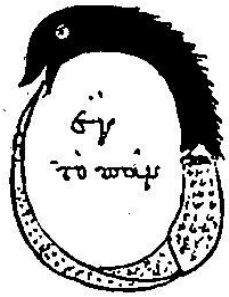
ATUM to ATOM

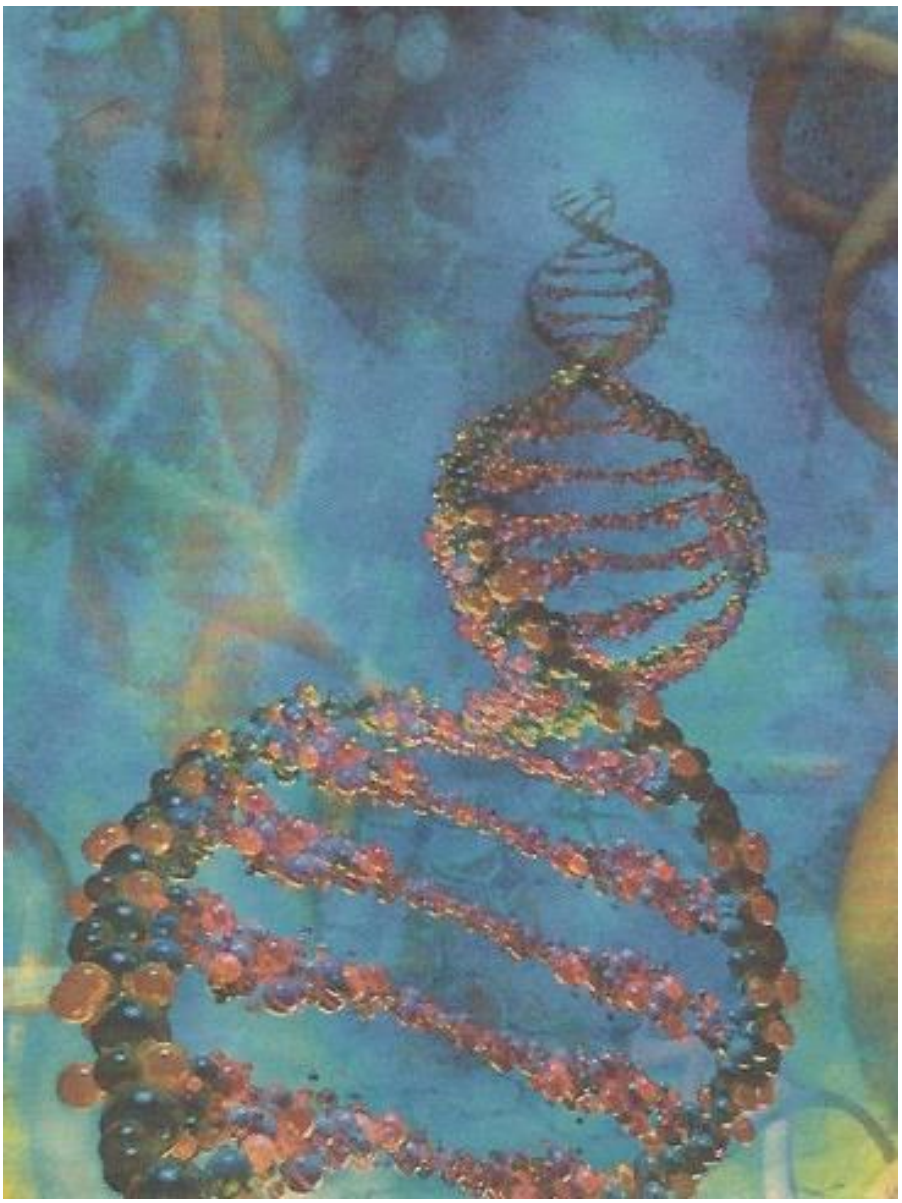
Book 5: Molecules and Three-Dimensional Orchestras

Asia Shepsut



Definition: ATUM is the ancient Egyptian name of the Invisible Divine Power beyond All Gods

2018



Frontispiece: DNA, the Life Molecule

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Suggestions for inclusions, amendments or corrections are welcome, and should be sent to asia@cosmokrator.com. All versions of the Cosmokrator model accompanying the books can be ordered individually from the same address.

Title and Contents pages: The Ouroboros Symbol

The *Ouroboros*, - the snake eating its tail - represents the seamless continuity of the Universe, the reality beyond the illusion of a beginning and an end. In our books it stands for the meeting of Ancient with Modern knowledge, and encapsulates the idea of recurring octaves in cycles – *the one on the title page is taken from an Alexandrian Gnostic manuscript with the Greek inscription 'All is One', whilst that on the Contents Page twists into the symbol for infinity*

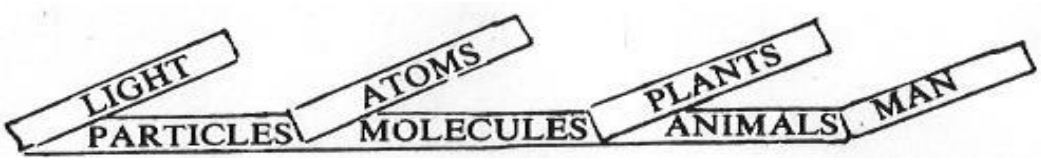
CONTENTS

MOLECULES AND THREE-DIMENSIONAL ORCHESTRAS

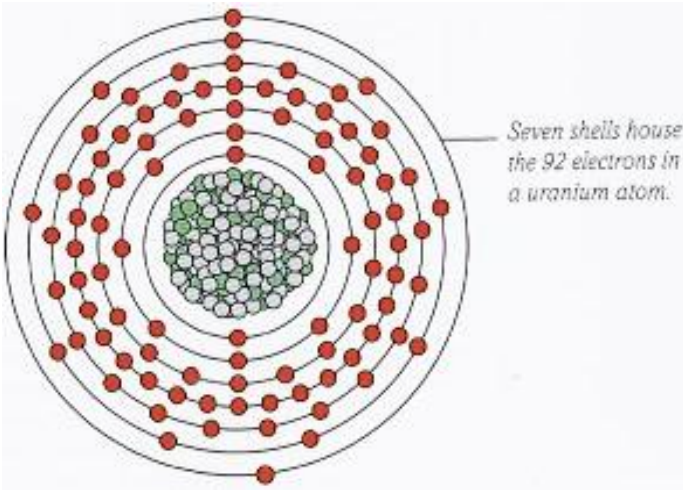
Harmonic Archetypes: The Five Platonic and Thirteen Archimedean Solids

AIMS OF THIS BOOK

We give here the bare bones of the fascinating story of what happens when atoms combine and the three-dimensional material world comes into being - in both natural *and* artificial guises – with recommendations for fuller books to refer to all the way through. Where single atoms are invisible to the naked eye, amassed molecules surround us in plain sight – *every substance is made of molecules* – thus constituting a turning point in the creation of material life on our planet, leading to the development of plants and animals, neatly summed up in this diagram:



In ***Book 3*** we showed that the sequential order of atoms by atomic weight in the Periodic Table is governed by the gradual increase in the number of subatomic particles surrounding the nucleus, positioned in seven surrounding shells of increasing capacity to hold them (see, for instance, the example of Uranium below where all the surrounding orbital spheres are occupied). At rare intervals, however, throughout the Table pairs of atoms next to each other reverse the sequence with each other, for reasons we do not yet understand[1]. Atoms work through the interaction of a core triad of particles: proton, neutron and electron and these along with others, as described in ***Book 3***, occupy a miniature octave of seven keynote sub-particles, all in the end derived from photons (primary light pulses – see diagram above).



The seven electron-occupied shells of Uranium – from Tom Jackson THE PERIODIC TABLE BOOK

When we come to molecules - which are combinations of atoms - the variety of ways in which they can be constituted and interlinked is almost countless, each compound playing a specific role in the fabric of life. If the Elements are like the fixed number of letters in the alphabet of matter, then we could say molecules are the words that can be written with them – while interlinked molecules make whole sentences.

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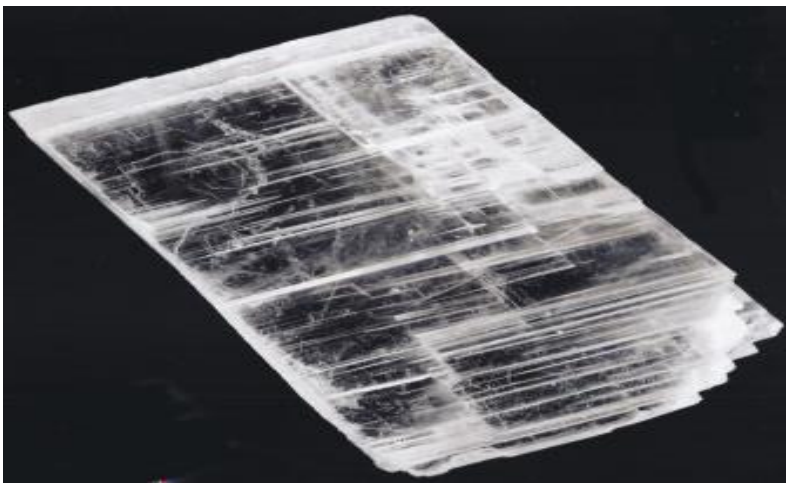
[1] These are Argon-Potassium; Cobalt-Nickel; Iodine-Tellurium and Thorium-Protactinium - and some radioactive pairs among the heavy, man-made Elements – perhaps analogous to the loops made by some planets when retrograde.

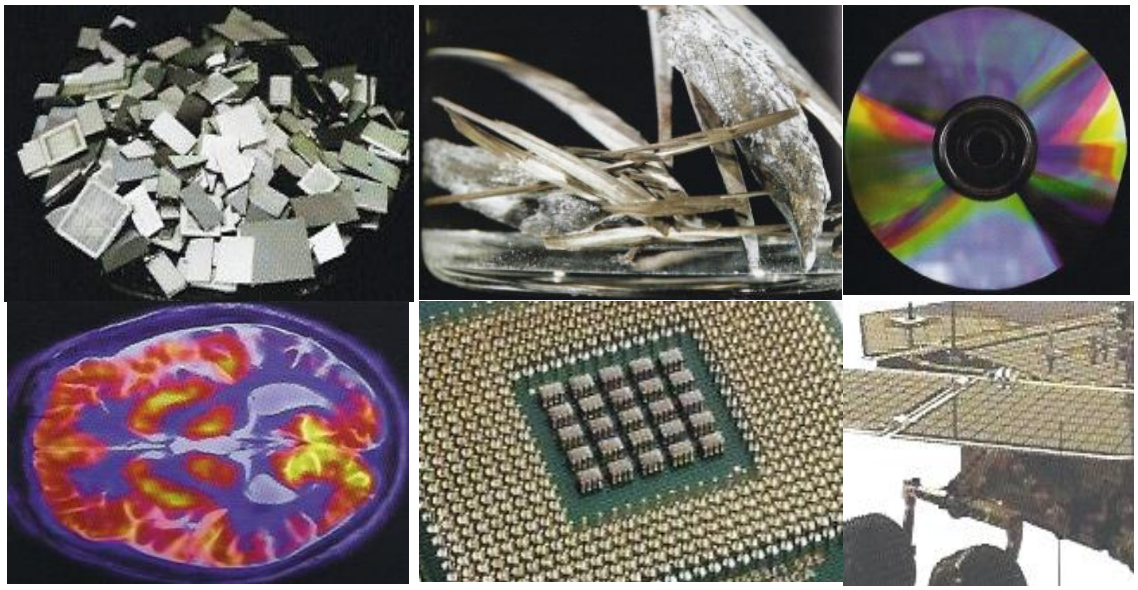


Ill.5- 1: Calcium Sulphate (gypsum)– from Theodore Gray MOLECULES: THE ELEMENTS AND THE ARCHITECTURE OF EVERYTHING [Photos Nick Mann]

It is in the nature of this nano-numbering that we can explain the nature of the music and colour underlying each Element. When combined to form molecules, musical phrases form, sometimes revealing intermediate colours. This is a vast subject, and our aim differs from most other popular publications by trying to characterise the broad framework for that hidden musical order and colour harmony perpetually playing on the molecular world level, seen and heard in heightened states of consciousness by shamans and visionaries.

ELEMENTS ANCIENT AND MODERN

By now the trust people place in the power of specific molecules is as unquestioning as that vested in the healing powers of holy relics in the Middle Ages, and we forget how radically the analysis and use of molecules has rewritten humanity's self-image in every domain of life, from crime detection to food analysis, or medicine to ancestry-tracking. I would like to think that after reading this short booklet you will be better able to match intellectual knowledge about molecules to individual substances you come across in your daily lives, and start becoming more aware of the patterns governing a miniature world whose structures consist of myriads of combinations of specific atoms. Some Elements in molecule form have only recently come into their own: these include (below top row from left to right) Silicon chips used in computers;



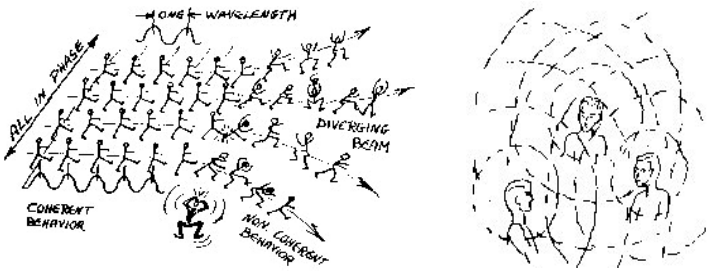
Ill.5- 2: Modern Elements that few people are aware are used in modern daily technology

Strontium used in Sensodyne toothpaste; or Tellurium, the active ingredient of the rewritable data layer on CDs or DVDs (as I name these, try to locate them on the Periodic Table). On the bottom row above left to right we have a brain-scan made possible by radioactive Rubidium (better than X-ray); in the centre is a detail of the electronic components on a microchip using Hafnium (other kinds of circuit board use Ruthenium Dioxide), while on the right we see a section of the solar panels on a Mars explorer robot that are activated by Gallium and Arsenic. Indeed, Iridium[2] content in a particular archaeological stratum turns out to be an indicator of 'the dinosaur destruction level', whilst Indium makes it possible to fix pictures and data on smartphone and TV screens; Selenium is used in office photocopiers; Americium is the active Element in smoke detectors - and Thalium enables the thinning down of what used to be thick glass pebble lenses in spectacles for the badly short-sighted.

At the same time we still need the substances we have long known and taken for granted, such

as - above left to right - Zinc, used to make many DIY materials such as nuts and screws or (in alloy with copper) brass artefacts (cheaper than bronze, an alloy of copper and tin); Chromium (at centre) is used as a harder alternative to silver to plate tools, ornaments and cutlery more cheaply – and was very much the hallmark of the 1950s streamlining of many a flashy Cadillac or Buick; and the active incendiary metal Phosphorus has long been put to use on match-heads (these last-minute inserted images are often uncaptioned, standing outside the illustration number sequence). Even traditional materials find new uses in modern times – like Silver: light-sensitive Silver Nitrate coatings made photography possible, while recently with the gradual failure of anti-biotics, people are going back to Colloidal Silver as a disinfectant, said to be capable of reducing as much as 99.9% of the MRSA bacterium in hospital outbreaks.

How do we make sense of the ordering of all these Elements in their various combinations? From the showers of molecules that exist we cannot possibly discuss them all in every combination – but with the help of other writers we at least try to categorise the main groups



Ill.5- 3: Two sketches by Bentov characterising human interaction in terms of wave fields

[2] As pointed out by Aldersey-Williams, when natural platinum is dissolved in aqua regia, the residue is mostly composed of two different metals: Iridium and Osmium: when Osmiroid pens became popular in the 1970s, their nibs had been hardened with these two metals – and were also used for gramophone needles.

and types in musical order of complexity to draw up a simple beginner's handbook. As a non-scientist I myself have found doing this book useful for gaining a heightened awareness of substances, that open up new worlds for meditation (***Book 12) –*** or provide models for insights into how humans interact rather like molecules – it helps to see integration or non-integration of immigrants in terms of their shapes or valencies! Even a slight awareness of what goes on behind the scenes of the materials we are and use creates a kind of X-ray vision, opening doors to a deeper awareness of why materials behave the way they do and why they hang together within the scheme of things in their particular place – whether it is being more informed about the food and medicines we ingest or material objects we value in daily life – so as to work with, and not against them. This booklet is as much intended for children as for adults, and like the earlier books could serve as a teacher's course plan and/or pupils' text book. Users can amplify its framework by inserting their own pictures, observations and experiences at relevant points.

THE COSMOKRATOR MODELS

Finally, as done so far to accompany the first Cosmokrator books, for use as contemplation *foci* or *aides-mémoires,* we have devised three Cosmokrator models that assign the key Elements on the Periodic Table - and key *groups* of Elements – to the Signs/Planets and their relevant colours/musical notes on each zodiacal facet. I have done the same for molecules, with one model for the twelve most important molecules in our daily life – and another for crystals/semi-precious stones which many will find useful in choosing or making jewellery – or checking birth-stones. I have no doubt readers could come up with their own valid versions of Element and molecule-assigned Cosmokrator models too! While photos of the earliest models I made are pictured on the www.layish.co.uk website under *Zodiac Sculptures,* pictures of the recent ones coming under the subject zones of ***Books 3, 4*** and ***5*** are shown at the end of this book in *Appendix C.* Your own individual version can be commissioned on demand (all are based on the core Cosmokrator model available on www.cosmokrator.com).

PRELUDE: BACK TO THE PERIODIC TABLE

To bring our pursuit of the music of molecules to life, we need to revisit the Periodic Table in more detail than in ***Book 3*** - because the search for the individual Elements that build it was often pursued by dismantling molecules into their separate constituents - whether by freezing or heating, dissolving in water or acid, viewing through the spectroscope or bombarding with atomic particles. As a start, why not go back to the previous paragraphs, and on the Periodic Table given on the next page locate each of the Elements I mention! Despite legendary cooperation, sometimes the intellectual and personal battles between scientists working to understand molecular structures have often been as lethal as jungle warfare, and as Sam Kean puts it so well, in some ways the more recent search for individual substances, undertaken in many different countries over history, almost reads like the account of a big game hunt lasting just under three centuries, with final capture of the trophies completing the eighth row only announced in January 2016 (see *Appendix A* for an account of these last discoveries). Mendeleev's consequent fully completed table comes below (updating the as yet incomplete one given in ***Book 3!***). Compared to the full 118 we now know of, one of the earliest lists of the

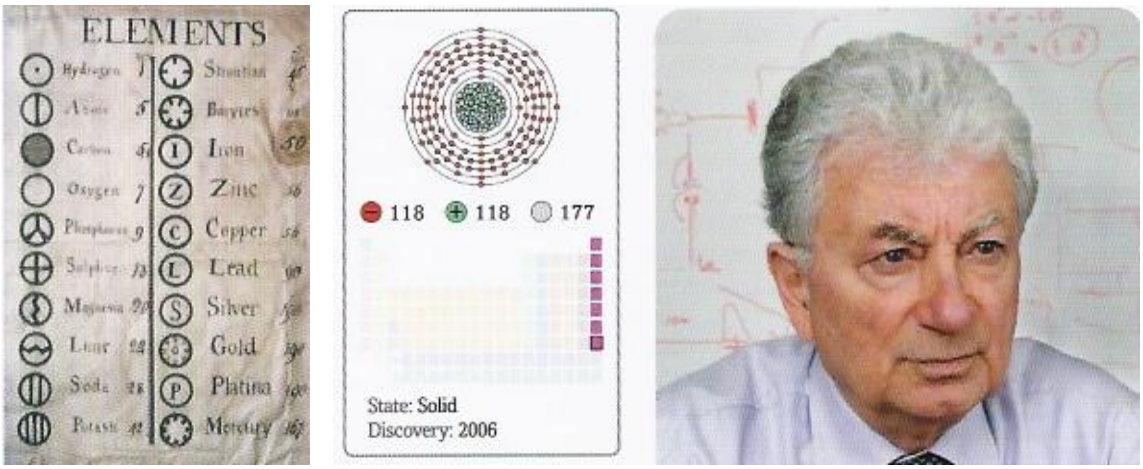
Periodic Table of the Elements

1 1IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9	10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.99	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.789
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [286]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]

Lanthanide Series	57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.243	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.500	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.055	71 Lu Lutetium 174.967
Actinide Series	89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide

first-identified Elements drawn up by Dalton (below left) recorded but a handful, while before that Paracelsus had rated Mercury, Salt and Sulphur as the only primary atoms. The new ones are down mostly to the work of the Russian scientists of Dubna or of Glenn Seaborg and his colleague Albert Ghiorso at Berkeley USA, who between them unravelled much of the radioactive end of the table (these last Elements often with a lifespan of nanoseconds). In fact they extended the sum total of all the Elements by almost one-sixth (Neptunium and Plutonium were discovered during World War II – changing the nature of warfare in the future for ever).



(Left) Dalton's list of the-known Elements of his time, using the then conventional symbols; (centre) Element 118 and its atomic structure, named Oganesson after the leader of the team (right) which discovered it at the Joint Institute for Nuclear Research in Dubna, Russia

This is why it pays dividends in greater understanding if you, the reader, constantly 'touch base' with the Table to activate a larger number Elements in your mind than the usual familiar ones, as if incorporating all the notes of a Bach fugue in your brain properly. Rather than use the tome used by professional scientists, ***The Handbook of Chemistry and Physics,*** to do this painlessly I turned to three popular writers to get a grip on this game hunt - worth reading before or after this booklet. Thus John Buckingham in ***Chasing the Molecule*** is strongest on the earliest chemists, their experiments and rivalries – which we will refer to in the early pages. Sam Kean's ***The Disappearing Spoon*** takes a vivid journey through the Periodic Table, likening its layout to a map of the United States and giving accounts of individual groupings of Elements that came to light at different times in history, really helping the newcomer to navigate this modern icon of the universe through intelligible clusters, always with insights about the lives of the researchers involved and inside stories on some of the newest Elements.

The discovery of some revolve around scientific centres of excellence like The Royal Society in London, the Academy in Paris or Berkeley University, San Francisco; others highlight rivalries between Sweden, the USA and Russia before and during the Cold War; some are closely bound up with the involvement of science in the world wars both for good and for bad, highlighting issues around nuclear and chemical weapons (including poisons) that are still live today; further single discoveries are linked to particular individuals and named after them, whether well-known or obscure, including a handful of women shamefully overlooked - apart from the lone career of Marie Curie. The balance is rectified in recent accounts in which several unnoticed women are brought to the fore. Kean describes the shabby way some were treated (often

unpaid or not deemed to be part of the team) – one such overlooked until now is Marguerite Perey who discovered Francium in 1939 when she observed how Actinium broke down into Thorium and a new, radioactive Element that she named after her country, France. The Element is so rare that it is calculated there is only an ounce of it in the rocks of the entire planet, and it has no known use other than to fill up its spot on the Periodic Table. Meitner was refused a laboratory because she was a woman, though in the end Meitnerium was named after her (locate these now!). More women are known from the world of *molecular* research – the most heroic being Frances Kelsey, whose painstaking analysis of Thalidomide enabled the banning of the drug before its distribution in the US, saving thousands of children from potential deformity (caused, Kean says, because the wrong-handed version of the molecule for morning sickness, not separated from its curative, left-handed double, cancelled it out). This raises the topic of chiral drugs, the one synthesised by William Knowles at Monsanto using Rhodium as catalyst being L-Dopa, whose left-handed molecule miraculously brought catatonics back to life (we will find in our account of DNA just how crucial spirality in molecules is). Kelsey's story is given in Simon Cotton's ***Every Molecule Tells a Story*** , best read fully at a technically higher stage later: only using diagrammatic formulae, it is readable and informative.

But back to the Periodic Table to carve out more groupings from my three *vade mecum* books.

ELEMENT CLUSTERS AND COLOURS

Where most of us might start out after our school chemistry lessons only familiar (in Kean's visualisation) with the core Elements on the Great Plains zone covering the top centre of the Table, he starts out with a meeting between Elements on the east and west coasts, as it were, separated by the Noble Gases and topped by the watchtowers of Hydrogen and Helium. He then pursues the highways and byways of particular mountain ranges or underground rivers (such as the Actinides and Lanthanides, which we have to imagine as running at right-angles to the main table, slotted in at the empty pink squares on rows 6 and 7). Right at the end of his book he expresses an interest in alternative arrangements of the Periodic Table as ***Book 3*** did.

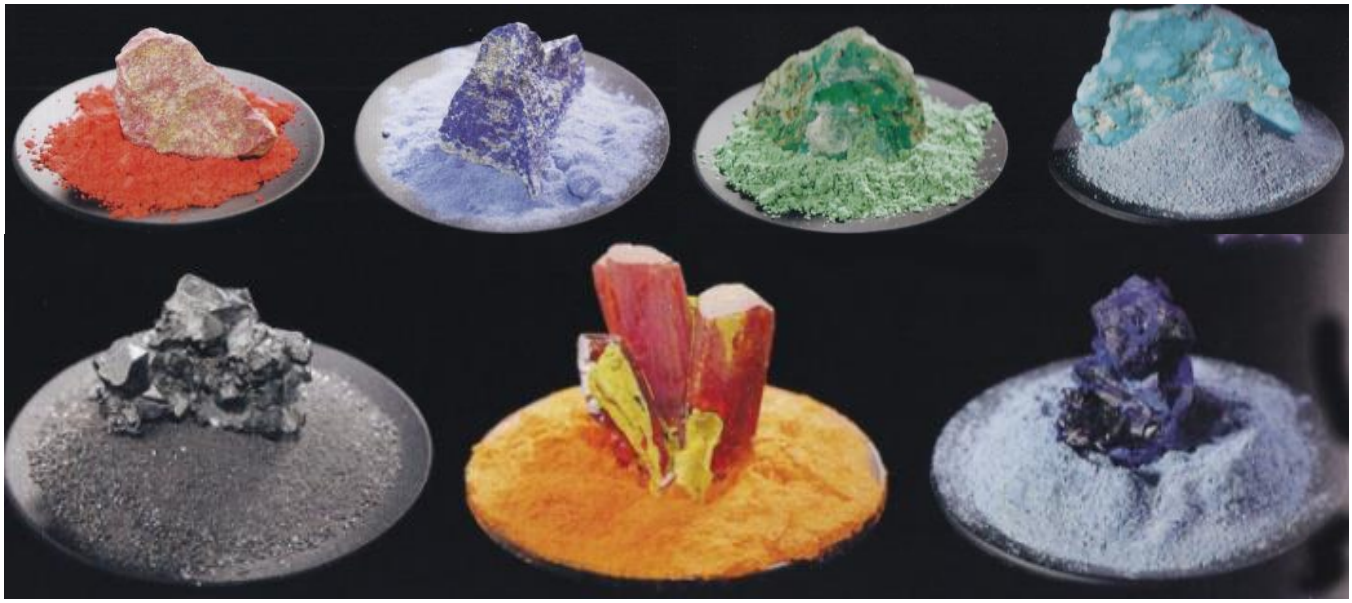
At first sight the majority of the Elements in crystalline form - all technically 'metals' - look dull and grey (see Gray-Mann's amazing photographic version of the Table). Thus, aside from use in ancient eye makeup, in alchemy grey Antimony (below) was understood when boiled down in the retort as being the stage of *negrido* (blackness) immediately preceding its dramatic trans-

Ill.5- 4: Star Antimony

formation into Gold - an experiment once attempted by Newton. Despite the fact it would never change into Gold in that way (we now know it could do so in certain successive processes of

Outer Space), at least Star (or Regulus) Antimony (above, today called Stibnite) - grey like the other metals –promises stellar transformation by the angular manner of its crystallisation!

Nonetheless, here and there on the Table particular outcrops of Elements in fact sequester a host of bright colours (which can simply be put down to their subatomic structure), often only brought out in certain molecular combinations – an angle we particularly enshrine on a Cosmokrator model based on our final pages considering jewellery stones and crystals. Colours also appear in paint and dye pigment molecules, firework chemicals – as also public (or advertising) gas lighting using the inert Noble Gases, that can be lit up in colours by electricity).



Ill.5- 5: Permanent artists' pigments are powdered metallic ores (organic pigments fade over time), their atomic and molecular structure determining colour (top left to right, from Gray & Mann) cinnabar, lapis lazuli, malachite and turquoise; (bottom left to right) galena, realgar and azurite (their formulae are given in table below)

CINNABAR[3]	*(Vermilion) Mercuric sulphide (HgS)*
LAPIS LAZULI	*(Ultramarine) A contact metamorphosed limestone, its blueness arising from the complex molecule lazurite* $(Na,Ca)_8(Al,Si)_{12}O_{24}(S,SO_4)$
MALACHITE	*Copper carbonate hydroxide* $(CuCo_3(OH)_2)$
TURQUOISE	*A phosphate of copper and aluminium* $(CuAl_6(PO_4)_4(OH_8.5H_2O)$
GALENA	*Lead sulphide (PbS)*
REALGAR	*Arsenic sulphide (AsS)*
AZURITE	*Copper carbonate* $(Cu_3(CO_3)_2(OH)_2)$

In the third popular book I have turned to, Hugh Aldersey-Williams' personal pilgrimage through other sets of molecules and their constituent Elements is entertainingly presented in his ***Periodic Tales,*** helping the reader to get a grasp of some of the more rarefied Elements that hardly ever crop up in regular parlance, yet are unobtrusively present in every aspect of our newly extended way of life. With the aim of building up his personal collection of Elements

[3] The formulae for these pigments have been looked up in W R Hamilton, A R Woolley and D A C Bishop ***The Country Life Guide to Minerals, Rocks and Fossils*** Feltham 1974 and reprints. Good pictures of them all can be seen there, as also in W Schumann ***Stones and Minerals of the World*** New York 1972 and reprints.

at a more moderate level than Theodore Gray did, the account of Aldersey-Williams' pilgrimage to Sweden to the village of Ytterby and its fluorspar mine, found to contain in one place almost the entire sub-octave of the colourful Lanthanides, has at last brought that line of Elements to life for me. Being so closely related to each other, they run into each other like atomic Russian dolls and can barely be separated from each other for more than a few seconds. Yet in the cases of Neodymium (for powerful lasers); Samarium for miniaturised loudspeakers in personal

Ill.5- 6: Yttrium – spiked with Neodymium it produces the most powerful laser beams

stereos, or Gadolinium (perfect for magnetic resonance imaging in MRI scans and magnetic recording discs and tape), several of these individually are vital ingredients for new processes we now use in everyday life (please look for them on the Table now!). On a different tack later in his book, he describes the experiment done for fun by two Dutch chemists at the University of Utrecht on some Euro bank notes by shining ultraviolet light on them and through spectroscopy recording the colours emitted from the inks. He goes on, 'From this they were able to declare that the red light was due to ions of the rare earth element Europium bound in a complex with two acetone-like molecules. They were less sure about the other colours but speculated that the green might be due to even more elaborate ions involving Europium combined with Strontium, Gallium and Sulphur, and the blue to a Europium complex with Barium and Aluminium Oxides'. Then for fear of breaking the law, they took it no further!

EARTH, PLANETS AND METALS

Kean also reminds us that Elements 3-26 (Lithium to Iron) is the sequence found in most stellar material when stars form – and that Elements beyond that point will simply emerge in the stuff of Outer Space in due sequence (as on the Periodic Table, in Atomic Number order) in other processes that bring about the almost inevitable natural unfolding of one Element out of the next (formerly attempted so laboriously by the alchemists). This means the Periodic Table is a picture of the Universe, and as much an Outer Space Icon as it is a Pan-Earth Icon (see the final two images of this book). We have to thank Fred Hoyle for being amongst the first to push the idea that matter is made up of the same stuff everywhere (and that even bacteria may initially have entered Earth via interaction of the Solar System with the universe beyond - Crick himself sees DNA as an extraterrestrial visitor to Earth through 'directed panspermia'[4])! Beyond Lead, the heavier the Element is, the more radioactive it becomes, subject to fusion, fission or radioactive decay - yet Lead can be used to store radioactive material, at its position on the Table turning out to be a totally inert barrier able to protect against the harmful emissions of its successors, much as Saturn is the wall between the traditional Seven Planets and those beyond.

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[4] Francis Crick ***Life Itself: its Origin and Nature*** London 1981 - to him the heated soup idea was outdated.

Kean describes how certain Elements are linked to particular geographies on the Earth, and often associated with dire events at certain times in history – thus Tungsten (W) is almost only available in Portugal and was particularly sought by the Nazis - while Tantalum and Niobium, vital ingredients in cell phone manufacture, are extracted from the river muds of the Central African Republic of Congo - for which prize the locals are prepared to kill or die (Tin is also plentiful there and a key source of funding for the endless civil wars in Central Africa).

With several Elements using the names of the Greek Gods/Planets of the solar system (a convention beginning at a time when gentlemen scientist-philosophers had been brought up on the Classics), more recently named outer planets like Pluto or Neptune have been aptly applied to radioactive Elements, though running out of these they are now more often named after countries or individuals. We have to remind ourselves that although in the ancient world Silver was analogous to the Moon, there is no Silver on that planet, nor is there Gold on the Sun as such (or Tin on Jupiter) – yet that core tradition of metallic analogy with the *power order* of the planets still stands up in spiritual symbolism today, notably as applied in heraldry and astrology.

CHANGES OF STATE

Along with stellar connections we have to ponder the matter of changes of state – some Elements separately or in molecule combinations can exist in gas, solid and/or liquid forms, sometimes behaving so differently at extreme temperatures that they become superconductors with no electrical resistance: thus Maglev trains are held just over the rail lines by superconducting Niobium-Titanium (NbTi) electromagnets because superconductors at the right temperature are not subject to gravity (and even flow upwards). Semi-conductors such as Silicon or Germanium vied with each other in enabling the revolutionary transistor that made manageably sized computers - or hand-held Walkmans and pocket radios. Since Silicon Dioxide is the most common mineral on earth (the main constituent of sand and quartz, from which also glass is made) it means the cost of materials is not a problem at all – in the same way that the combination of common Nitrogen and Hydrogen easily forms cheap fertilizers (unfortunately adaptable to make explosives and poisons by rogue members of the public). The best example of changes of state dependent on temperature is, of course, Water, and we know gases like Helium or Oxygen are better stored in liquid form. Mercury has the merit of being the only naturally liquid metal at room temperature, where other metals have to be kept in water or in strong glass vacuums to avoid bursting into flames on contact with air – or water. We can consider the radioactive Elements as a different order of change of state from gas, solid or liquid, beginning at a very definite point in the unfolding of the Periodic Table with Plutonium.

MOLECULE REPRESENTATION

The books we refer you to use different conventions to describe molecules apart from their formulae just using letters. If not amenable to photography (this applies particularly to radioactive Elements of course), either flat linear structures using the Periodic Table abbreviation letters at the junction points are used, or photographs of rod and ball constructions if their architecture is particularly three-dimensional. In this book we use all three, hoping our rain-checks on individual examples in one way or another are adequate enough to lead you on to build on them and pursue the full complement from other, more

specialist books (further titles are given in the Bibliography at the end). John Emsley goes further than Simon Cotton: despite fascinating information, astonishingly he gets away without a single illustration or diagram in his ***Molecules at an Exhibition***, while the mathematical detail supplied in Mark Ladd's ***Symmetry of Crystals and Molecules*** - despite some sparse references to the Platonic Solids - is indigestible for the general reader, who emerges still no better equipped to see the wood for the trees.

INTRODUCTION

Our Prelude was by way of saying that it is worth touching base in one way or another with the Periodic Table overall (according to your particular interests) before setting out on the quest this particular booklet has set itself in line with preceding Cosmokrator books. In fact, Kean tells us that one individual, John Newlands, early on in 1865 did try to classify the seven columns of the then known Elements according to the notes of the octave (the Noble Gases had not yet been discovered), but when he presented his theory he was derided by the members of the then Chemical Society of London (later Royal). However, since then there has always been a minority of writers who have tried to assess the genesis of substance in this light, and we will describe the work of pioneers and current writers who gradually improved on this approach - simply developing one valid perspective that clarifies the subject and filling out the picture more conclusively as fuller information emerged to establish the Periodic Table's actual content.

Even more than for atoms, the supposition that harmonic laws are at work in molecules in musical terms is not assumed by the average scientist, even though they are aware of the formulae which constrain the ways in which atoms behave and combine. Many are blinkered by their own specialisation to the idea that all molecular behaviour might be governed by an overall law of harmonics, the very overview the ordinary intelligent person seeks amid the Hydra-like sprouting of the subject in so many directions. The person who still thinks of all the subjects of their school curriculum as pursuable in parallel is shocked by the disjunctions caused to a harmonious world picture by specialists who cannot see how the information they know meshes into a complete world view, instead recasting the world to the limitations of their particular specialism (think Richard Dawkins). A key error in thinking, even amongst highly intelligent people, is an astonishing inability to understand the universe at different levels. There is no point in studying separate subjects unless in the end they play their own part in a unified cosmology - a difficulty foreseen by J C Bose, the great Indian physicist who at the turn of the century initially encountered hostility because of his broad view of things: 'This great abode of nature is built up of many wings, each with its own portal… and each comes to think that his own special domain can remain untouched by the others… We must, however, remember that all enquiries have, as their goal, the attainment of knowledge in its entirety'. With Bose's attitude in mind, by following in the footsteps of early pioneers seeking a grasp of the principles behind molecules in musical terms we explore this truth simply by looking for any recurring patterns of Number, Colour and Music that show up. But of course we still need to rely on the work of scientists who do not particularly like this approach!

To find the harmonic rationale behind molecules is in several ways going to be harder than it has been for atoms, even if they are larger in size and within closer reach of the senses. This is because where the general reader might have barely gone beyond O Level physics and chemistry, few scientists studying molecules in depth from a restricted point of view have the Pythagorean sense of harmonic unfolding or of the hierarchy of octaves at work in the Creation (though there are several notable exceptions). It may appear the 'wrong people' write general books about harmonics and molecules since the 'intuitive amateurs' are scorned by the professionals who have done the real donkey work in the laboratory in analysing the materials first-hand. Yet if the latter cannot pull their material into an overview, the former can at least use the scientists' work to make a first attempt at shedding light on the bigger picture they know must be there, in the hope others better informed will emerge to make a better job of it.

Ill.5- 7: Three Neolithic hand-held granite balls in the British Museum (photos author)[5], and a Roman bronze dodecahedron (literally 'with knobs on') also in the British Museum

So, very much aware of our own inadequacies, we conduct our enquiry in cautious stages, hoping to arrive at an overview of the molecular world that can in time be validated by those who know the whole field of molecules in professional detail as well. It is surely ironic that the Holy Grail for scientists today is to find a *Theory of Everything* – but only in terms of physics - meaning they cannot fully relate all other subjects to it. Strange so few see the theory already exists in the structure of music!

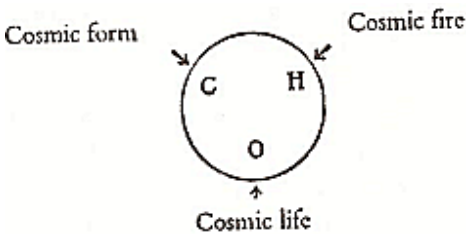
First and foremost our aim is to help you develop the habit of picking out the basic underlying musical patterns in the molecules that hold the world together. We will give most attention to the first five molecular notes making up the Grand Octave, with just thumbnail outlines of the last two to hold over for deeper inspection in **Book 6** where it is more appropriate to watch their operation in animal flesh. Even in concentrating on the first five major notes of molecule development it is a mistake to study them like objects outside us, since at the end of the day we have to realise they are *in* us as much as we are in *them* (more on this when we get to our

[5] Their full significance is discussed in Keith Critchlow's ***Time Stands Still*** 1982

climax at DNA - at the last note of the octave). Variant, dissonant and half-way forms are part of the story since there is a constant process of transformation from one form to another as they slide into each other's structures. We will not be able to look in depth into the radioactive end of the molecule spectrum, however, which in itself is a huge field on a higher Octave.

ORGANIC -V- INORGANIC MOLECULES IN THE FIRST DIAPASON

Our main focus is to start simply, with descriptions of those molecules that form the basis of our everyday lives – then it is easy to see how jumps in their structure constitute a new 'note'. Inorganic chemistry covers molecules made up of the Elements of the Periodic Table. Where it is easy to assess inanimate substances against their harmonic blueprints (we laid down the musical and geometric principles for spotting these in ***Books 1, 2*** and ***3***), there is a turning point in molecular interaction that leads to the development of living entities that are born, live and die – occurring when inanimate molecules become *organic*. Such a process began with algae (below right) in seashore rock pools stewing in sunshine over millions of years until they generated enough Oxygen to support the genesis of higher forms of life in the next stage of development. This *organic* molecular world simply consists of countless variations on Carbon, Hydrogen and Oxygen structures - summed up in ***Ill. 4-33*** in ***Book 4*** on Plants, repeated below left - making plant life possible, and then making possible the complex structures of the animal world. Nigel Hawkes in ***The Times*** of 26-8-1996 described 'a strange organism living in extreme conditions at the bottom of the sea' (*Methanococcus jannaschii)* which grows without



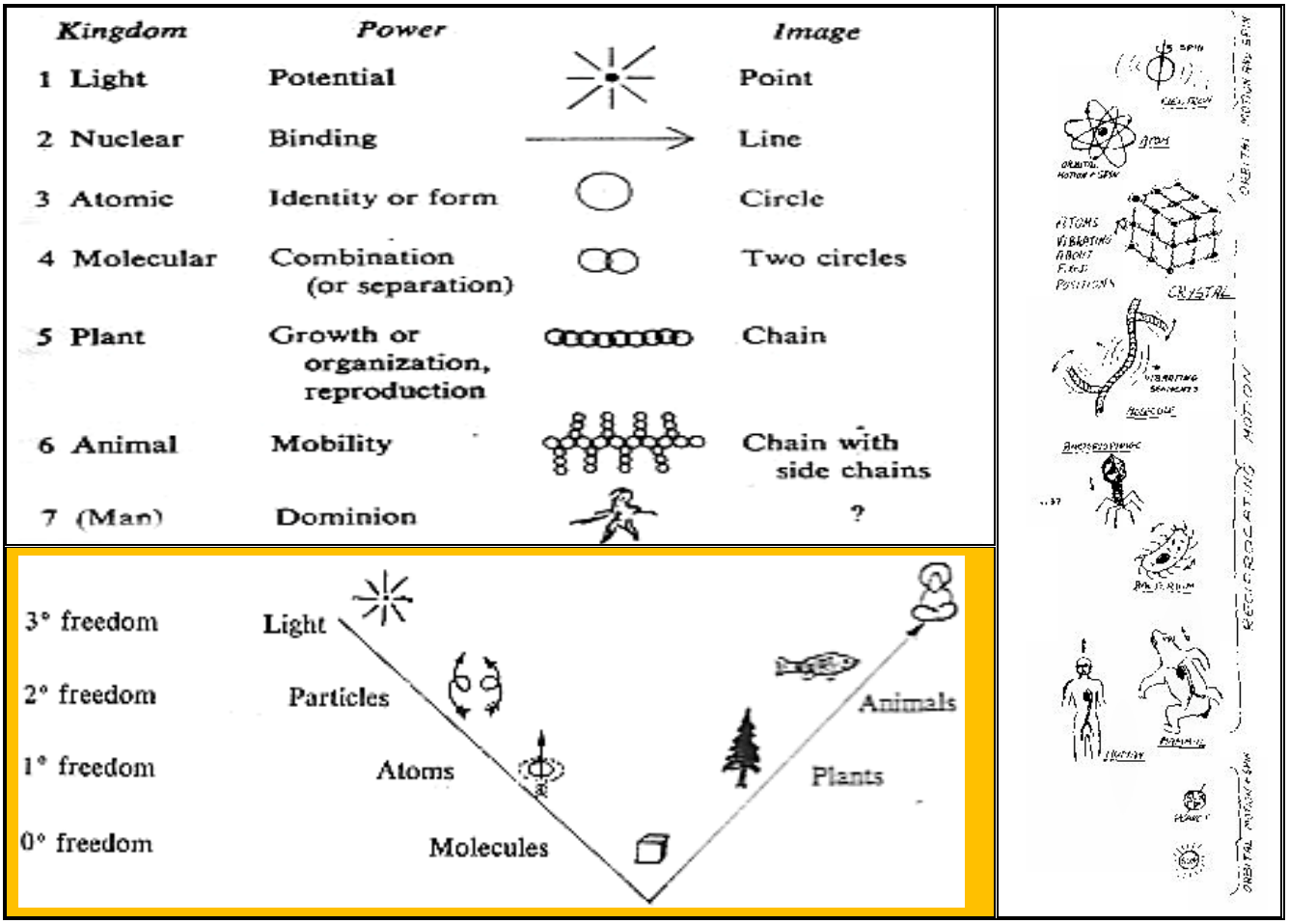
Ill.5- 8: (Left) Organic life is founded on the three Elements of Carbon, Hydrogen and Oxygen – from Hauschka; (right) Cyanobacteria were instrumental in creating the planet's atmosphere through photosynthesis – photo Steve Gschmeissner National Geographic 125th Anniversary edition January 2013

Oxygen and - although a bacterium along the lines of the simple one shown above (categorised as a prokaryote) – 'showing a surprising amount in common with human beings' (which belong to the eukaryote molecular class) since even at this early stage the genes that control the organism's DNA information system are ancestral to the eukaryotes group (analysis of its genome showed up its parallels with higher life forms). How many genes are required before a living molecule can be generated, you might ask. *Methanococcus jannaschii* was found to have 1784 genes whereas *Mycoplasma genitalum* 'gets by on only 468'. By comparison with other simple organisms it was found (according to ***The Times*** of 23-9-1996) that '256 genes are close to the minimum set necessary and sufficient to sustain the existence of a modern-type cell'. It had already been estimated that 250-ish was the ball-park figure for the number of genes required to tip the balance towards 'life' - which number as we know from our earlier Cosmokrator books is the harmonic (256hz) for Middle C. Its transitional stage was well described by Nigel Hawkes (again in ***The Times*** of 3-7-1995), whereby life began in a 'primitive mixture of hydrogen, ammonia, methane and other simple chemicals exposed to light

and ultraviolet radiation'. Scientists found that the development initially of RNA within this soup was the key: 'Along the edges of evaporating lagoons or in pools on drying beaches, they imagine the formation of pools containing strong solutions of urea. In these pools they show both cytosine and uracil would have been formed in plentiful amounts' (in Kean's opinion probably protected by the bubbles created in that process) - then somewhere along the line the transition occurred from RNA to DNA (***Ill.5- 96*** shows how these two amino acids feature in the complex RNA and DNA molecules at *Note 7* of the *Grand Molecule Octave*). These newspaper snippets taken together give in a nutshell of the full diapason of the molecular octave we will seek to characterise, involving very simple step changes in structural complexity between Middle C and Top C, straightforward to understand. So let us begin at the beginning.

