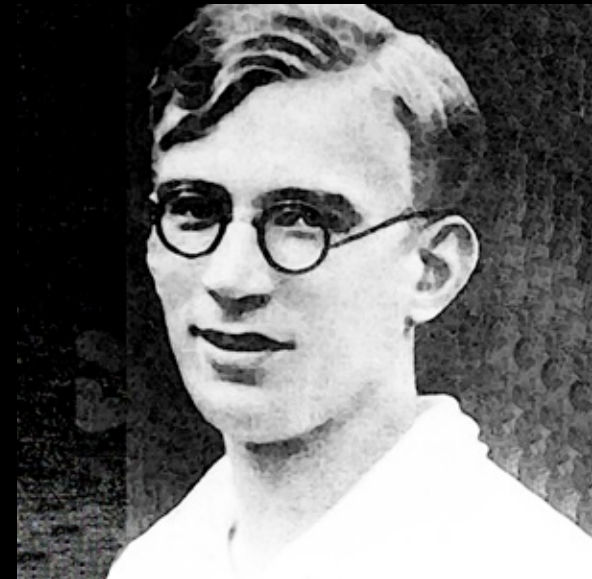
This early table, by **M. Courtines**, was published in a magazine with instructions, as a do-it-yourself project. Note the d-block departure from the main group elements, and accordion-like handling of the Lanthanoids.



Developed and published before Alexander's, **George Gamow's** patent drawing was almost identical to Alexander's, and also used for education, in his Mr. Tompkins series.

**Gamow** also:

- was one of the foremost early advocates of the big-bang theory
- developed first successful explanation of the extremes in the decay rates of radioactive elements
- aided the developers of DNA





During the 20<sup>th</sup> Century the **periodic table of the elements** had attained the perfect logic of a **three-dimensional format**, built on the innovations, inventions, hard work, dedication and brilliance of those before.

**Thanks for watching.**