THE OCTAVE OF LIFE AND THE GRAND MOLECULAR OCTAVE WITHIN IT

Arthur M Young in ***The Reflexive Universe*** when considering that journey from photon to subatomic particle to atom to molecule, points out in two diagrams (below left) that at each jump onwards, matter moves at a different degree of freedom, with the molecule at stage 4 at the greatest level of complexity where, although spelling out specific 'words' with combined atoms, they pay the price by the greatest loss of flexibility or movement. They are so enchained that either they are immobile in crystalline form, or locked into some higher organism.



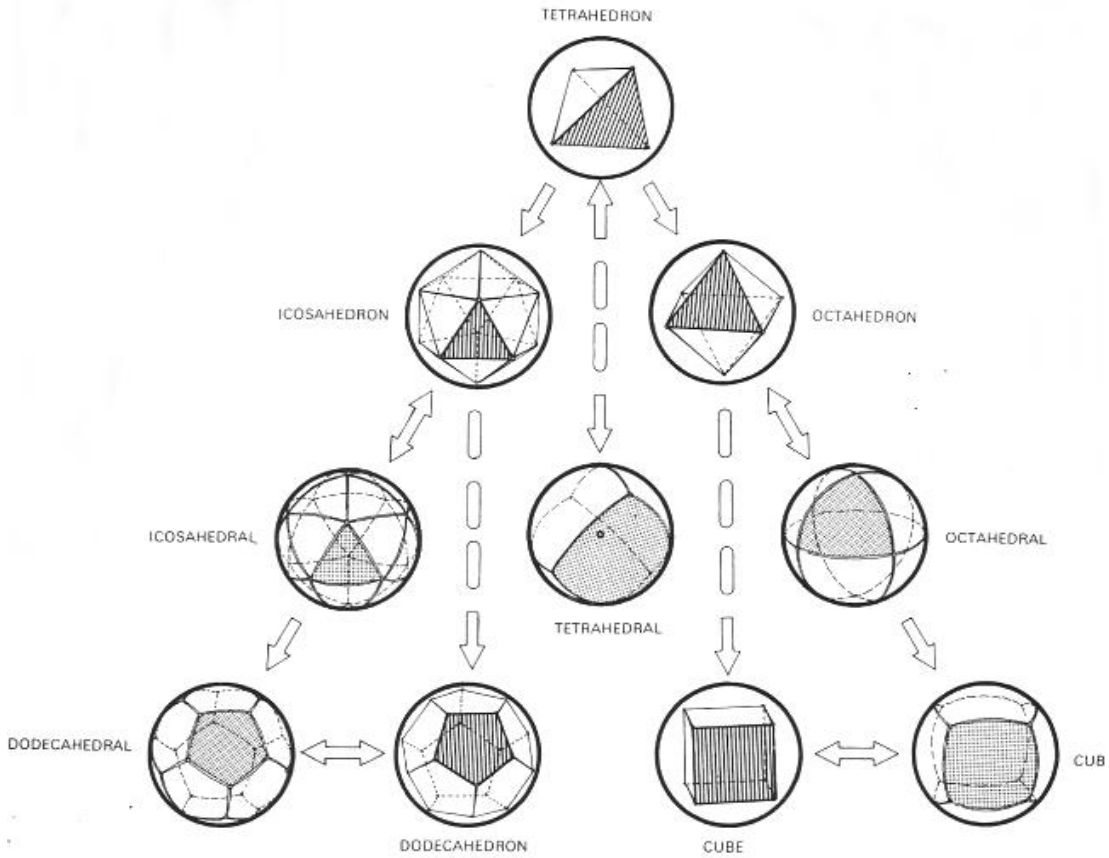
Ill.5- 9: (Top left) The Seven Levels of Creation according to Arthur M Young (see the fuller version, Ill.5- 30: Young's filled out scheme for each note of the Octave of the Creation of the Universe as roughly sketched in Ill.5- 9(below left) gives an alternative view of the journey as descent and ascent, with the turning point at the Molecule level of least freedom after which movement is regained in plants, animals and mankind (compare Bentov's similar sketchy progression on the right)

But then the incorporation of higher molecules into plants and living flesh gives back some movement to the world of molecules - such that Young saw the entire molecular domain as standing at the fulcrum between the optimum descent of musical principles into matter – and the start of an ascent involving a mysterious evolution that leads through plants, animals and Man at Note 7 on to a higher (we might say more radioactive or Spiritual) Octave.

BLUEPRINTS FOR ORDER: THE PLATONIC SOLIDS

It is interesting to ponder that Plato in his ***Timaeus*** describes the building blocks of the cosmos as groups of numeric and geometric principles that can be expressed mentally in terms of the Five Platonic Solids, their simple shapes determining interchangeability of parts throughout the Universe. He saw each solid as the embodiment of one of the Five Cosmic Elements – a first attempt at categorising substance:

Fire	Tetrahedron
Earth	Cube
Air	Octahedron
Water	Icosahedron
Aether/Space	Dodecahedron

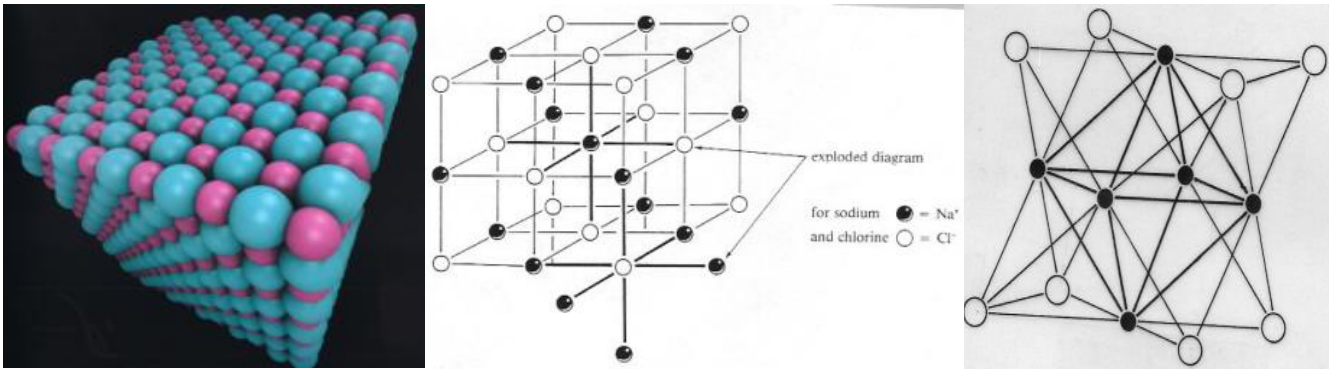


Ill.5- 10: The five regular Platonic Solids and their spherical versions

The Platonic Solids show the three-dimensional interplay between laws of 3 (the triangle), laws of 4 (the square) and laws of 5 (the pentagon) which can be applied to our understanding of molecules. The regular solids are so called because each is made of the same geometric shape all round –making up a three-dimensional model - while each can fit inside or contain a sphere (see diagram below). It is astonishing that as far back as the 4-3rd Millennium BC, Neolithic

Man in Aberdeenshire was already fashioning spherical versions of the Platonic Solids out of *solid granite* (see the three examples on display in the British Museum in ***Ill.5- 7***). The Sphere is the supreme Platonic body expressing perfection, being the same from its central point in any direction. It must be precisely the right size for any solid to nestle inside it with points touching its outer surface - or outside with facets touching - so it is not easy to test this out physically (which makes the Neolithic balls all the more amazing in that they are sophisticated spherical versions of the Platonic Solids, along with others).

The Five Platonic Solids are the only possible regular solids there are, meaning the Cosmic Law of Everything is really simple, allowing myriads of variant forms to be deployed from them in the symphonic molecular world. By keeping in mind the archetypes of the Platonic Solids it is not difficult to cope with the extraordinary variations found in the forms of actual substances, if viewed as visual music. In the introductory books the Platonic Solids were merely theoretical but here they come in as blueprints in the Universal Mind, the molecules even adopting their pure forms in many cases - the best-known being the cubic arrangement of common table salt,



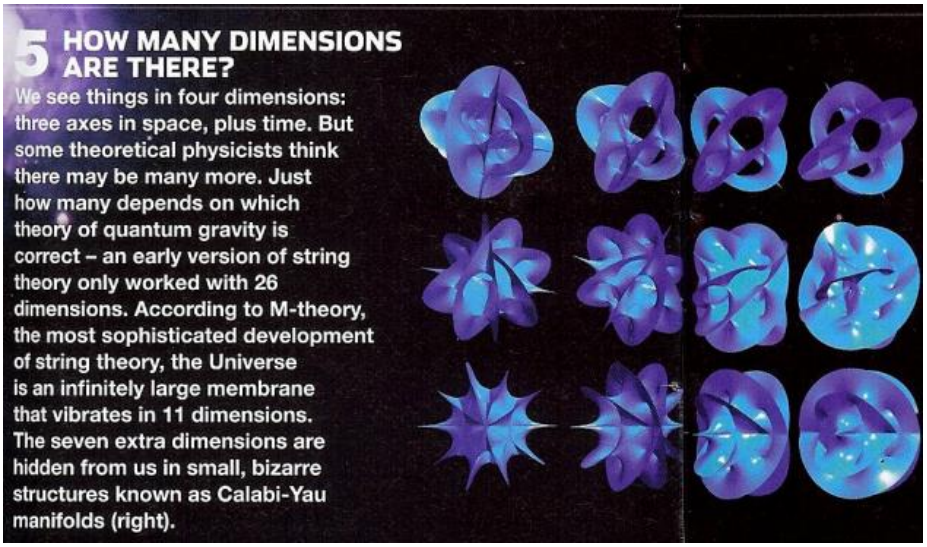
Ill.5- 11: Model of the sodium and chlorine atoms in rock salt (Sodium Chloride) - and (centre) lattice showing how it repeats; (right) the cube-octahedron dual

Sodium Chloride ($Na(H_2O)_8$, above). In fact, as salt crystallises it moves from an octahedral to its cubic formation, the cube being the *dual* of the octahedron. Similarly the icosahedron is the dual of the dodecahedron (the two vertical lines in ***Ill.5- 9*** link them) - while the tetrahedron is its own dual. It means that one is the inside-out version of the other: to test this, run threads from the mid-point of each side within a Perspex or card octahedron, and a cubic structure forms – or vice versa. Bear this principle in mind for the further duals to be discovered in the quarter-tone note arrangements of ***Book 7 -*** when it is the Archimedean Solids' turn.

FORMS AND DIMENSIONS

Just because Plato's theory is the oldest (though we now realise from the Neolithic balls that people knew of these regular solids some two thousand years *before* him as oral tradition) does not mean they are no longer valid. The forms express principial archetypes on the plane of Mind *before* manifestation on the material level – a difference few can distinguish between in our materialist age! Philosophically the cube best represents the reality of the third dimension – that of the six directions of space, with the centre point from which the directions move making the seventh note (see ***Books 0*** and ***1***). The Bible's description of the Creation of the World as occurring in six stages, with the resting point being the crucial seventh stage at the centre that locks six into the octave, is another way of expressing it, underlining why Seven is such a

spiritually powerful number, deeply embedded in our culture (the above image attempts to show other possible dimensions involving the changes that a cube can go on to experience - the 4th Dimension being Time – though of course it is actually impossible to express even the 3rd Dimension on a flat photograph, let alone the others!). The ancient Chinese tradition posits Six as the formative principle that brings matter into the realm of volume, summed up for Plato



Ill.5- 12: The Calabi-Yau manifolds – from BBC Focus magazine November 2008

by the cube which sends out from its centre point, as it were, six square facets in the directions of up, down, before, behind, to the left and to the right – a model applicable to all crystalline molecules (remember, too, that the cube has eight corners), with intermediate angles accounting for the twists and torques of the molecular forms.

MAKING YOUR OWN MODELS

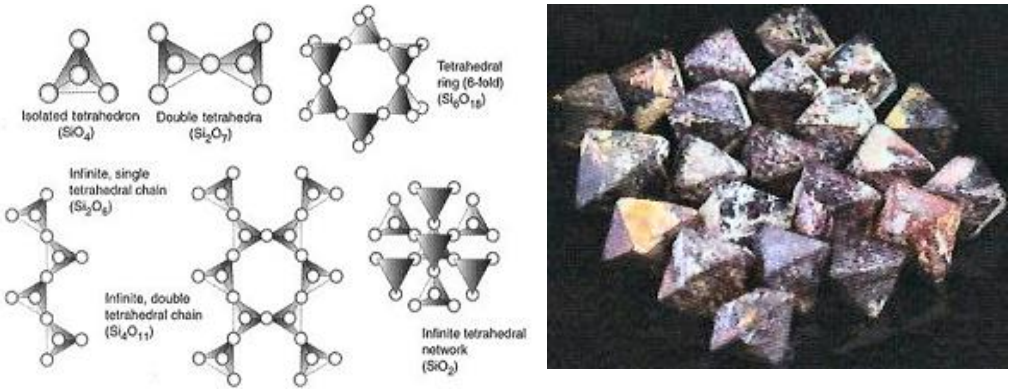
It is certainly worth spending time making your own set of Platonic Solids because it gives you a strong baseline for understanding the 3-D world of molecules. As with the cube just described, it is intriguing to note for yourself the respective numbers of facets, edges and corners for each solid, because these point the way to crossover harmonies with other forms. The models can either be made out of rods and balls, from cardboard, or even glass or perspex. If of carboard, the entire net made up of similar shapes is drawn with ruler and compass onto a large piece of cardboard (not forgetting to add tabs folded in to lock the solid together when sticking the sides to each other). There is not room in this book to give the nets – the best book that draws them all out is by Cundy and Rollett (see Bibliography). Looking at any book on molecules today, the favoured form of presentation is stick and ball structures – the main problem with them being that the holes in the balls need to be drilled at the correct angle.

Because of their geometrical simplicity, since each can fit inside a sphere, at the right scale to each other the Platonic Solids can also all fit inside each other (see ***Book 9*** on ***Astronomy*** for Kepler's famous illustration of the ratios of the planetary spheres to each other in terms of the nested Platonic Solids). Should you decide to make your own models, insights will crowd in on you as your draw out and stick the models together – be judicious, too, in your choice of colour – they don't have to be grey! You will notice how interchangeable they look on the one hand, and yet that there are dissonances where the shapes of one body cannot exactly knit with those

of another. The barriers posed between triangle, square and pentagon (already explored in ***Book 2***) - though not reconcilable in obvious ways – can integrate by the right 3-D spacings as seen with the duals. Beyond these, further reconciliations are mediated by the Archimedean solids - while the organic molecules in chains or spirals integrate like entwined snakes.

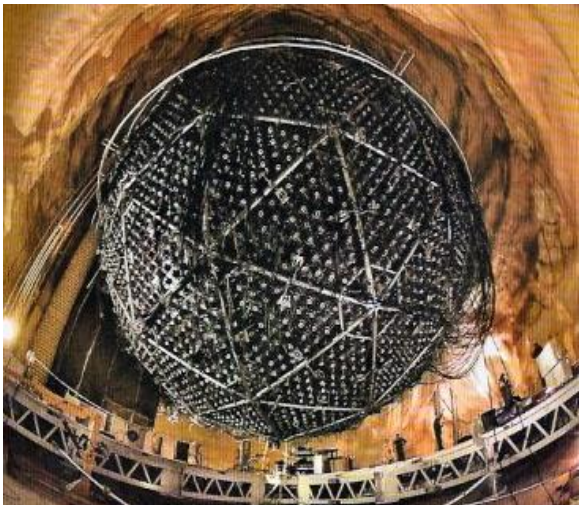
THE PLATONIC SOLIDS AS BLUEPRINTS AND IN MANIFESTATION

Taking the Platonic models one by one as described by Plato in ***The Timaeus***, the Element Fire is the most penetrating, so represented qualitatively by the four equilateral triangles making up the Tetrahedron= *'Four-faced'*. We are told the basic Carbon molecule, without which no organic molecules could exist, is tetrahedral, and Silicon compounds also like tetrahedral arrangements (here I show below left the only helpful item I found in Ladd's book!):



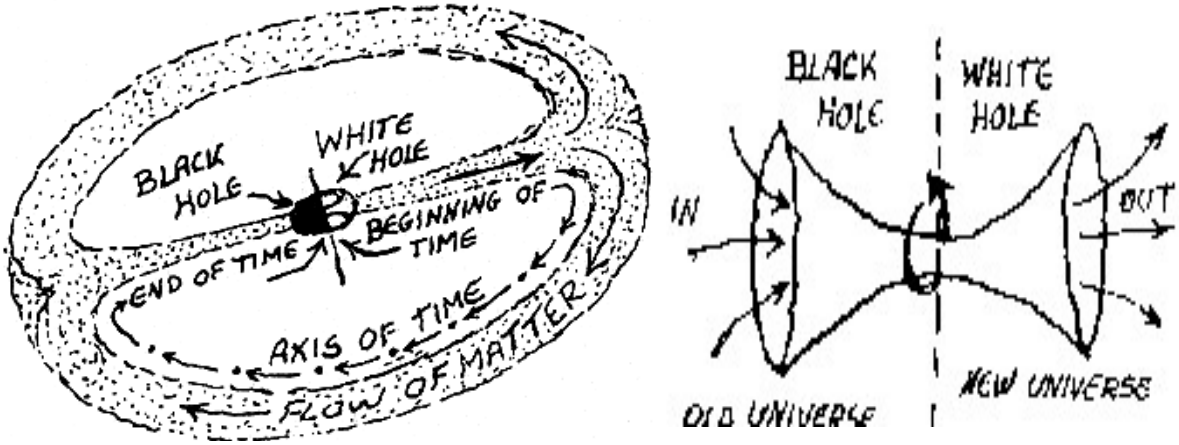
Ill.5- 13: (Left) Silicon compounds using tetrahedral arrangements identified by Dr P Stoffer – Ladd fig. 8.1; (right) octahedral formation of the mineral Rhodozite

Earth, the Solid State, for Plato is formed of √2 triangles, pairs of which make squares – six squares folded up join sides to form a Cube. Eight equilateral triangles joined together form an Octahedron, representing Air, the intermediary between the sharpness of Fire and solidity of Earth – if on the right scale an octahedron fits inside or outside a cube – as happens with several kinds of crystal (hence the octahedron manifests in table salt as well as overtly in Rhodozite (above right) and several other crystals. Looked at another way, the Octahedron actually consists of two pyramids placed over each other but the angles of the equilateral triangles forming them are √2 triangles, and not those with the powerful 51°51′ of the Great Pyramid, on which Krüger based his arrangement of the Periodic Table (***Ill. 3-49,-Book 3***).



Ill.5- 14: Sudbury Neutrino Observatory – Nat. Geog. Mag. Oct 2006 [photo R Kaltschmidt]

The Icosahedron is also formed of equilateral triangles (20 this time) and perfectly conveys the archetypal flexibility of Water. It is interesting to see above the octahedral structure used for the Sudbury Neutrino Observatory deep under the earth in Ontario, Canada (with the Cube, the Solid most conducive to architectural use). It is dual to the fifth Platonic Solid which over the centuries has been accorded at least as much mystery as the Great Pyramid, since composed of 12 pentagons and thus bonded throughout by Golden Sections (see the earlier playful Roman example with knobs on). Representing the forces of Aether, for Plato the Dodecahedron stands for the hidden order of the Cosmos that binds together the Four Elements of Fire, Air, Earth and Water by acting as the means of interchange between otherwise contrary parts (***Ill.5- 16***). This hidden aspect of matter emerged to puzzle 20C scientists in a new form: even as Aether as a concept was ditched, it came round to confront them in the form of 'fields', 'black holes' or 'dark matter' (***Ill.5- 15***).



Ill.5- 15: Bentov's rendering of the first Black Hole, the Ultimate Ying-Yang (his figs 41/42)

Below left is a dodecahedron model carved from quartz, and below right some naturally occurring garnet crystals on their way to becoming pure dodecahedra without quite getting there. The changes of shape of one molecule into another, seen very simply in the case of the hexagonally based molecules of organic chemistry, is understandable after playing with the Solids using triangles, but we cannot so easily interpenetrate Cube and Dodecahedron with the triangular bodies (though Fluorites (***Ill.5- 98***) compete between cube and dodecahedron).

Ill.5- 16: Dodecahedron carved from crystal - and natural garnet crystals

Misfits between forms can be caused by incompatible substances to the extent of bringing about disasters such as destruction by Fire (that cancels out Earth), or drowning by Water (that pushes out Air). And yet the Octahedron has an inner square which locks it into the Cube, and the Tetrahedron has four faces which link it to the four-sided faces of the Cube – two examples of the more unusual 'fits' that find a way round incompatibility. Keith Critchlow's ***Order in Space*** draws out all such interrelationships for those who want the detail, but building up your own personal observation of particular cases counts most.

In fact, thanks to the advances of scientific equipment, doubts about Plato's 'accuracy' have come full circle. In Victorian times his 'triangles' were ridiculed, but electro-microscopy has revealed that even these archetypes which Plato considered as existing only in Mind do actually manifest in material form. As seen in our example of the garnets above, crystals are a particular step in the unfolding of atomic combinations which in the case of their relation to the Platonic Solids are particularly easy (and confirmatory) to spot. Mankind has a strong spiritual affinity with stones because they so often coagulate and lucidly mirror the intangible Platonic worlds.

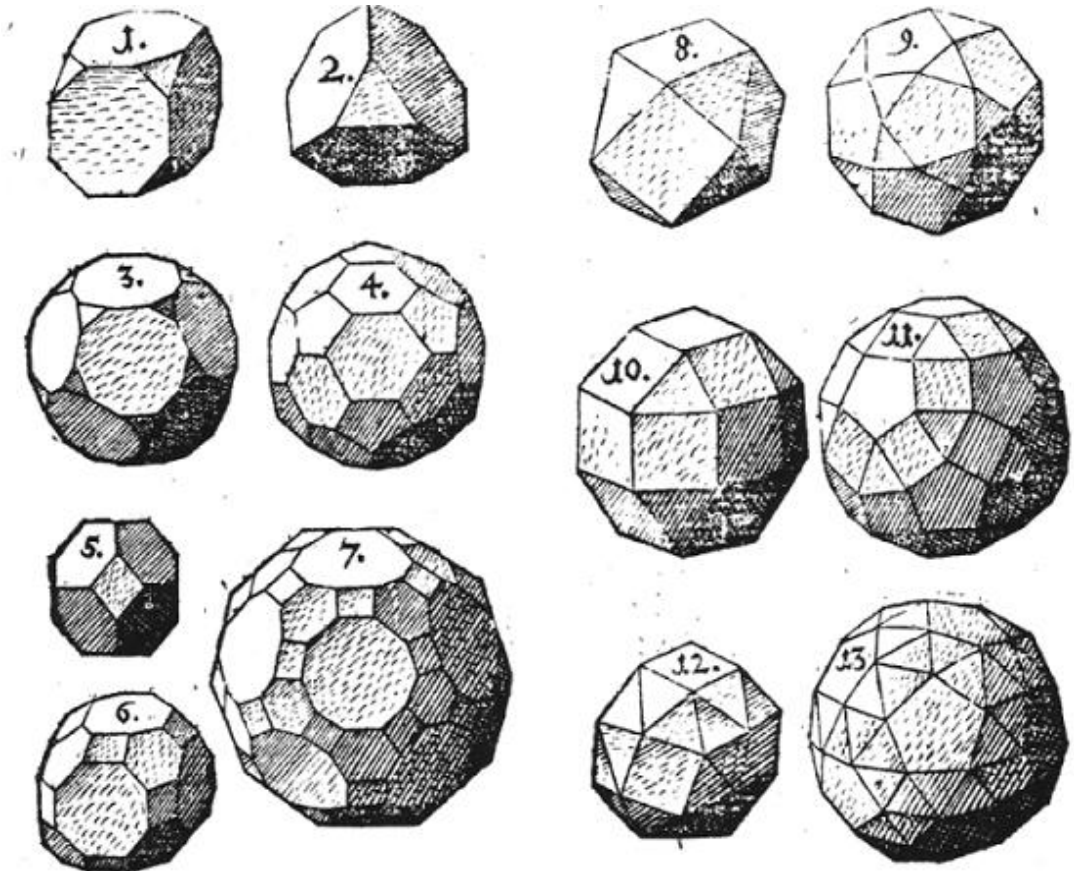
THE SEARCH FOR MOLECULAR ORDER: THE FORERUNNERS

Moving from the notes and octaves of atomic nuclei and their harmonic overtones to consider the three-dimensional orchestras of any type of molecule entails a complexification of factors. Thus in this book we fully analyse just a handful of molecules in detail to stand for the implications of what is involved in all the others. This is a field where advances in information have been made mostly in the late twentieth century, and is still in a state of constant update. Not only has the electron microscope made it possible to bring their complex structures into view, but by now the volume of accumulated data on the geometric and numerical ordering of individual molecules has made it possible, in the final analysis, to discern the simple overall hierarchy of seven stages within the molecular world as outlined by Young. There is certainly no doubt in my mind that explaining molecules according to their octaval development clarifies and simplifies teaching *and* learning! At this stage we have to bear in mind that in the popular books devoted to molecules each writer could only refer to a few key examples - so it is still down to the reader to go to the fully systematic textbooks put out by the scientists for comprehensive coverage - before working out how to place them within the bigger picture.

THE ARCHIMEDEAN SOLIDS

The next range of solids as far as the philosophers were concerned were neatly tabulated by Archimedes as the Thirteen Semi-Regular Solids, each made up of two sorts of geometric shapes bonded together (laid out below). They show in a nutshell the implications of the descent from the few Platonic archetypes to the increasing possible combinations of their mixings at the next level of material form which molecules then spell out for us in myriads – we study their musical implications more fully in ***Book 7***. Platonic or Archimedean analysis of substance came before the discovery of the molecular world, and after its discovery thinkers still tried to find the common denominator in terms of music and form. Apart from Young's main Octaval arrangement, some more complex molecules probably need at least a twelve-tone or 22-tone scale to unlock their true position, as Krüger does. But before we try to apply Young's

theory of the Grand Octave, since he was preceded by many others who attempted to classify and simplify in this mode, we look at the work of two pioneers who attempted to understand



Ill.5- 17: The thirteen Archimedean Solids as illustrated in woodcuts for Kepler (see Book 9)

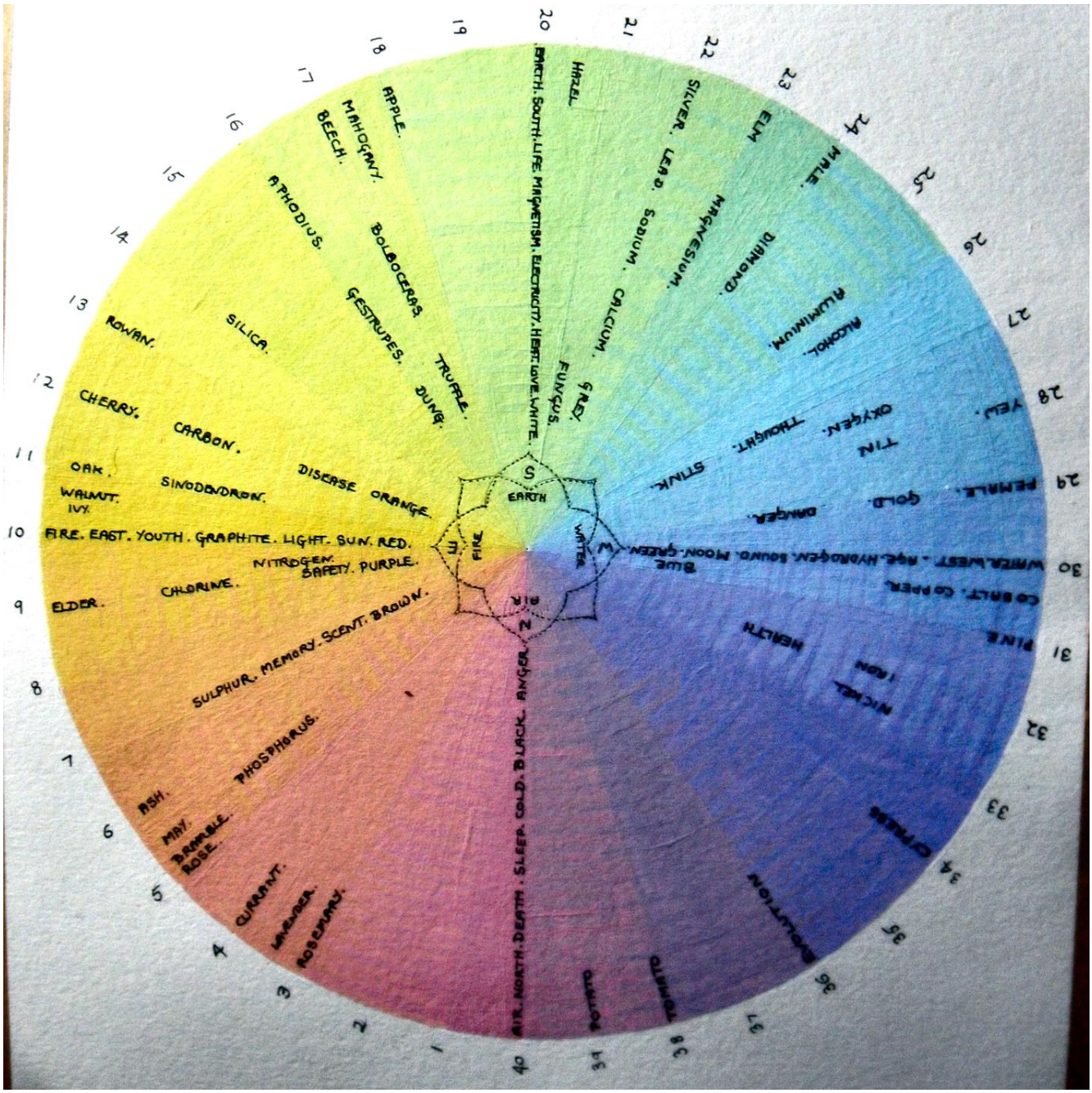
material in such terms,. We start with the work of a man fascinated by different materials who worked almost solely by intuition, though recording his data in a rigorously scientific fashion.

T C LETHBRIDGE

Lethbridge's work is mostly linked with the materials of the everyday world around us. He had a first career as archaeologists and leader of research expeditions to the Arctic. But his most intriguing activities were those he undertook after retirement when he returned to his family roots in Devonshire. Through a series of events he became interested in the operation of a small gadget, its validity often regarded with suspicion at the time (the 1950s) - the pendulum – and what he discovered was fascinating. The pendulum has been used for centuries by country people for finding underground water courses, and today by prospectors for locating mineral deposits and even oil wells. Every dowser will evolve his own methods of using the pendulum or divining rods. What Lethbridge did was unique.

He started by using it to find lost objects – something, say, hidden in a cupboard or outhouse whose location had been forgotten. Further experiment showed that it could detect both tangible or intangible things, answer questions that required a straight Yes or No, and even react to concepts visualised in the dowser's mind. These experiments are described in several books and they led him to map out what he called his Compass Rose of Rates, which he later developed into a Spiral of Rates (both shown below), both charting how different substances emit different fields – not an evaluation of molecules as such, but simply a human tuning in to

materials at an gut level, magnifying the vibratory reactions via the pendulum. These compare quite closely with Kayser's Tone Circle and Tone Spiral given in ***Book 1***. Lethbridge's labelling is not easy to read (hence our new rendition below, by Barry Stevens) but clearly he tested a vast number of substances which the Compass Rose distributes within the four directions of



A coloured, clarified version of Lethbridge's Compass Rose painted by Barry Stevens

space, though 'up' and 'down' emerged once the spiral came into play due to the shortening or lengthening of the pendulum string. He would hold the pendulum thread in one hand and either hold a sample of some material in one hand, or think about it. Swinging the pendulum gently while releasing the thread, at certain appropriate lengths (never longer than 40") it would either oscillate or start gyrating (40 is also an important number in the spiral molecule DNA, as we see later). This process became more marked if he pointed his finger on outstretched arm in the direction where the object or substance was to be sought. In this way, if he visualised 'iron' and swept his pointing finger across a horizon, the pendulum would gyrate once the finger

pointed at any iron buried, say, in the ground. If he dug at the spot he would find, perhaps, a nail or a forgotten mole-trap. Sometimes he would draw a circle round himself and use two or three positions round it as anchor points for easier verification. Similar results could be obtained indoors over a map: a method used by many dowsers which cannot be disputed.

Ill.5- 18: Lethbridge's original Compass Rose of Rates: Barry Stevens' version puts South at the top

The length of the thread at which the pendulum reacted became the 'rate' for the object sought – e.g. 29" for Gold, 20" for white, 32" for iron, 14" for oak, and so on. Any mental abstraction, quality or emotion for which a word exists produced a rate on the pendulum. He found rates for anger, joy, old age, youth, heat, cold, east, west, green, blue, sleep, spring, evolution – and reckoned there was no limit to what can be detected with the pendulum. [If you are reading this on-line, click on the pictures and zoom in to see the information on them more clearly.]

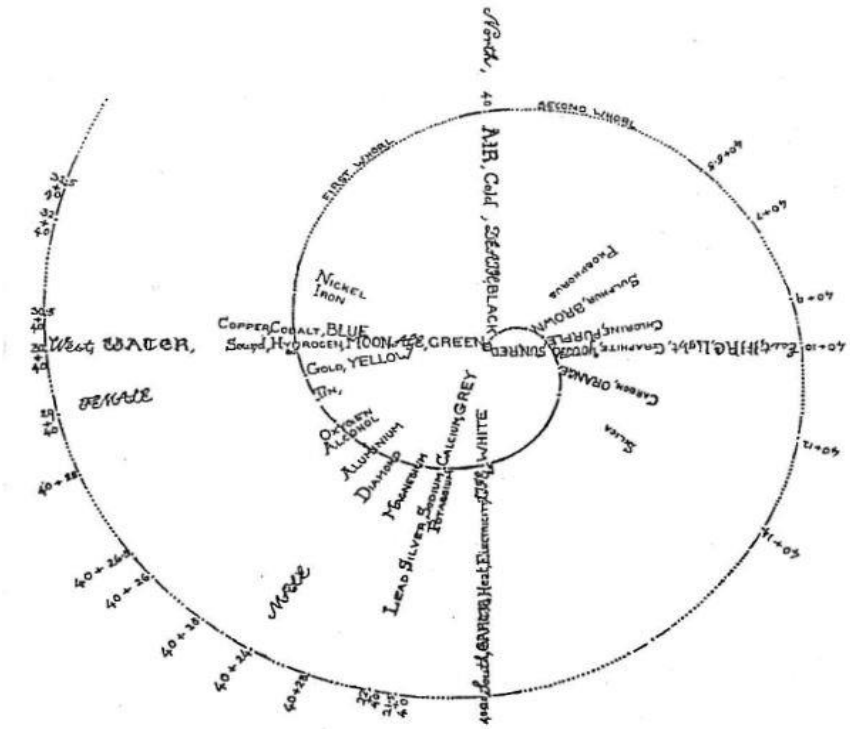
He first plotted this information in terms of 40 sectors, each corresponding to one inch in length on the pendulum and distributed round the circle. Thus the compass is divided into quarters at 10", 20", 30" and 40". These key correspondences emerged:

10	20	30	40
East	South	West	North
Fire	Earth	Water	Air
Red	White	Green	Black
Good Luck	Good	Bad Luck	Evil
Sun	Heat	Moon	Cold
Light	Life	Age	Sleep
Youth	Magnetism	South	Death
Graphite	Electricity	Hydrogen	Anger, etc.

The arrangement echoes the four directions of the Chinese tradition and the Four Elements of the philosophical traditions of India and Greece (note that 'South' comes up twice, at two different lengths). He mapped comparatively few rates so myriads more wait to be discovered, but already a format had emerged on the basis of which he believed some much more elaborate scheme of classification would need to be drawn up, and his work is continued by disciples today. Testing Lethbridge's Compass Rose by looking at numerical or other 'opposites' charted on it, they appear to complement each other across the circle, as in zodiac oppositions:

27″	Thought, stink	-v-	**7″**	Memory, scent
32″	Health, iron	-v-	**12″**	Disease, Carbon
7.5″	Sulphur	-v-	**27.5″**	Oxygen
36″	Evolution	-v-	**16″**	Dung

For the last contrast, it is true that without manure there is no life, let alone evolution. The correspondences are poetic and refreshingly oblique compared to the deterministic (if also just



Ill.5- 19: Lethbridge's Spiral of Rates with allocation of pendulum lengths as well as colours

as uncertain) world of physics and chemistry. For the third opposition there is some kind of confirmation in the Periodic Table where Oxygen at 8 and Sulphur at 16 are in an octave relationship, and while not opposite to Carbon (12" on the Compass Rose), at the quarter position we get Sodium at 22, Calcium and Lead. At 22.5 we get Magnesium, hinting at an alternative structure to the Periodic Table of the kind we explored in ***Book 3*** perhaps to be more accurately arranged in some kind of 3-D structure. Many lone items were plotted by Lethbridge without any correspondences emerging, and still need more examination.

One compelling comparison was pointed out by Daniélou from the ***I Ching*** Trigrams which are arranged in fixed tables of musical notes for everything to which it is possible to give a name (discussed fully in ***Book 12***). The traditional layout of the Chinese tables for the 64 Trigrams in a circle of the cardinal directions and four intermediate compass points strikingly resembles Lethbridge's Pendulum Compass Rose: that a retired English archaeologist should have discovered such a comprehensive scheme with a pendulum in a Devonshire garden in the 1960s is astonishing if through such means it corroborates ancient wisdom. For all that they relied on personal intuition and its amplification by pendulum, though seen as dubious by trained scientists, his findings cannot be dismissed out of hand. The beauty of them is that what particle physicists might assign to an obscure particle, such as 'spin', 'self-energy', 'axiality', 'anti-matter' – realms of energy splicing into idea or emotion - the pendulum takes into its stride without the person holding it needing to analyse their qualities in terms of physics.

If you have time it is worth having a go at checking Lethbridge's findings for yourself by generating your own compass rose using his method – good preparation for ***Book 7A***, which devotes itself to the Law of Correspondences and tables used in the ancient world. Lethbridge was a cautious and careful researcher and never jumped to conclusions, and had several co-researchers who, he reported, got the same results as he did. Nevertheless, for reasons as yet not understood, for a few people the pendulum behaved differently and this is a stumbling block in the eyes of scientists who need to have everything repeatable in all circumstances. However they, too, have in recent decades taken on board the sober truth that the experimenter can affect his experiment simply by being the participant and observer. To many researchers the variable results of Lethbridge's pendulum experiments are a stimulus to further endeavour because his result do show he was 'on to something'. He simply reported what he found – whether 'good' or 'bad' results – and did not try to explain them.

RELATION OF LETHBRIDGE'S WORK TO MUSICAL HARMONICS

Besides gyrating, the pendulum also oscillated back and forth, indicating a different message but at first it was not clear what was being communicated. Lethbridge speculated for a long time about what could be going on, coming close to the idea of harmonics in his book, ***A Step in the Dark*** which describes this phase of his work when he pondered on ancient Greek assertions that the universe consists of music and harmonics. In the case of the spiral arrangement Lethbridge realised that thought forms could be laid out round a 360° circle with the string lengths, just as in Kayser's Tone Spiral, giving the corresponding musical note. Thus if the string lengths were laid out from a common centre at their differing angles his Compass

Rose became a perfect Archimedean spiral (***Ill.5- 19***) that could also be rendered in three-dimensional form, adding weight to the idea that the Octave itself is innately spiral in nature.

If Lethbridge had known of Kayser's work (he in fact died ten years before Lethbridge) he could have clarified many obscurities that he could not explain. Harmonics do seem to be a strong candidate to account for the operation of the pendulum, on the basis of harmony or dissonance between vibrations emitted between the seeker and the object sought, the reactive agent between the two sets of vibrations being the pendulum. No complicated 'rays' need to be imagined: rather, on the principle of harmonic resonance, two rates resembling each other will cause the pendulum to gyrate since, being the same, they meet and inhabit each other and the energy engages with no need to pass further on. This kind of phenomenon was explored by Rupert Sheldrake in his recent books on morphic resonance that look into how we are aware someone is looking at us even if they are behind us – or how dogs know when their owners are on the way home or birds in the garden know when we have come into the kitchen and fly into the garden anticipating food. Dissimilar vibrations affect each other, but if in harmony (as in the ratio C:G, for instance) the pendulum will oscillate happily between them because they enhance, rather than inhibit, each other. On such a basis the harmonics of pendulum behaviour can be built up and the rates seen as notes. (Itzhak Bentov pursued the pendulum idea in other ways in ***Stalking the Wild Pendulum*** – see the illustrations from his book used earlier).

OTHER EXAMPLES OF LETHBRIDGE'S FINDINGS ON HARMONIC RESONANCE

It is intriguing that Lethbridge's rate for 'Male' is 24" and that for 'Female' 29": pliable Gold is also 29" and hard Diamond 24". He proposed a neat theory about these two pendulum rates which oscillate smoothly between the two: the male and female belong together like two notes forming a chord. Overall oscillation, therefore, seems to mean the right combination of male and female. A pendulum could help decide whether partners are compatible, so there is something in the gold and diamond engagement ring after all, with the golden wedding ring giving supremacy to the female, it might seem. All kinds of similar combinations can be found in nature. The theory of Companion Plants, a basic concept of Anthroposophy, where the right plants growing in company with each other will enhance each other's growth, yet inhibit others, could be explained through this musical hypothesis, while the overall principle of resonance rounds out the argument. Extending the field, another example reveals that families of species have both family and personal rates and in nature those organisms whose lifestyles impinge on others and are dependent on other species must be able to tune in. So truffles have one rate, and the beech trees beneath which the truffles grow provide an umbrella rate for truffles too. And the truffle beetle that lives off the fungus has a rate that fits into both. This fact has far-reaching implications for understanding the importance of not disturbing the harmony of ecosystems, and implies also that it can be tested by something as simple as a pendulum, rather than complicated scientific equipment.

Lethbridge's experiments showed that every object emits its own frequency on both physical (molecular) and pre-physical (atomic) levels, affecting each other through the senses, as well as on the higher consciousness octaves where 'signals' are passed relating to the archetypes of

the things signalled. Resonance links the octaves to each other and we experience the impact. Again we turn to Daniélou to ascertain the Hindu approach: in his ***Introduction to the Study of Musical Scales*** he says, 'the different aspects of the perceptible world are parallel manifestations starting from undifferentiated common principles… There are… natural and irresistible correspondences between different aspects of manifestation and, starting from one particular aspect one can easily reach or evoke corresponding stages in other aspects. According to this principle, notes and chords *must* have exact equivalents musically with other aspects and in every category of existence… Only the knowledge of such correspondences can allow us to understand the real meaning of sounds or use them rationally...'. As we keep trying to make clear in the Cosmokrator books, on this basis every thought form and every feeling re-echoes at different levels of substance and is also discernible by its opposite – the combinations of the I Ching rest on this axiom.

It is important to know the theory *and* experience the practice: in the end watching the world and experiencing it for oneself is more important than watching too much television! Although knowing music theory might enhance our experience of music - and although gaining an understanding of the theories behind molecules might enhance our appreciation of the physical world – these can get in the way of simply living on the physical plane and savouring it all without analysis. Lethbridge's experiments show that the pendulum rates are notes in the octaves of natural substances, encompassing the entire domain of the molecules in all the staggering richness of their variety. There is a lot to be said for exploring different substances as we know them through the senses as Lethbridge did in this direct way and not bothering to classify them as molecular science would, which is why we have given several pages over to his work. We leave it to the reader now to follow up on the full ramifications of Lethbridge's work if they wish and, moving on to a generation after Lethbridge, now consider the work of the next pioneer who tried to go further in bridging the gap between science and musical classification.

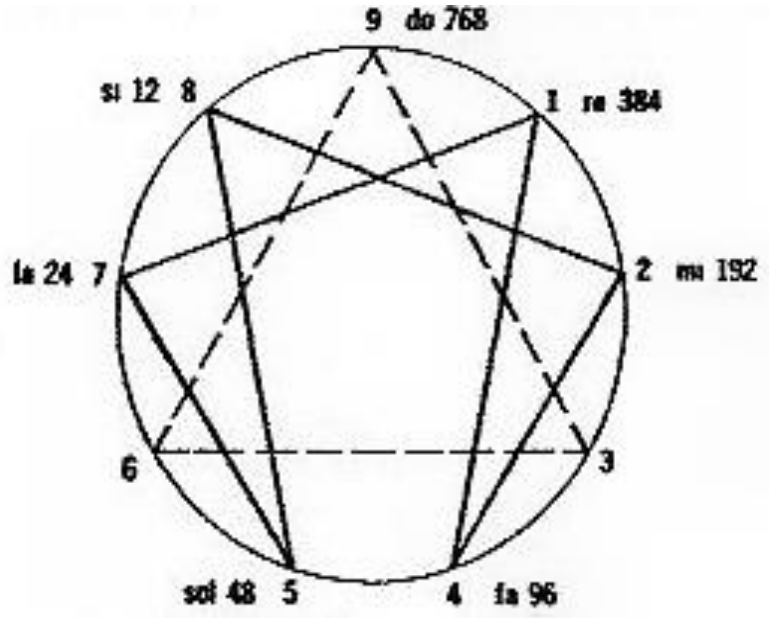
OUSPENSKY

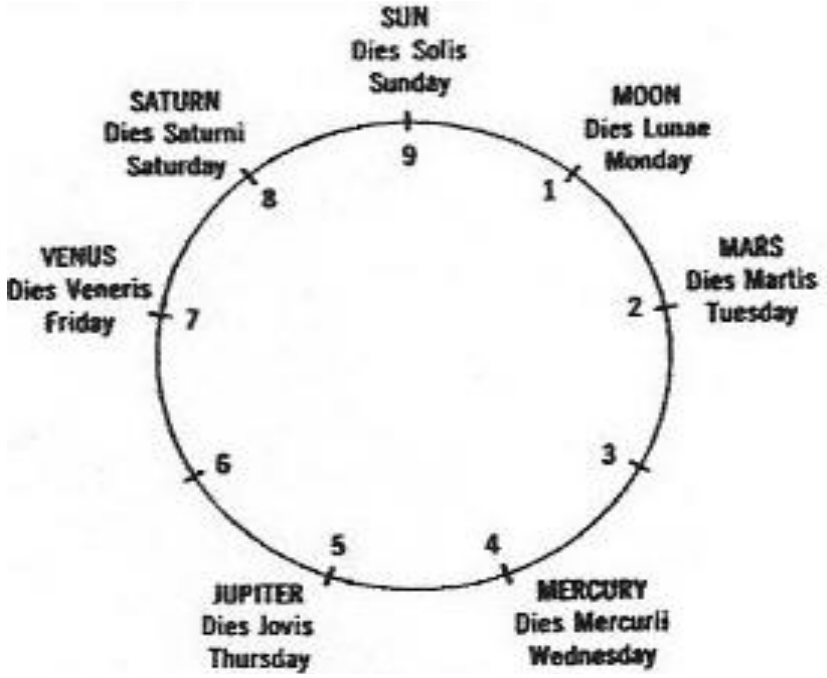
From the outset the Russian P D Ouspensky believed in the octaval structure of the universe, though he often presented his teachings on the subject in such a recondite way that few of his pupils really understood what he was getting at, and could rarely 'check him out'. However, sections of his writings, and certain of his tables and diagrams (such as the Enneagram, illustrated below) do ring true. We bring him in here because he based much of his exposition on the nature of atomic combinations in molecules and had many intuitive insights into how the molecular world could serve as a model for unfolding chains of musical notes to higher or lower levels of existence or consciousness, in turn to enable self-development on a human level. He emigrated from Russia after the 1917 Revolution, wandering and teaching in Paris, New York and London. Once he had parted with his mentor, Gurdjieff, he set up schools of his own, claiming his books ***Tertium Organum, A New Model of the Universe*** and ***In Search of the Miraculous***[6] described 'fragments of an unknown Teaching', the key to which he felt was just

[6] All his books are available in electronic/pdf form on-line if the titles are googled.

Ill.5- 20: Ouspensky's Enneagram took off as a cult diagram in many 'alternative' groups – especially with regard to the analysis of different human types and their evolution

round the corner. ***Tertium Organum*** he pretentiously called 'the third instrument of thought' as a follow-up to Aristotle's ***Organon*** and Bacon's ***Novum Organum.*** But before his death in 1947 he summoned members of his English School for six farewell addresses, declaring that since he had not been able to track down that 'lost teaching' in full, he was now abandoning his system. He said his followers should now be 'set free' from it to find the Truth on their own (causing consternation amongst many devoted acolytes who felt washed up high and dry, with nowhere else to go (though one or two founded successor Schools giving havens to the old membership). In the next decades, as Gurdjieff and Ouspensky had, people now made their own pilgrimages to sit at the feet of Hindu gurus and Sufi masters in Central Asia and the East: streams of books exploring the results of their searches for ancient teachings were produced in





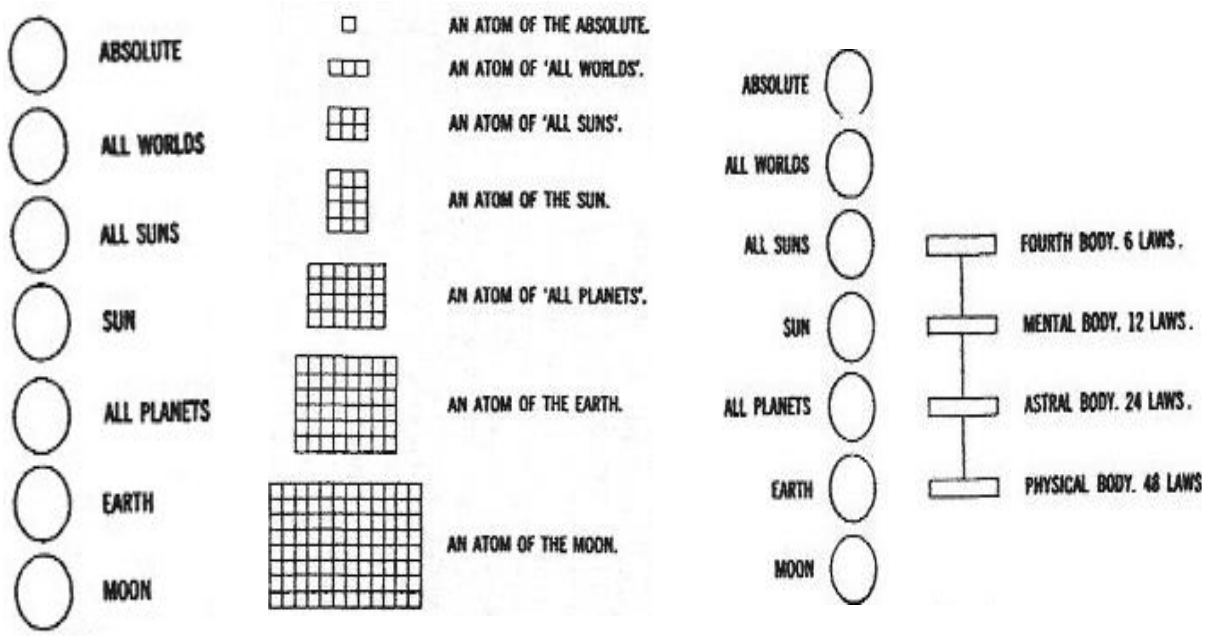
Ill.5- 21: Ouspensky applied the Enneagram to many fields: (top) to the do-re-mi Octave (plus the two 'shock interventions') and (bottom) to the planets and days of the week – In Search of the Miraculous figs 59/61

the 1960s and 1970s – many of them quoted in the Cosmokrator books. Largely left unsaid was the puzzle that Ouspensky and his followers no longer found hope in the body of teachings of their own Christian Tradition, now weakly practised by its own leaders. The missing pieces were sought not only in lost pockets of the esoteric East, in ashrams, Buddhist monasteries or amongst the dervishes, but the question was also to somehow try to meld onto them the new disciplines of science and psychoanalysis in the hope that lost dimensions of their own tradition might be resuscitated and reintegrated – but only if the old Wineskin could bear it, and usually that last step was never taken (there was little place for prayer, for instance - though Transcendental Meditation was 'in').

OUSPENSKY'S ORDERING OF ATOMS AND MOLECULES IN COSMIC OCTAVES

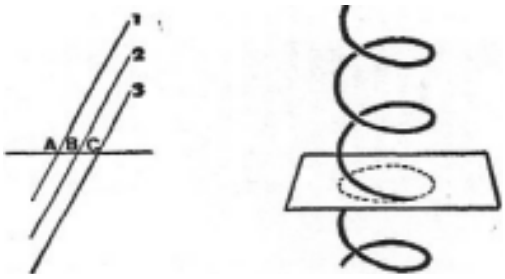
As briefly discussed in ***Book 3***, Ouspensky's nomenclature and choice of numbers are his own, except for his tables of octaves which - at every level from 1 to 12288 - uses 256hz/Middle C as the fundamental, with 384hz as the fifth. When he talked about atoms he saw them all as 'Hydrogens' at different octaves, with Carbons, Oxygens and Nitrogens appearing in two-dimensional triads overlapping and interlinking with each other in ways we cannot really grasp. The relevant tables from ***In Search of the Miraculous*** showing these arrangements are shown on the next page where - despite the fact actual organic chemistry *is* founded on those three Elements – no applications to actual molecules are referred to.

There was an assumption behind all his thinking that the entire Creation is in the process of change and evolution, from the atomic and molecular levels onwards, and that the unfolding is only possible in terms of musical intervals. The different levels of that Creation are outlined in the three diagrams below as a Grand Octave (left) subject to an increasing number of laws (centre), and against which the four levels of the human being are aligned (right).



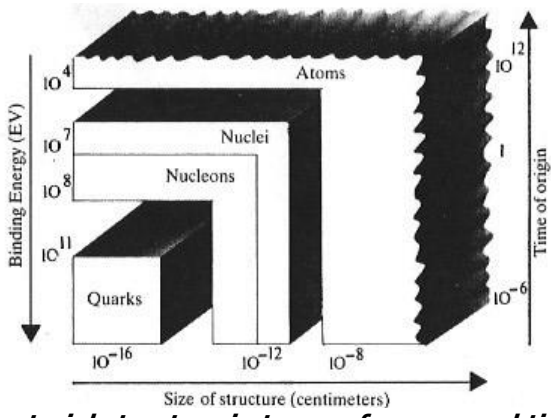
Ill.5- 22: Ouspensky's In Search of the Miraculous figs 3, 6 and 4 (like the Hindus he considered the Moon to be a world lower than Earth - where the unevolved souls of unrealised men would be parked at death, subject to thousands of restrictive laws)

Humans spliced into the Grand Octave at physical, astral, mental and spiritual levels (see above right) are inevitably part of cosmic unfolding, each having a duty to actively participate in the grand evolution which takes place in a spiral - rather than linear - process:



Ill.5- 23: Ouspensky's figs I & II in Tertium Organum

Ouspensky was fascinated by the application of the 'Law of Three' to the structures of molecules, meaning he only considered triadic relationships between the atoms within them. In the tables below his chain of octaves starts at the Absolute (1) [? the first photon] and opens out in sequences of fifths to 8092 and 12288 vibrations twelve octaves on. (One of Timothy Ferris' diagrams in ***Coming of Age in the Milky Way*** written half a century later – below - illustrates the beginning of that process in a more informed way, but minus the music.) While



Ill.5- 24: The start of material structure in terms of energy and time – from Ferris p.339

mentioning Ferris, we could remind ourselves of the 'givens' in his other well-known book, ***The Mind's Sky***: that the Universe is (a) all energy; (b) uniform (made of the same Elements wherever the observer is placed); (c) isotropic (the same in every direction) – and (d) abundant. Ouspensky takes these givens for granted - as we all do - but they should be mentioned as the assumed ground-line. His coverage in terms of molecules and their vibration equivalents is a kind of reverse reflection of the Chinese spiral of fifths that we look at in ***Book 12***, and the triads are arranged in such a way that they are interlocked and all in ratios of octave and fifth to each other. Although each row is given a name and a note they are simply theoretical: we record his work because the attempt to classify the Creation under twelve octaves was a step in the right direction, if incomplete in comparison with Krüger's application of musical scales to molecules (which we come to later). Ouspensky in that early period just did not have access to enough atomic and molecular data to know what he was really doing beyond following his intuitive grasp of the scenario. Sadly the disciples not progressing from his work were left with fruitless struggles in coming to grips with this half-baked aspect of his work.

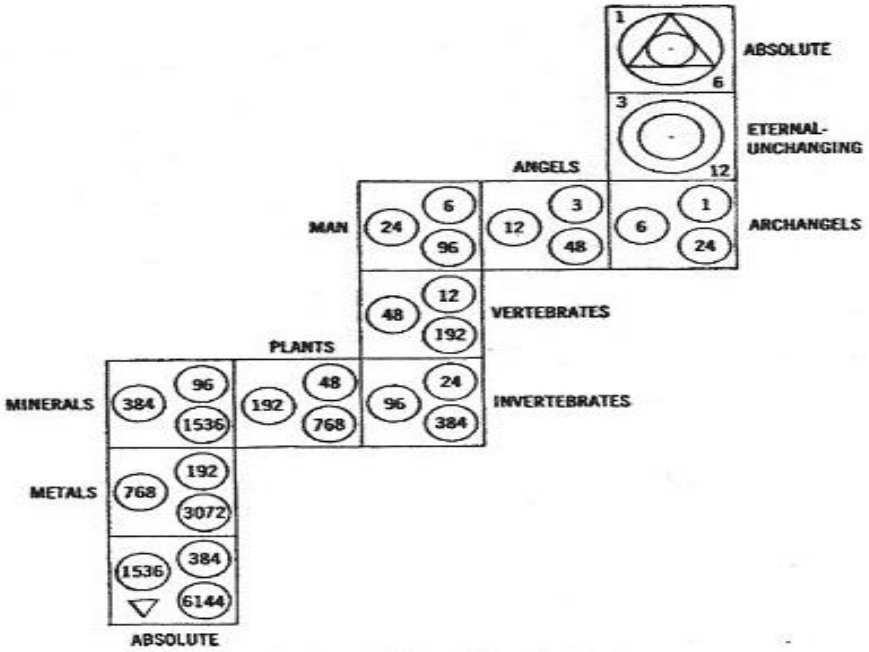
do	C	1	1	1													do		
si	O	2	3	2	H6												si	H6	
la	N	3	2	3		C	2	2	2								la		
sol						O	4	6	4	H12							sol	H12	
fa	C	4	4	4		N	6	4	6								fa		
—	O	8	12	8	H24												—	H24	
mi	N	12	8	12		C	8	8	8								mi		
re						O	16	24	16	H48							re	H48	
do	C	16	16	16		N	24	16	24								do		
si	O	32	48	32	H96												si	H96	
la	N	48	32	48		C	32	32	32								la		
sol						O	64	96	64	H192							sol	H192	
fa	C	64	64	64		N	96	64	96								fa		
—	O	128	192	128	H384												—	H384	
mi	N	192	128	192		C	128	128	128								mi		
re						O	256	384	256	H768							re	H768	
do	C	256	256	256		N	384	256	384								do		
si	O	512	768	512	H1536												si	H1536	
la	N	768	512	768		C	512	512	512								la		
sol						O	1024	1536	1024	H3072							sol	H3072	
fa	C	1024	1024	1024		N	1536	1024	1536								fa		
—	O	2048	3072	2048	H6144												—	H6144	
mi	N	3072	2048	3072		C	2048	2048	2048								mi		
re						O	4096	6144	4096	H12288							re	H12288	
do						N	6144	4096	6144								do		

										H1	H6
									H1	H6	H12
								H1	H6	H12	H24
							H1	H6	H12	H24	H48
						H1	H6	H12	H24	H48	H96
					H1	H6	H12	H24	H48	H96	H192
				H1	H6	H12	H24	H48	H96	H192	H384
			H1	H6	H12	H24	H48	H96	H192	H384	H768
		H1	H6	H12	H24	H48	H96	H192	H384	H768	H1536
	H1	H6	H12	H24	H48	H96	H192	H384	H768	H1536	H3072
H6	H12	H24	H48	H96	H192	H384	H768	H1536	H3072	H6144	H12288

	ELECTRON	MOLECULE	SMALL CELLS	LARGE CELLS	MICRO-COSMOS (Man)	TRITO-COSMOS	MESO-COSMOS	DEUTERO-COSMOS	MACRO-COSMOS	AYO-COSMOS	PROTO-COSMOS
IMPRESSION					$\frac{1}{10,000}$ second	3 seconds	24 hours	80 years	3 million years	90 milliard years	$3\ 10^{15}$ years (number of 16 figures)
BREATH				$\frac{1}{10,000}$ second	3 seconds	24 hours	80 years	3 million years	90 milliard years	$3\ 10^{15}$ years (number of 16 figures)	$9\ 10^{19}$ years (number of 20 figures)
DAY and NIGHT			$\frac{1}{10,000}$ second	3 seconds	24 hours	80 years	3 million years	90 milliard years	$3\ 10^{15}$ years (number of 16 figures)	$9\ 10^{19}$ years (number of 20 figures)	$3\ 10^{23}$ years (number of 24 figures)
LIFE	$\frac{1}{300,000,000}$ second	$\frac{1}{10,000}$ second	3 seconds	24 hours	80 years	3 million years	90 milliard years	$3\ 10^{15}$ years (number of 16 figures)	$9\ 10^{19}$ years (number of 20 figures)	$3\ 10^{23}$ years (number of 24 figures)	$9\ 10^{28}$ years (number of 29 figures)

Ill.5- 25: (Top left) Octaves of C-O-N triads in Hydrogens (Hs) (Ouspensky's Table 1); (top right - rotated) orders of Hydrogens from 1 to 12288 (his table 4); (bottom) progressions of worlds from the Electron and Molecule onwards, ending in cosmic entities (his table 8)

His first two triadic sequences (above) deal with the combinations of Elements which together form what he calls 'Hydrogens', each with a different number. The third series deals with the transformation of the Elements in molecules in relation to everyday life, such as breathing and eating (the lower table above). Food in the physical range has numbers, and less material foods

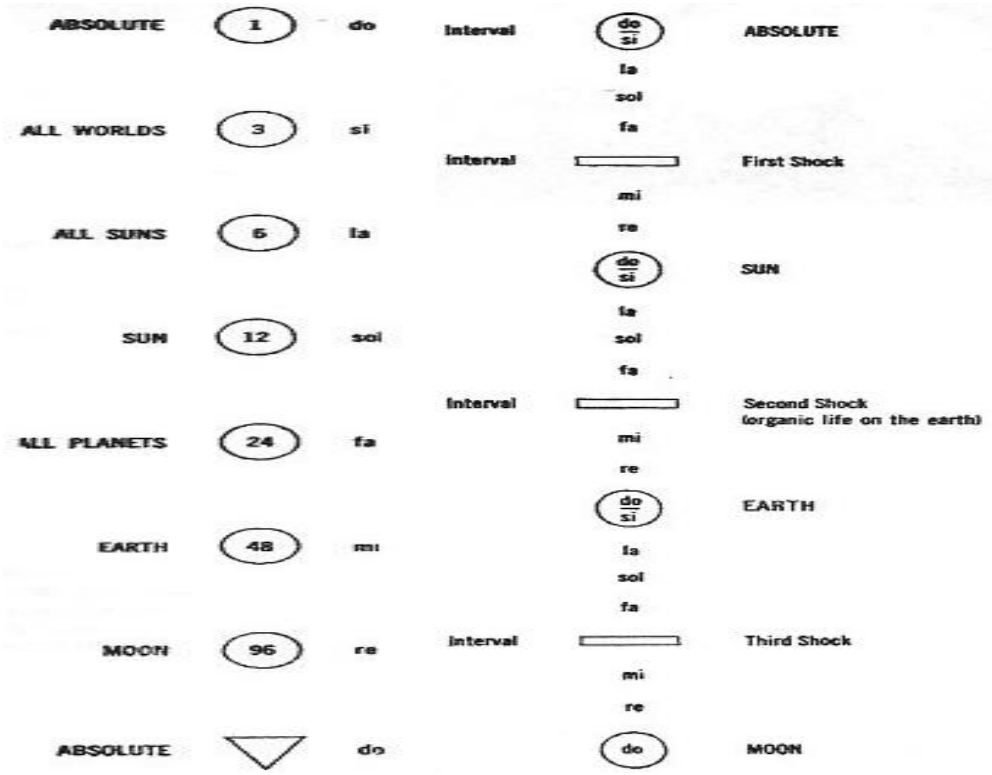


Ill.5- 26: Ouspensky, like Lethbridge – and even Zoroaster - tried to combine material and spiritual realities on one diagram – In Search of the Miraculous, fig. 58

such as sense impressions, air, emotions, all are given vibration numbers. Higher up, angels, archangels, and the constellations, etc. even have numbers (see his more simplified diagram above). Modern physicists would not mix up different categories in this way (though interestingly there is a precedent in Zoroastrianism which categorises the Elements, Planets and Stars along with virtues and vices – summarised in ***Ill.5- 29***[7].) The end result for the student

[7] For a full account of this approach, see the section analysing the Zoroastrian tradition in ***Catalogue E part 2*** on the third level of www.layish.co.uk

was not the clarity of ancient cosmology as gained from the primary Teacher of the Octave, Pythagoras, but a somewhat doctrinaire application of notes to all levels of experience that do not quite add up, despite the sound underlying intuition (not helped by his dry and visually unappealing diagrams). In many ways Ouspensky was another Lethbridge, taking a diagonal



Ill.5- 27: Ouspensky In Search of the Miraculous figs 18 & 24 (NB the third shock point)

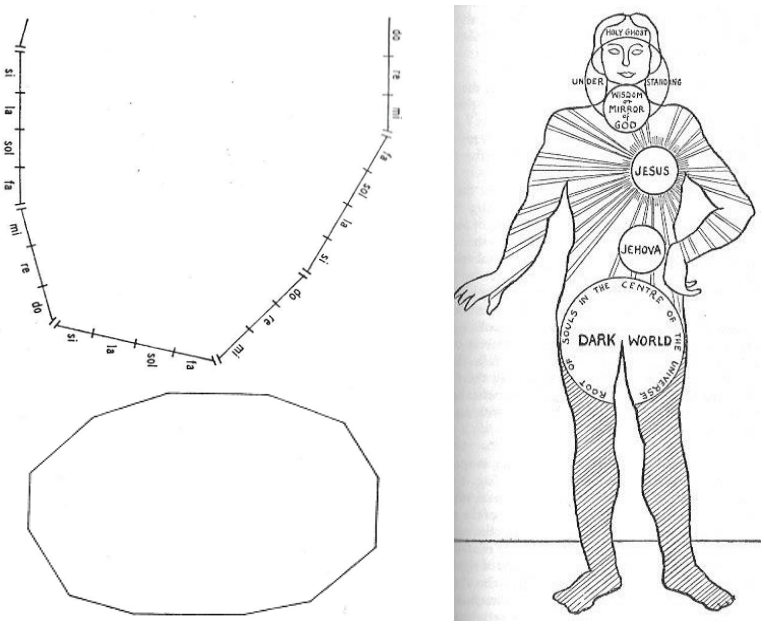
walk across the cosmos at a different angle – with his imprecise knowledge of modern science in many ways coming up with even vaguer results - but his effort to codify the Universe as a chain of Octaves gives his ideas merit. The notes of the musical scale are applied to his Grand Octave in two further diagrams (above), the one on the right also taking into account the points at which a shock injection of energy through outside events is needed for the next stage to crystallise. Overall, the unifying theme of his work was his Law of Octaves, but only inasmuch as he simplified it in terms of the Law of 3 (already familiar to us) and the Law of 7.

OUSPENSKY AND MAN 7

In essence he saw these laws as applicable to the pattern of steps to be taken on the Spiritual Path by the person desiring self-realisation, enabling them to 'wake up' from the average sleep-walking state in which most humans live their lives. According to his system there are seven levels of Man – the fully awake, self-realised man being the Christ-like *Man Seven*, an idea inspired by prototypes such as Adam Kadmon in Kabbalah (see ***Book 0***), or Gichtel's 17C image of The Perfect Man (below right) to which he refers in ***A New Model of the Universe***).

He saw the process of moving towards that goal as possible in modern times by following the methods of his and Gurdjieff's *Fourth Way* in a gradual circle of progress turning round on itself in a series of octaves moving, note by note, at angles that form a faceted ellipse (below top left). He pointed out that at the 'places of tightening' between Mi-Fa and La-Si (explained in ***Book 1***), the vibration of the octave changes direction due to outside energies that come to

maintain momentum if the octave is not to come to a stop for lack of energy (in chemical terms we might term these *quantum leap* points – note in the diagram above right his introduction of



Ill.5- 28: (Left) Ouspensky's diagrams in In Search of the Miraculous showing how the stepped notes of octaval development towards Man 7 become the ellipse below (his figs 15/16); (right) Gichtel's Perfect Man, referred by Ouspensky in A New Model of the Universe

yet a further shock-point halfway through, left unexplained). According to the number of notes in an octave and its intervals the human entity will follow nine basic stages in the same way molecules develop from the simple to the complex, summmarised by the Enneagram. As far as he saw it, by the end of the entire megacycle of repeated octaves (not necessarily completed within one life-time) an individual's spiritual journey will have come full-circle to form an kind of segmented ellipse (above bottom left). This is awkwardly expressed, and caused much puzzlement amongst his followers on the path to self-improvement.

However, at other times his writing makes perfect sense as, for instance, when he writes, 'The fundamental octaves are connected with subordinate or surrounding octaves in a definite way. Out of subordinate octaves of the first order come those of the surrounding order, and so on… [This] can be compared with the construction of a tree. From the straight basic trunk there come out branches into more branches, becoming smaller and smaller and finally covered in leaves. The same process goes on in the construction of leaves, in the formation of veins, the serrations, etc.' (we considered this kind of hierarchy in ***Book 4*** on ***Plants***). Away from his arbitrary numbers and diagrams we can agree with him, but not being strong on graphics he does not think to use a diagram of a tree to help the explanation. When he chooses a concrete example his exposition of octaves is perfectly acceptable, but when it comes to cosmology we run into difficulties, indicating his own thinking was misshapen – as he himself finally admitted.

As far as Ouspensky's triadic understanding of molecules is concerned his approach is relevant when considering the simple makeup of Water or Carbon Dioxide molecules, but with the Platonic Solids as benchmark we know the Law of Three contributes to only part of the story - and he was conspicuously unable to take his precious Law of Seven to its logical conclusion and make it relevant to the entire array of molecules as they actually exist either – which is down to

the fact that *did not think three-dimensionally* (though he did 'do' flat spirals). But we have to forgive that in his particular circumstances since at that period of history he simply did not have sufficient access to data on molecules to enable him to move to full term.

	ELEMENT	DIVINITY	MATERIAL MANIFESTATION
1	SKY *AETHER*	*KHSHATHRA (VAIRYA)*	*STONE (stone box containing deposit)*
2	LIGHT/FIRE – DAY *SUN*	ASHA (VAHISHTA) (MITHRA)	*GOLD (Gold Sheet with trilingual Darius Declaration of Rulership of the Four Quarters/four lion-bull Croesids)*
3	WATER – NIGHT *MOON/SIRIUS*	HAURVATAT (APAM NAPĀT/ VARUNA) ANAHITA*	*SILVER (Silver Sheet with trilingual Darius Declaration of Rulership of the Four Quarters/one silver Griffin tetradrachm from Abdera; one silver Turtle stater from Aegina)*
4	EARTH *EARTH*	SPENTA ARMAITI	*CAVE/HOLLOW/MOUND* *hollow foundation for the stone box*
5	PLANTS	AMERETAT	*PLANTS, embodied in the Haoma drink*
6	ANIMALS	VOHU MANAH	*ANIMALS, especially Cattle*
7	MANKIND	AHURA MAZDA SPENTA MAINYU	*JUST MEN, especially King and Priest*

Ill.5- 29: The Zoroastrian Heptad (Sibitti) – or analysis of the Universe as Seven Sacred Materials (showing the same progression as our very first diagram), symbolised by artefacts in the NE Persepolis Foundation Deposit (the constituents of the SE Foundation Deposit were similar, but with different silver coins) – information compiled from Nimchuk[8]

It is useful place the work of people like Lethbridge and Ouspensky as forming a transitional phase of the analysis of matter between the ancient thinkers like Zoroaster, Plato or Pythagoras – and those with a full grasp of the actual structure of molecules (while still holding on to the ancient idea of harmonic form). Now if we move on yet one more generation to consider the categorisations of Arthur M Young, from his matter-of-fact analyses we will see he benefited from the latest developments in science to be able to start to apply the Octave to it intelligibly.

ARTHUR M YOUNG

Young was unique in being a well-informed scientist (who also had no problem in dove-tailing physics with 'higher dimensions'). He was the inventor of Bell's helicopter and came to a musical understanding of the structures of life through his experience of organising a factory assembly line for its manufacture. In his book, ***The Reflexive Universe***, he recounts how he could not partially alter or adapt the arrangement of the assembly line since 'it seemed to have a life of its own': the chain of work following an octaval unfolding impossible to interfere with (in earlier books we have looked at diagrams for the way catastrophes – and even small events – also unfold in stages like the notes of a scale). This led Young to look into what he called

[8] Cindy Nimchuk 'The Persepolis Apadana Foundation Deposits' in Curtis and Simpson (eds) **the World of Achaemenid Persia** 2010, 221-30): this was the topic of her PhD thesis supervised by Margaret Cool Root.

Process and the resistance points that occur in any setup which impede adaptation - as if, once programmed, beyond the initial stages there was something inevitable about the impetus behind it to complete the process. Ouspensky had shown how any process is easy to begin, then after a note or two difficult to continue, and then easy for a long stretch of the way – but again in the final stages incredibly difficult to bring to a close - the resistances occurring, he saw, at the two tightening points of the octave referred to above (***Ill.5- 21*** and ***Ill.5- 27***).

Young applied the same word to the steps in the creation of substance, initiated in the cosmos, descending into matter and increasing in physical complexity up to its densest point – but then reascending, liberating itself from physical limitations to return to source (lower illustration in ***Ill.5- 9***). The climax of the outward journey reached in mankind and beyond the human state at note 8 (note 1 of the next octave) means leaving materiality and following a new journey through higher consciousness. (Young's Octave begins with Light at Note 1 where the Zoroastrians place Ahura Mazda, their Prime God of Light, at Level 7 at the end of the climb – compare also with the ***Genesis*** account of the Six Days of Creation and Seventh Day of Rest.)

Like Ouspensky, Young viewed the unfolding of the entire universe as a hierarchy of octaves, working out a scheme of seven levels of seven groupings (illustration next page) – immediately easy to grasp since clearly illustrated and considerably fleshing out Ouspensky's sparse renditions as given in ***Ill.5- 21*** and ***Ill.5- 27***. For him, Note 1 of the Octave is Light, with the second note at the subatomic, Nuclear level, and only at notes 3 and 4 do Atoms and Molecules feature. Following that come the Vegetable and Animal Kingdoms at notes 5 and 6, while Note 7 is devoted to the spiritual realm and fully realised spiritual leaders such as Christ and the Buddha. We can closely compare his classification of seven levels with the First Millennium BC Zoroastrian Heptad[9] (***Ill.5- 29***) which assigns the first four levels of Creation to each key Element/ planet/star, ending with Plants, Animals and Mankind at notes 5, 6 and 7 – each level powered by a God or Goddess (compare with Young's diagrams in ***Ill.5- 9***). We thus have three permutations: Spirit starts things off, Spirit emerges as the final state, or Spirit permeates throughout. This is the paradox of spirituality which traditionally is the generator (thus present in all things); or as a power left behind as it proceeds and self-maintains; or is the power latent in creatures that die and return to their beginnings in Spirit. Different formulations of the Octave of Creation need not cancel each other out[10]! All three viewpoints are valid, expressed in the Lord's Prayer: *Thy Kingdom come, thy Will be done - on Earth as it is in Heaven*.

Young had a sound background in science, and the sections of his book dealing with chemistry and physics are particularly helpful for the clarity at Note 4 of the differentiation of molecular types and subsequent stages of organic development in plant and animal worlds into distinctive octaves. His final arrangement for the hierarchy of molecules was in fact suggested to him by the chemist, Dr Charles Price, and after his own researches he found no need to alter it. Young

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[9] Given in the discussion on the Zoroastrian tradition in ***Catalogue E part 2*** on the third level of www.layish.co.uk – and fully analysed in relation to the site of Persepolis in ***Catalogue B***, also on the third level of www.layish.co.uk

[10] Hence Philip Pullman in his series of books on *His Dark Materials* is sadly misguided in siding with the *fallen* angels!

KINGDOMS STAGES →	POTENTIAL	BINDING	IDENTITY	COMBINATION	GROWTH	MOBILITY	DOMINION
1.LIGHT 3 deg. of freedom no symetry POTENTIAL: No rest mass; No charge; Space-Time path has no length; Quanta of Action.	10^{25} 10^{-15} 10^{11} Cosmic rays Proton rest energy →	10^{22} 10^{-11} 10^{7} Gamma rays Nuclear binding energy	10^{18} 10^{-8} 10^{4} X rays Atomic spectra	10^{15} 10^{-4} 10^{0} UV IR Molecular spectra	10^{11} 10^{-1} 10^{-3} Microwaves Cellular rad.? ← hν=kT	10^{8} 10^{3} 10^{-7} Radio waves Animal radiations?	10^{4} CPS 10^{6} CM 10^{-10} EV Low freq. waves
2.NUCLEAR 2 deg. of freedom bilateral sym. BINDING: Substance; Force of Attraction & Repulsion. The spell aspect of image, hence Illusion.							
3.ATOMIC 1 deg. of freedom radial sym. IDENTITY: Acquires its own center. Order creates properties of the Elements by the Exclusion Principle.	Hydrogen	Lithium to Fluorine	Sodium to Chlorine	Potassium to Bromine	Rubidium to Iodine	Cesium to Astatine	Francium to 117
4.MOLECULAR 0 deg. of freedom complete sym. COMBINATION: Molar properties; Classical Physics; Determinism; The only Kingdom we see.	Metals Metalic bond	Salts Ionic bond	Nonfunctional Compounds Covalent bond	Functional Compounds	Nonfunctional Polymers	Functional Polymers (Proteins)	DNA & Viruses
5.VEGETABLE 1 deg. of freedom radial sym. GROWTH: Self multiplication; The Cell or organizing principle; Order building by negative Entropy.	Bacteria Unicellular	Algae Colonies	Embryophytes Embryos	Psylophytes Vascular stems	Pteridophytes Segments	Gymnosperms Seeds	Angiosperms Flowers
6.ANIMAL 2 deg. of freedom bilateral sym. MOBILITY: Action & Satisfaction; Eating & Sex; Force becomes volitional.	Protozoa Unicellular	Sponges Colonies	Coelenterates One organ	Mollusks etc. Many organs	Annelids Segmentation	Arthropods Side Segments	Chordata Integrated brain
7.DOMINION 3 deg. of freedom no symmetry CONSCIOUSNESS: Memory of one's own acts leads to Knowledge & Control.	?	TRIBAL SOCIETIES Collective Unconscious	← MODERN MAN → Self Consciousness	Objective Thought	Creative Genius	CHRIST BUDDHA	?

Ill.5- 30: Young's filled out scheme for each note of the Octave of the Creation of the Universe as roughly sketched in Ill.5- 9

could see that from the point of view of structural development, jumps in molecular complexity correspond to the succession of notes in a Molecular Octave (spelled out in the fourth row above) which we will use for the main section headings in the rest of this book. They are:

1. **DOH MONATOMIC MOLECULES** made up of row upon row of atoms of one Element only - which *en masse* behave quite differently from the single atom on its own;
2. **RE** Ionic compounds consisting of **COMBINATIONS OF TWO ELEMENTS** to make crystalline salts (or three for some acids or bases) – the stuff of school chemistry lessons (the earliest chemists spent much time in achieving perfect crystals of the compounds they studied);
3. **MI** Non-functional compounds (meaning substances relatively unable to combine with others), in essence organic compounds consisting of combinations of Carbon (C) and Hydrogen (H) - **THE HYDROCARBONS** - arranged symmetrically in some kind of planar or three-dimensional ring (as for instance the Methane or Benzene series);
4. **FA** Functional compounds or **ORGANIC COMPOUNDS AS IN STAGE 3 BUT WITH OTHER ELEMENTS ADDED (NOTABLY OXYGEN (O) AND NITROGEN (N))** which can occur naturally or be synthesised artificially, arranged in planar or three-dimensional clusters;
5. **SOL** Non-functional polymers (inert when it comes to combining with other molecules or atoms) where the molecules consist of **LONG CHAINS MADE UP OF UNITS OF COMBINATIONS OF ELEMENTS OF ANY KIND** endlessly repeating by at least 100,000 units;
6. **LA** Functional polymers that are **COMPOUNDS OF COMPOUNDS** whereby the combinations of molecules create chains of what we know as proteins, with side chains as amino acids;
7. **TI SELF-REPLICATING MOLECULES OF TYPE 6 ARRANGED IN HELICES** which give 'commands' in intermolecular interchange and development – notably DNA, RNA and viruses.

Beyond Note 4 the more complex molecules can only exist in certain critical temperature ranges, otherwise they die by breaking down since they cannot change state. Finally we are ready to look at examples of each molecule note at Level 4 in Young's Creation Octave chart.

YOUNG'S MOLECULAR OCTAVE NOTE 1 (DOH): ONE-ELEMENT CRYSTALS

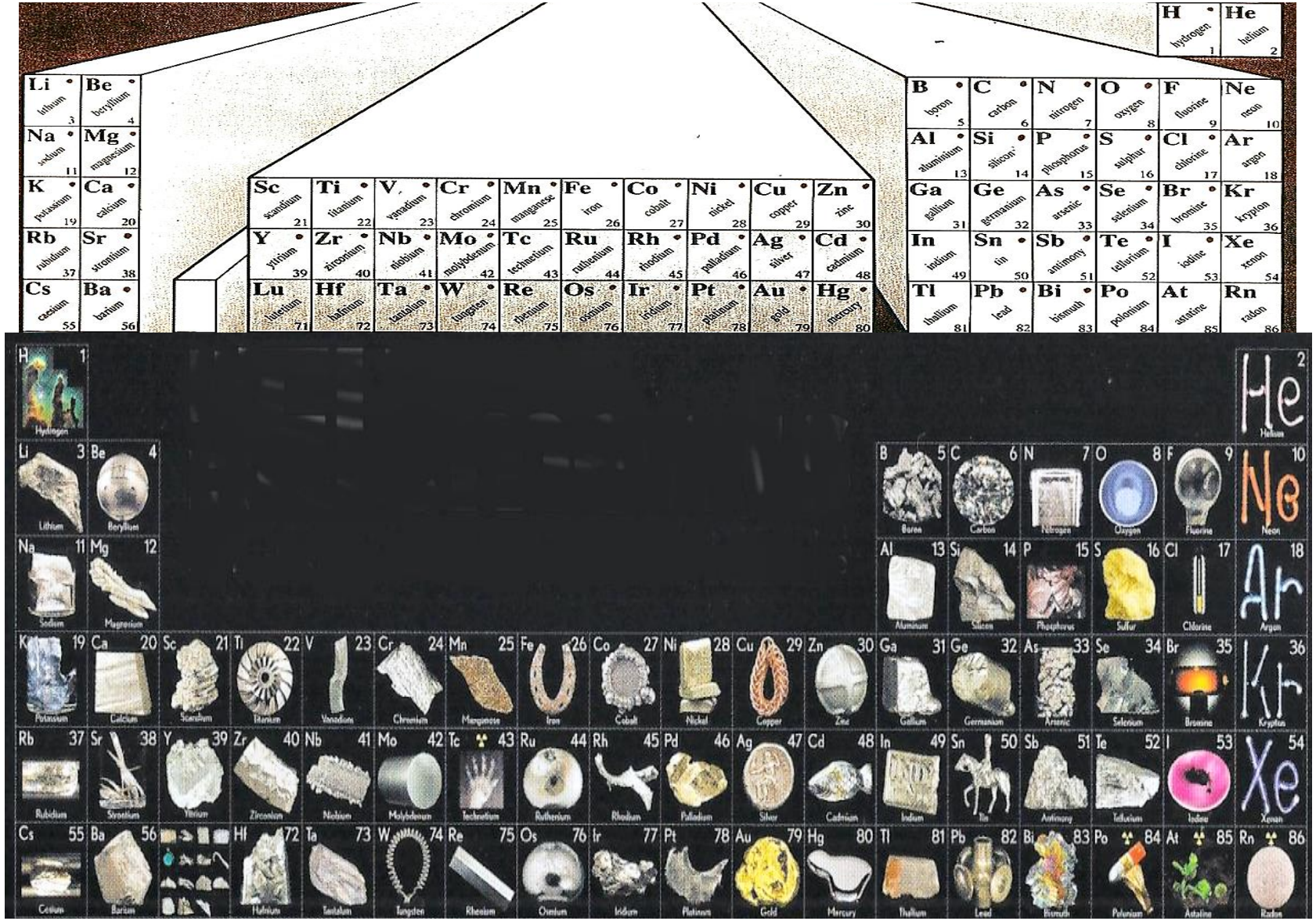
Young defines Middle C of the molecular world as monatomic, consisting of masses of one kind of atom arranged in rows. I can show a few examples of these below, but if you want to look at all of them, the best manual to have to hand is Theodore Gray's ***Elements*** with beautiful photos by Nick Mann. At the top right-hand corner of each page is a diagram of its structure. Jackson's similar book has the merit of showing the electron orbits for each Element. You can Google the *Elements* on the Internet, too, with an inexhaustible array of pictures or diagrams.

The Element molecule has quite a different nature from the atom on its own, since the bond that holds the atoms together gives rise to a substance that has properties such as density, malleability, conductivity and the tendency to exist in differing states. This is particularly noticeable with metals such as Copper, Iron or Tin, all of which are able to conduct electricity. Strictly speaking, *all* monatomic substances are known as metals – from the days of classical chemistry when any Element on the Periodic Table was known as a metal, rather than Element. We usually experience all pure substances in their molecular - rather than atomic - state, for even a Hydrogen molecule loses its characteristic chemical properties when broken down into its two component atoms. Ouspensky might have been interested that the Law of Three applies to such early-stage molecules where most can change state into gas, solid or liquid depending

Ill.5- 31: (Top left) the metals Copper, Iron (in the form of Iron Pyrites), Tin and Sulphur (the ingredient of a variety of 'bad small' molecules; (bottom left) Indium (used in mobile phones), Mercury, a Lithium rod in water and Osmium

on temperature and pressure. Indeed, substances like Helium or Thalium when supercooled to almost Absolute Zero become superconductive, offering no resistance to electric charges and thus vital for developments in magnetically levitated trains; smaller, faster computers or controlled nuclear fusion. The grouping of atoms of the same Element manifests most usually in crystalline form, but also as gases and - more rarely, as in the case of Nitrogen or Oxygen – as liquids, and quite often showing up in the pure form of one of the Platonic Solids.

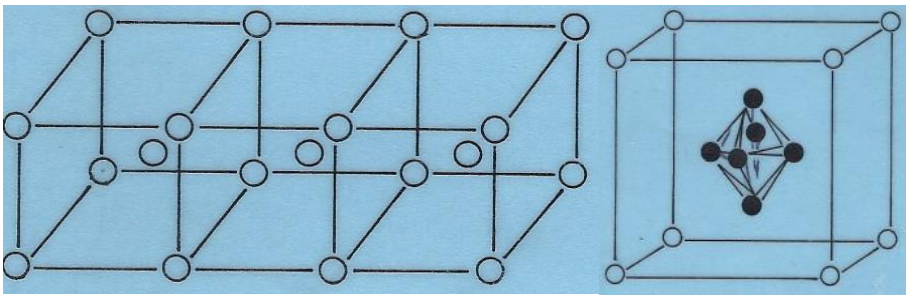
If you run through the first 82 Elements on the Periodic Table (part-reproduced from ***Book 3*** below, with the same section of Gray & Mann's photographic version under it) think for yourself in what form you have experienced each Element in everyday life: for the common ones you will have known them in solid or gaseous form, but rarely in liquid form, maybe as liquid helium or oxygen under pressure. Leafing at random through an average chemistry text book you find that Iron has a cubic lattice structure with one iron atom in the centre of each cube, while Tungsten when incorporated in Boron also assumes a cubic formation. Gold, Copper, Sodium, Phosphorus, Potassium, Barium and Molybdenum all have a cubic structure, the first two being face-centred (cubes with an inner octahedron whose points touch its faces) and Potassium body-centred (an octahedron within a cube whose horizontal four points face the cube's four upright edges, and whose two vertical points touch the upper and lower surfaces of the cube.



Ill.5- 32: Elements 1-86 on the Periodic Table – and as photographed by Nick Mann for Theodore Gray[11]

[11] Useful for quick reference is ***The Photographic Card Deck of the Elements*** 1978 produced by Theodore Gray with the photos of Nick Mann – viewable on his website www.periodictable.com

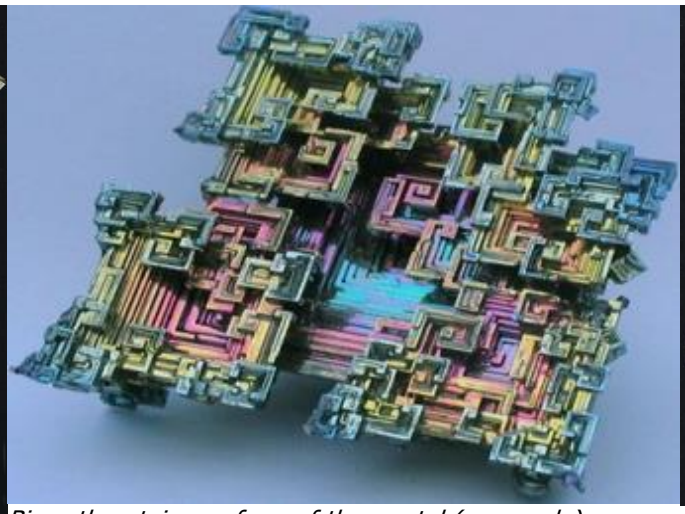
In fact, running through Gray's book on ***The Elements*** nearly all at the beginning turn out to be cubic or hexoid in structure - e.g. Hydrogen falls into hexagonal structures, so do Zinc and



Ill.5- 33: (Left) Iron molecule; (right) Potassium molecule

Magnesium – (Gray gives a thumbnail drawing of the crystal on each top-right page corner). Nonetheless, massed Boron (5 electrons) comes up as a dodecahedron; Niobium atoms arrange themselves as tetrahedra within a cube of Chlorine ions which themselves are octahedral (below left). This shows why it makes sense to first study and make the Platonic solids yourself and understand the interpenetration by their duals.

Niobium



Bismuth - staircase form of the crystal (manmade)

Magnesium

On the other hand the pure geometric shapes can get 'pulled out of true' as if elastic, and one must not be disappointed if many molecules seem 'squashed' or twisted versions of the triangular, square or pentagonal planes of the Five Regular and Thirteen Semi-Regular Solids (the example of the garnet crystals in ***Ill.5- 16*** being a clear example). Arsenic and Mercury are rhombohedral; Sulphur and Iodine are orthorhombic – any rhomboid shape simply being a rectangular shape whose angles are pushed off the right-angle to assume obtuse and acute ends. We cannot illustrate all the variations, but it is easy to follow them up for yourself.

Glazewski[12] early on drew attention to the musical and geometrical principles underlying the forms of crystals and the arrangement of molecular matter generally. He wrote, 'Atoms are known to be harmonic oscillators, where the oscillators themselves are the nuclei and the electrons and their orbits the reverberation and echoes of the periodic harmonic motions of the nucleus…. From the very foundations of the atoms up to stars and galaxies, the harmonic law

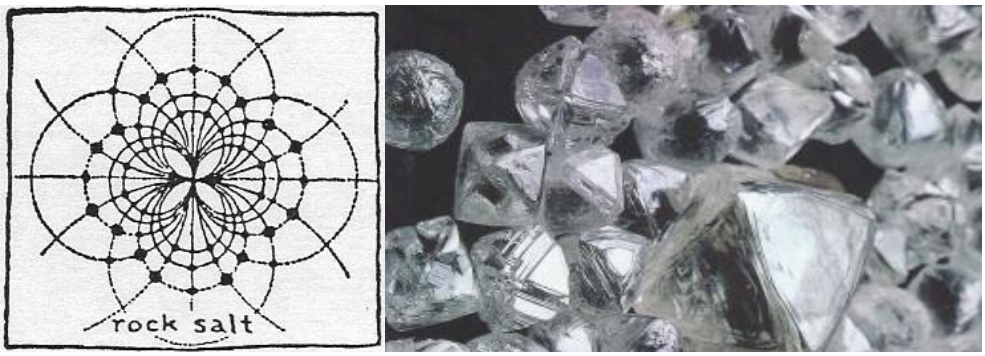
[12] A Glazewski 'The Music of Crystals, Plants and Human Beings' ***Radio-Perception*** Sept 1951 1-24

of proportions is the fundamental one.' We have for ourselves in the early Books followed the steps of equating sounds with shapes and directions, and now with molecules it is a matter of considering this platform of the Universe from a specific and complex three-dimensional angle.

YOUNG'S MOLECULAR OCTAVE NOTE 2 (RE): TWO-ELEMENT CRYSTALS

The next note of the molecular scale occurs when two Elements combine to form a 'salt' – the exceptions being Water and Carbon Dioxide which occupy intermediary positions later in the octave and are dealt with in an interlude outside this summary. Take a well-known molecule such as Sodium Chloride (previewed in ***Ill.5- 11***) where the positive ions of the Sodium atom combine with the negative ions of the Chloride atom. Combination cannot take place unless the positive and negative charges between the atoms concerned balance each other – again it is all a matter of numbers. Each Element has, as it were, a fixed number of 'hooks' or 'spikes' (in reality the vacant spots not taken up by electrons on the outermost inhabited ring of their structure (or, conversely, the spare atoms on an outer ring waiting to pop into a vacant space in another atom determining that atom's *valency* (discussed in ***Book 3*** – also very well explained in Kean's book). So Oxygen has a valency of 2, Nitrogen of 3 and Carbon of 4. This means that to make water, H with its valency of 1 will have to give two of itself to every one atom of Oxygen to create H_2O, whereas Carbon Dioxide needs two Oxygen atoms to join with Carbon's four available bonding 'spikes' for CO_2.

Most salts resulting from ionic bonding are soluble in water but form crystals readily if the water is evaporated off. For table salt, the way the Sodium (1 spike) and Chlorine (also 1 spike) atoms pack together determines its crystalline structure, visible even to the naked eye as cubic. But shining an X-ray through Sodium Chloride reveals its crystalline structure at atomic level as octahedral: when its molecules in solution begin to solidify their first appearance is triangular or pyramidal as viewed from above and only in the second stage does they reveal the inner cubes.



Ill.5- 34: (Left) Diffraction patterns for Sodium Chloride; (centre) mixture of its transitional cubic and octahedral crystals - National Geographic Magazine March 2002;

Corinne Heline[13] writes, 'Seven may be considered the underlying keynote of nature because it governs the periodicity of all natural phenomena… Seven dominates the series of chemical Elements (as in the rows of the Periodic Table). The refraction patterns of rock salt from its cubic angles radiate diapasons of 1:2.' Salt is essential to life, perhaps because we swallow the complete octave in the simplest ratios! But it must be unrefined sea-salt, for if 'refined' it is no

[13] C Heline ***The Sacred Science of Numbers*** 2000

longer whole (this applies in a wider context to all 'refined' foods -like white bread, for instance – because the subtle harmonics, or overtones, of other trace Elements are missing.

We can see from all these basic examples that it is rare to see the appearance of five-fold formations in crystals at *Molecular Octave Note 2*, and the reasons for this are beginning to emerge. Five-based molecules mostly occur in organic, living systems which grow, change and die to create new life (see Octave Notes 6/7 below). There is a preponderance of triangle and square/rhombs to be found in the static, crystalline world (geological crystals metamorphosed over millions of years are given a section on their own in the final Coda to this book). However, the occurrence of the more active odd numbers and the irrational proportions of √2, √3 and √5 signifies those formations that are edging over to the organic realm. Due to lack of space we leave it to the reader to seek out the more specialist books to see the full range of variation.

If we have accepted that shapes form due to the vibration of sound, then crystals are among the first – and simplest – resulting combinations of atoms to manifest in the tangible sphere as molecules. They are static and do not grow other than by accretion. Glazewski showed how they 'coordinate themselves in splendid networks of lattices according to their specific axes'. Like Young (see his lower chart at ***Ill.5- 9***), he draws attention to their lack of freedom of movement, explaining that crystal molecules have a limited scope for vibration, only able to resonate along their axes. In technical terms he shows how thermal agitation over a crystal surface will produce a 'forced vibration' in its surroundings which can be so strong that it almost becomes ultrasonic. Normally crystals' natural vibration is very faint, but with the right instrumentation it can be measured. An extreme case of hitting the note of the crystal is the phenomenon of shattering a glass if the human voice hits the note that is keeping it in its form: by meeting its 'double' the exteriorized and inherent notes cancel each other out and the material disintegrates. The sound patterns latent in each crystal are different, and simply through measuring its angles they can be worked out since we have shown in ***Books 2*** and ***3*** that comparative line lengths and angles of stretched lines are the equivalent, in the physical dimension, to musical notes. Most of the time we forget that *everything* has its own sound, though at the molecular level a substance needs special equipment to enhance it and bring it into the sphere of the human senses. If we were really able to follow the theory of angles and lines well enough we ought to be able to tell what a molecule's chord must be from its geometry, just as a doctor can gauge a patient's health or illness from listening to the lungs or knocking a person's ribs – or that a motor engine is running well from a harmonic hum.

Critchlow pointed out in one of his Kairos workshops that although we talk of tri-angles, further up the line it is hexa-gon and penta-gon (rather than hexangle/pentangle) because the syllable 'gon' (also seen in the word 'gonad') is linked with the ancient Greek word connected with 'genesis' and 'generation'. In his explorations of all possible geometrical combinations in two - and three - dimensions in his books on Islamic patterns and ***Order in Space*** in a way he gives us in the abstract the full portfolio of potential molecular combinations – but real life gives all sorts of unexpected twists to the theory, depending on the valency and temperature of the atoms concerned, making their study in some ways rational, in others completely unpredictable.

YOUNG'S MOLECULAR OCTAVE NOTE 3 (MI): ORGANIC MOLECULES

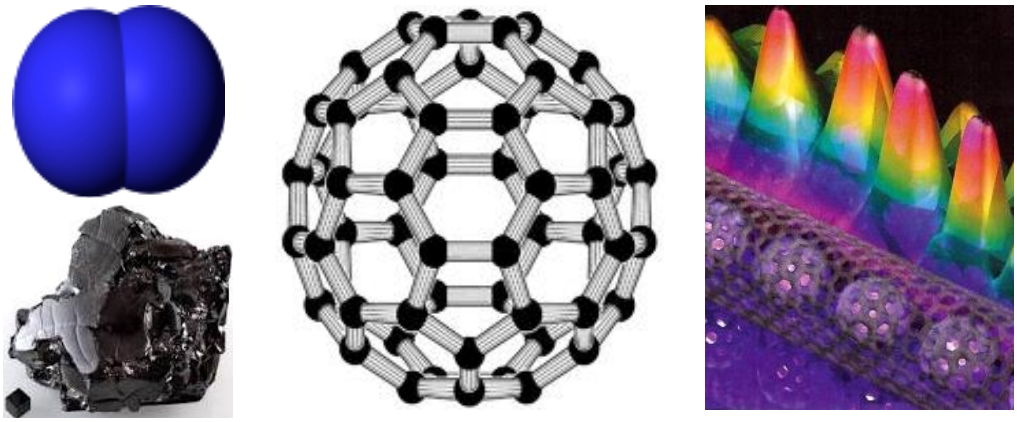
Young's third stage of molecules consists of all the possibilities that exist in the bonding between Carbon (C) and Hydrogen (H). Remembering that Carbon has four 'spikes' and H one, the arrangements that follow are in essence circular, even if for the complex ones the centre area is a core consisting of a row of Carbon atoms, as for instance in the Methane series, all of which are gases, the simple ones of use in everyday life being Methane, Ethane and Propane:

	H			H	H			H	H	H		
H	C	H	H	C	C	H	H	C	C	C	H	
	H			H	H			H	H	H		

Ill.5- 35: Structures of (left) Methane; (centre) Ethane and (right) Propane

The progression continues, with Butane having 4 Carbons, Pentane 5, Hexane 6 and Nonane 9 – the reader can work out the predicable number of Hydrogens around them! The series then continues with more units of two Hydrogen and one Carbon until we reach fuel oil, lubrication oil and finally asphalt – in other words the order of succession manifests in increasing density and inertness and successive loss of volatility and all such Hydrocarbons can be seen as fuels.

The nature of the bond in these molecules is covalent, meaning that some of the 'spikes' in these arrangements double up with each other, making doubly strong bonds difficult to 'open up' in order to combine with other atoms or molecules – hence Young brands them 'nonfunctional' (not the best choice of word, but we are following his system through). The gas Hydrogen which usually occurs as molecular Hydrogen in pairs of H atoms Young considers as the zeroth member of the Hydro-Carbon Series in this third category of molecules since it is the

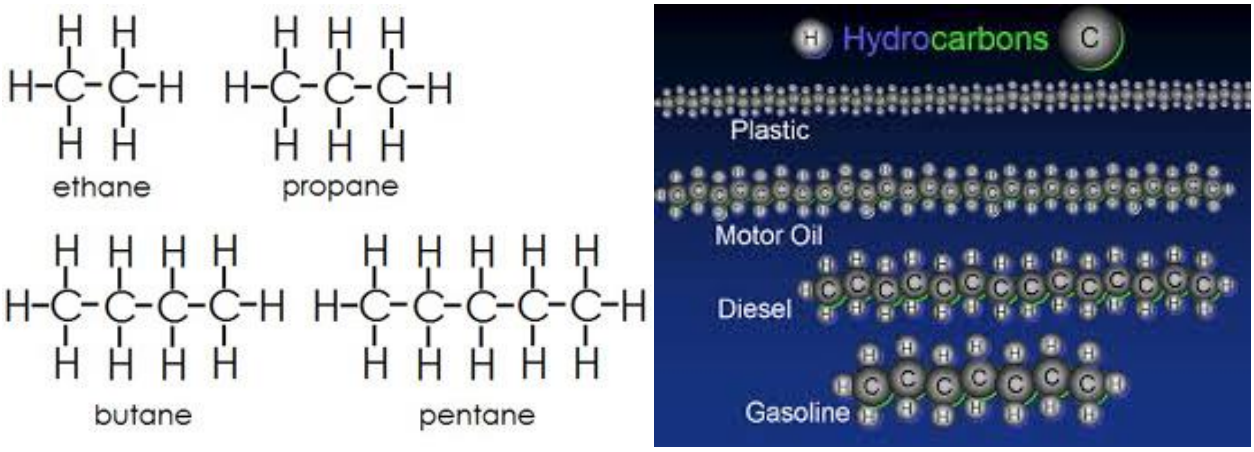


Ill.5- 36: Structures of (top left) Molecular Hydrogen; (bottom left) Carbon as Coal and (centre) the 'Bucky Ball'/Buckminsterfullerene[14], used to make nanotubes (right – from FOCUS magazine 7/2008)

simplest form of a covalent bond. And of course we are familiar with molecular Carbon in its various forms of diamond, coal and graphite – and more recently its famous isotope C60 (or Buckminsterfullerene), known for short as the Bucky-ball, takes the form of a truncated icosahedron (above centre) and is highly useful in nanotechnology.

[14] For the fascinating story of the accidental discovery of this molecule see Hugh Aldersey-Williams ***The Most Beautiful Molecule: The Discovery of the Buckyball*** 1998. Although initial attempts were made to patent the molecule, in 1992 mineralogists at Arizona State University found small amounts of it in rare carbonaceous Precambrian rock, and later it was found in a meteorite sample and rock formed at the boundary between the Cretaceous and Tertiary eras.

More obviously recognizable as a ring are the hexagonal arrangements of the hydrocarbons known as the Benzene ring series, some of which manifest as liquid. Their bonding was much more difficult to fathom because it was harder to see how the four 'spikes' of Carbon could be distributed within a hexagonal arrangement, until Kekulé in a waking state dream saw that the alternate Carbon bonds are doubled up like men linking arms round each others' shoulders, so that they stand in a ring of six Carbons surrounded by a further ring of six Hydrogens (see illustration next page). The succession of complexity in this series mostly consists of two, then three, and so on Benzene rings joined to each other (see the successive examples below left), but at times a Carbon combines with three Hydrogens at the outer ring instead of a single Hydrogen, as in the case of Xylene. Young noted that the number of positions to join onto on a ring or combination of rings follows the same sequence as that of electrons in atoms: 2, 6, 10



Ill.5- 37: Successive structures in the Benzene family, and (right) more complex hydrocarbons

and 14. I ask the reader to refer to any organic chemistry book for diagrams of the full range of this type of hydrocarbon, which includes such interesting substances as Toluene, Acetylene and Styrene, some of which, as in the case of Polystyrene, can polymerise into chains. The principle to bear in mind is their underlying hexagonality. A teacher once told me he could teach his VIth Form class this subject in a day - or take a whole term: the former is possible if you first point out the underlying principle: then the unfolding of the variations is easy to see and remember.

THE EARLY HISTORY OF THE DISCOVERY OF NOTE 3 MOLECULES

Scientists in the 17th and on into the 18th/19th centuries had worked under different guises – very often starting in roles running on from previous periods - such as alchemists (even including Newton, who had a foot in both worlds), herbalists, apothecaries and doctors - or discoverers of exotic plants in foreign lands who learned what they did to you from indigenous tribes (these included quinine, opium, tea and coffee). Only gradually did the chemist as we know the role today emerge as a separate profession when the systematic study of substance started to become their main occupation. The earliest emerging scientists - such as Hooke, Boyle, Faraday, Priestley, Lavoisier, Davies or Dalton – often grounded in what was called 'natural philosophy' were at pains simply to understand the real nature of the materials surrounding us that we take for granted, such as air or water. John Buckingham engagingly gives an account of the early history of such enquiries into 'matter' describing how only during

the 19C was there a 'breakthrough … centred on the belated realization that there was such a thing as a molecule, the smallest particle of a chemical compound that can exist – and that the molecule had a shape and size and properties, even though far too small to be seen[15]. It was the absence of a clear concept of the molecule that led science down many blind channels, and it was a major feat of the human intellect and imagination to guide it out again'. Nicolaou[16]'s highly illustrated version of the history of molecules - with a full display of the personalities involved and all the molecular structures spelled out - concentrates on the discovery of plant -v- newly synthesized drugs during the 20C with an judicious balance between text and pictures.

Dalton turns out as one of the pioneers who guided that search out of the 'blind channels' since instinctively from the recesses of his mind he saw atoms and the Elements in a more developed way than the Greek philosophers such as Anaximander or Democritus had. He gave different explanations for how his concept arose from deep in his subconscious, the first being that he was studying hydrocarbon gases such as methane and ethylene and noticed they had double the amount of Hydrogen to Carbon in them. Amazingly, he got a friend to make models of atoms in the form of balls of wood, presuming that different substances must be made up of different combinations of atoms – and even intuitively supplied them with their 'hooks/spikes' yet at the same time seeming not to consciously understand what he was doing. The problem was their invisibility: as Buckingham puts it, 'The smallest amount the human eye can see is a microgram [and] we now know that the number of molecules of cinnabar/mercuric sulphide (illustrated in ***Ill.5- 5***) in such a barely visible speck is 2,700,000,000,000,000'.

Ill.5- 38: Monument to Kekulé in Bonn, with detail below of the relief showing a Muse presenting him with the Benzene ring, Athena presiding; (right) model of the ring

Kekulé's story was a turning point in the story of pinning down individual molecules as they actually are, since his 'vision' of the Benzene ring drew up the portcullis onto the world of

[15] J Buckingham ***Chasing the Molecule*** Stroud Glos 2005

[16] K C Nicolaou & T Montagnon ***Molecules that Changed the World***

actual molecule construction, beginning simply with a two-Element combination that pointed the way to the refinement or synthesis of the many other kinds of fuel the hydrocarbons have to offer, used in the world of industry. It is worth noting just what he saw in his dream when he fell asleep in front of the fire, since it is relevant to how DNA was perceived later: in Narby's[17] wording, 'he dreamed of a snake dancing in front of his eyes while biting its tail and taunting him'. There are memorials to Kekulé in several cities in Germany, the most vivid being the one in Bonn (above) where he stands on a plinth flanked somewhat bizarrely by two sphinxes. On its front a relief shows the Muse Germania presenting the Benzene ring to him in a dream, with the working man of industry who benefits standing behind him. Not until the discovery of DNA did a molecule earn a reputation high enough to deserve a sculpture.

We must return to the development of the story of Carbon-Hydrogen links with the introduction of two further Elements coming under the next Molecule Octave Note, and consider the work of more big personalities involved in the long march of research – with just a taste of its personal clashes and victories. Let us quickly consider the centrality of those next two Elements.

INTERLUDE: OXYGEN AND NITROGEN ENTER THE SCENE

Two more gases had always been central to the studies of the 18C natural philosopher due to their importance for life: Oxygen and Nitrogen. Even though a creature contains traces of all the Elements in order to be whole, there are four master Elements upon which organic life depends: Hydrogen and Carbon (just considered above), along with Oxygen and Nitrogen (Periodic Table Elements 1, 6, 7 & 8). Hydrogen, from which all atoms progress (we remember how Ouspensky insisted on calling *all* Elements 'Hydrogens') forms its own molecule (***Ill.5- 36*** above) and immediately becomes crucial for organic life in molecular combination with Oxygen to form Water (H_2O). Oxygen comes into its own, not only as the Element breathed in by all animals and plants to ensure survival, but also through its combination with Carbon to form Carbon Dioxide (CO2), breathed *out* by all plant life at night. Water and Carbon Dioxide stand between Molecule Octave Notes 3 and 4 in Young's table as special cases of two-Element molecules that use atoms crucial to organic compounds - so we should look at them separately before taking the next full step to the next molecule note. (Nitrogen, too, enters into its full status in molecule form at Octave Note 4, especially in relation to the soil.)

MASTER SUBSTANCES OF ORGANIC LIFE 1: WATER

Water, with its clusters of tripartite molecules adding up to an icosahedral structure as a liquid - and hexagonal structure as a crystal - could almost be classed along with the benzene-type rings of Molecular Octave Note 3. But because Oxygen is involved it stands beyond Note 3 and just before Note 4 where Nitrogen and Oxygen join in with the Carbon and Hydrogen combinations. In other words, Water embodies an important step-change of quality – situated at what Ouspensky would see as the first tightening point of the entire molecule sequence.

Water is surely the most important molecule in our life, for its remarkably flexible and interchangeable qualities and its ability to absorb or act as matrix for most substances while

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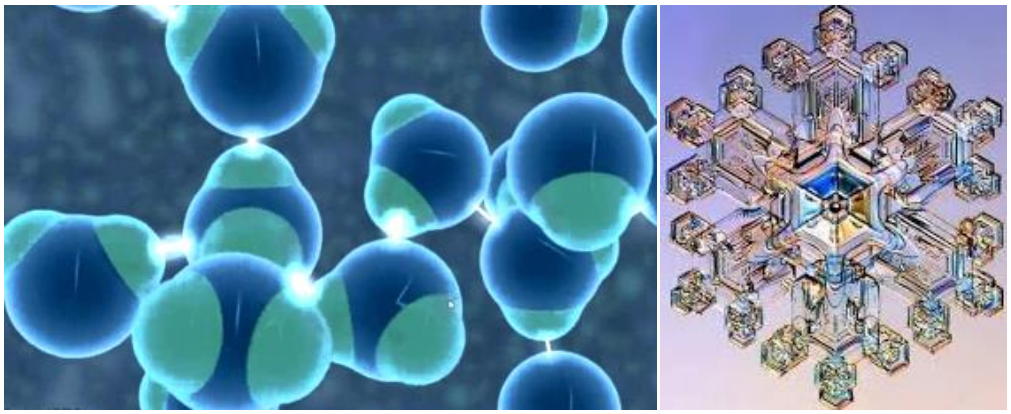
[17] Jeremy Narby ***The Cosmic Serpent: DNA and the Origins of Knowledge*** Geneva 1995

itself remaining unchanged. We have so far talked of solid crystals, but the very formation of the water molecule means that it is liquid. Its triadic nature enables it to undertake many



Ill.5- 39: (Left) The molecular shape of water; (right) hexagonal ice crystal

flexible transformations. The molecule consists of triangles of one Hydrogen atom and two Oxygen atoms collected together (when it comes down to it) into continuous icosahedra. It is worth remembering that although water is made up of two Hydrogen atoms to one Oxygen, the ratio of their *atomic weight* is 1 for Hydrogen to 8 for Oxygen - an octave in itself as diapason.

We know first-hand how temperature is crucial to the behaviour of Water when it becomes crystalline as solid ice, frost, or snowflake, when its triangular structure becomes fixed and hexagonal. Water is unique amongst molecules, behaving quite unlike any other. Its fusing and boiling points do not match the scale of other substances, nor does it sink when it hardens. Instead it sits in the form of chunks of ice, floating serenely on the surface of the liquid beneath it, because when it fuses the triangles expand and fill with air, becoming buoyant. ***The Times*** of 19 September 1994 reports that two chemists at the University of St Andrews found a way to remove all the water from a jelly without the jelly collapsing. What they were left with at the end was an unbearably light object, jelly-shaped but full of holes where the water had been. Imagine the same happening to a plant or animal if all the water was removed!

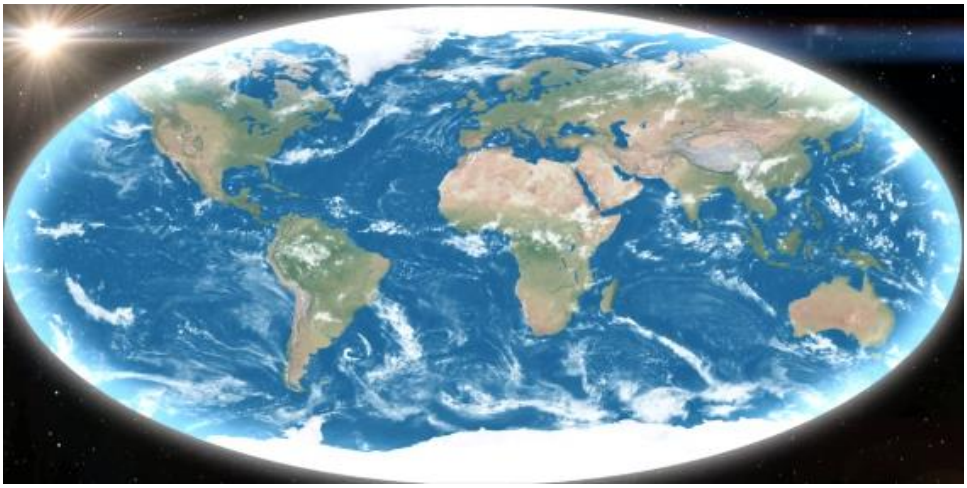
Each atom of the Water molecule when subject to different temperatures emits a note, and each note also radiates its own one or more colours in the resulting spectrum for water. The note C, Andrews[18] says, radiates a deep red, and if you strike the water notes on the piano you will hear the water chord in the atmosphere around you as if water molecules surround you. He describes how the exact ratios of water activity can be plotted with three electron oscilloscopes. The molecule is like a small bird as it dashes round at incredible speeds and its bonds stretch and move up and down at angles varying from 51° to 58° or so (beyond which it becomes steam), its shrill cries altering all the time. 51° is the angle of slope of the vertices of the Great Pyramid of Gizeh, an angle on the resonance between Water and the Pyramid as master structures of life. Andrews calculated frequencies for the Water molecule, his figures being 1615/3674/3796 (the chord $EC^{\#1}E^{b1}$) which he said sounded melancholy and depressing. An article in ***The New Scientist*** for 7 April 1977 gave a spectral wave diagram for the water

[18] Donald Hatch Andrews ***The Symphony of Life*** London 1966

molecule to compare with Andrews' observation, giving the numbers 1595/3652/3756, but did not include the musical notes. This reminds us of a passage in Narby's book (p.68), worth bringing in at this juncture as a pointer to more detailed accounts of DNA later, which concludes that 'in their visions shamans manage to take their consciousness down to the molecular level' and then quotes the anthropologist, Reichel-Dolmatoff:

> *Angelika Gebhart-Sayer[19] discusses the 'visual music' projected by the spirits in front of the shaman's eyes. It is made up of three-dimensional images that coalesce into sound that the shaman imitates by emitting corresponding melodies.*

Water is the most abundant molecular substance in existence, and our own bodies consist of over nine-tenths water. Critchlow describes in ***Islamic Patterns*** how Water, no matter which way you view it, is always icosahedral, showing three-fold, pentagonal, hexagonal and octahedral symmetries, all mediated through equilateral triangles. In this three-dimensional spatial symmetry and regularity the icosahedral structures, he says, combines the archetypes of 2, 3 and 5 (in other words contains all possible patterns within itself up to 12 (11 consisting of 6 + 5). With the introduction of the 5 factor comes the secret of organic molecules that are alive, with water as their implicit foundation through attached Hydrogen and Oxygen atoms. The inclusion of the pentagonal factor - as opposed to the dry crystals or volatile gases or liquids so far described - gives biological logarithmic spiral growth dimensions to water, enabler of biological life. Remembering the octave inherent in the atomic structure of the Oxygen atom (***Book 3, Ill. 3-26***), maybe this is why Oxygen fixes and makes whole all that it combines with. The square, hexagon (made of triangles) and pentagon are the three geometric harmonies of the double helix at *Octave Note 7* of the molecular world, so that in an uncanny way Water heralds the encoder of higher life-forms lying at the *end* narrowing point of the molecular octave, much as John the Baptist heralds Christ. The wonders of water, its position in the molecular hierarchy and its meaning in religious ritual[20] is multivalent, underlining its unique



Ill.5- 40: The Blue-Green Planet –the yellow being desert and brown the mountainous parts providing a host of geological and molecular variety

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[19] Full bibliographical references are given by Narby – they are too specialist to include in ours.

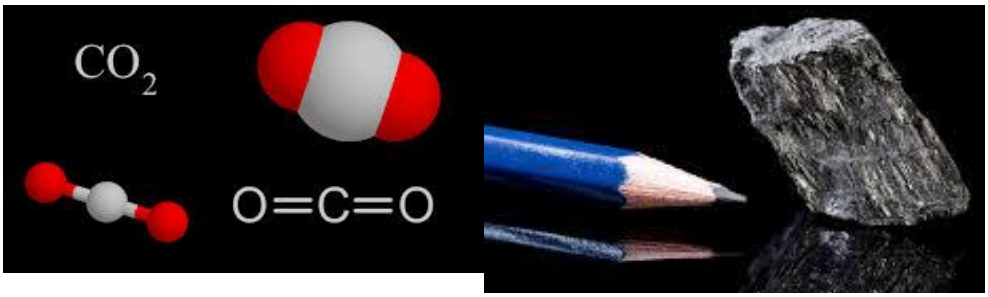
[20] Paolo Consigli ***The Hidden Secrets of Water: Discovering the powers of the magical molecule of life*** London 2008

role as the molecule of Life. Indeed, we call Planet Earth 'The Blue Planet' due to the blue colour of the oceans caused by the Oxygen component of the water (or the white ice of the Poles) – while all the green areas are created by the Chlorophyll molecules of plant life[21] (see in ***Book 3, Ill. 4-34*** from Hauschka's ***The Nature of Substance*** and ***Ill. 4-35*** from Krüger ***Das Universum Singt***). This leaves the mountain and yellow desert areas which are full of minerals with the most common components in their geological makeup (many from the mountains, studied under our last section on stones) being Calcium and Silicon compounds with added single Elements providing the colour. In the case of the Chlorophyll of plant-life, it is Magnesium added into the CHO triad that with exposure to sunlight causes the greenness of the leaves, in the process giving off Carbon Dioxide at night but breathing it in during the day. Let us look at this gas more closely.

MASTER SUBSTANCES OF ORGANIC LIFE 2: CARBON DIOXIDE

Even though (like Water) Carbon Dioxide is not a salt, it is on the face of it a Note 2 combination of two Elements – this time Carbon and Oxygen. It could be seen as the zeroth stage of the Hydrocarbons - except that Oxygen is involved - thus it is better placed as the zeroth molecule of the functional organic molecules of Molecular Octave Note 4 – which we come to shortly.

Why is Carbon so crucial to organic life (the definition of an organic molecule is that it contains Carbon)? Is it to do with its simple, yet flexible structure for combinability? Certainly it is only Carbon atoms that can hook onto one another to form long chains – other Elements do well if they can form a chain as long as six. It has been known for a long time that Carbon, 6 on the Periodic Table, joins up with other Elements to form hexagonal rings and itself forms hexagonally based crystals in solo molecular form, either as planar sheets of graphite or hard, stepped hexagonal diamond crystals, harder than quartz. The disposition of the single atoms



Ill.5- 41: The Carbon Dioxide molecule CO2 – and Carbon as graphite, used in pencils

with each other at Note 1 gives coal (***Ill.5- 36***), graphite or diamonds depending on whether its four 'spikes' point out tetrahedrally, in planar disposition, or stepped back as in the diamond structure. In its common tetrahedral form it is the way other Elements join on to its apices which conditions the turn to left or right in certain crystalline or organic molecules, determining whether the molecule is dead or alive: Pasteur had first noticed the phenomenon, saying 'If you've ever wondered what defines life, chemically that is the answer'.

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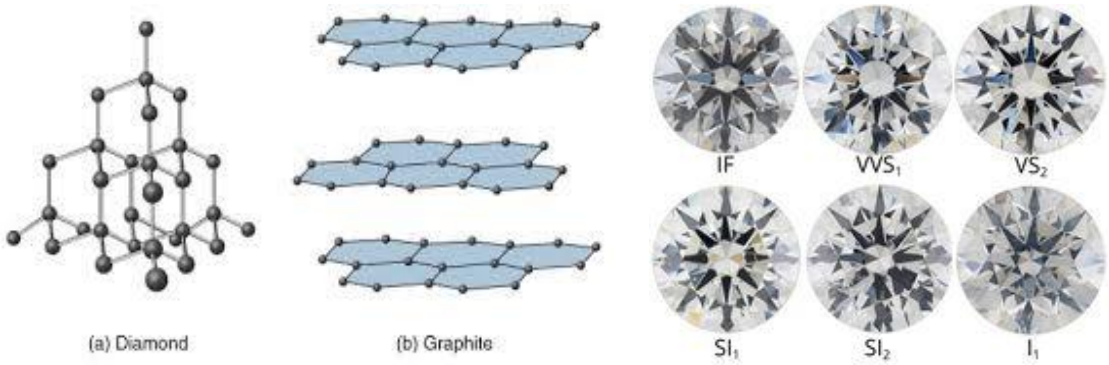
[21] See our ***Book 4*** in conjunction with M Séquin's new book, ***The Chemistry of Plants and Insects: Plants, Bugs and Molecules*** Croydon 2017

Lingering on diamonds a little longer, I cannot resist quoting from a rather clever piece by Saatchi[22] on his regular feature page, *The Naked Eye:*

> *Large diamond hailstones routinely fall on planets Saturn and Jupiter, surely tempting space explorers to really put their backs into it and develop robotic mining ships… Scientists continue to probe the unknowns of space: in fact in the past 20 years over 1000 planets outside our own solar system have been located. One has been discovered that is composed mostly of carbon, known somewhat prosaically as 55 Cancri; it is fully one-third pure diamond. Even more glamorous, a star has been identified which is essentially a single giant diamond of 10 billion trillion trillion carats. It was named Lucy after the Beatles song,'* Lucy in the Sky with Diamonds'.



Ill.5- 42: The graphite and diamond isotopes of Carbon (the latter picture is a page from a diamond jeweller's guide for identifying different qualities of diamond)

In 1985 the more complex molecular form of Carbon (see ***Ill.5- 36***) was discovered by Prof. Harry Kroto at Sussex University when he and his colleagues were trying to mimic the surface of a star. Its structure consists of hexagonal facets clustered in fives, creating the sides of a pentagon which means its 60 atoms are arranged in the form of the first Archimedean Solid, the Truncated Icosahedron. Because it reminded people of the geodesic domes of Buckminster Fuller so ubiquitous in the 1960s/70s it was named Buckminsterfullerene and Archimedes lost the credit. It has many practical applications, since it is impervious to laser beams in the same way plain Carbon blocks electricity, so it can protect radioactive materials in its tiny molecular capsules, but it also may be used as a super-lubricant, extending Carbon's scope and indicating it is an Element as amenable as Oxygen to the variety of combinations it can take on or attract to it. In atomic weight it relates to Oxygen as 6:8 or 3:4, and in its truncated icosahedral form it is closely related to icosahedral Water! These are easy numbers into which a host of other Elements can lock in, with material results that are astonishing in their variety and scope.

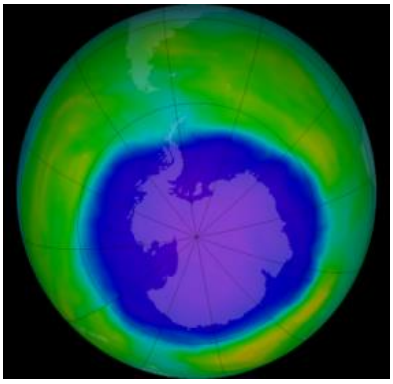
But here we concentrate on Carbon's bond with Oxygen to form CO_2, so vital to the plant world and its reciprocal return of Oxygen to the animal world - which might seem to qualify it as a special case of the hydrocarbon molecules describes under Note 3. The entire scenario of Climate Change rests on the quantity of Carbon Dioxide/Carbon Monoxide emissions (as well as Methane emissions from the dung of the animal world) which have risen to such high proportions that the balance in favour of life-giving Oxygen is being lost (since methane is the

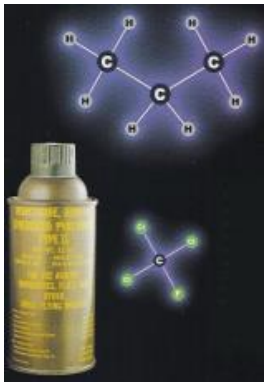
[22] Charles Saatchi 'It Rains Diamonds on Saturn' ***The London Evening Standard*** 12 October 2017

fuel for gas stoves, some attempt has been made to link cow methane to the kitchen but impracticalities of the logistics put it far from resulting in a national grid). Deforestation means fewer trees are absorbing excess Carbon Dioxide and the move towards vegetarianism is partly driven by attempts to cut down on large animal herds emitting Methane into the atmosphere in larger proportions, possibly an even greater problem than CO_2 emissions. Below are relevant quotations from public notices on the Internet:

> *Natural gases, including atmospheric water vapour, methane and carbon dioxide, act as an insulating blanket for the earth by retaining heat from the sun which keeps the earth warm. This is known as 'the greenhouse effect', and the gases that cause it are known as 'greenhouse gases'. Without these gases, the earth would be much colder than it is. Increased concentrations of greenhouse gases in the earth's atmosphere cause global temperatures to rise. This is known as 'global warming'.*
>
> *Since the industrial revolution, emissions of greenhouse gases (mainly carbon dioxide from the burning of fossil fuels) have increased sharply. Emissions of the greenhouse gas methane from livestock are larger than previously thought, posing an additional challenge in the fight to curb global warming, scientists have said. Revised calculations of methane produced per head of cattle show that global livestock emissions in 2011 were 11% higher than estimates based on data from the UN's Intergovernmental Panel for Climate Change (IPCC).*

This change in the balance of gases in the Earth's atmosphere has resulted in a huge hole in the Ozone layer over the Antarctic (its role being to act as a protective layer above Earth, filtering out harmful ultraviolet rays), among other things resulting in the birth of blind or





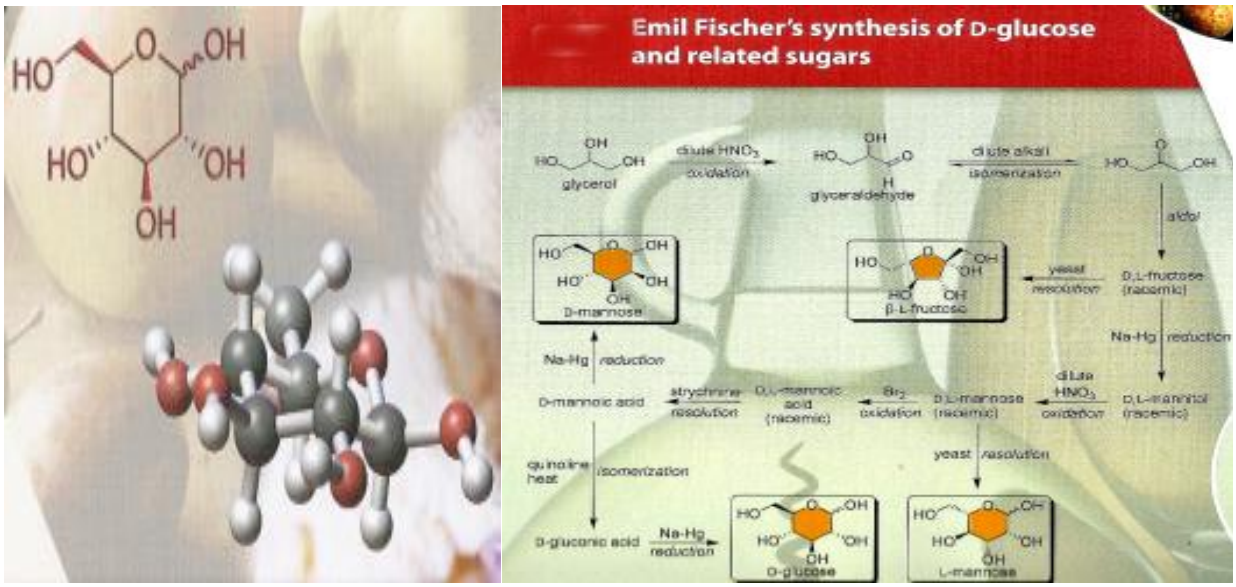
NASA's space view of the Ozone hole in 2015 – and Gray's image for CFCs

otherwise deformed livestock in Patagonia. Thankfully, human action to mitigate any manmade contribution to this destruction is bearing fruit: the hole was reported in 2017 to have shrunk appreciably. Bans in force also covered the Fluoride and Chlorine contained in the compounds known as CFCs, formerly widely used as a propellant in spray canisters and in refrigeration coolant mechanisms - the principal compound being Difluoro-dichloro-ethane (one of May and Cotton's 'molecules that amaze us') that is simply left to float off into the atmosphere as is and extremely damaging to the Ozone layer in its own right.

All this said, Carbon Dioxide itself in a way belongs with the molecules of Note 4 - which we can now move on to consider.

YOUNG'S MOLECULAR OCTAVE NOTE 4 (FA): COMPOUNDS OF COMPOUNDS

For Young, the keynote of Molecular Octave Note 4-type molecules is that they are closely bound up with the transformational processes of everyday life involving molecules that easily break up and interchange with other forms of organic life as food and therefore to be seen as 'functional compounds'. These molecules consist of the compounds of *Note 3* expanded by the addition of other Elements, most importantly Oxygen and Nitrogen, to create much larger molecules that consists of clusters, often anchored on a central atom or cluster of the same atom. For example, much of the substance we take from fruit are forms of sugar, called carbohydrates since made up of Carbon, Hydrogen and Oxygen. Research into their makeup started with the structure of Glucose ($C_6H_{12}O_6$) and related sugars (below). Chemists realised the atoms involved could be arranged in sixteen possible arrangements, or isomers (like atomic isotopes), each of which have slightly different properties – and not all occur naturally. They undertook the synthesis of all sixteen, and it turned out that the structure of some of them turn to the right (the dextrose sugars) while others turning to the left are 'sterile' and not absorbable by the animal body (note again the crucial matter of turning one way or another)[23].



Ill.5- 43: (Left) Glucose structure; (right) other key sugars – from Nicolaou (zoom for detail)

EARLIEST STEPS IN DETERMINING MOLECULE COMPOSITION

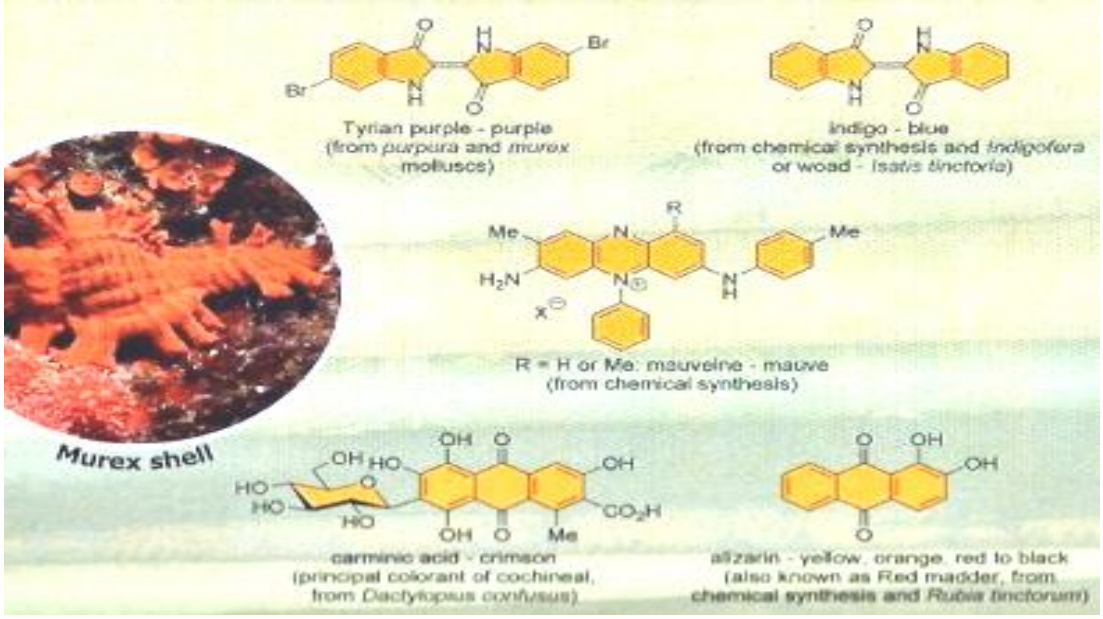
Not only had chemists such as Berthelot in the 1850s found out that organic molecules could be synthesised artificially in the laboratory, but he, Wöhler, Liebig, Hofmann and Perkin went on to

Ill.5- 44: Portraits of Liebig and Wöhler who worked closely together – and Berzelius who devised the definitive alphabetic notation for the Elements

[23] For a study of the phenomenon in general see Martin Gardner ***The Ambidextrous Universe*** London 1964

discover hundreds of new substances by playing around with the different combinations of Hydrogen, Carbon, Oxygen and Nitrogen (Perkin particularly contributed towards the synthesis of aniline dyes - one of the first being mauveine – as well as artificial versions of natural dyes). In other words, knowing the basic layout of organic molecules meant that they could work out in advance alternative variant blueprints for as yet unknown compounds. In the case of Hofmann and his pupil, Perkin, they spawned an entire range of beautiful purple and red aniline dyes - resulting by the mid-20C in no less than 3500 synthetic dyes derived from such molecular manipulation, completely revolutionising the wool and clothing industry.

> [***Note**: A methyl group containing one carbon atom bonded to three hydrogen atoms (CH_3) occurs in many of these molecule structures, for simplicity shortened to **Me** (used for the first time in the illustration below). A stable constituent of scores of this type of molecule, the **Me** cluster appears constantly in organic hydrocarbon compounds.*]



Ill.5- 45: Dyes were formerly derived in the natural world from HCON molecules: Mauveine was the first to be artificially created - a vivid purple hue – from Nicolaou (zoom for detail)

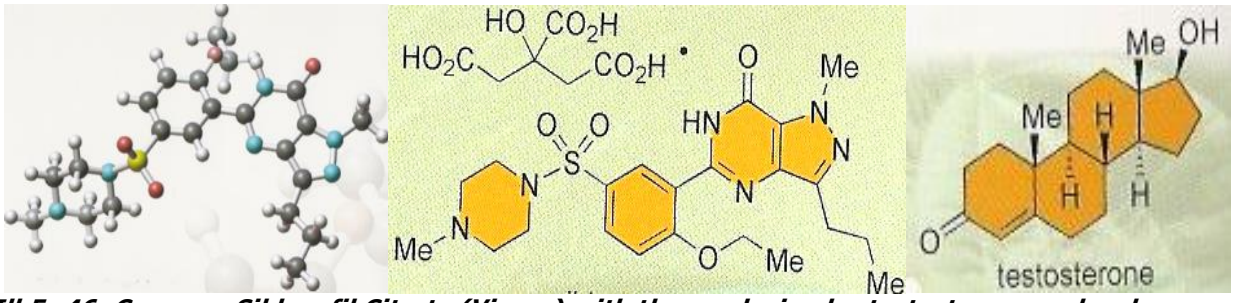
Liebig served his apprenticeship in the laboratories of Paris, made famous earlier by the work of Lavoisier (who was in the end a casualty of the French Revolution), but probably would not have been so successful once back in his own centre at Giessen without the stabilising presence of Wöhler. Completing the influential triumvirate was the Swede, Berzelius, serving initially as a link to Davy in Britain when both pondered the nature of combinability between atoms. It was Berzelius who came up with the system of notation for the atoms that we use today (the alphabetic initials relating to their names) – as opposed to other systems put forward by Dalton and Lavoisier. As Buckingham points out, none of these 19C chemists could move forward in identifying different molecules until they had accurate atomic weights for the Elements (at the same time a clue to their musical note – see Kayser's table below), whereby to find 'the ratio by which the atom of one Element is heavier than that of another. Without these, it was impossible to assign accurate formulae to the compounds…'. He goes on *(p.93)*:

> *Berzelius, a much better experimenter than Dalton and a strong believer in the atomic theory, set out with a main aim to find out the atomic weights of all the known*

> *Elements by meticulously measuring their equivalent, or combining, weights. By 1818 he had published a table containing the percentage weight compositions of nearly all of the 2,000 chemical compounds then known. On this he based what he thought were the atomic weights of 45 of the 49 known Elements… . It was a remarkable achievement.*

The interesting thought here is that atomic weights *could be only deduced via molecules* - by breaking up compounds and measuring the constituent products – a process pursued throughout the 19C by hundreds of chemists, mainly in Britain, Germany, France and Italy. We must leave it to the reader to get a fuller idea of the characters involved from Buckingham and (for later chemists) from Nicolaou, Kean and Aldersey-Williams – but we should at least here name Dumas, Laurent, Gerhardt and the Italians Avogadro and Cannizzaro, the latter best defining atomic weight as 'the least weight of it present in the molecular weight of any of its compounds'. In drawing up succeeding versions of what became the Periodic Table, apart from leaning on pioneer work such as Döbereiner's Pillars (see Kean p.242-3), at a key conference of leading chemists at Karlsruhe on 3 September 1860 Mendeleev was impressed by Cannizzaro's work, which eventually helped to clarify his own thinking on the arrangement of the Periodic Table as we know it today. Cannizzaro, similarly, had learned from his fellow-countryman Avogadro's increasingly accurate understanding of atomic weight, also taking into account Frankland's understanding of *valency* or the nature of atomic combinability – another important concept to get sorted out before any real progress could be made on the actual structure of the molecules they were all splitting, measuring and synthesising. Over the decades progress was far from smooth: clashes between personalities and opposing theories are all summed up in Buckingham's quotation: 'The history of organic chemistry… presents a distressing picture of animosities between Berzelius, Liebig and Dumas: when they combined forces and turned on Laurent [who defined all organic compounds as derived from hydrocarbons] and Gerhardt, the effect was even more deplorable'. (Laurent and Gerhardt lived outside Paris and tended to be looked down on and left out of the loop by their Parisian colleagues - going by my encounters with the Sorbonnais in other fields, nothing has much has changed there - miaouw)).

In tandem - while this data was constantly being refined in the background at the hands of a host of chemists - Liebig and Wöhler were the key perpetrators in undertaking the analysis of the constituents and formulae of hundreds of compounds which again and again revealed that combinations occur according to whole numbers ratios (how else would so many variant combinations be possible?). Against this background we have the analysis of the Benzene formula (its actual structure came later with Kekulé), described as the culminating achievement

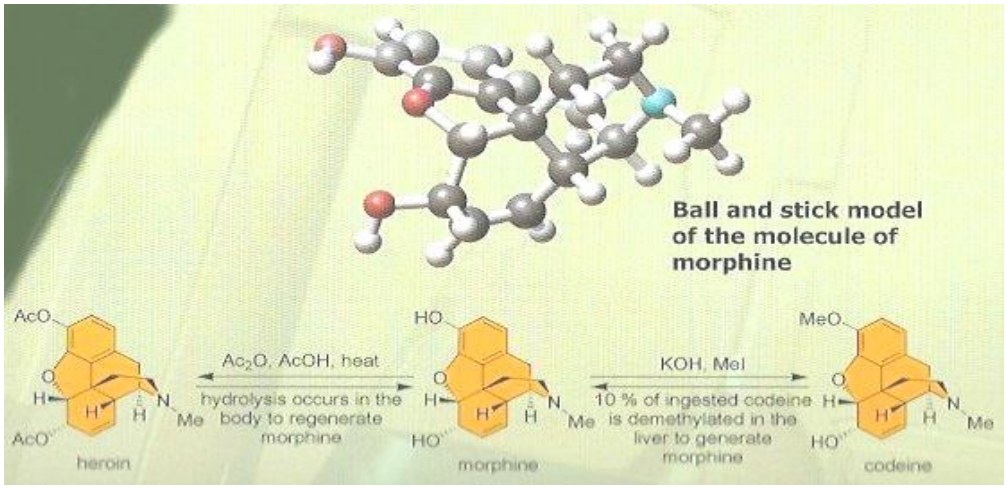


Ill.5- 46: Compare Sildenafil Citrate (Viagra) with the much simpler testosterone molecule

of Faraday's career. Much later it was determined that even sex hormones derive from the Benzene series – the establishment of one step formed the foundation for the next.

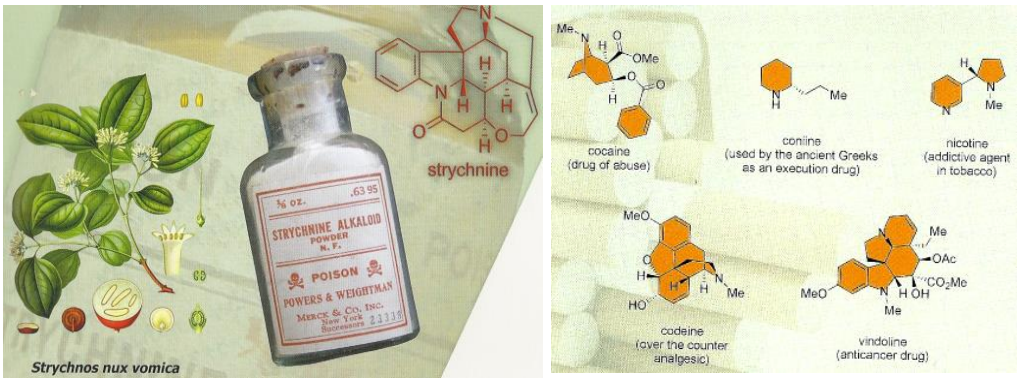
KEY CLASSES OF MOLECULE 4 GROUPS

Another family of combinations gives the alkaloid group of pain-killers (analgesics), some of which in high doses are poisons (next illustrations). For instance the formula for Morphine is



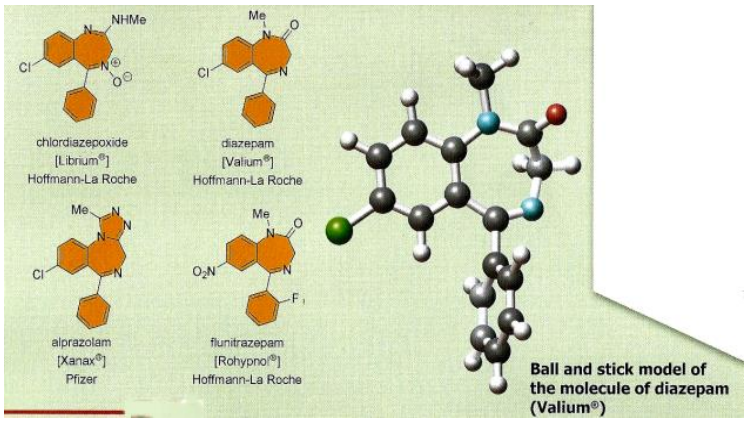
Ill.5- 47: The similar structures of Heroin, Morphine and Codeine – from Nicolau

$C_{17}H_{19}O_3N$ as compared to Strychnine $C_{21}H_{22}O_2NN$: related Alkaloids are Cocaine, Quinine, Hemlock/Deadly Nightshade – and of course Nicotine. The simplest member of this group must be N_2O, Nitrous Oxide, also used as an anaesthetic – in its structure a 'brother' of CO_2. A form



Ill.5- 48: (Left) the plant poison Strychnine and (right) Cocaine, nicotine and codeine molecules among others – from Nicolau

of Cocaine has been synthesised artificially for use as a local anaesthetic, and of Quinine to cure malaria. The synthesised version of cocaine (Novocaine) does not have addictive side-effects but still does the anaesthetic job required, acting as a local anaesthetic in dentistry. On

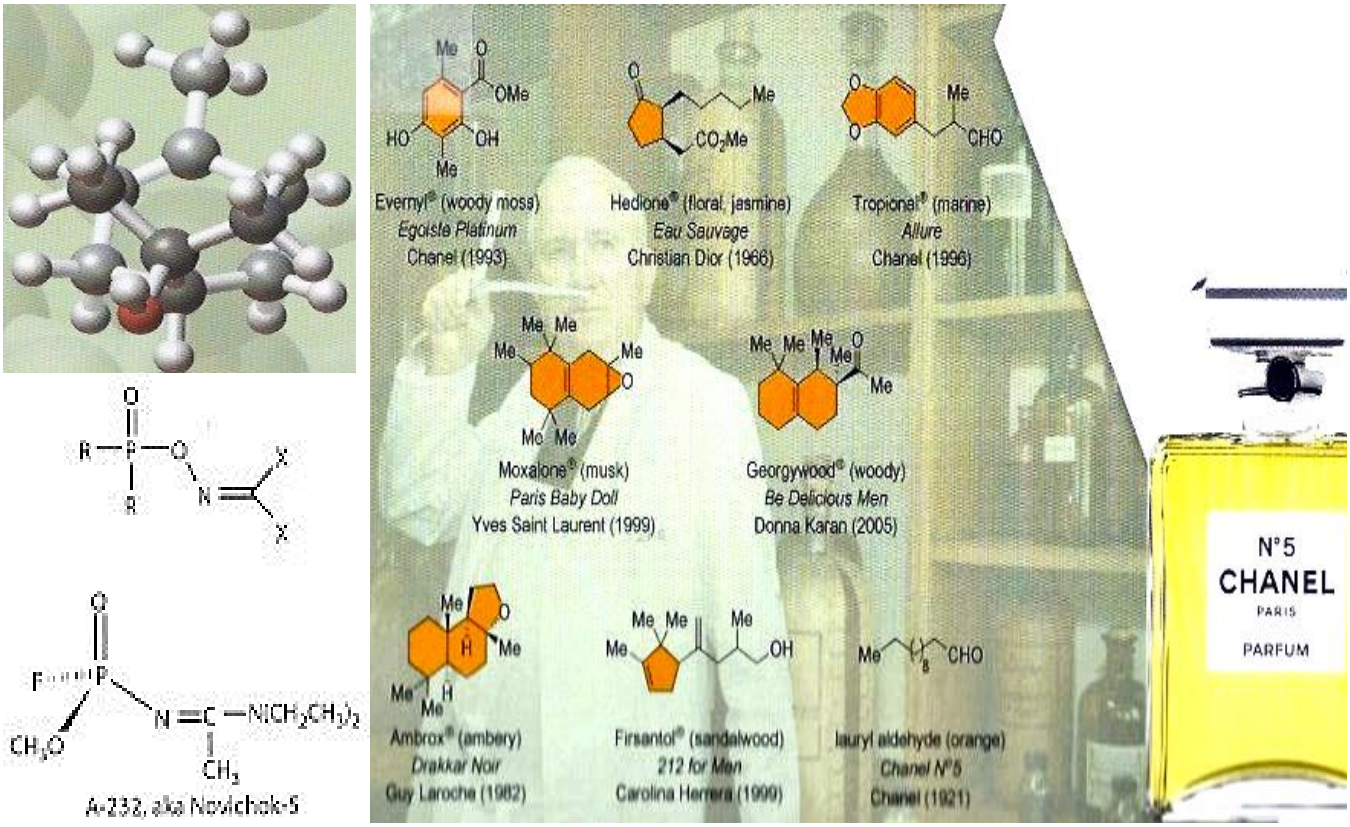


Ill.5- 49: Structures of some well-known sedatives – from Nicolau

the other hand, the synthetic form of Morphine, Heroin (see ***Ill.5- 47***), has turned out to be a highly dangerous drug in its damaging addictiveness. Sedatives such as sleeping pills (above) come into the same group– and so do all the alcohols consumed by humans (only addicts find out how devastatingly poisonous alcohol and nicotine can be: moderate dosage is essential).

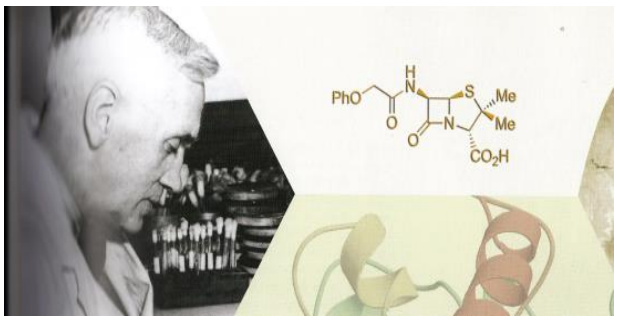
MODERN DISCOVERIES

When radioactive or highly unstable Elements such as Phosphorus come into the formulae one obtains a whole series of drastic synthetic poisons recently worked on by Russia for use in chemical warfare – a thoroughly dangerous arena altogether, best left alone by humanity. Coincidentally, while writing this section in March 2018, an ex-Russian spy (General Skirpal) experienced an assassination attempt through such a poison in England (see excerpts in ***Appendix B*** from an on-line report by the Russian chemist who worked on the poison, known as Novichok)). An entire family of related poisons can be created from common, unrestricted and undetectable industrial and agricultural organo-phosphate chemicals available worldwide: all kill by inhibiting enzymes (see *Molecule Note 6*) that control nerve receptors in the brain.



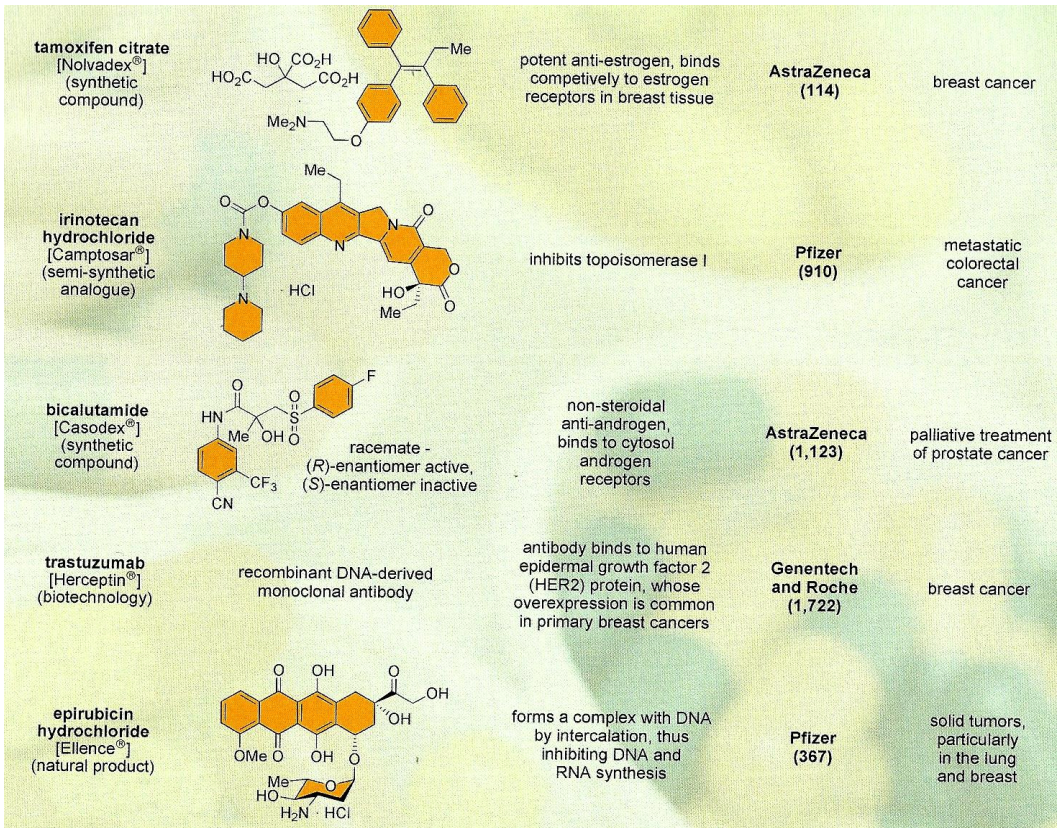
Ill.5- 50: The Turpineol molecule and some famous perfumes using its derivatives – from Nicolaou; below left one version of the Novichok molecule – from Cotton

We cannot possibly show the multitude of differing chains composed of the four master Elements that have either been discovered or synthesised – enhancing many spheres of human life in so many different ways. For other material, see the generous display of examples given in Nicolaou's book which in many ways is a masterpiece: I have borrowed many of his vivid diagrams for this section, hopefully giving it a free advertisement! He tracks the work of his own generation of international teams of chemists from the 1950s onwards who followed in the wake of Alexander Fleming's discovery of Penicillin, over the years working not only on already known natural drugs, but moving on from them to synthesise further medications for anti-



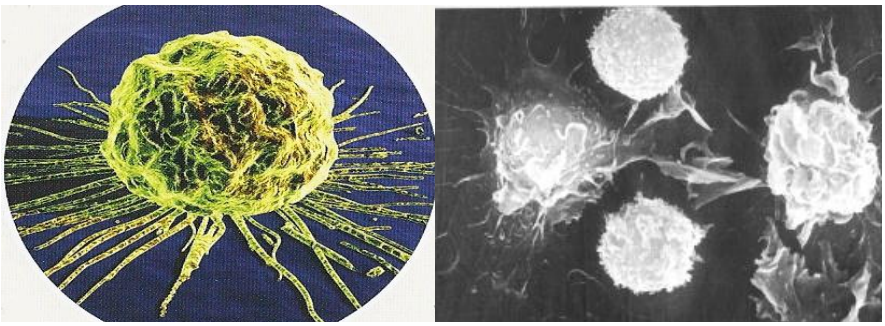
Ill.5- 51: Sir Alexander Fleming and the Penicillin structure

cancer, anti-cholesterol, anti-HIV, or anti-sexual disfunction - let alone a host of other ailments connected with the degeneration of the human brain and body.



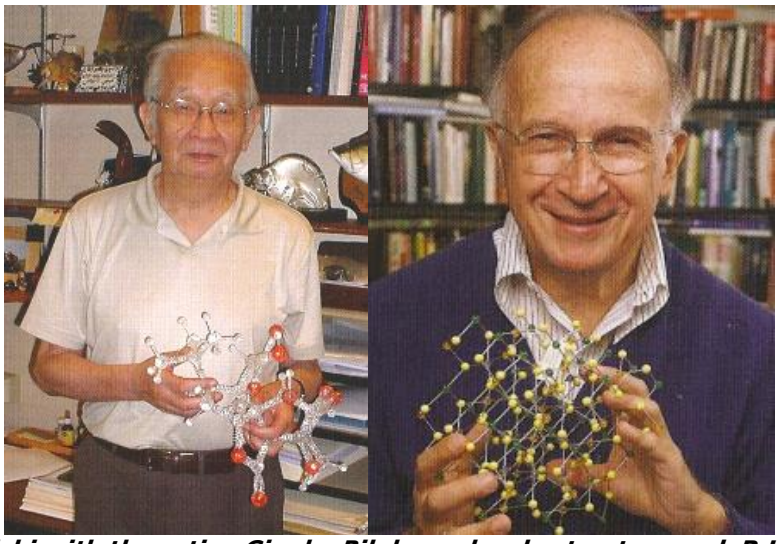
Ill.5- 52: Some well-known anti-cancer drugs and the laboratories who patented them – from Nicolaou

In combating so many of these illnesses, the effectiveness of the drug depends on its ability to disarm the dissonant or aggressively spiky shapes of the deformed cells or virus concerned (viruses, and Kean puts it so well, 'hijack cells by clamping onto them and then, like inverse mosquitoes, injecting rogue genetic information').



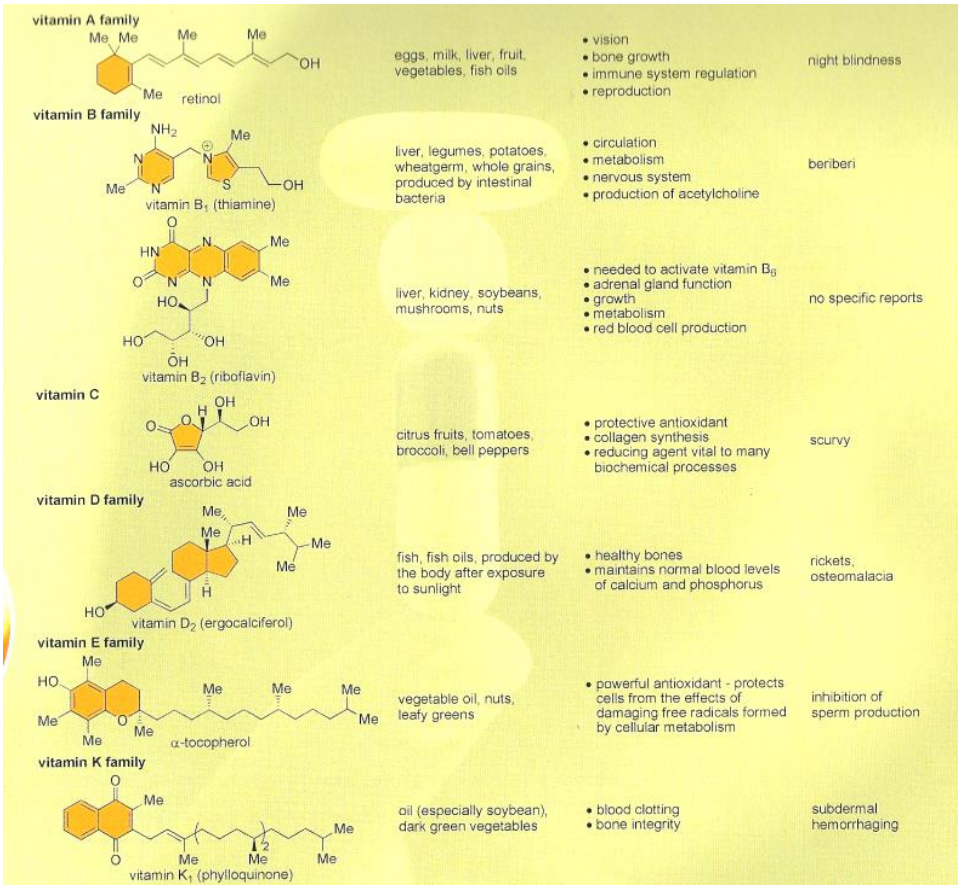
Ill.5- 53: (Left) Single cancer cell which will (right) go on dividing if not checked or excised – Nicolaou and The Times 21 March 1995

Other scientists have worked on the vital constituents of food – with a whole branch devoted to Vitamins and what they do. Where in times past the public might have relied on herbs, decade



Ill.5- 54: Nakanishi with the active Gingko Biloba molecule structure and R Hoffmann holding the structure of Vitamin B_{12} on which he worked with R B Woodward – both from Nicolaou

by decade science has gone in search of elixirs or 'wonder-drugs' of life, moving from vitamins to amino acids and on to other classes of beneficial molecule. At the same time tonics known for millennia by indigenous peoples[24] - from South America to China - are analysed by researchers, harvested and packaged, fuelling the next fad.



Ill.5- 55: Summary of key vitamins – from Nicolaou

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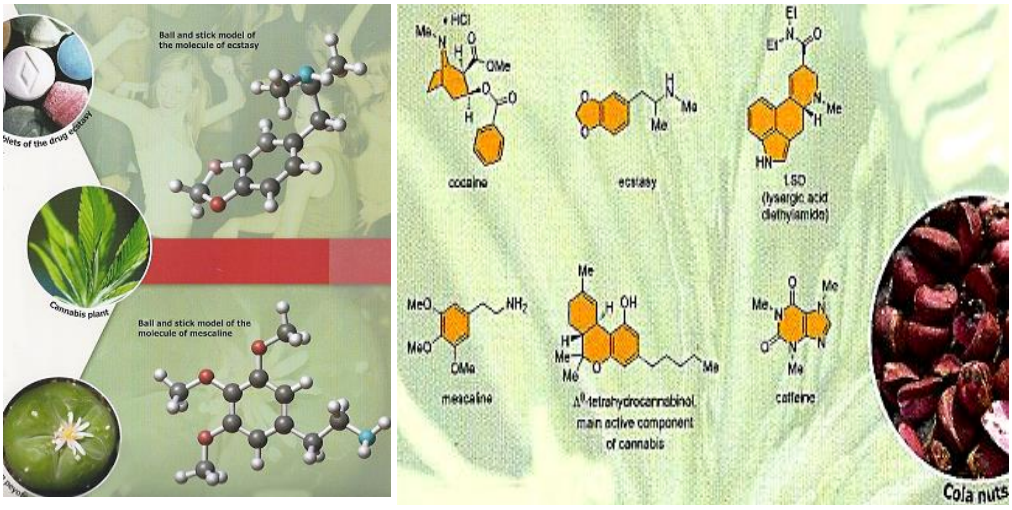
[24] Narby *ibid.* states '74% of the modern pharmacopoeia's plant-based remedies were first discovered by traditional societies', most of them in tropical forests. The matter of their intellectual property rights is now an international issue, given that rapacious pharmacy companies find ways to steal and/or synthesise medications to take ownership.

We remember how that trend began in the pioneering years of research with the discovery of quinine: by now many fatal diseases of the past have been eradicated, thanks to vaccines, and these all come under Note 4 Molecules.

Date of introduction of first vaccine	Disease
1796	smallpox
1885	rabies
1897	plague
1923	diptheria
1926	pertussis
1927	tetanus
1927	tuberculosis (BCG)
1935	yellow fever
1955	poliomyelitis (injectable)
1962	poliomyelitis (oral)
1964	measles
1967	mumps
1970	rubella
1981	hepatitis B
2006	human papillomavirus

Ill.5- 56: A time-line for vaccine discoveries – from Nicolaou

From the many examples we have been able to show above, it is obvious that the complexity of the clusters takes them onto a very different level from the simple and usually symmetrical layouts of Note 3 Molecules. Carefully measured dosages are required in animal/human use of the alkaloids to achieve the state required (balanced health being the most important goal of all). These not only include the depressant, alcohol – certainly a high-octane type of fuel for humans to ingest (we ignite the brandy on the Christmas pudding!) – but more so the



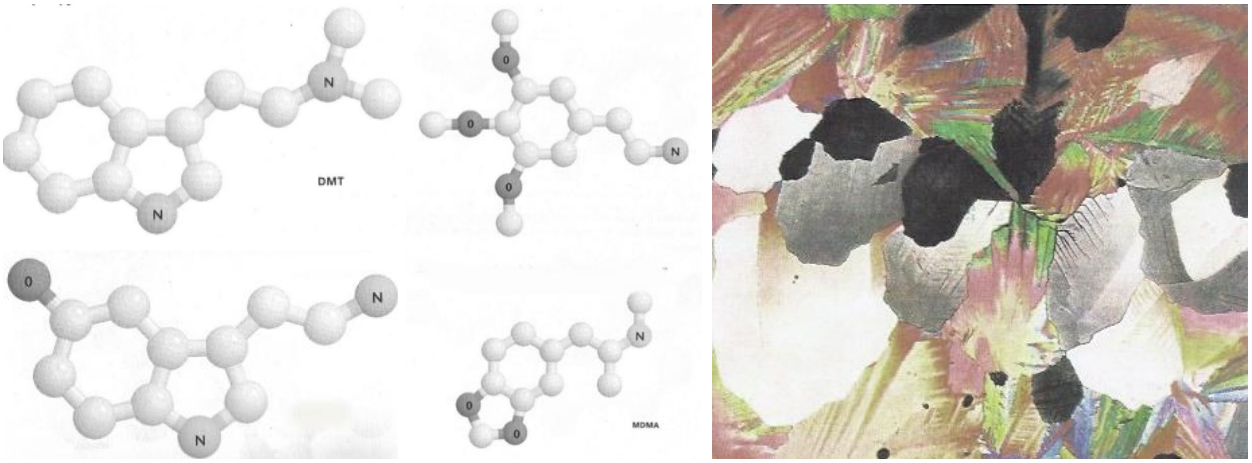
Ill.5- 57: Mind-enhancing substances range from cannabis to peyote, or even coffee to Coca Cola [zoom]. (Timothy Leary's famous hippie mantra was 'turn on - tune in - drop out', while the Beatles song Lucy in the Sky with Diamonds refers to an LSD trip)

hallucinogenic/analgesic molecules, on the brink of being classifiable as poisons, that interact directly with the nervous system including the brain. Again we have the scenario where 'natural highs' were long known in the ancient world, but - when developed further through modern chemistry – are rarely ingested in association with religion as they used to be, though it has to

be said books like ***The Psychedelic Guide to Preparation of the Eucharist*** was produced in 1968 by the Neo-American Church explaining how to manufacture and cultivate marijuana, peyote, mushrooms, morning glory, LSD and STP for religious purposes[25]

Thus where Note 3 substances are not suited for animal consumption at all, Note 4 substances are double-edged swords, leading towards cessation of life or disintegration, but also in the right proportions opening out the organism to higher worlds through molecular interaction alone (this is due to the laws of correspondence between worlds, to which the master key is the music or dissonance of levels lining up together - or not). For instance, Rick Strassman's research into DMT, 'the spirit molecule' (the illustrations below show some related structures, all ringing the changes on combinations of Carbon (not labelled), Oxygen, Nitrogen and numerous Hydrogen atoms left out in order not to clutter the diagrams) revealed that many taking it had out-of-body experiences and visions akin to the 'near-death experience' of those who come back alive from the operating table – an experience the seers of the Great Religions would have found more gently through meditation, fasting and sacred art and music.

For the more familiar middle range stimulation forming part of our daily lives, it is worth reading Emsley's ***Molecules at an Exhibition*** on coffee and Coca Cola – while May and Cotton in ***Molecules that Amaze us*** add further fascinating information on molecules such as nicotine and coffee or tea through which the human race delights in semi-poisoning itself in the name of life enhancement.



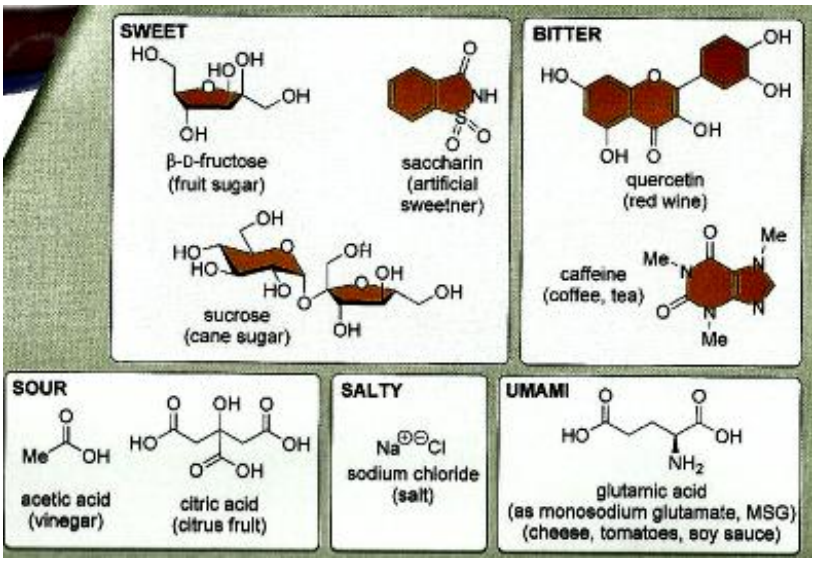
Ill.5- 58: (Top left) DMT (or dimethyltryptamine, the main ingredient in ayahuasca); (top centre) Mescaline, found in peyote; (lower left) Serotonin (non-addictive), (lower centre) MDMA (Ecstasy); (right) caffeine crystals – L'Illustration 21-3-31

ROLE OF THE HARMONICS OF COMPLEX NOTE 4 MOLECULES IN HEALTH

One way or another, Young seems to be right in seeing the world at Molecule 4 level as being the turning point beyond which the only way is 'up'. But if the 'up' journey (trip) using Molecule 4 substances is undertaken in violation of natural processes (storming the castle instead of going in through the front gate) then - as we know only too well from the newspaper reports describing many a lost soul – physical, mental and spiritual fragmentation results instead of simply being well-fed and slightly tipsy.

[25] I discovered this only when near completion of this book, from a fascinating review of a new book by Sam Leith in ***The Spectator*** for 12 May 2018 by Michel Pollan entitled ***How to Change your Mind: The New Science of Psychedelics*** (Allen Lane) in which the use of such substances are at last being embraced in religion and medicine.

Thus at Molecule Octave Note 4 we have the full complexity and endless variety of compounds of full-blown organic chemistry that include sugars, alcohols, aldehydes, amines, carbolic acids, the esters that are responsible for flavours and scents, and dyes. It is their intercombinability

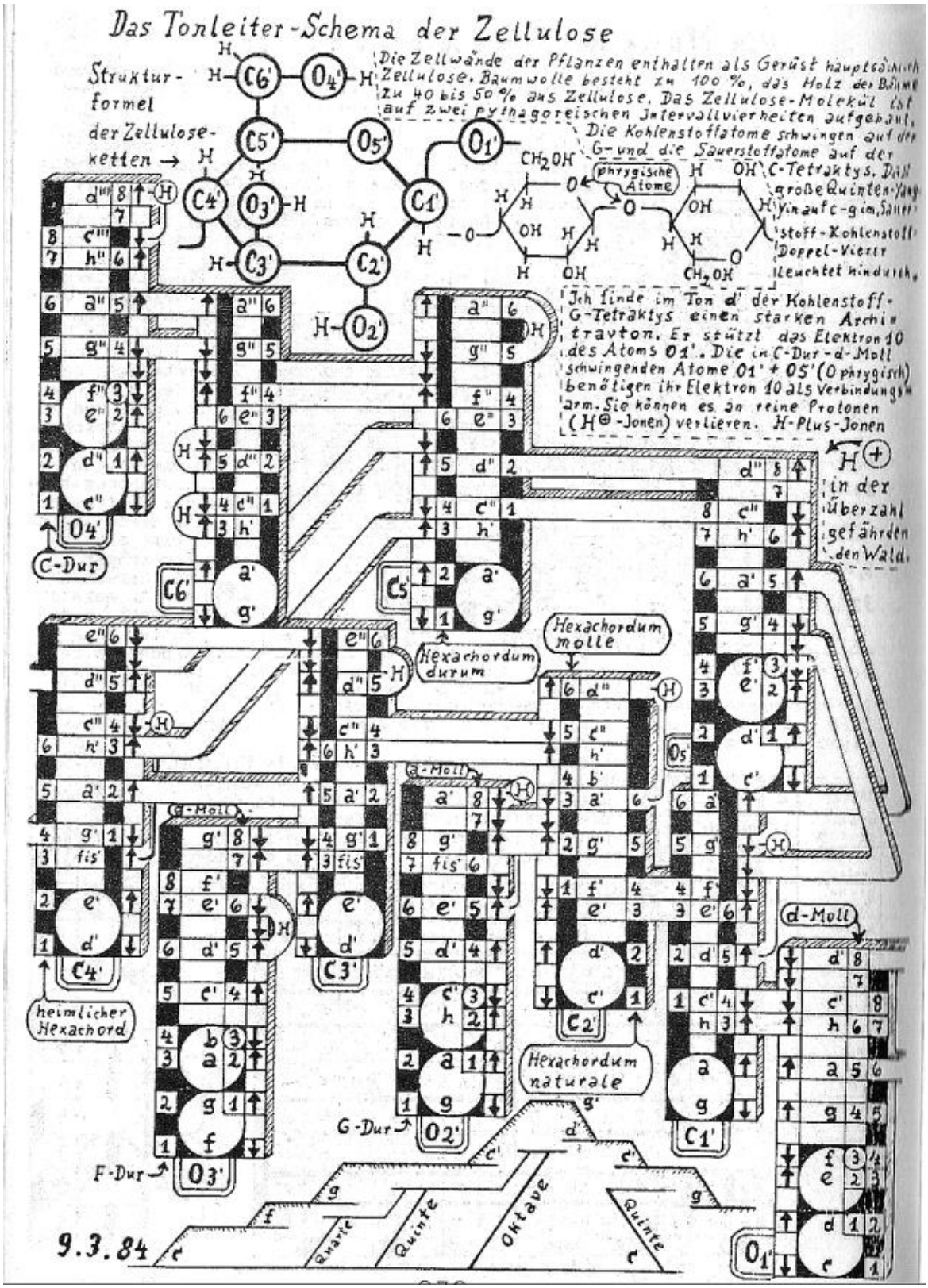


Ill.5- 59: Taste molecules – from Nicolaou – see also for pineapple and apricot at Ill.5- 69

with a host of other compounds that makes them so useful and functional: perhaps because they are particularly harmonically resonant and still comparatively simple in the range of Elements they use. At the same time, any dissonances arising from asymmetries of structure, even if slight (as seen in the sugars, ***Ill.5- 43*** above) is as important as the numerical harmonies of their atomic bonding. Andrews calculated musical chords for molecules such as Methane (note 3) and organic molecules which come under Young's Note 4 such as Acetic Acid (Vinegar), Methanol (Wood Alcohol) and Ethanol, as also of Water. Electronic oscillators are required to pick up these high frequencies. Vinegar (CH_2COOH) works out as $G_1CGC^1D^1E^1F^1E^{11}$ (play these notes on the piano, both one after the other and together). Being fermented, Vinegar seems to have lost its harmonic coherence and the sounds express its acidity. He said Benzene is like jazz; Methyl Alcohol is harsher; Ethyl Alcohol reminded him of Debussy.

Banwell describes similar effects in molecular vibrational activity known as Fermi resonance. Here what he calls 'accidental degeneracy' takes place, for in a complex molecule where there will be many fundamentals and overtones (each fundamental presumably being the nucleus of one of the atoms in the molecule), resonances become extremely complex. Some, at least, of the sum total of harmonics (or overtones) will not be in agreement. The word 'discord' on the whole equates with 'degeneracy' due to departures from harmony. It is in the thermal agitation discussed by Glazewski that irritation, friction and discord arise, such that the atoms and their particles will break bonds and eventually disintegrate if the discord is too great or lasts too long. If this describes usual inter-atomic activity, then discord does in fact have its place in the natural arrangement of things in that it is part of the means whereby development and progress can take place in the form of interchanging molecules. Krüger's painstaking studies (see for example his musical equivalences for Cellulose below) show that it takes a lot of work to pin down the actual notes for one compound – to the extent that we would probably rather hear the music than pore over the diagram! This means that once one or two molecules are

understood in depth in this way to prove the principle, we are quite ready to take the rest on trust, perhaps now with the added idea in our mind that when listening to music at a concert it may among other things represent the dance of the molecules in one zone of life or another.



Ill.5- 60: Krüger's rendition of the chords for the Cellulose structure (Molecular Note 5)

NATURAL -V- ARTIFICIAL

True resonance brings about and encourages harmony and orderly growth in stepped phases, as in the case of a human being who is healthy because he or she is well-fed on all those

organic molecules that have interlocked to build up and then maintain their living tissue. As already seen, 'notes' and the 'intervals' between them are complementary when the ratios agree, forming chords. The human body consists of an entire hierarchy of such interlocking chords which it would be tedious to spell out (indeed, I like Kean's idea that the human body is another form of the Periodic Table). Discord (i.e. bad food or a drug overdoes) induces irritation which precipitates a reaction in the form of disease or side-effect to relieve the irritation. Given we are studying molecules, it is worth bearing in mind how many natural molecules can also be artificially synthesised – and to ask, for instance, whether the side-effects of 'manufactured' drugs are worth the mainline cure they are intended to bring about. It is interesting how often – just because one or two atoms of the structure differ –the artificial version just isn't the same (compare the taste of saccharine as opposed to sugar), and how the body is such a sensitive instrument that it can pick up on that subtle 'falling short'.

Nonetheless, deliberate imbalances may be required as part of the pattern to enable a transmutation of one combination into the next stage, seen often in biological development. A seed bursts into life, agitated by the heat of the sun and increased water supply, and this thermal agitation triggers growth processes that lead on to stalk, leaf, flower and seed. The 'right' discords, i.e. inherited differences in atomic numbers as laid out in the Periodic Table, will produce their own subsequent reactions along the way with a final end product, in the same way that in music an unresolved chord sequence by the end of the piece is through a set of transitions resolved in a concluding chord that reconciles the incomplete. In a limited, local situation if dissonance is unresolved the situation becomes untenable. As in listening to music with too much discord, too great a loss of harmony becomes intolerable after a while, which is when molecular organisation just breaks down: the organism degenerates, atoms fly free, the plant collapses, the human being falls ill and can even die. For instance, too much ingestion of artificial substitutes for natural ones (white bread instead of brown; saccharine instead of honey; tinned vegetables instead of fresh) sends the body on a downward path.

With no discord there would be no chemical reactions, no organic living process, no seasons, no life – nothing but (in Hindu terms) the absolute silence of the Sleep of Brahma lasting 311,040,000,000,000 years, unopposed by the onset of Creation and its unfolding through interchange and conflict! Everything would cease, grind to a halt and disintegrate. Modern astrophysicists realise that both states can exist simultaneously within the physical universe: black holes where matter disappears are dotted about within the expanding galactic swirl (see ***Ill.5- 15*** – just recently on *The Sky at Night on BBC4* NASA has mapped many more Black Holes peppering our own Milky Way).

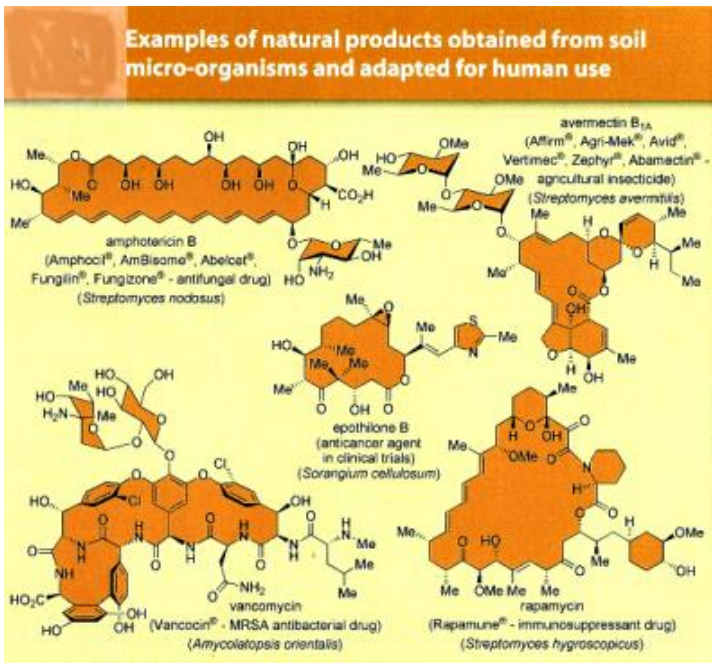
Let us consider this situation particularly in relation to agriculture and soil fertility.

NATURAL NITROGEN -V- FERTILISERS

Good soil depends in the material world on the maintenance of the originally intended structures of atoms and their combinations to form organic compounds in which Nitrogen and Phosphorus figure prominently in the form of Nitrates and Phosphates (note that on the Periodic Table Phosphorus lies one octave higher than Nitrogen so that they are in diapason to

each other). Plants do not take up Nitrogen from the air – they can only process it where it is present in the soil. Organic molecules are subtle and loose. If they are forced - as in factory farming or in chemical fertilisation of the soil - to take on hard, artificially synthesised approximations, there are resonation consequences in plant, livestock and ultimately in our own bodies. Since other nitrates are used in explosives it may not be far-fetched to say that chemical fertilizers doing only half the job of organic compost or manure are actually working as a miniature destructive blast on the soil. If the molecules turn to the left rather than the right they are as good as useless and simply create infertility causing desertification due to the break-up and disjunction of food chains.

Kervran's discovery that plants naturally restore the Elements present in soil lends weight and credence to the ancient custom of re-establishing agricultural fertility by the universal practice of the fallow year[26]. The restoration of harmonic equilibrium is Nature's own way to replace missing deficiencies, and making good the depletion caused by crop growth (understood through ancient custom for thousands of years) allows organic growth to proceed naturally and to start over again. In fact (reinventing the wheel) a programme of leaving fields to lie fallow became an EU rule, and ***The Times*** announced on 4 October 1994 that in the UK itself the Ministry of Agriculture was beginning to back the return to organic farming. The Minister for Agriculture, speaking at the launch of a month-long promotion of food growth without chemicals, pesticides or animal cruelty came out strongly with the view that this was no longer the concern of fringe groups but should be put back at the heart of agricultural policy. The trend moved forward exponentially in the following 30 years - some would say not fast enough.



Ill.5- 61: Some natural soil micro-organisms adapted for human use – from Nicolaou

How did it ever happen that the organic approach was left behind in the first place? It is a long story, and there are many factors involved, mostly to do with an almost deadly combination of untried scientific research, the effect of two World Wars and the need to provide much greater

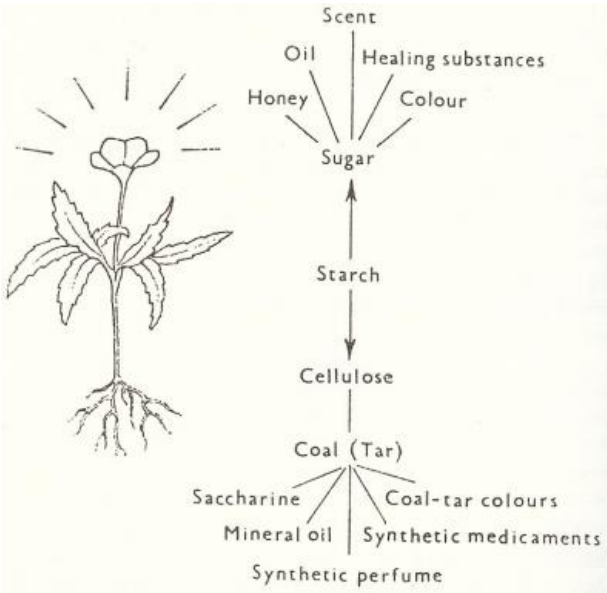
[26] Compassion in World Farming (www.ciwf.org) campaigns tirelessly for the re-establishment of the natural order.

quantities of food to a hugely increasing world population after 1945. But, while flying in the face of millennia of farm-lore, no matter how much farmers chemically drenched their farms with artificial fertilizers, in due course they could not restore the earth's health. There are atoms over - or gaps in the molecules - which lead to poisoning by molecular dissonance. One of the most striking examples has happened in the Nile Valley in Egypt which used to have natural alluvial silt brought down from the Ethiopian highlands in its annual flooding. When the Aswan Dam was built by Gemal Abdel-Nasser, the silt was held back and farmers turned to chemical fertilizers. Within two decades the soil became infertile for the first time in millennia and the farmers gradually got caught up in the poverty trap of indebtedness for their fertilizer bills and deteriorating soil, where before it came free through the earth's natural processes.

Artificial chemical fertilizers might bring a quick and dramatic early result but, spread around in larger and stronger doses alien to true organic life year by year, they create ultra-disruption in soil structure and food chains, causing such a breakdown in the natural order that the land produces malformed progeny - until in the end the land becomes completely and inimically sterile like a moonscape. The imbalances that then follow due to overcompensation by the insect and microbiological worlds compound the plague and rot. This failed world experiment lies at the heart of all our modern problems of disease and pests in agriculture, horticulture and forestry - yet just as the West is learning to abandon these ways before it is too late, the Third World leans out for its short-term chemical embrace, ignoring the dire long-term consequences.

NATURE'S OWN MOLECULAR CHORDS

The scientist A N Whitehead asked, 'Does Nature have a tendency to be in tune?' To ask such a question he must have had intimations of the answer. We now rather ask, 'Can She get *back* into tune by Herself after being to radically disturbed?' The answer is that She can – often surprisingly quickly. 'She seems', Whitehead observed, 'always to return to Her own strong rhythms. She adjusts little by little and sometimes Her phases are longer than our impatience would allow - but She will not be hurried. Each step is taken quietly and in good order, one at a time. Nature regenerates her own substances within her own framework, if allowed the time'.



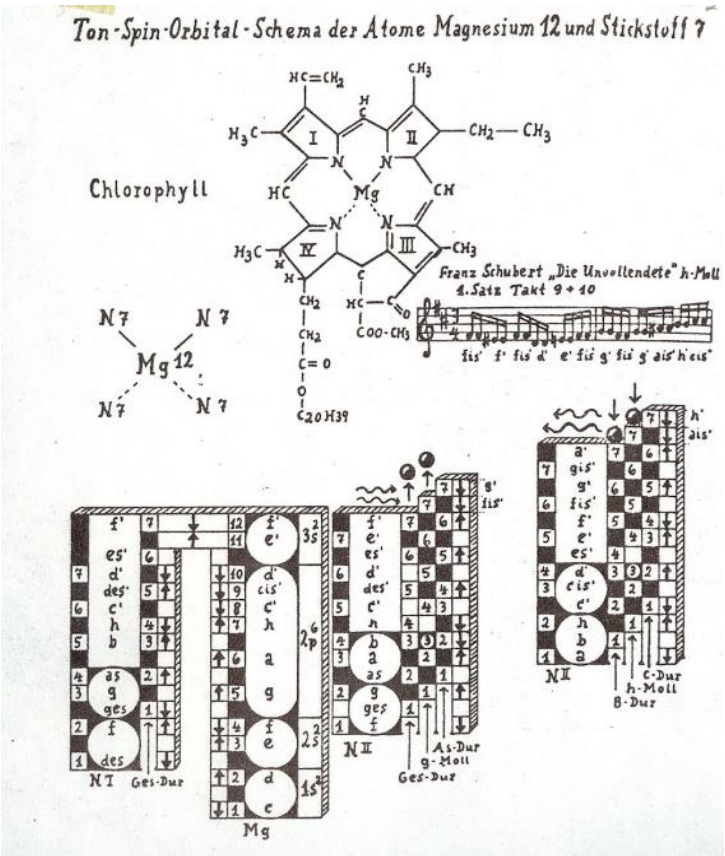
Ill.5- 62: Byproducts of the plant octave that use CHO molecules of increasing complexity

In ***Book 4*** in the diagram above we showed how Hauschka summed up the natural molecule realms at stake in our efforts to sustain health in soil, plant, and animal life – a chain of substances on the go every day. Hans Kayser in ***Harmonia Plantarum*** (see also ***Book 4)***

ELEMENT	H	C	N	O	Na	Mg	Si	P	S	Cl	K	Ca	Fe
Kayser's no.	1	2	3	4	5	6	7	8	9	10	11	12	13
Atomic no.	1	6	7	8	11	12	14	15	16	17	19	20	26
TONE	c	g	b	c	*fis*	g	b	b*is*	c	c*is*	d*is*	e	a
Atomic wt.	1	12	14	16	23	24/5	28	31	32	34/5	39	40	56
TONE	c	g	b	c	*fis*	g-g*is*	b	b*is*	c	c*is*	e	e	b

Ill.5- 63: Kayser's table for the key Elements and notes of plant life

gives the octave numbers and notes for the range of atoms that form the majority of species of organic plant life. He lists 13 key Elements found universally in plants, spread over nearly four octaves. It is interesting to note that the series stops at Iron (see also ***Ill.5- 32***), already noted in our book on Atoms as an end-point in the first phase of the generation of world Elements – and so vital in the molecular make-up of blood. These start with the four master Elements of plant life so neatly illustrated by Hauschka (see also ***Appendix C*** for other material by him given in ***Book 4***), followed by those chemicals over the next two and a quarter octaves which occur in the soil in combinations of Octave Note 2 salts, especially Nitrates and Phosphates, important for soil fertility since ingestible by plants. Starting with Hydrogen at atomic number 1, Oxygen at 8, and Sulphur at 16, forming two octaves, Carbon at 6 is at a fifth between Hydrogen and Oxygen. In the diagram he devised below, the note equivalents given are those



Ill.5- 64: The musical notes of the Chlorophyll Molecule, which adds Magnesium to the CHO triad – from Krüger Das Universum Singt

of the main octave, with semitones up from the note (sharp) signified by *is* added to the note and semitones down (flat) signified by *es* added to the note. Two tone rows are given: the first row gives the notes of the atomic *weight* of each Element and the second tone row gives the note of the atomic *number*. Comparing the two octaves shows one or two semi-tonal differences that reflect that discrepancy between atomic number and atomic weight where the weight is sometimes just over the exact double of the atomic number because calculated according to the average of all the isotopes of that Element.

Kervran, too, understood chemical analyses of this type, yet stressed, 'we must avoid refining everything in biology to … chemistry … since there are too many unknown factors involved… we do not know the answers set by many biological problems… One is reminded of the work of Pasteur on polarized light which showed how polarization distinguishes between living and dead matter even if the chemical composition is the same'.

As with left- and right-handed sugars, Kervran showed that in photosynthesis there is a helicoidal twist to the right for living proteins and to the left for synthetic or dead ones. In living plants Chlorophyll turns spirally to the right (see repeated from ***Book 4*** Krüger's musical rendition of the Chlorophyll molecule above). 'The chemical industry', he reminds us, 'cannot make right-handed proteins'. But here we run ahead of ourselves in the Molecular Octave.

HAUSCHKA'S ATMOSPHERIC CROSS

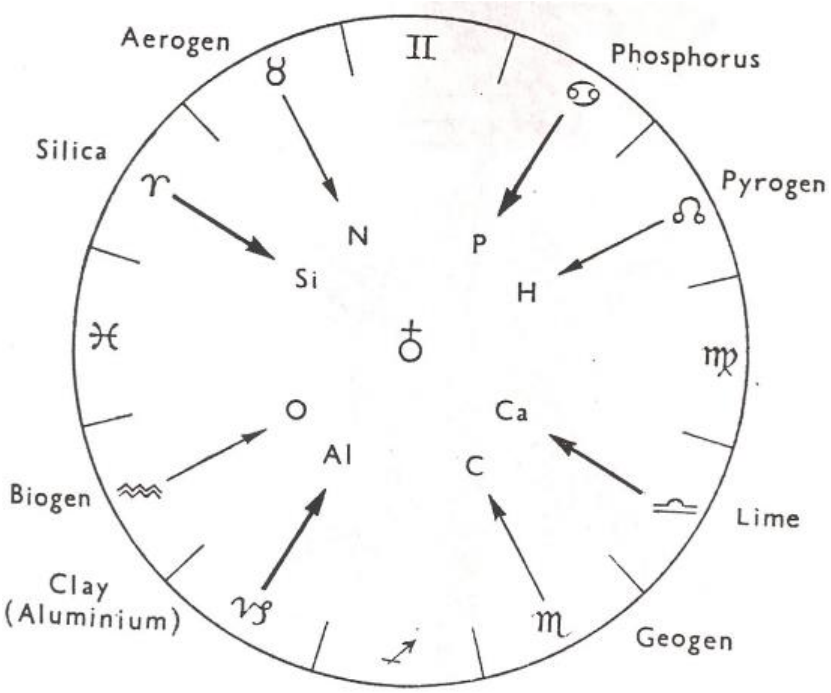
Hauschka saw the abundantly occurring plant Elements - Carbon, Hydrogen, Oxygen and Nitrogen – as the 'carriers' of the higher-plane ancient Four Elements of the ancient world, renaming them and assigning them to the Cardinal Signs in his 'Atmospheric Cross'.

ZODIAC SIGN	ANCIENT ELEMENT	CHEMICAL ELEMENT	SYNTHESISED NAME
AQUARIUS	Air	Oxygen	Biogen
TAURUS	Earth	Nitrogen	Aerogen
LEO	Fire	Hydrogen	Pyrogen
SCORPIO	Water	Carbon	Geogen

Ill.5- 65: Hauschka's Atmospheric Cross

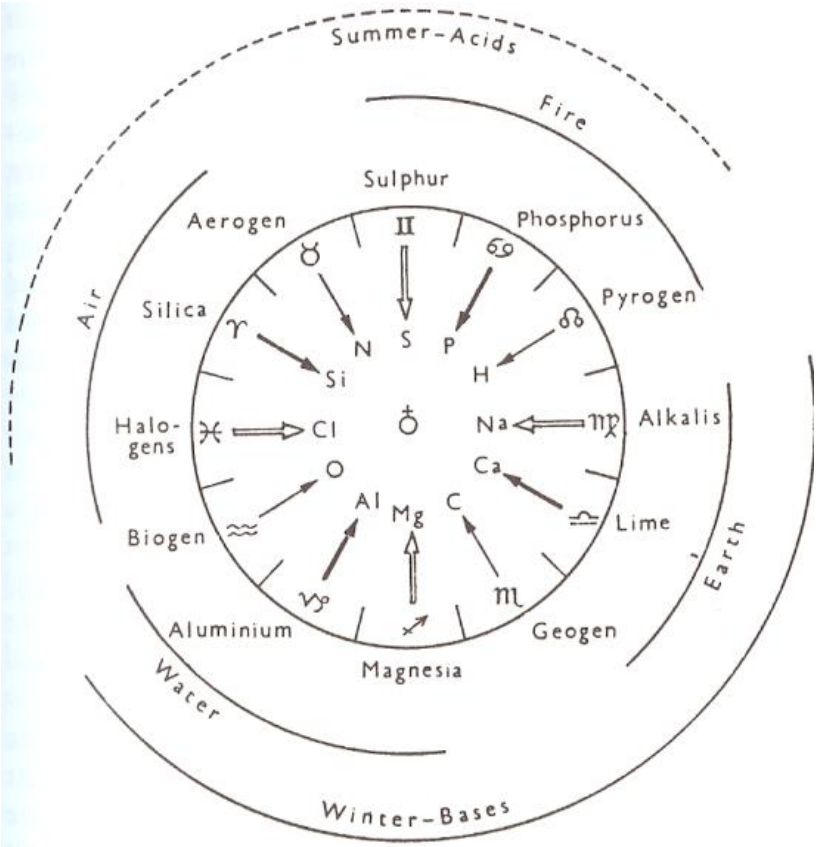
He assigned another four key Elements in soil (Silica, Phosphorus, Calcium and Aluminium/Clay) to the present-day Solstitial-Equinoctial Cross of Capricorn/Cancer and Aries/Libra, naming it the Mineral, or Geospheric, Cross (next illustration). These are basic soil ingredients essential to plant growth and absorbed for further assimilation in higher biological structures.

This leaves what he calls The Hydrospheric-Oceanic Cross of Virgo/Pisces and Gemini/ Sagittarius, to which he assigns the Elements Chlorine/Sodium and Sulphur/Magnesium, essential to acid-alkali interplay. He brings all three crosses together in the next diagram to represent the twelve essential Elements in the plant life realm (often attached to others of similar nature) that key in to the Zodiac as vehicles for their influence.



Ill.5- 66: Hauschka's Cardinal Atmospheric Cross and Geospheric-Mineral Cross combined

The reasons for these allocations take up half his book, requiring attentive reading – and to me make sense overall as an exciting way of associating particular Elements with the Signs. We can



Ill.5- 67: Hauschka's Hydrospheric Cross - combined with the Atmospheric and Geospheric Crosses into Summer/Acid and Winter/Alkali halves - completes his Zodiac of the Elements, each allocated in the light of plant growth in its atmospheric and soil contexts

also lay out the information in this interpenetrating triad of Crosses as the zodiacal Elements in table form - as below. His allocations certainly look in the right direction, and some matches ring particularly true, such as Oxygen to Aquarius or Nitrogen to Taurus, the gardener's sign. I

based a variant Cosmokrator model on this Zodiac of the Elements (see *Appendix C*) but since it includes *all* the now known planets - as well as Sirius and the Pole Star - on I thought hard and made some changes and additions – for instance giving Silica to Virgo and Hydrogen to the Sun. You will have your own thoughts, but one has to bear in mind the suitability of matching an Element to water, air, fire or earth signs (thus Hauschka's allocation of the gas Chlorine to Pisces, a water sign, does not fit – nor does his allocation of Silica to the fire sign Aries agree).

SIGN		ATMOSPHERIC/ GAS CROSS	GEOSPHERIC/ SOIL CROSS	HYDROSPHERIC/ WATER CROSS	ANCIENT ELEMENT
♓	PISCES			Halogens/Chlorine Cl	AIR
♈	ARIES		Silica Si		
♉	TAURUS	Aerogen/Nitrogen N			
♊	GEMINI			Sulphur S	FIRE
♋	CANCER		Phosphorus P		
♌	LEO	Pyrogen/Hydrogen H			
♍	VIRGO			Alkalis/Sodium Na	EARTH
♎	LIBRA		Calcium Ca		
♏	SCORPIO	Geogen/Carbon C			
♐	SAGITTARIUS			Magnesia Mg	WATER
♑	CAPRICORN		Aluminium Al		
♒	AQUARIUS	Biogen/Oxygen O			

Ill.5- 68: Hauschka's Zodiac of the Elements as a table emphasising the Four Classic Elements, revealing the fusion of Air and Fire by him, and thus leaving out the Air Signs

So much more could be done by scientists to match electron energy ratios to the octave intervals of nature's molecules by using shamanic experience and the work of such people as Hauschka, Krüger, Kayser, Young and even Lethbridge but these writers are not fashionable. Andrews has pointed the way in his musical analysis of molecules. Based on the simple, prime number ratios which are the 'bones' of each organism, all the smaller intervals will develop from the resulting harmonics that put flesh on bones, gloss on fur or feathers, and bloom on the flower. This will happen so long as – in Glazewski's words, 'the natural molecular interference pattern' is not inhibited or distorted but allowed to grow as intended into a perfect organism. If molecular growth is not permitted to happen smoothly and naturally the organism will be more or less distorted, leading to disruption, breakdown and even premature death. If any molecule is made to disintegrate – whether it is a bullet into flesh, the use of chemical fertilizers or the deliberate creation of radioactive materials like Plutonium and Uranium, 'disordered energy cannot reassemble itself… it is a one-way street, an incline down which order slides'. This is true of bomb-making or poison creation (the latter used by the Luciferan Russians in their foreign assassinations and chemical warfare referred to earlier). With the human body, 'living cells have an internal order… [but] the radioactive particle mars its beauty: it tumbles the pillars and pediments of its architecture and its passage leaves the city of cells in ruins'. Where

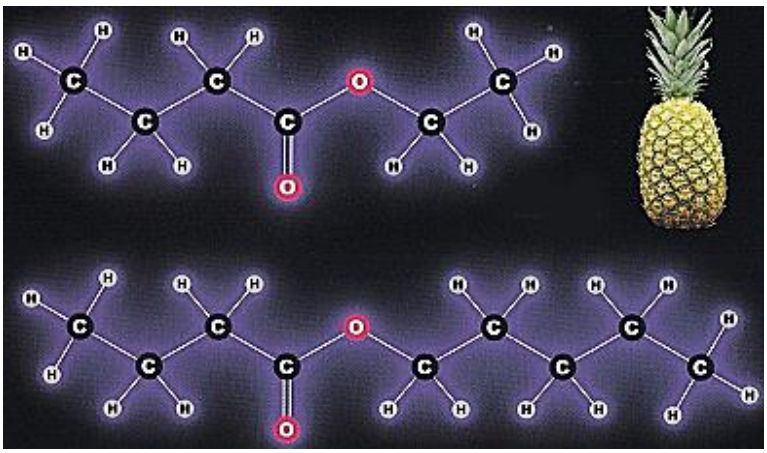
an organism such as a plant or animal is not destroyed altogether, it might just remain as a malformed specimen in relation to its true prototype, unable to function as it was intended. To allow this to happen is surely a dereliction of the responsibility placed on mankind within the Universal Octave which - since Adam and Eve - is to be custodians of the Creation.

In fact, ingestion of inimical substances and wrong use of molecules in agriculture and factory farming has wrought far more havoc than the atom bomb. Humans over the past century have ruined themselves in the cause of playing around with molecules, whether explosives, drugs, or forbidden substances. The damaged human body that does not die passes on its distortions. What is more, intentional genetic engineering tinkers with human cells and is similarly fraught with the same potential for abuse despite the spectacular early successes that mirror those of chemical fertilizers, as in the use of cloning. As Cousteau said before the United Nations in 1976, 'Human society is too diverse, national passion too strong, human aggressiveness too deep-seated, for the peaceful and warlike atom [and, we could add, molecule] to stay divorced for long. We cannot embrace one whilst abhorring the other; we must learn, if we want to live at all, to live without both'. The actuality is that we must learn to live *with* both, under control.

In real life it is still possible to paint pictures without knowing the molecular structure of the paints we use and eat food without cutting ourselves open to look at our digestive organs at work – we just get on with it without thinking too much about it. We can be generally informed about food groups without needing to know their molecular chain every time; and we won't go far wrong if we use natural ingredients and natural methods as a rule of thumb. Each person will draw the line at a different place. Do we really have to know the sex of our child before it is born – and (thinking of the psychological effects on them) do we really have to use artificial methods to make children if life did not deal those particular cards to us? In many ways the manipulation of molecules to always get exactly what we calculate we want has gone too far – if it consumes and dehumanizes our lives to the extent we forget how to surrender to and accept chemical and biological destiny. The old horror stories about the mad scientist juggling with the components of life - going back to the alchemists and on up to Frankenstein –are now coming true in real life. Must we give up the good intertwined with the monstrous? We cannot!

YOUNG'S MOLECULAR OCTAVE NOTE 5 (SOL): CHAIN MOLECULES/POLYMERS

Looking back again at Young's Master Octave of Life and the Molecule Octave Notes level, this next molecule category is characterised by those molecules found in organic plant or oil structures which in Young's definition fall into chains of hundreds of thousands of simple units



Ill.5- 69: (Left) The CHO chains of Ethylbutirate and Pentylbutirate account for the particular tastes of pineapple and apricot; Omega-3 fish oils also form CHO chains - from Gray

based on Carbon, Hydrogen and Oxygen atoms, each unit made up of a dozen or more atoms loosely strung together, that can be endlessly varied and also easily manufactured artificially.

NATURAL -V- ARTIFICIAL (AGAIN)

On a normal day in the household I might start with a visit to the supermarket. Most vegetables and meats are in black plastic trays covered with plastic film and I walk out at the

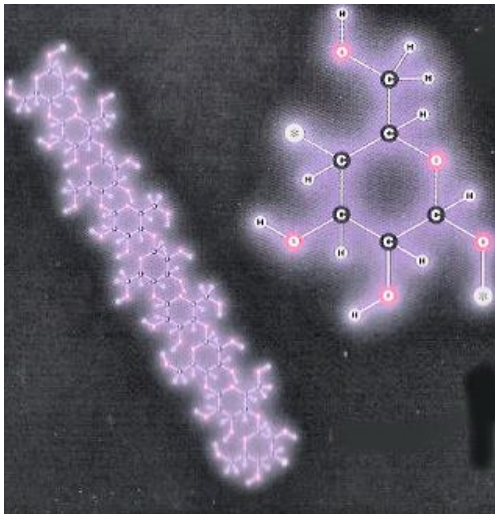
Ill.5- 70: (Top) The CHO chains for Nylon and Polyester, used for stockings, textiles, ropes, heavy-duty bags or webbing; compare these and (centre) fibreglass with (below) the looser cellulose chains of Cotton which allows the skin to breathe and can absorb perspiration - Gray

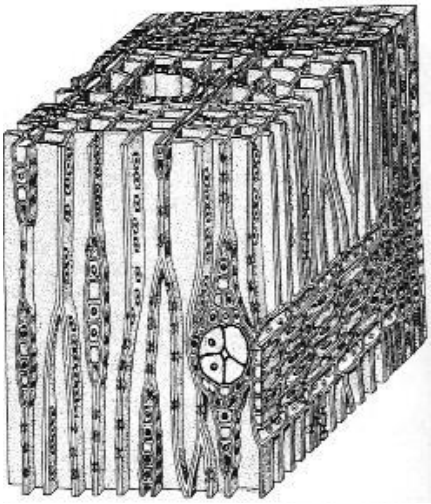
end with other buys piled into a plastic shopping bag. I could have also bought polyester tights and disposable wipes and nappies. There are powders and gels I can add to my washing machine load to wash, soften and otherwise treat my fabrics. What does an immigrant from a village in Egypt make of this – where the women usually spend an hour or two a day going down to the river to fetch water and whose life revolves around freshly picked vegetables and slaughtered meat, cooked immediately at the point of harvesting? Like women in India they are probably used to wearing local cotton fabrics suitable for the heat – yet they think it 'modern' to wear nylon. The contrast between the two rafts of materials easily to hand in these two worlds serves to highlight oppositions in quality or enticements of enormous saving of labour which do not need to be spelled out – there are losses and gains in vitality and time on both sides. It is all down to what we might call molecule-swapping, whereby the 'natural' takes longer to deal with than the 'artificial', yet the latter lack life. So at this note we have a host of molecules both organic and synthetic.

Ill.5- 71: The basic Acrylic polymer chain – a variant combination of COH units – from Gray

Knowing that the constituents of the naturally occurring Molecule Octave 5 chains in Nature (such as Cotton and Cellulose) can be juggled and developed to form new compounds, we have all probably worn (or used as kitchen cloths) many types of artificially synthesised Polymers like Acrylic, Viscose, Nylon or Polyester - since so much cheaper than the cotton or silk[27] they imitate (some are the signature of particular decades in popular fashion - Nylon is '*So* Fifties')!

The structures of natural *or* artificial Polymers are monotonous but useful, able to self-replicate and expand easily by repetition. This endless self-copying of the same unit comes up with quite





Ill.5- 72: Cellulose fibre is made up of repeating units of the glucose sugar molecule, in the end also underlying the structure of Wood (right) – (left) from Gray and (right) Mondadori[28]

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[27] For a full account of silk (and artificial silk – nylon) their molecular structure and the long story linked to the Silk Road, it is worth reading the relevant chapter in P Le Couteur and J Burreson ***Napoleon's Buttons*** NY 2003.

[28] Quoted by J E Gordon in ***The New Science of Strong Materials*** first published London 1968 and many reprints

new substances and possibilities (here we use many examples from the wonderfully clear diagrams and photos in Gray's book on Molecules – a free advertisement for *all* his books, I hope – in the same way we turned to Jackson's children's book on Molecules). Thus Starch and Cellulose (above) are the main components of vegetable stalk and leaf structure, including tree-wood (see also Krüger's diagram for it at ***Ill.5- 60***), again consisting of Glucose units in simple patterns joined together in longer chains. Starch/Carbohydrate (and its stored fatty form) is a key food for animals, yet Cellulose - due to the different arrangement of similar units - though of greatest importance to the structure of plants - and digestible with added stomach equipment by some animals - is quite indigestible by humans despite the adage 'eat your greens' (the Chlorophyll is useful nutritionally but the Cellulose is only good for roughage).

Ill.5- 73: (Left to right) Linen (woven from flax); jute webbing and string; bamboo fibre rope (a form of natural rayon) and a clump of ramie made from nettle fibre – all from Gray

Then of course there is an entire range of natural plant fibres not as rigid as wood, gratefully used by human kind for tough fabric such as flax (for linen), or jute for sacking or string/rope. These can be compared with the tough, artificial Kevlar, looked at in a few pages' time.

PLANTS AS TRANSMITTERS OF ZODIAC AND PLANETARY INFLUENCE

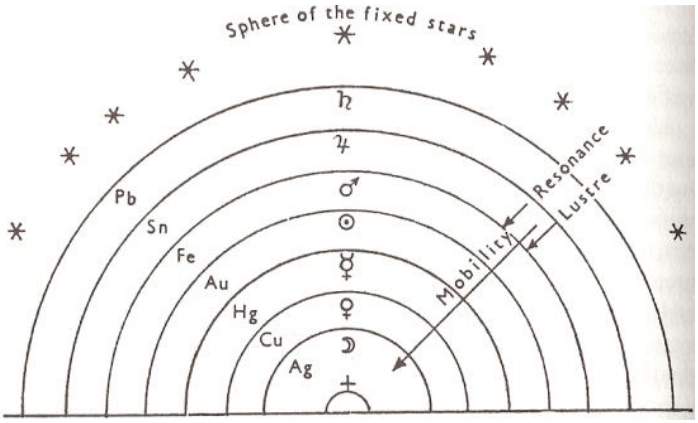
This is a good point at which to reiterate material from ***Book 4*** to bring in the Elements at work within molecules in the plant realm that Hauschka saw as relaying planetary influence[29]. Since these Elements are more or less evenly distributed across the columns of the Periodic Table (within which Elements behave rather like each other, as if in mini-octaves) I have summarised *and expanded on* this information in a Cosmokrator model - see ***Appendix C***.

At school we were all shown how light (and thus the Sun) is necessary for all organic life – combining with water, air and certain Elements to initiate processes such as green leaf development –the broad idea at the heart of the minutiae of plant chemistry and physics. Having (hopefully) just finished reading ***Book 3*** on atomic structure and ***Book 4*** on plants, if we now look at the arrangement of the key Elements making plant life possible - including the Chlorophyll molecule responsible for the greenness of plants - as we would expect, Carbon, Hydrogen and Nitrogen again form the base. We have already defined the field of organic chemistry as the study of Carbon, Hydrogen and Oxygen combinations in molecules of ever-increasing complexity. Hauschka explains how these three Elements are the basis of plant life, with others coming in to play specific roles - such as Magnesium's ability to attract light. In his drawing shown earlier (***Ill.5- 62***) Hauschka neatly summed up the plant archetype in terms of the variations of substance manufactured at different levels of its own vertical octave consisting

[29] See also Jeremy Narby ***Intelligence in Nature*** London 2006. We have much more to say on this under Note 7.

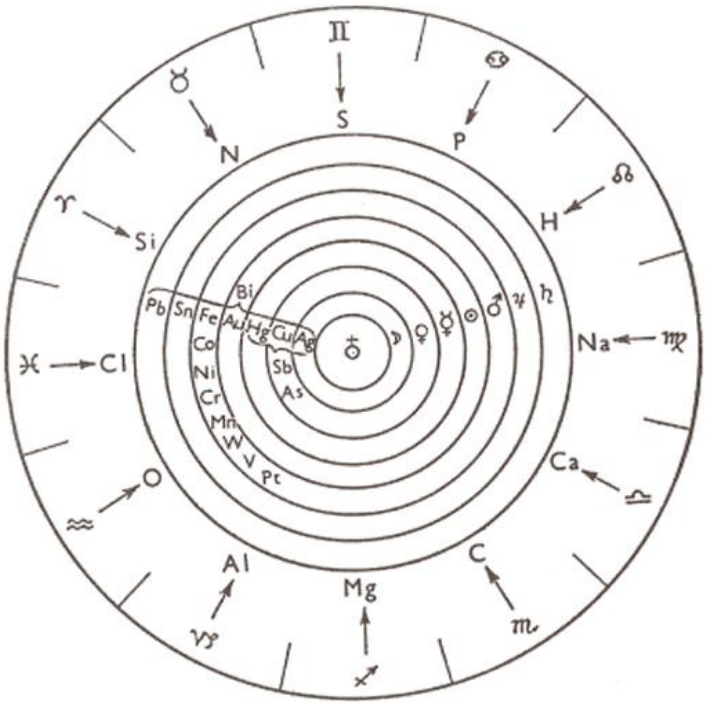
of increasingly complex organic molecules - including the addition of Nitrogen to these chains to make proteins - which come under ***Molecular Note 6***. Looking at his diagram, we have mentally to add the presence of Water and the Sun, without which the molecules would not form. All plants need Chlorophyll in order to photosynthesise (process sunlight) and breathe.

However, when too much Carbon Dioxide is given off (by the plant world at night and a vastly increasing human population 24 hours a day) the balance between Oxygen and Carbon Dioxide is upset, a factor in Climate Change (looked at earlier). But from a quite different angle Hauschka has made a novel contribution to our understanding of the role of plants in our lives through his explanation of how – according to different Elements they absorb - in precise ways they act as relay transmitters between the vast powers of the Signs and Planets, and Earth.



Ill.5- 74: Hauschka's matching of the traditional metallic Elements to the Planets: Lead conveys Saturn; Tin Jupiter; Iron and its mini-octave Mars; Gold the Sun; Mercury, Mercury; Copper, Venus and Silver, the Moon

His arguments for matching Elements to the Signs also makes sense, and though I would apportion them to the signs slightly differently (as I have done on a Cosmokrator model), for reasons of space I leave it to the reader to read his arguments and make their own conclusions.



Ill.5- 75: Hauschka's final layout for the Elements as cosmic forces playing through plants – coming not only under the influence of the Planets and their metals, but also of the Signs

In ***Book 3*** we discussed some of the problems in the sequencing of Elements in parts of the Periodic Table, in that it might make more sense to have a three-dimensional arrangement of its octaves – or indeed understand certain sequences as mini-octaves within a particular Element or Element family. In Hauschka's chapter, 'The Brothers of Iron' the minor metals often found together with Iron: Cobalt, Nickel, Chromium, Manganese, Tungsten, Vanadium and Platinum are explained by him as Iron's mini-octave – and he expresses them as such when he inserts the Planets and their Elements into his Zodiac of Elements (above). We should probably understand the other key Elements he assigns to the Signs or Planets in the same way, as probably encapsulating an entire mini-octave of associated Elements, much as we see in the Actinides and Lanthanides let alone each column. We were unable to handle plants as their carriers until we came to their molecules, which is why they feature so strongly in in this book.

Taking into account this approach, along with Hauschka's assignment of Elements in the combined Atmospheric, Geospheric and Hydrospheric Crosses looked at earlier, we can see the key role the Plant world plays in mediating equally between Air, Earth, Water and Sun and the entire manifestation of the Periodic Table in higher formulations at later notes – meaning that in fact without the plant substrate animals would not exist: indeed their interdependence as perceived by the seers is astonishingly interpenetrating[30]! Let us look at some examples.

PLANTS AS CHEMICAL TRANSFORMERS AND CARRIERS OF THE PERIODIC TABLE

Different plants specialise in acting as the 'carriers' of other, sometimes quite rare, Elements: an obvious example is spinach with its high levels of Iron, important in the diets of those suffering iron deficiency and a component of red blood cells; seaweed which manufactures Iodine, crucial for a healthy thyroid gland; Lithium is found in tobacco and Titanium in roses. More than this, plants can break down atoms at proton level (whose number, we know from the previous chapter, determines the nature of each Element) and they rearrange subatomic particles into Elements of higher or lower number, as long as the atomic numbers involved are exactly divisible, or linkable with soil or atmospheric substances or the enzymes found in animals, higher plants and the micro-organisms which live round plants like fungi, actinomycetes, bacteria and microscopic algae. In this lies the entire magic and importance of plants, which need no expensive or complicated scientific instrumentation to undertake this natural re-processing of the Elements. As seen from Kayser's table above, in plants this usually happens amongst the first 20 Elements of the Periodic Table - whose proton numbers are simple - and to a lesser extent within the following 10 (we know from ***Book 3*** that the alchemists' search to transmute one Element into another was neatly solved by modern physics and chemistry by simply changing the number of electrons and/or protons in atomic structures). The oak tree, for instance, which grows naturally in granite and schist regions where the soil is rich in silica, can nonetheless show up to 60% calcium in its ash, and from other experiments we now know plants in general easily transmute silica into calcium. As the scientist Lawrence observed, 'Perhaps plants are the true extra-terrestrials, for they converted an early mineral world into a habitat suitable for Man by processes that border on near-perfect magic!'

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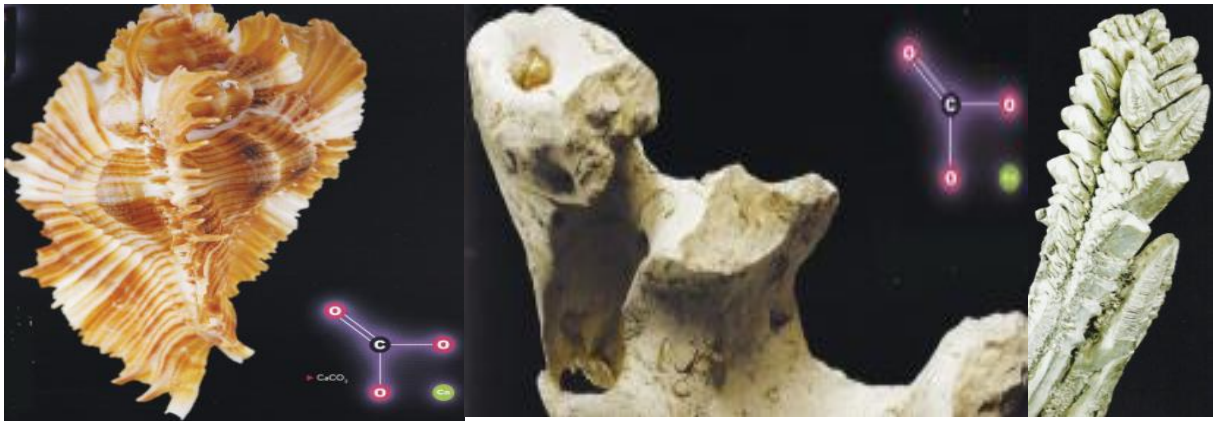
[30] Pam Montgomery ***Plant Spirit Healing: A Guide to Working with Plant Consciousness*** London 2008

The best-known writer on this subject, C L Kervran, described what goes on in his best-known book in English, ***Biological Transmutations.*** He was aware of the work of Anthroposophists such as Pfeiffer, who continued Steiner's work and noted that lawns only start to produce daisies when there is Calcium deficiency in the soil, since the daisy plant is rich in this Element: it has come from somewhere, but not the soil. Thus when the daisies die the soil is replenished with their Calcium. This is the rationale behind leaving fields to lie fallow, to regain their fertility naturally, for whatever plants spring up naturally when the field is left to its own devices is an indicator of what the soil deficiencies are, and they will contain the Elements to make it whole again if they are left to die where they are. Similarly, algae create Iodine of themselves since it is not present in the sea, as formerly thought. Kervran himself showed that plants return far more Potassium to the soil from their own structures than was initially present there, and other experimenters showed that a plant like lucerne can synthesise their own Magnesium even where none is present in the soil. Supporting these processes are the structures of Cellulose.

This means plants not only have the power to transform living molecules, but also to transmute atomic structure itself. Hauschka undertook several experiments showing how plants and animals during their digestive process transform Elements into others, a good example being the high amount of Calcium Carbonate in bird droppings, which is what is left after other components of their food have been digested. We are familiar with Calcium Carbonate in shells



Ill.5- 76: The $CaCO_3$ molecule creates shells, bones and over aeons chalk, limestone or marble: the example of limestone above centre still has the remains of unmerged compacted shells in it; (right) a clump of naturally occurring raw Magnesium

or bones – and we remember that the accumulation in geological strata over millions of years of chalk, limestone or marble is nothing other than their compacted skeletal remains. As expanses of white marble or chalk, the whiteness of this substance often had connotations of purity and cleanliness at the top of society's hierarchy – the concept of The White House is found from Egypt to the USA, the white cliffs of Dover earning Britain's name, Albion.

Hauschka also discovered that some people's metabolism can cope with, say, high levels of alcohol or protein, transforming them into more nutritious substances (meaning that some people are less affected by seemingly harmful diets than others). Of course plants provide food from all stages of its octave - roots, stalks, leaves, flowers, fruits and seed/grain – usually transforming into various aspects of our body cells. These truths are proved by the more extreme examples - such as poisons which are dissonant to human cell structures and bring the

body to its end, or the psychotropic plants which even unlock memories held within the body cells or open them up to resonances in higher worlds. These are two vast areas of enquiry that depend, in the first case, on deliberate mismatches between biological cells and in the second, on stretching open latent correspondences between levels – precise dosage is crucial.

PACKAGING AND STRONG MATERIALS

An entire panoply of new Gums, Resins and Plastics started off from prototypes in nature, as in the range of Rubbers going all the way up to the super-strong Kevlar, used in the army. As J E

Ill.5- 77: (Top left) The Polyethylene floppy molecule chain; (top right and bottom left) the repeating Kevlar chain used for extra-strong body protection; (centre left) latex gloves used in hospitals or kitchen, and Kevlar gloves; (lower right) typical set of Kevlar army gear

Gordon explains, Kevlar is 'made up from benzene rings joined together without folding, much as the sugar rings are joined in cellulose; in fact, both the density and the modulus are closely similar to those of a high-grade cellulose such as flax. But the strength is about four times as high as that of the best flax and … virtually immune to moisture and rot'.

The inertness of artificial Polymers is their strong point in packaging and fabrics of all kinds, though they are often dangerously flammable. Their other disadvantage is that most are not biodegradable and the environment-conscious Western world is now horribly aware of turtles caught in plastic webbing and entire islands of plastic bobbing about in the ocean from which sea life gains no sustenance – and often death. Since Sir Richard Attenborough's BBC TV series

Blue Planet showing such scenes, the clarion call has been sounded to ban any plastic shopping bags or plastic packaging in supermarkets that is not biodegradable. Now at the time of writing, ***The Times*** reports, however, that 'an enzyme that breaks down a common plastic accused of polluting the oceans has been engineered by scientists'[31]. Again like the use of fertilizers, it has taken a whole generation to realise that the proliferation of artificial plastics needs to be regulated – simply because they will not intermesh with the rest of the material world as natural fibres eventually do. Young therefore calls these Polymers non-functional because they are comparatively non-reactive structures that nonetheless provide a stable arena for the performance of other chemical processes (as we have already noted, plant structures are held up by Cellulose: the wood of trees consists of the polymers Cellulose and Lignin, and within the framework of the Cellulose architecture of leaves, photosynthesis can proceed, meaning the leaves function as natural solar panels). The scaffolding provided by the Polymers of Octave Note 5 also constitute the matrix that gives a home to the higher molecules of the proteins (*Molecular Octave Note 6*) and, finally, DNA and related cells (*Molecular Octave Note 7*). Thus not surprisingly we start to see vague pentagonal linkages in non-functional Polymer chains which only come into full use in the circular arrangement of units in *functional* Polymers on the next note, which we can now move onto straight away.

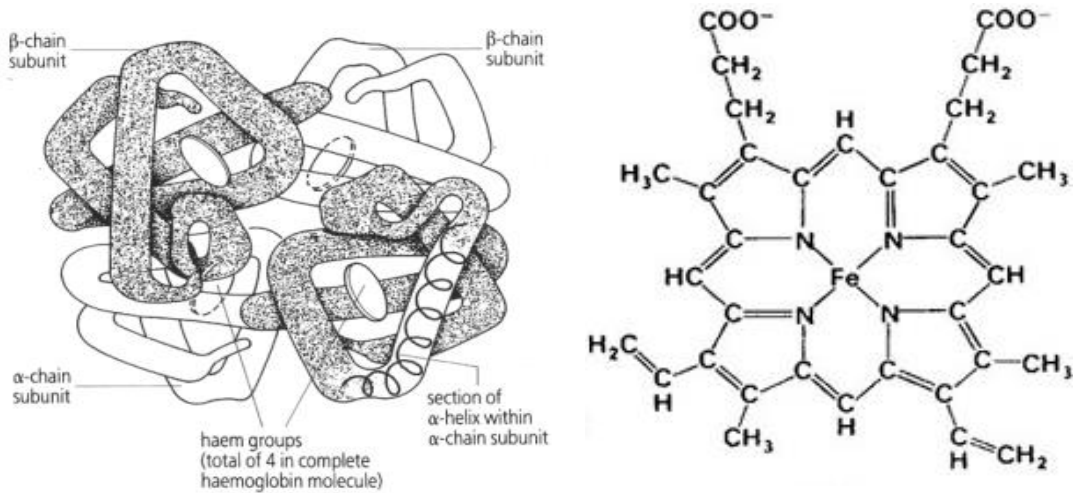
[31] On the front page Science Editor Tom Whipple and Environment Editor Ben Webster report that Polyethylene Terephthalate (PET) when recycled degrades and is an ideal candidate for 'an enzyme that would degrade PET [more fully] and turn it into its original chemical chains ready to be used again. The breakthrough comes after a bacterium that had evolved to eat plastic was found at a Japanese recycling plant two years ago: when scientists rearranged its structure to examine how it had evolved they found that they had inadvertently made it even more efficient'!

THE LAST TWO MOLECULE NOTES OF ASCENT

On the brink of entering the realm of proteins, amino acids and many more complex molecules, also compounds of compounds, we are about to embark on Young's *Molecular Octave Notes 6 and 7* whose essentials we will need to cover quite summarily since (as Plants have done in this booklet) they will emerge again to play a much fuller part in ***Book 6*** dealing with the astonishing music of the workings of the physical bodies of animals and humans. All the same, these last two notes of the grand molecular octave behave in such a spectacular way that their foundations need to be firmly established here, in this final section. Although our modern molecular approach to animal life has sometimes undermined many of the former attitudes and understandings about the status of the human body, we will in ***Book 6*** (much as we have looked at the early pioneers who analysed molecular structures) need to revisit what the human form in its full glory truly embodies – from ***Genesis*** onwards - and set its molecular processes in perspective to find areas of reconciliation between differing approaches towards its largely ignored symphonic makeup - in many ways debased since Ancient Greece, Egypt and India.

YOUNG'S MOLECULAR OCTAVE NOTE 6 (LA): PROTEINS AND AMINO ACIDS

Young's *Molecular Octave Note 6* covers Proteins, which are polymer chains with side chains sprouting from the sides. They have a certain life of their own, with a higher degree of 'freedom' than the previous notes. These side chains enable the molecule to hook onto other parts of itself and twist into knots or open helices of various kind – a good example being the haemoglobin molecule, which consists of four interlocked knotted chain subunits, centred on the one Iron atom responsible for the red colour of blood that carries Oxygen round the body:



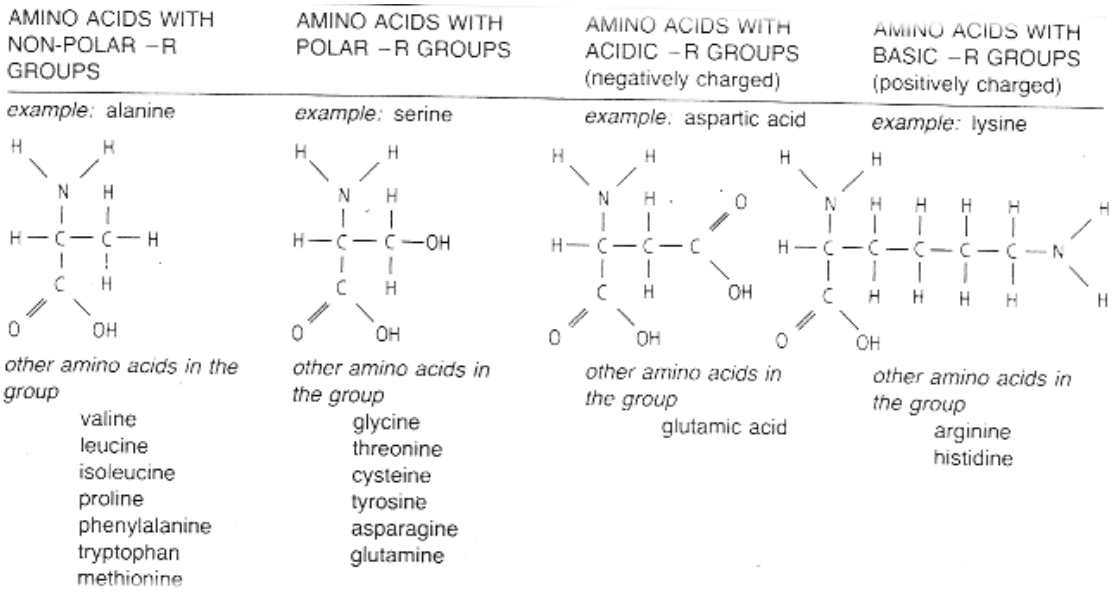
Ill.5- 78: The haemoglobin molecule – the structure of its subunits centring on one Iron atom

Interestingly Chlorophyll, which instead traps sunlight, vital for the life of the plant and responsible for its green colour, has a closely similar structure, but centres on one Magnesium atom (Vitamin B12 is quite similar – this time centred on a Cobalt atom).

It has taken a great deal of work to analyse the structure of Proteins, such as, for instance, Insulin which consists of four Polypeptide (Protein Unit) chains, two with 21 Amino Acid side chains and two with 30. Consisting of different combinations of the four master Elements CHON, the Dutch chemist Mulder worked out protein's basic formula as $C_{40}H_{62}O_{12}N_{10}$ which in all its combinations is a giant molecule consisting of Amino Acids, just as Cellulose in its single

chain is constructed of Glucose, or Rubber of Isoprene units. The numbers for the combinations of these four master Element combinations clearly get higher with each rise of note in the molecular octave. Von Liebig came to see that Proteins are even more essential for fleshly life than Carbohydrates or Fats because they concern not only the four master Elements for organic life, but also Sulphur and Phosphorus which are often embedded within them.

There are in total 20 different Amino Acids (a number significant for our work in later books on the quarter tones). They fall into four classes of structure, illustrated below. The repeating unit of any central Polypeptide chain from which the side-chains/Amino Acids hang consists of six atoms held rigidly in one plane with Carbon atoms at each end joining the links. To each of the joining Carbons is attached the side chain consisting of any one of the 20 Amino Acids via an ionic bond (rather than a covalent bond). Not all are used on any one Protein type, so the ones used are not necessarily different from each other, but repeated. Nonetheless, Asimov in his ***Guide to Science*** calculated the number of possible arrangements in which these Acids can be placed in a chain (even assuming that only one of each is used) comes to nearly 120 million billion. Some parts of the side chains are more essential than others – especially the ends – and can be synthesized with sections missing and still be operative. It is the side chains/amino acids which determine the angle at which the peptide units ride in relation to each other. Indeed as I write this the keep fit health vogue has moved from Vitamin supplements to ones based on



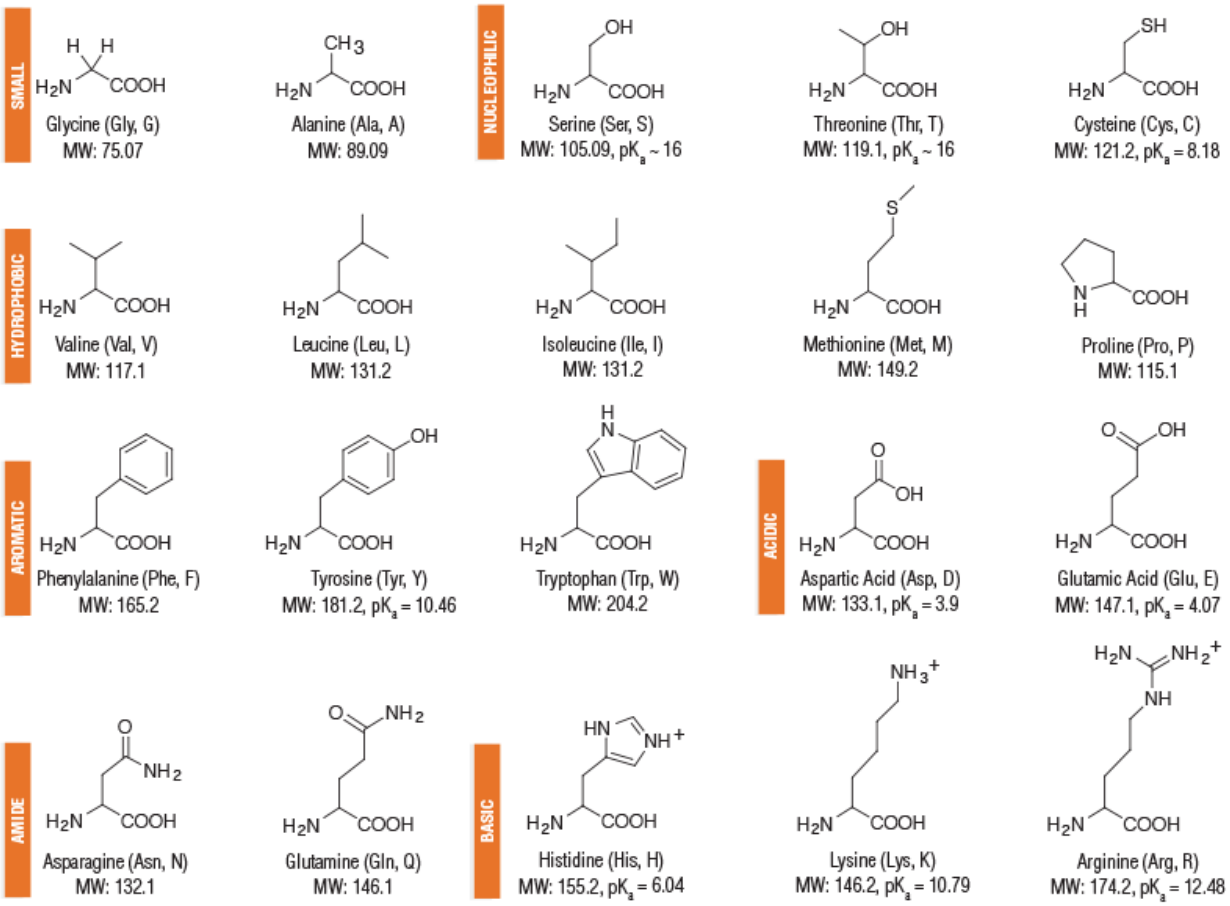
Ill.5- 79: The initial classification of four classes of Amino Acids

Amino Acid – the latest being the Branched Chain Amino Acids (leucine, isoleucine and valine) in capsule form, used by those wanting to build up muscle fibre (which does not necessarily mean sportspeople, but also the elderly whose muscle fibre declines in old age).

The bonding of the main Polypeptide units of the central chain of any Protein accounts for the strength of the protein fibres in such substances as silk, spiders' webs, fingernails, claws, horns or scales. Picking up from where we left off at Note 5, with artificial -v- natural plant fibres, natural *animal* fibres, such as Wool and Silk, come under *Molecule Note 6* (the hair, nails and horns of all animals and insects consists chiefly of Keratin which is nothing more than pure, hardened protein):

Ill.5- 80: (Top left) Silk cocoons with larvae still inside before spinning; (centre left) mohair; (lower left) sheep wool raw, spun and knitted; (top right) camel hair; and (lower right) angora from the angora goat

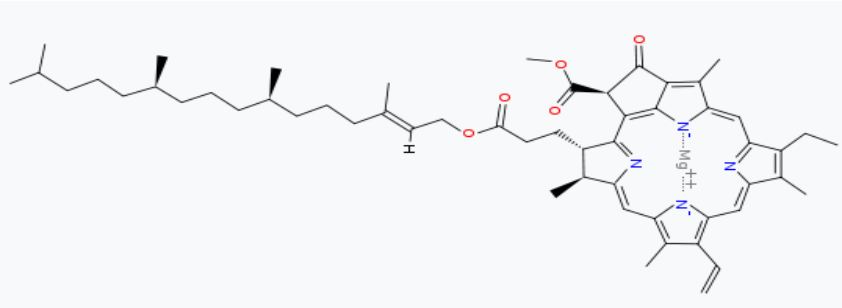
Again I must leave it to the reader to consult a more specialist book on the character of each Amino Acid - their structural units are below - and of the full complexity of Protein molecules.



Ill.5- 81: The currently accepted common 20 Amino Acid structures

HAEMOGLOBIN

To take but one example of a protein, if we go back to Haemoglobin (***Ill.5- 78***) it has been calculated that it contains around 550 Amino Acids, and this is only an average-sized protein. The German chemist, Hans Fischer, painstakingly worked out how it was constructed by first analysing the pentagonal unit (or pyrrole) consisting of four Carbon atoms and one Nitrogen. He then managed to unite four of them into a bigger ring with the addition of its Hydrogen components. The next stage was to fuse that fourfold circular construction with one Iron atom at the centre (clearly marked in our illustration above) in order to obtain the quarter-unit of the entire functional polymer/Protein with side-chains - the full molecule having four Iron atoms. The side-chains' importance lies in how they twist the Haemoglobin molecule (known as the *Heme,* formula $C_{34}H_{32}O_4N_4Fe$) into the most efficient shape for optimal exchange or release of gases (Oxygen and Carbon Dioxide) in the human body. This molecular arrangement has been noted as close to that of the Chlorophyll molecule ($C_{55}H_{72}O_5N_4Mg$) below (which instead has one Magnesium atom at its centre) which with its side-chains means that it, too, is a protein! This



Ill.5- 82: Core structure of Chlorophyll (with long Hydrocarbon tail) – diagram David Richfield

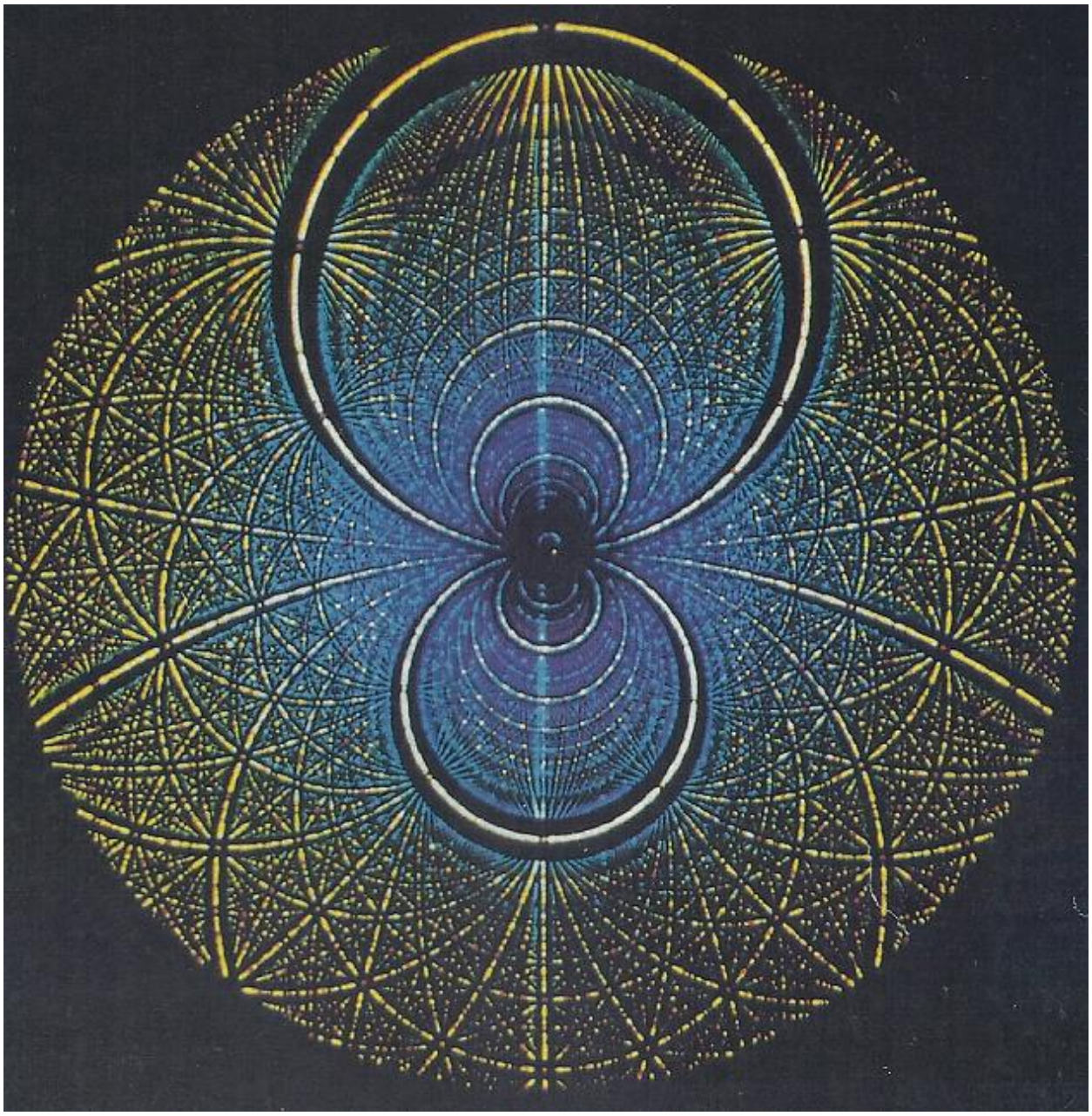
molecule is responsible, via photosynthesis, for manufacturing carbohydrates, fats and proteins, and for breaking down water into Hydrogen and Oxygen at normal temperatures (in the laboratory humans require a temperature of over 2000°C and an electric current passing through to achieve the same result). Of the overall global photosynthesizing process, 90% is contributed by the one-celled plants and seaweeds of the oceans (look back again to ***Ill.5- 8***). In all this, we the importance of Magnesium is central - in Kean's words:

> *Obviously Magnesium is less important than Oxygen or Carbon, but Element 12 could be a huge help for primitive creatures, allowing them to transition from organic molecules to real life. Almost all life forms use metallic Elements in trace amounts to create, store, or shuttle energetic molecules around inside them. Animals primarily use the Iron in haemoglobin, but the earliest and most successful forms of life, especially blue-green algae, used Magnesiium. Specifically, Chlorophyll (the most important organic chemical on earth) drives photosynthesis by converting stellar energy into sugars, the basis of the food chain.* [pp328-9 – note his use of the term, 'stellar energies']

ENZYMES

A forward surge has recently been made in mapping Protein structures since techniques have been found to crystallise them, then to submit them to the X-ray microscope, a highly delicate Process. Enzymes – specialist Proteins which speed up organic chemical reactions in living systems (present, for example, in the stomach to enable digestion) have, like Haemoglobin, a

complex three-dimensional structure and X-ray diffraction is used as the basis for synchrotron computer simulations to reveal their patterns of activity (as below). So far some 2000 different Enzymes have been identified.



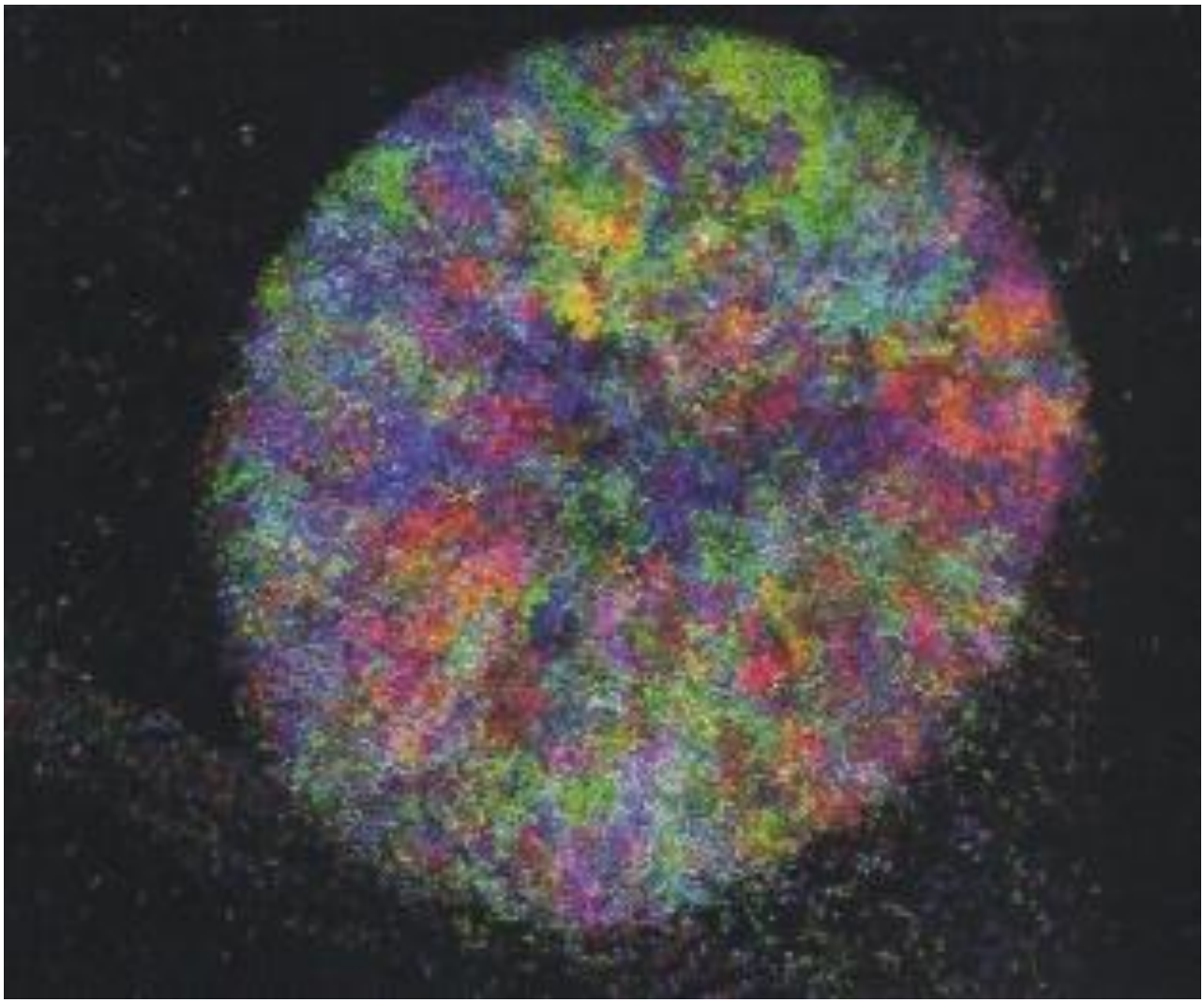
Ill.5- 83: An early computer-simulated X-ray diffraction rendition of the Enzyme Glycogen Phosphorylase at work – New Scientist 14 December 1991

AMINO ACIDS AND THE BEGINNINGS OF TERRESTRIAL LIFE

Again I must turn to Kean here: 'Just as you could never guess, unless you'd seen it, that individual Carbon, Oxygen and Nitrogen atoms could run together into something as useful as an amino acid, you'd have no idea that a few amino acids could fold themselves into all the proteins that run a living being.' As recently as 1994 Glycine, the simplest Amino Acid, was found to be present in the Milky Way. In the huge interstellar clouds of dust still present from the aftermath of the Big Bang some 40 molecules have been identified, including Ammonia, Water vapour, Formic Acid, Methanol/Wood Alcohol, Cyanoacetyline, Acetaldehyde, Carbon Monoxide, Formaldehyde, and Hydrogen Cyanide. The latter three came to dominate the

production of the chemicals of terrestrial life. It is believed that comets and meteorites hold many cubic miles of organic molecules which start to function if they come within the orbit of a planet providing the right conditions – such as Earth. For instance, the Murchison meteorite that fell in Australia in 1969 contained 18 Amino Acids, including six to be found in living cells.

Much research has been done on the inevitable natural genesis of molecules on planet Earth itself during the development of the solar system. As it took up its critical position within the octave of the planetary array swirling around the Sun, due to the effects of heat and light on the Earth as a whole, simple atoms forming its atmosphere grouped into the molecules of the primordial seas and land masses, consisting at first of the early notes of the Molecular Octave such as Hydrogen, Methane, Ammonia, Water, Carbon Monoxide, Formaldehyde and Hydrogen Cyanide. ***The Independent*** of 30 April 1993 (a UK newspaper) reported that a fossil had been found in Western Australia which 'contains the mortal remains of microbes that could use sunlight to photosynthesize like modern plants. Evolutionists said the discovery means that the very first life forms must have originated nearly 4 billion years ago'. The development of the octave would have proceeded and chemical reactions continued to synthesize into the higher molecular notes of Carbohydrates, then Amino Acids as the building blocks of Proteins, Urines and Pyramidines (the units for genetic material – see *Molecular Octave Note 7* coming next), as



Yeast cells and amino acids – photo postcard, Crick Institute, London

well as Fatty Acids and other organic compounds. All these at a certain crucial juncture moved together to form the next Octave – that of living cells.

This astonishing natural formation process was well expressed by the brothers Kenneth and David Brower in the first number of the popular science magazine, ***Omni***, in October 1978. 'Somehow', they wrote, 'back in this planet's youth, molecules organized themselves into a structure that could reproduce itself. Dusk quickened, and into an inanimate world came animation'. Perhaps, they said, we have by now overlooked the fact that this was 'a miracle of organization', given there are always 'potent forces of disorganization loose in the universe'. Crick in his book forcefully emphasises that such a phenomenon could not be explained by random chance.

As Narby puts it, 'The DNA molecule… is incapable of building itself on its own. Proteins do this, but they are incapable of reproducing themselves without the information contained in the DNA. Life, therefore, is a seemingly inescapable synthesis of these two molecular systems' (*Notes 6 and 7*). We should also bear in mind Crick's own criticism of the 'primordial soup' theory and his preference for the likelihood of the early stages of this chicken and egg relationship taking place in outer space where the needed transformational temperatures occur at a cosmic level. It is difficult to understand now that when Fred Hoyle and his colleague Wickramasinghe first introduced the idea of bacteria coming in from outer space, he endured a painful extended period of being shunned by his colleagues, as he describes in his autobiography[32]. Now the science world accepts that the entire battery of Elements is shared with the universe at large.

ANIMALS AND MAN AS PROTEIN EDIFICES

As Narby sums it up: 'In all living species, Proteins are made up of exactly the same 20 amino acids, which are small molecules. The average Protein is a long chain made up of approximately 200 amino acids'. Thousands of Proteins make up the structure of the animal body. For example, Actin and Myosin constitute muscles; the harder Proteins provide frameworks and protective sheaths for inner organs – just as cellulose does for plants – such as bone, tendons, ligaments and cartilage – all of which consist of specialised macro-protein molecules. They also play a central part in servicing body processes (blood cleansing, air transportation, food digestion). Hence in Young's terminology Proteins are all functional Polymers, because they are open to interaction with other molecules to build higher forms of life. Fats lie mid-way between Carbohydrates and Proteins in structure, consisting mostly of Carbon chains, and are a stored form of food which can be broken down by Enzymes – a famous example being Cholesterol, related to Steroids. Even Hormones are Proteins, and thus we could describe the human body to a large extent as an edifice of interacting Proteins talking to each other – but governed overall by master blueprints and messages transmitted by the DNA and RNA molecules, emerging as the final note of the Molecular Octave – to which we now turn.

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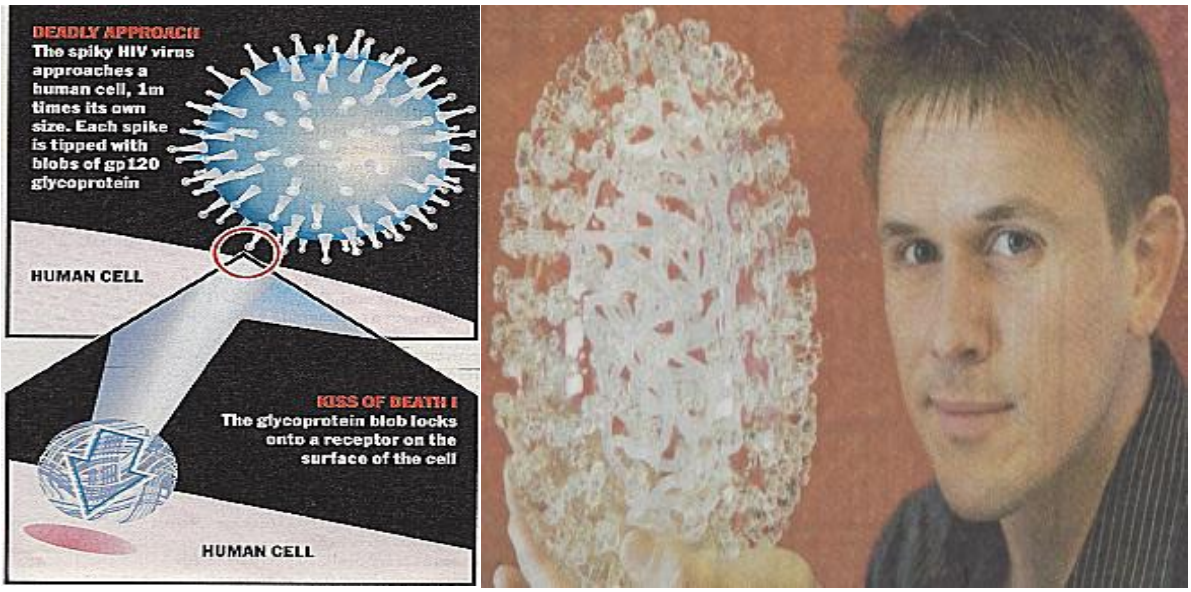
[32] F Hoyle ***Home is Where the Wind Blows: Chapters from a Cosmologist's Life*** London 1994

YOUNG'S MOLECULAR OCTAVE NOTE 7 (TI): CODED MOLECULES AND VIRUSES

For Young, the final note of the molecular octave is struck when Proteins cluster together in such a way as to form the complex molecule, DNA, the encoder placed in the nuclei of the living cells that are to unfold as plant or creature. Such signals were elaborated over four billion years of evolution, so by now DNA incorporates redundant or nonsense rows of code now set to one side as obsolete archive as it were, and not in current operative use in the present world scenario (much as someone in a house inhabited over a lifetime has many books and possessions they no longer use, yet which form part of their present situation). Although, as Steven Weinberg[33] puts it, 'The genetic code is pretty much a mess; some amino acids are called for by more than one triplet of base pairs, and some triplets produce nothing at all: the genetic code is not as bad as a randomly chosen code, which suggests that it has been somewhat improved by evolution, but any communications engineer could design a better code' - nonetheless these redundant parts may yet have a hidden function, even if lost in storage chasms like the old possessions of the long-occupied house. Weinberg continues, 'The reason of course is that the genetic code was *not* designed: it developed through a series of accidents at the beginning of life on earth and has been inherited in more or less this form by all subsequent organisms.' In other words, the estimated 100,000 human genes take up only 10% of the DNA molecule, the remainder having become no more than 'stuffing' through built-in obsolescence over evolution.

VIRUSES

In the same family as DNA is its 'anti-matter equivalent' – the virus, actually an incomplete DNA molecule possessing certain limited proteins. It invades the nucleic programming mechanism of living cells and, through its restricted range of codings, hijacks them and instructs them to give up their substances to the virus so that it may replicate itself, leading to disease in the host



Ill.5- 84: (Left) HIV virus attacking human cell as described in the VAXGEN research; (right) Luke Jerram with his glass sculpture of the swine flu virus structure (H1N1) – London Evening Standard 18-9-09, now exhibited at the Wellcome Institute, London

[33] Steven Weinberg ***Dreams of a Final Theory*** London 1993

creature. Such a scenario is graphically displayed in the rather expensive BBC DVD (well worth getting hold of) entitled ***Secret Universe: The Hidden Life of the Cell***.

This happens on a minor scale when we are afflicted by the rhinovirus – or common cold – but the flu virus can often lead to death. Electron microscope images of viruses show they are complex spherical balls with many spikes or protrusions which alter from year to year to evade the corresponding 'grappling hooks' in the immune system which, if rightly spaced, lock with them and disarm them. Study of the flu virus in terms of ever-shifting geometric structures in spherical dispositions to avoid the latest vaccines has become particularly applicable to research on the HIV virus (strictly termed a retrovirus) which operates on the same principle but is far more 'cunning' in evading the grip spacings of the immune system that ever lag behind in keeping up with HIV's hydra-like structural transformations: what is needed is a vaccine that speeds up the immune system's ability to adapt its locking mechanisms to fit changing viruses.

As with the story of the attempt to patent DNA, in the cases of AIDS and Hepatitis C viruses, legal moves have been taken to patent their discovery. Testing for Hepatitis C in blood depends on knowledge of its molecular structure, as it already does for the Hepatitus B and HIV viruses, where competition between national laboratories to gain possession is cut-throat. You would think it obvious that humans are not entitled to seek public recognition and exclusivity for structures they may have observed but have not themselves created: but we live in a greedy world. All the more horrendous is it when one group of humans in a particular organization claim sole ownership of the patents on sections of the human genome (the entire list of codings in the collective DNA of all 46 human chromosomes) when its Creator alone is the rightful owner, as perpetrator of their geometries.

Fred Hoyle and his Indian colleague Chandra Wickramasinghe maintained that the viruses causing epidemics and plagues of the world come from outer space and, like full DNA, require the presence of living cells to become active. This would happen when the cosmic atmosphere is disturbed, for instance, by a passing comet sending waves containing viruses and other cosmic flotsam and jetsam to beach up on Earth. As they explain in ***Our Place in the Cosmos*** 'The view we have maintained since 1978 is that viruses provide the vehicle of biological change… The immediate source of the viruses is the cloud of evaporated cometary material in which the Earth is perpetually embedded, from which the Earth's atmosphere is known to pick up some 1000 tonnes per annum, sufficient in quantity to supply in the order of 10^{21} bacteria and 10^{25} viruses'. Since viruses trigger massive alterations in organic deficiency, and therefore new reactive developments in the plant and animal kingdoms 'this makes the viruses act only as switches' (as opposed to the natural patterns playing out under the commands of DNA). They believe the main phases of evolution in the plant and animal kingdoms were furthered by these switches (cosmic viral attacks) – the case for which they make in detail. Viruses nearly always seem to be spikey spheres (compare with the multitude of smooth spherical variations in pollen) – whereas bacteria are more likely to take up chain forms (as in the case of the close-up of the streptococcal bacteria below). We will wait to devote detailed attention to bacteria in ***Book 6*** when we find out how they form an integral part of the teeming invisible life inhabiting

Ill.5- 85: Electron microscope colourised image of the streptococcal bacteria responsible for such things as a sore throat – photo Martin Oeggerli in The National Geographic 125th Anniversary edition Jan 2013

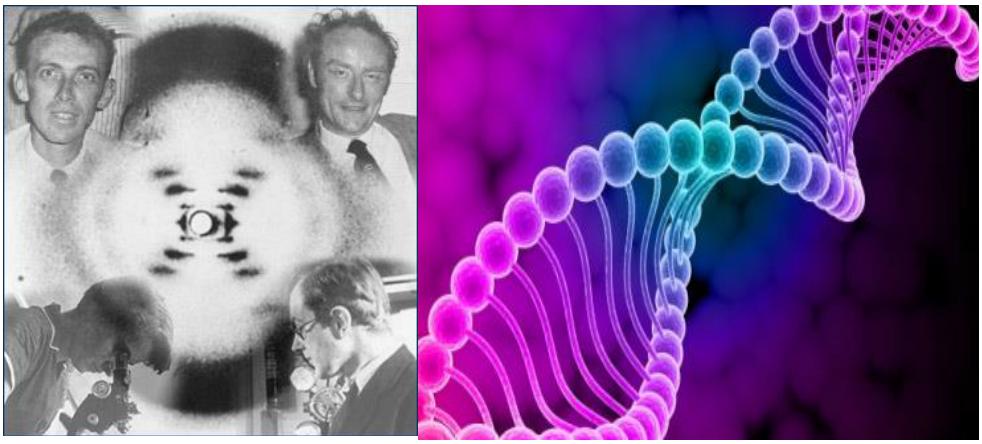
the human body, both inside and out. As Nathan Wolfe puts in in his ***National Geographic*** article, 'All told, the microbes in your body can weigh as much as or more than your brain – about three pounds in an average adult'. They are so small and so numerous that they far exceed the stars in the universe – and they not only inhabit the atmosphere, but the search is on to pinpoint them at key collection points of matter anywhere in interstellar space.

Just as with atoms, the ejection of one electron from its orbit leads to 'loss of accord' – on a par with taking Jupiter out of its orbit in the solar system – so this rule can be applied to disease in human beings caused either by the predations of the virus on flesh, or dislocation by other means of one crucial gene within DNA, as in Huntington's Disease, Down's Syndrome or Sickle Cell disease, all of which are now correctable by genetic engineering. This is yet another reminder that the whole depends on the sum of its parts, even at the microscope level. Thus, due to the Law of Correspondences upon which the unitive view of this book depends, any deficiency is devastatingly accurate in its translation into a physical manifestation that distorts from the norm. One investigator has found that the AIDS virus contains 7 unstable Elements (an entire octave) at various wave frequencies which affect a number of the chromosomes in both male and female patients causing a more drastic loss of immunity against disease than usual, ultimately meaning loss of that Pythagorean harmony of number and structure giving wholeness - and health.

DNA AND ITS MOLECULAR STRUCTURE

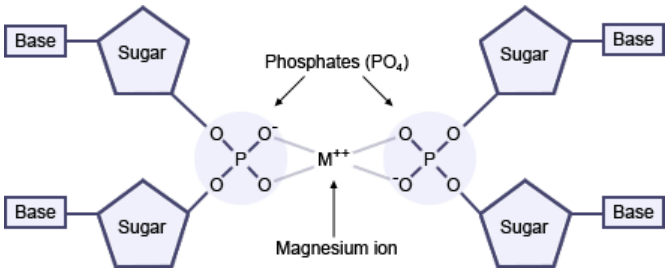
Having quickly glanced at the pathological structures of viruses we can now devote ourselves to DNA – the model of wholeness that is the antithesis of those malevolent, spiky spheres. Even to those who know nothing of chemistry or biology, ever since the discovery of its structure by Crick and Watson in 1953 (the top two faces in the collage below) - goaded by Rosalind Franklin and her tantalising photo of it seen from above - its image and key properties have been popularised globally to make it the molecular icon of our times, often glamorised as in some of the pictures shown here. Although its structure was worked out theoretically in that year, it was not until 1988 that, by means of a scanning tunnelling electron microscope (which

can achieve a million times magnification), Miguel B Salmeron with colleagues at the Lawrence Livermore Laboratory in California at last made it possible to look at it 'in the flesh'.



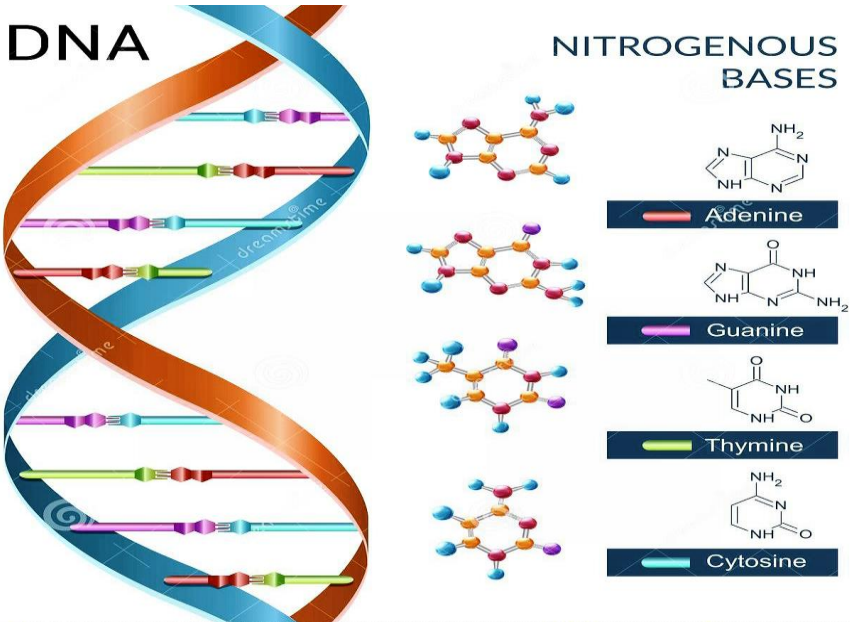
Ill.5- 86: (Left) Watson and Crick on the top and at centre of the first photo of crystallised DNA taken from above by Raymond Gosling (not shown) under the supervision of Rosalind Franklin and her King's College London laboratory boss, Sir John Randall seen below); (right) a glamorised view of the DNA twin spiral ladder

From the side view it consists of two ribbons of sugar phosphates (see diagram below) winding in a double spiral linked by rungs which hold the information necessary for sending formation



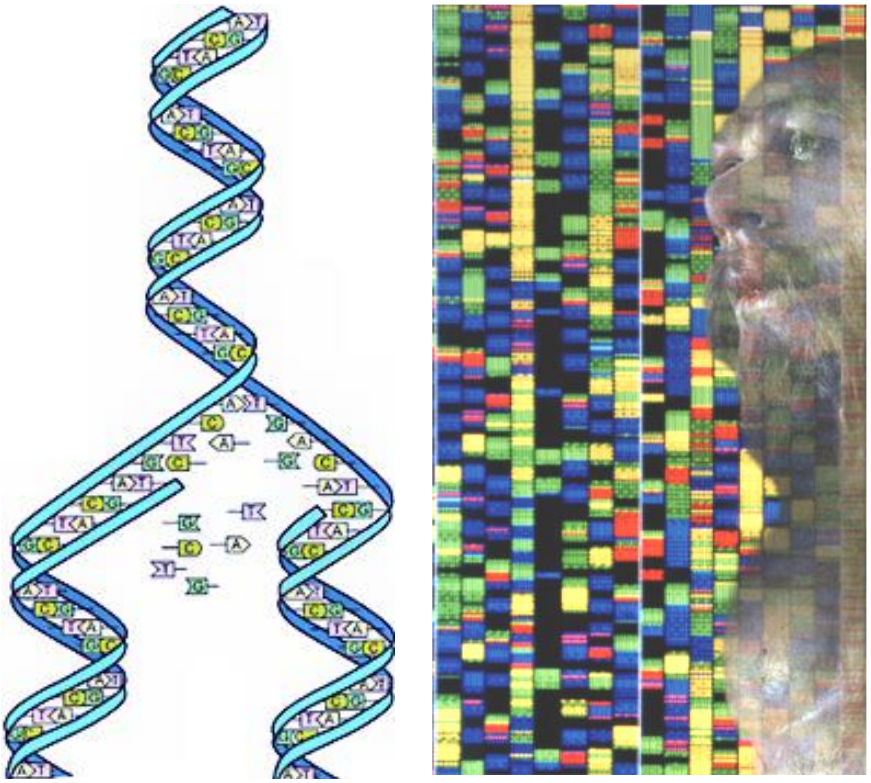
Ill.5- 87: Watson and Crick's initial model erroneously placed the bases on the outside of the DNA molecule with the phosphates, bound by magnesium or calcium ions, inside [Courtesy University of California Museum of Paleontology's Understanding Science Dept (http://www.understandingscience.org)]

instructions to be executed within any multi-cellular organism. The rungs are made up of four types of molecule consisting of rings and side chains made up (again) of combinations of CNOH



Ill.5- 88: The four 'rungs' of the DNA molecule, Adenine, Thymine, Guanine and Cytosine [CGAT for short] – image courtesy Dreamtime.com

as itemised in the diagram above, and are called nucleotides since present in the nuclei of living cells. Each stretches from helix to helix in pairs, bonding at the middle – and separating along those joins when the entire DNA molecule self-replicates, much as a zip zips and unzips by ripping itself in half down its length into two halves, thus self-reproducing by generating a complementary half. The twinned nature of the molecule, its laddered structure *and* its sinuous, spiralling nature are all qualities that Narby had cause to consider in relation to tribal myth – these we will ponder in our final *Conclusion*.



Ill.5- 89: (Left) DNA self-reproduction; (right) evocation of the DNA profile of a Neanderthal

The structures of the paired nucleotides shown in the previous illustration are such that they can link up from either end, making four possibilities: CG, AT, GC and AT. The end of each pair joins to a pentose sugar called deoxyribose and this in turn to a Phosphorus atom surrounded by four Oxygens which joins it to the main helix horizontally and to the other deoxyribose units that form the heliacal chains vertically (***Ill.5- 87)*** (the sugar component in RNA, which we come to shortly, is always a molecule of Ribose). Where in the previous *Molecular Note* the peptide units were sixfold, Young points out that 'counting Guanine and Adenine, each of which contains a five-and six-ring as linked units known as *purines* [portrayed in Barry Stevens' painting below] as opposed to the other two which are *pyramidines* with only one hexagonal structure, counting along a rung from one end to the other we find there are seven Elements on each rung of the DNA ladder'.

Four complete rungs straddle each full turn of the molecule and provide, as it were, an alphabet made up of the four nucleotides – signified by the four letters CGAT - in endlessly varied sequences, forming a specific, individual portrait of its owner, now termed a DNA profile (which can be expressed in rows of small coloured rectangles representing the four nucleotides as in the example of the Neanderthal profile above). When operating within human cells they

are, however, read off by the cells receiving their codes in groups of three, each triplet corresponding to an amino acid. The order of amino acids in turn determines the kinds of enzymes that will ensue, and therefore the particular characteristic brought about by it. Through them the DNA spells out the message which constructs the specific proteins needed to build any organism. In the case of the human being there are some 50,000 enzymes controlling 50,000 separate chemical reactions that end in the successful amalgamation of the human body. Even for a simple creature, the codes would fill a 2000-page book (one set of books containing the basic Human Genome with all its combinations of GCAT are exhibited at the Wellcome Institute in London, taking up a tall, wide bookcase).

In fact, the task of mapping the Human Genome Project has now been completed, consisting of around 3 billion letters following a specific order, and considered to be a greater achievement than Man's landing on the Moon. James Watson said, 'A more important set of instruction books will never be found by human beings. When finally interpreted, the genetic message encoded within our DNA molecules will provide the ultimate answers to the chemical underpinnings of human existence'. This new vision of humanity is regulated, not by the Ten Commandments (see Ernst Fuchs' painting of Moses below, repeated from ***Book 3***), but by the One Hundred

Ill.5- 90: Ernst Fuchs 'Moses and the Burning Bush' (1956/7) - the Belvedere, Vienna

Thousand Genes – submission to which entails unavoidable and total submission, as Krüger saw it (despite infinitesimal wriggle room for change now afforded by genetic engineering).

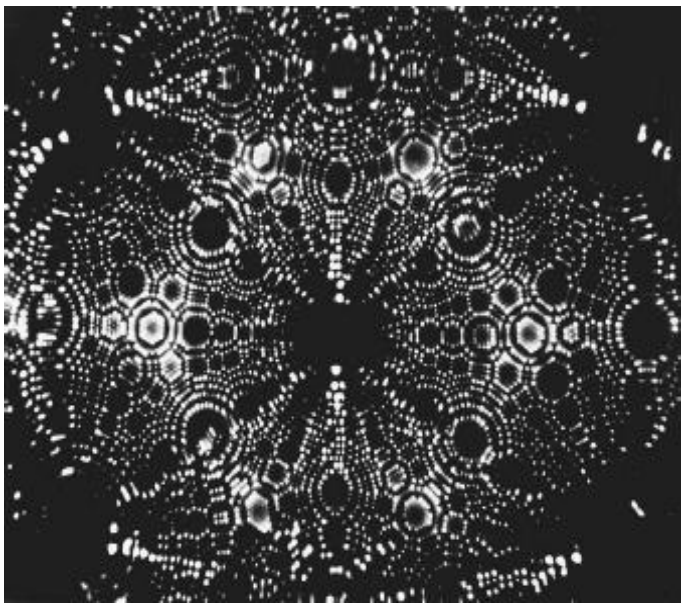
DNA AND DATA STORAGE

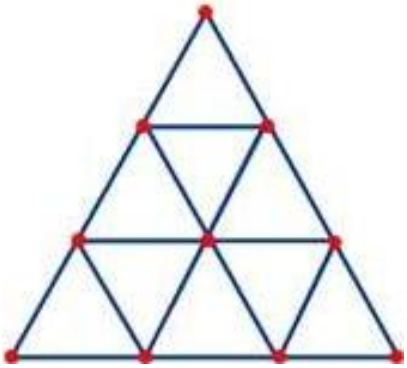
More recently (given it is a natural data storage molecule already), DNA has been used for data storage in massive equantities and as the matrix for calculators and computers infinitely more refined that its silicon chip predecessors: 'The potential for molecular computation is impressive', said Dr Leonard Adleman at his Los Angeles molecular biology laboratory in 1994.

Ill.5- 91: Use of the DNA molecule for data storage

Just looking through three BBC News reports for 2009, the first states that DNA can be 'folded', with engineers reporting that they can now get 'DNA origami' to self-organise on silicon chips: making chips with components closer together leads to smaller devices, and faster and cheaper computers. Two years before, it was reported that DNA was being used in 'biomolecular computing' which can beat electronic computers at solving large, complex problems. Such devices can also be used to detect signs of cancer at an early stage – and can even be programmed to release drugs at the right time to treat disease – the final aim being to perfect a nanocomputer to 'go to work inside a cell'. The report said, 'The "computer" consisted of a chain of three segments of DNA and an enzyme which could cut the strands'. Another report from 2009 described how a computer with DNA as its information carrier can even answer questions if strands of DNA are designed to give off a green light to signify 'yes'!

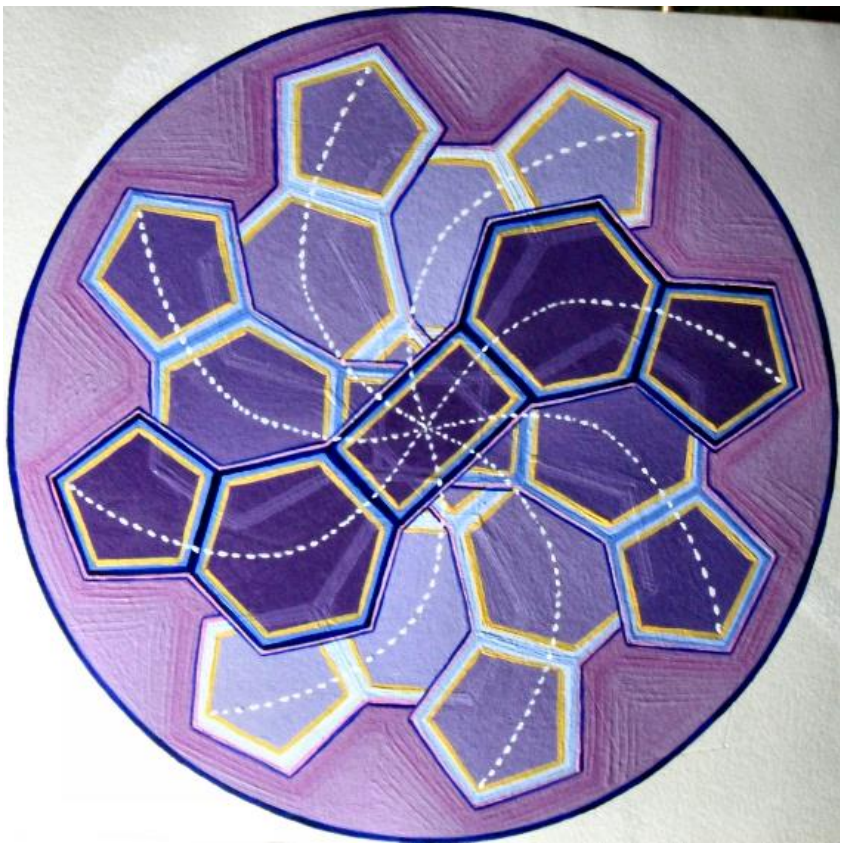
PYTHAGOREAN DIMENSIONS OF DNA





Ill.5- 92: Spectrometral photo of a Tungsten Atom, (Ill. 3-8, Book 3); (right) the Tetraktys

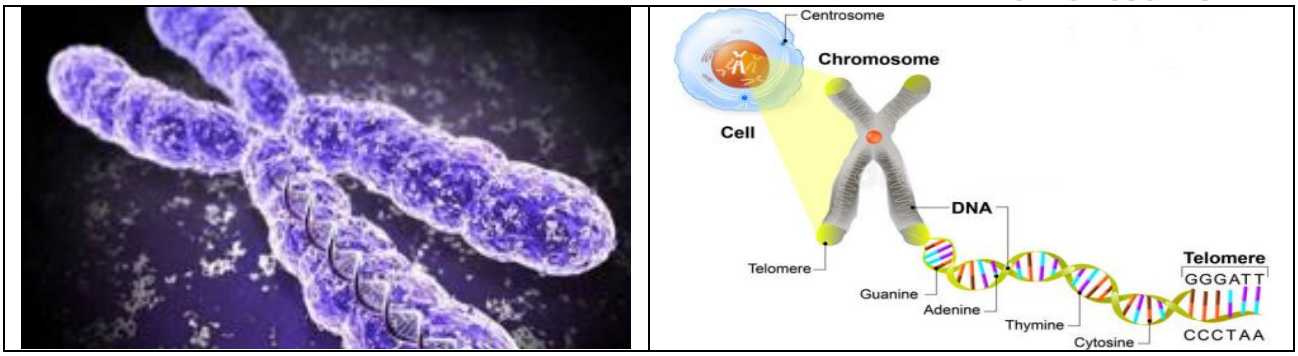
Let us consider the Pythagorean makeup of the DNA molecule. You might remember the spectral patterns of the Tungsten atom from ***Book 3*** (above) with its hexagons, pentagons and squares shimmering in a mesh from one centre (compare also with the Chlorophyll and Haemoglobin molecule foursquare layouts). When spectrally viewed from above, in one strand of the doubly spiralling deoxyribonucleic acid (DNA) molecule the same interlocked shapes feature, the pentagons and golden rectangles bonded by Golden Sections whose harmonic properties we studied in the early Cosmokrator books. All strands taken together seem in the view from above to spin like a propeller (it takes four rectangles to complete one circuit), filling out Rosalind Franklin's first photograph of it, and, we might say, becoming a DNA *mandala*



Ill.5- 93: Painting of the DNA spiral Molecule viewed from above – by Barry Stevens

worthy of contemplation. We remember Blair's description in his ***Rhythms of Vision*** of how Tantric Buddhist priests see any mandala not only as a circular configuration 'but also as a flat representation of a spiral, a crystalline map of the potential energies of human consciousness'. On this last note, we will have much more to add in our final conclusion.

CHROMOSOMES

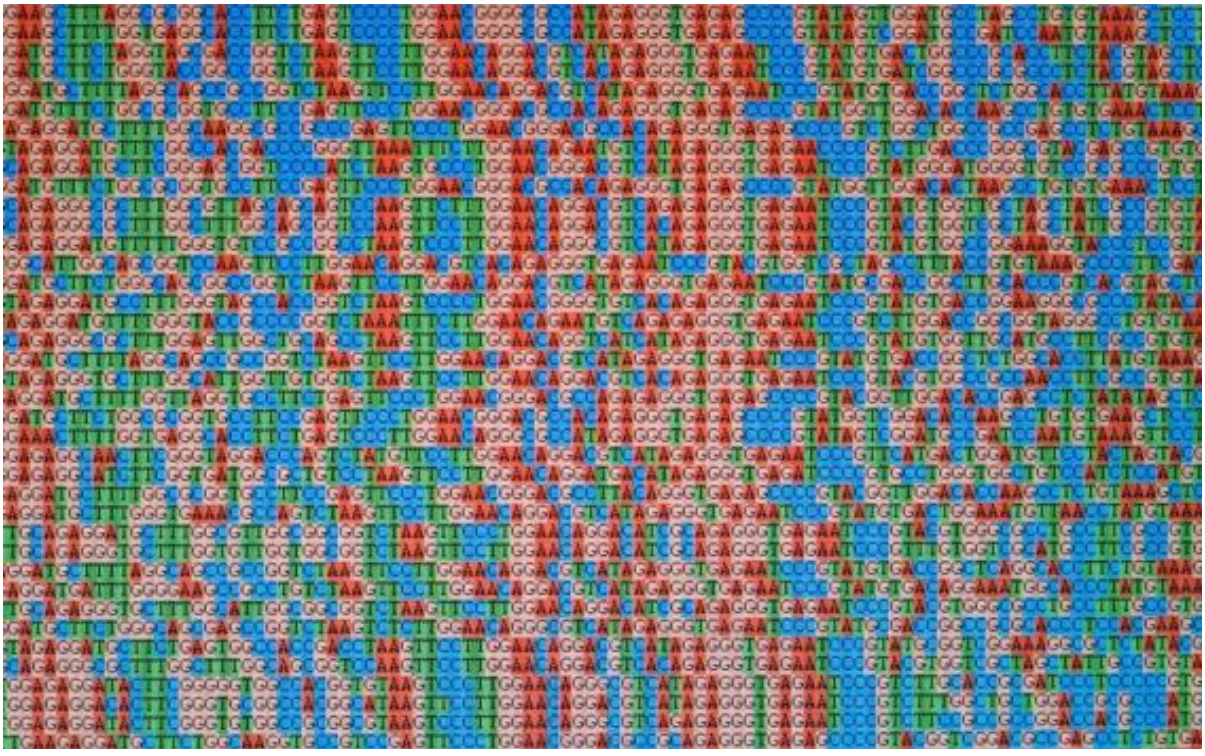


Ill.5- 94: Each human cell contains 46 chromosomes, each housing the owner's DNA with all its instructions – telomeres are at the tail ends, any deterioration there an indication of aging

Strings of DNA molecules link to form chromosomes whose last pair polarises humans into male or female: females have two X chromosomes as the final pair where males have an X and a Y. This, rather than sexual organs, has become the criterion whereby a person's sex is gauged. It is one tiny gene within the Y chromosome, the 'sex-determining region of Y' which actually determines maleness and consists of no more than 250 base pairs of DNA which produce a protein containing 80 amino acids that amongst other things determine the production of testosterone and the drop-down of testicles and penis. Otherwise on the main 22 pairs of chromosomes, men and women are exactly equal in their chances and that tiny difference brought in at the 23rd pair to one section of the Y chromosome which differentiates a man out of an originally female embryo clearly offers an argument for the precedence of women over men (rather than their fabled creation 'out of the rib of Adam', as posited in ***Genesis***)! In the case of some strongly built female athletes they have been found to be technically male on the chromosome count and therefore ineligible for female sporting events.

THE HUMAN GENOME PROJECT

The Human Genome Project in the USA may have devoted itself to spelling out each letter, word and paragraph of each chapter of each volume/gene of the human genome, but the naming of parts is a small part of the task still remaining of finding out what each set of codes actually controls – the function of only a handful has been pinpointed so far, and there is even talk of synthesising an artificial human genome. Being made in their likeness, men and women cannot but be curious to have spelled out to them what their cells already know and – just as we spotted an overall Fibonacci pattern to the Periodic Table or the fanning out of plant life's octaves, so from within the welter of rows and rows of GCAT phrases, within the vast overall harmonic firework display of significant numberings and groupings the individual codes for body part formation, illnesses, racial origins and very much more is emerging in stochastic streams.

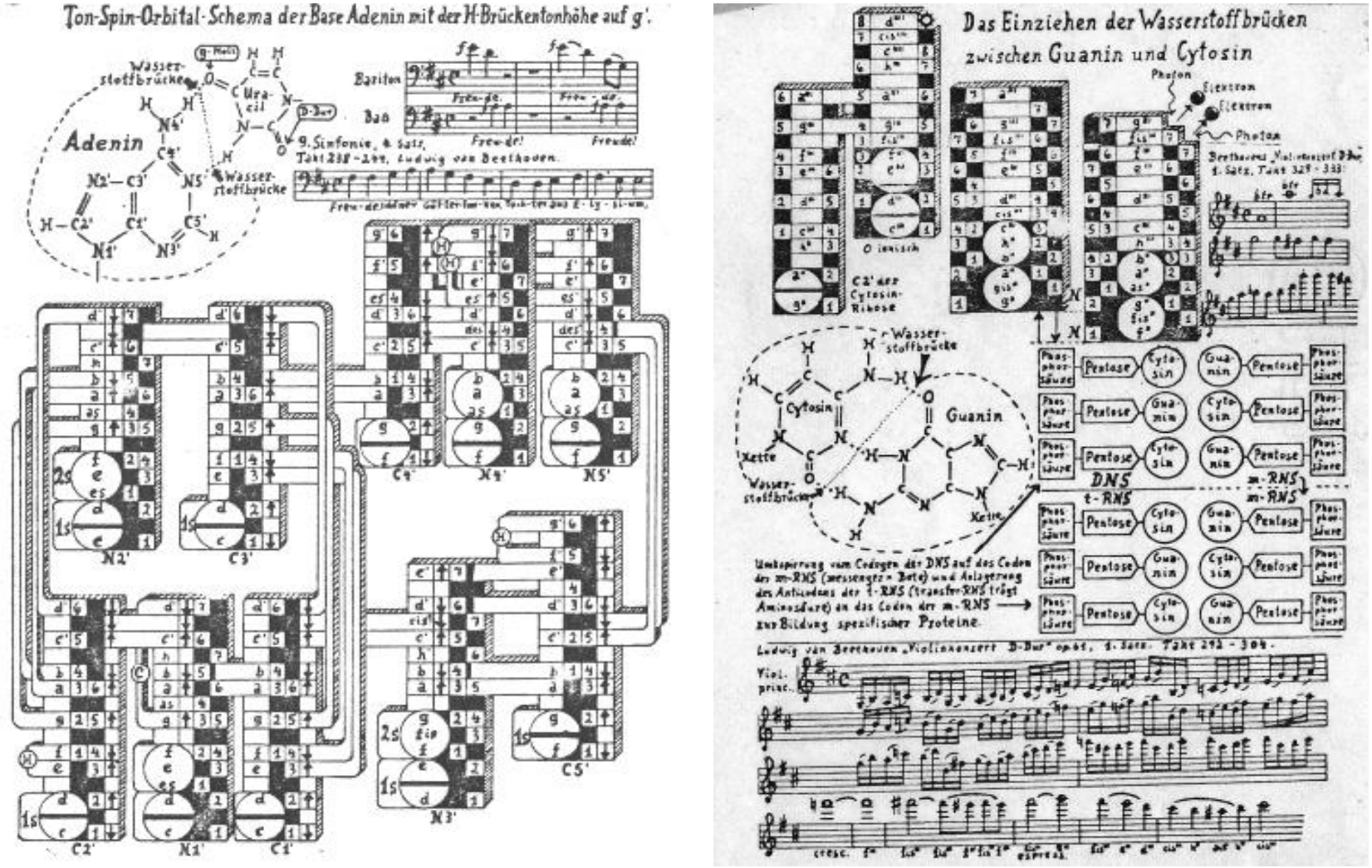


Seen side-view, the overall conglomerate DNA molecule, the most complex molecule known, consists of the two heliacal ribbons as already characterised – rather than the centred, spherical micro-universe we have with atoms. In this, we might say it is the ultimate chain along the lines of those first appearing at *Molecule Note 4* and continuing to appear in more complex forms in *Notes 5* and *6*. If all the DNA in the 46 chromosomes of one human cell could be pulled out and unfurled it would be about two metres long. Human DNA contains enough information to fill 1000 paperback books, according to an article in ***The Independent on Sunday*** for 25 April 1993 celebrating the 40th anniversary of the discovery by interviewing Crick and Watson at the height of their scientific seniority. Put another way, the human genome will ultimately fill 360 volumes each the size of the ***Encyclopaedia Britannica.*** Fortunately such vast information can be stored digitally in just the way DNA information itself is stored!

There are hundreds of millions of the four nucleotide bases, following each other in different combinations in each DNA molecule, sounding together in a mighty, invisible symphony. Hamel in his own book tried to convey how deeply Krüger sought to penetrate the musical equivalences of DNA and RNA, nucleotide by nucleotide (the next illustration shows his notations for three out of the four). He wrote, 'One of the deepest secrets of the Pythagoreans' most secret teachings of the sacred Tetraktys (see ***Ill.5- 92***) is traced in Krüger's work to the prime Elements of organic life, the nucleic acids'. The Tetraktys [discussed more fully in ***Book 10***] comprises the four intervals of the octave, fifth, fourth and second, according to which in the Pythagorean teaching the laws governing the life of the world and Creation itself unfold.

This same system, he suggests, underlies the work done by the DNA bridges, the spokes in a twisting ladder of similar intervals by which the helix ever spirals onwards. The combinations provided by the four nucleotide bases is seen by Krüger as the embodiment of music akin to Beethoven's symphonies (below right) – though one might be more inclined to match them to the Bach's more systematic ordering. To check his interpretations at this level of detail requires someone with the requisite experience in music *and* gene structure – which should not be entirely impossible, though perhaps out of the reach of the general reader, who can do no more than gain an impression of the general effect. Altogether, Hamel writes, 'Krüger's works seems to be entirely Pythagorean' – but publishers found his work so esoteric (yet no more so than atomic and molecular science itself) that no publisher would accept his work, even in German, let alone translated into English – so that only 500 copies of his book were privately printed. All the same, for the few who know of his work Hamel concluded that 'the intuitions and esoteric knowledge of the ancients can and will be tied in with today's scientific, advanced discoveries'.

One of Krüger's most interesting observations is of the recurrence of the key number 40, not only in the sum of atoms making up the mini-chains of phosphates, sugars and nucleic acids that constitute DNA (taking into account the nucleic acids, the pentose sugar and the Phosphoros atom surrounded by Oxygens), but also in the number of electrons present within significant subunits of any DNA chain (the German original must be read here in order to tease out what he is driving at, and it is not spelled out in easy terms). He observes that 40 reinforces the fourfold, as seen in the four nucleotides, the four directions, the four seasons –



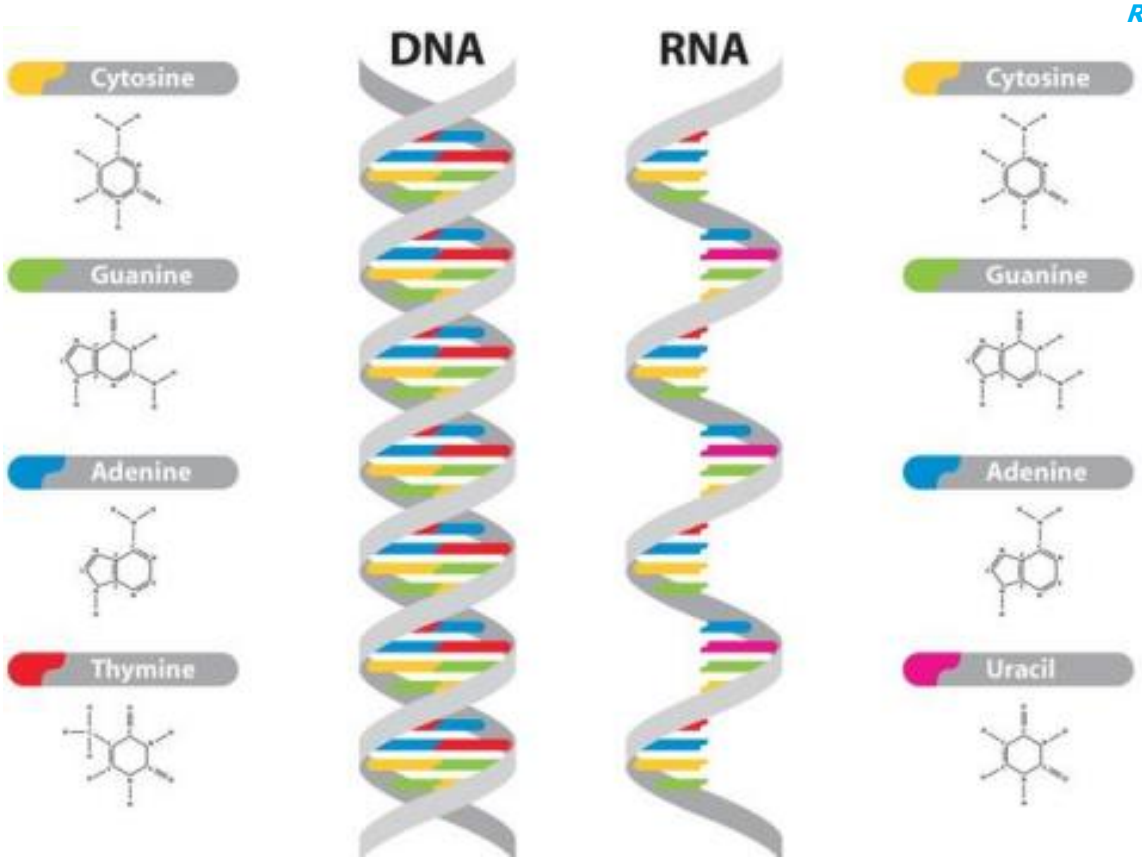
Ill.5- 95: Krüger's notations for Adenine (left), Guanine and Cytosine (right) - from Das Universum Singt

multiplied by 10 (the Tetraktys). This is a familiar number in the Bible as the number of days and nights Jesus was tempted in the wilderness, the number of days and nights Noah's Flood lasted, and the period Moses waited for the descent of the Ten Commandemnts on Mount Sinai – to name only three of the best-known instances.

The fact that 40 is the guiding number of DNA (8 x 5) means, he says, that 40 is the symbolic cipher for DNA, implying, as in the Bibical events just mentioned, a domain of Decrees, Rules, the Laying Down of Destiny, Testing, Endurance and Obedience. In other words, the real Tablets of the Law are in DNA itself, and at that level of interpretation the Bible mythologises its stringent rulings. Young came to the same conclusion about DNA by another route, saying that it was the molecule of Dominion and Rulership governing the octaves behind and before it. (In astronomy bodies like Venus or Sirius can disappear for a while and reappear 40 days later.)

Krüger also saw DNA as governed by an octave made up of 4 plus 3 notes: 4 for the nucleic acids in their paired combinations (64 different sequences of the four are possible), and 3 in what he called the Holy Trinity of Oxygen, Nitrogen and Carbon which crucially determine the character of the nucleic acids and pentose sugars without which DNA would not exist (Hydrogen adds the watery consistency but he sees it as standing over the Trinity). The octave is completed to note 8 by the vital Phosphorus atom that locks each rung into its spot in the double helix. Krüger seems to be onto something important here, but it needs a certain amount of counting and thinking to accept it and one lazily accepts his final generalisation, daunted both at the prospect of reading his original in German, as well as of following his thinking in his densely laid out diagrams (which do become more legible when blown up to giant A3 size)!

RNA



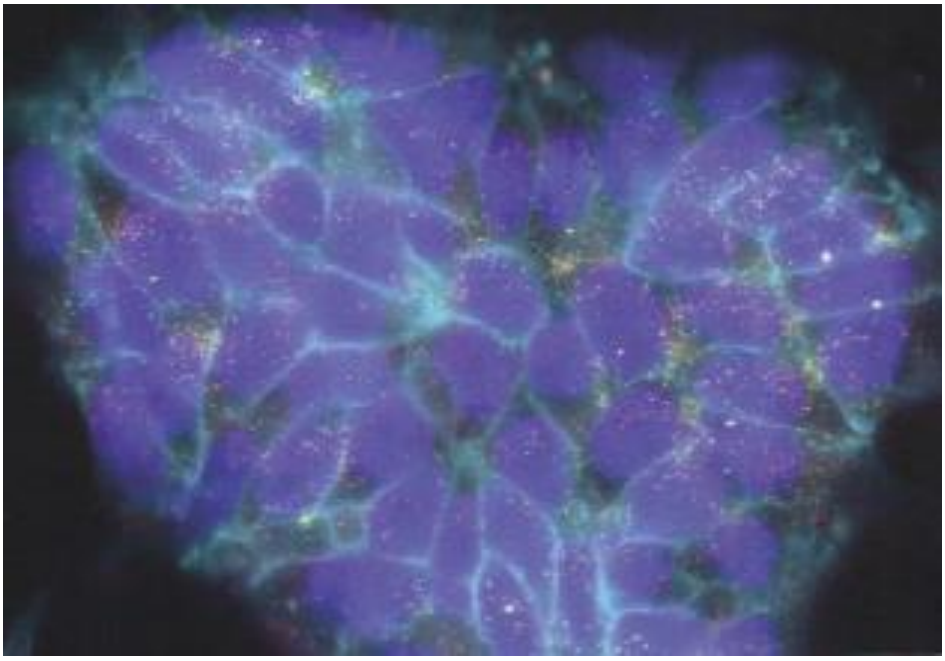
Ill.5- 96: DNA's double strand and RNA's single strand compared [zoom]

DNA itself is aloof, containing all codes, while single-stranded RNA is the 'photocopier' of codes from the DNA original, lining itself up along the split halves of DNA in order to 'print off' its copy. To do this, it is therefore very close in structure to DNA except that its sugar is simply a ribose (containing one more hydrogen and oxygen atom than DNA's deoxyribose), and in place of DNA's T nucleotide a U (Uracil) nucleotide is substituted which will still marry up with Adenine in the copying process. RNA combines with amino acids depending on the sequence of half bases and thus proceeds to form the different types of proteins and cells as laid down by the DNA. On its own, as a single strand of sugar with nucleotides along its edge like teeth, it is more fragile and evanescent, and can behave like an enzyme and fold into knots like the Haem molecule.

OVERVIEW OF DNA

DNA is tough and can even survive to meet the inspection of the archaeologist thousands of years from the time it was made: it needs to be robust in order to sustain the chain of life. Krüger found that its significant number was 5 x 12 – or 60 – though we shall have to wait for ***Book 12*** to discuss the significance of this and other sexagesimal measures.

Then again, the fact that every human is built from the instructions coming from 23 pairs of chromosomes (making 46 code chains in all) is most interesting. The significance of the division of the Octave into the quarter-tones 21/22/23/24 will be the subject of ***Book 7***, and the fact that 23 is the number of chromosomes in humans underlines the finesse of their musicality. The fact also that the entire set is duplicated also gives food for thought: simple organisms often just have one set, though plants even have as many as four, eight, or more sets of duplicate chromosomes, making them easy to hybridise. The chromosomes store the different DNA molecules as genes which determine each particular characteristic of a plant or animal, whether of blue eyes or flowers, long legs or stalks, quick mind, surly temper, etc. The genes in the DNA clusters grouped in the chromosomes consist, as it were, of paragraphs (proteins of the DNA) using words (amino acids) all spelled out by the combinations of the four nucleic acids.

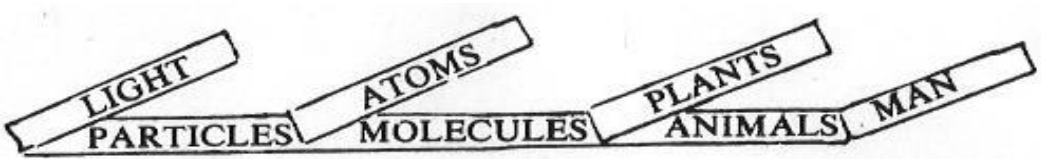


Molecules inside stem cells – photo postcard, Crick Institute London

There is no doubt that DNA, for which there is only one type of cell, is a huge step in development of structure from the Proteins of *Molecule Note 6*, and that it constitutes a return to an all-comprehending unity which only unfolds its full potential in the octaves of plant and animal life. As Young puts it, 'this suggests that process, as the seventh substage at least, anticipates its own future, pointing towards a stage beyond itself' in the same way that Mankind at Note 7 of the whole creation has the choice to move on to Spirit. With *Molecular Note 7*, he says, 'molecular evolution ultimately re-enters the intelligible world of light, in this case by encoding pure information'. This means that flesh is not only amenable to instruction at the cellular level but - as we shall describe in our final Conclusion – its structures can not only be directly experienced in heightened states of consciousness, but also diffused through consciousness to influence surrounding bodies (i.e. not necessarily physically ingested). This is why we should take a quick look at molecules that heal, whether through plants or stone crystals (which also have their own micromusic).

THE INFLUENCE OF PLANT OR STONE MOLECULES ON ANIMALS AND HUMANS

We began this book with this simple diagram, filling it out more fully as Young's Grand Octave



Of Creation at ***Ill.5- 30***. This book has been about the Molecule note of the Grand Octave which we have inspected within its own sub-octave. Noting the special place the Molecular level occupies at Note 4 in that Grand Octave of Creation, note by note within its own Molecular Octave we have seen how it literally stands at the balancing point between inert matter and living plants and creatures. More and more is being discovered about just how interleaved these final notes of the Grand Octave actually are, as we will describe in our final conclusion with the help of Jeremy Narby. The famous health expert, Deepak Chopra, talks of tuning in to our bodies at quantum level because 'happy thoughts make happy molecules'. Plants aid this process simply by transmission (rather than ingestion) because they radiate photons and more complex molecular patterns often also found in the brain. Recent work has concentrated on the astonishing healing power of plants in this mode[34], showing up the process of actually swallowing them as food or herbal remedies as crudely redundant.

As we read in ***Book 2*** from the letter of Marsilio Ficino who played the lyre, the doctors of old would, through the Law of Correspondences, often relied on healing disease through exposing the patient to truly harmonious music, triggering the dissonant parts of the body to take up their right place again by erecting an archetype of wholeness within the soul to which the body could re-adhere. In other words, music affects the body's molecules and can pre-empt genetic engineering just as plants can. The great healers have shown that consciousness, exposure to harmonics and positive direction of thought are ultimately where lasting body restoration or

[34] A recent title is Pam Montgomery ***Plant Spirit Healing: A Guide to Working with Plant Consciousness*** 2008

continued maintenance can be wrought, and such methods are within the grasp of every human being, costing nothing. The use of substances using the notes of the Molecular Octave to bring about change in the body relies on matches between their structures with cellular molecules and neurotransmitters that open up amino acid pathways back reaching as far as the structures fundamental to genetic coding – even in the case of drugs, though here cell damage can be a side effect. All the same, we have to eat and drink, and as far as other substances such as alcohol and drugs are concerned (whether recreational, mystical or medical) *when precisely dosed* there is no harm in using these physical means as a first stage towards gaining confidence in exercising one's autonomous higher faculties unaided – as one might resort to water wings when learning to swim.

We can add to the range of power molecules the healing power of stones (both precious and semi-precious) – whose molecules can be as simple as the Carbon of the Diamond, or as complex as Lapis Lazuli where several substances have compacted together over millions of years under huge temperatures and pressure. In *Appendix C* I show the Cosmokrator model to which I have assigned the stones that most radiate the power of each Sign and Planet, hoping that one day a rich patron to pay for a hand-held Cosmokrator actually made from these substances, facet by facet, will appear on the scene to make it happen! For those interested in healing in that direction, before coming to our final sum-up, it is worth quickly considering the restorative molecules of stones or crystals because they are all powerful and tangible substances whose beauty penetrates and heals (and not subject to decomposition, like plants).

CRYSTAL INFLUENCE AND THE ZODIAC OF PRECIOUS AND SEMI-PRECIOUS STONES

Stones have been prized and worn by Mankind far back into Palaeolithic times – as far back as the Neolithic period we know certain attractive stones were traded over vast distances to make axes and jewellery. From the 5M BC the mineral-rich area of Central Asia presided over an astonishing exchange of brightly coloured stones which I have described in some detail in ***Catalogue E*** on my www.layish.co.uk website: these were the material for all kinds of artefacts that are part and parcel of the history of Ancient Near Eastern Art[35].

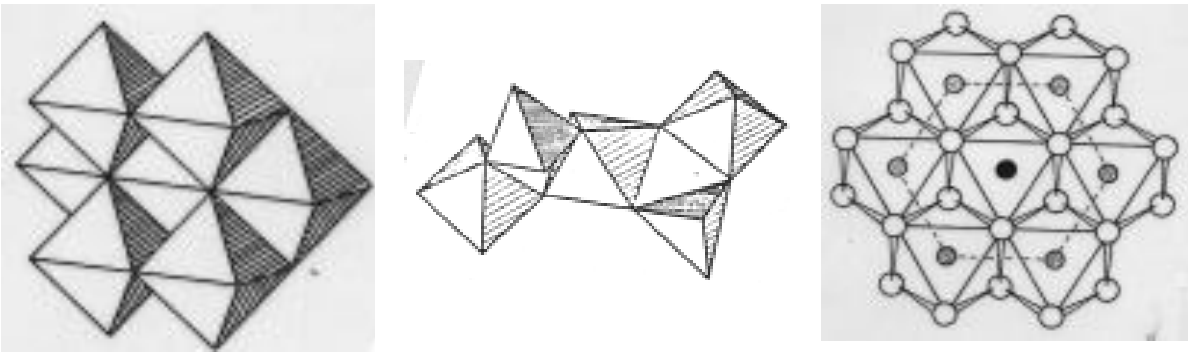
Coming forward to more recent times, crystal organization was investigated in Germany for over a hundred years by Goldschmidt, Weiss, Nowacki, Kayser and others. Weiss was a 19C crystallographer from Berlin who showed that the angles of crystals and the proportions between their edges and planes could be represented by musical relationships – in other words, angles and notes express each other. Viktor Goldschmidt in 1901 took the research further in his book ***Über Harmonie und Komplikation***, showing that different crystals follow different musical scales, such as B^b minor and $E^\#$ major and that they 'have separate collections of tones and show along their coordinate axes different motifs for polyphony and counterpoint'. Nowacki showed that crystal lattices are based, according to their symmetry, on a sevenfold axial system. It was the axes of the crystals, Goldschmidt said, that are the points of reference in measurement and proportions, confirming that the angles define not only the ensuing shape,

[35] From the Home Page click on the Centre Square, then on the Centre Square again and go to ***Catalogue E:*** Part I contains the visual material and Part II the commentary on it.

but also its music. Sheldrake believes all crystals are held in place through morphic resonance, manifesting rhythmic patterns of organisation that run through the entire universe.

This corroborates Kayser's understanding of musical angles, already introduced in ***Book 1***. Glazewski showed how crystals 'coordinate themselves in splendid networks of lattices', according to their specific axes which thus engender their shapes, or 'the morphological appearance of the crystal'. He, too, saw that it was through measurement of the angles in the crystals that their musical structures could be worked out. Decades later, photography of such (often hidden) angles was opened up under the pioneering work of Lawrence Bragg who 'thought of atoms in the crystal as a series of layers like apples in a greengrocer's box. Each layer, or plane could reflect X-rays like a mirror if they happened to hit an atom'[36]. From then on, based on the phenomenon, he worked out what became known as 'Bragg's Law' so that by the time Dorothy Hodgkin attended the Chemistry Departments of Oxford and Cambridge, according to her biographer she 'had learned the technique of measuring the external angles of crystals to discover the crystal system' and through geometry and other techniques was able to determine the patterns and rotation of their atomic arrangement. She worked on determining the structure of many substances, but is particularly known for protein crystallography, for which she won the Nobel Prize in Chemistry in 1964. In fact, she was one of the first people - in April 1953 - to travel with a group of 'inner circle' colleagues from Oxford to Cambridge to see Crick and Watson's double helix model of the structure of DNA.

We now know psychic resonances between man and matter are set off by the harmonics of crystalline form to a very high plane which, radiant through pure ratios, can carry the mind to the archetypes of existence. The most effective gemstones are carefully cut in order to bring out the hidden lights sparkling within its inner axes: for instance, the enormous Sapphire in the crown of the Maharajah of Jaipur is cut into a precise icosahedron – the actual shape of Blue Water, as it is named. On the other hand, the Hope Diamond was not cut according to its inherent structure – was this why it brought misfortune upon all who owned it? The non-faceted molecules of semi-precious stones, on the other hand, move the crystalline world into the stone equivalent of the organic sphere, as you will see from the examples on the Cosmokrator model for stones.



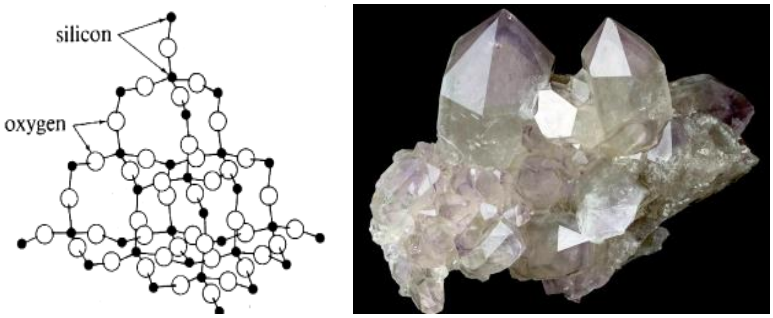
Ill.5- 97: Octahedral packing (seen from the side and from above) works as seamlessly as cubic or tetrahedral packing - the example of Manganese Oxide in the centre uses both

[36] Georgina Ferry ***Dorothy Hodgkin: a Life*** London 1998

Simple crystalline packings work best with triangles and squares, and with the cubic packing for rock salt and many metals already referred to in the Introduction to this book. Triangular packing is illustrated above showing how the angles and shapes fit together, with the actual example of Manganese Oxide shown in the middle (with one stray tetrahedron - there was a time in the 1970s when milk was stored in tetrapacks as a more efficient use of space than milk bottles, but they were a little awkward to open and pour from.) Two examples of fluorine shown below, move between cube and rhombic dodecahedron, showing how in real processes intermediate stages between forms become the very nature of the solidified crystal.

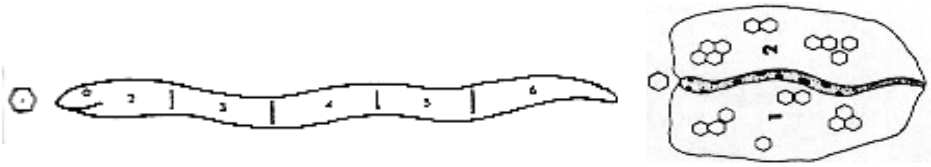
Ill.5- 98: (Left) Fluorite - photo Andreas Schmid; (right) Green Fluorite with one or two dodecahedral edges emerging from the cubes

Another clear-cut example is Quartz, the drawing below showing its lattice of hexagonal rings of alternate Silicon and Oxygen ions, each Silicon atom with three bonds, and each Oxygen atom with two. Guy Murchie noted that Quartz crystals consist of never less than three Silicon Dioxide molecules – and if less (i.e. only two), then it is not Quartz. Quartz is hard because the



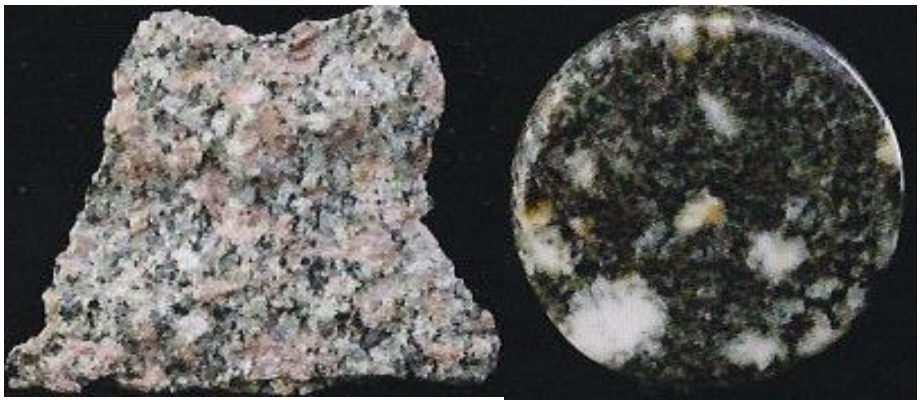
Ill.5- 99: The hexagonal Quartz structure

hexagons are stepped forward and back (mirroring the difference between flat graphite and faceted diamond molecules). Furthermore, the Quartz molecule is arranged in a slight spiral to the left or right and has the power to rotate the plane of polarisation of light in either direction. The shamans of South America prize quartz, imagining their visionary Life Anaconda as guided by a quartz crystal at its head and visualised as situated in the brain (the same visualisation is used for the Aborigines' Rainbow Snake, again with its powers represented by quartz):



(Left) The ancestral anaconda guided by the divine rock crystal; (right) the shamanic visualisation of the human brain with the fissure between the two hemispheres occupied by the anaconda and its visionary crystal – Reichel-Dolmatoff quoted by Narby pages 64 & 57

Dowsers claim special properties for Quartz, and many stone megaliths or Egyptian obelisks have Quartz in the granite used for their construction (the Egyptians used pink granite from Aswan, and the 'blue-stones' at Stonehenge were specially brought in from the Preseli mountains in Wales): analysis of the harmonic ratios of their atoms may give some explanation.



Ill.5- 100: (Left) Pink granite and (right) blue Preseli granite, the white crystals being Quartz

Of course, the Silicon integrated circuit 'chip' used in computers is nothing other than a form of Quartz containing Aluminium, said to be the most common substances in the earth's crust and found in ideal combination in Silicon Valley in California.

When Aluminium was discovered, for a time in France under Napoleon III's patronage it was accorded a higher value than gold and silver – one reason why around the same period it was decided to cap the Washington monument (originally one of Cleopatra's obelisks from Alexandria) with aluminium sheeting. In the end its lightness and imperviousness to rust became its most prized qualities in the sport and engineering industries as its price came down, while still bestowing a streamlined glamour to the many artefacts in the design world of the Art Deco period. Titanium, on the other hand, is synonymous with toughness and has saved many a hip bone – let alone being used in jewellery as much as it is in aero-engineering for its bluish tinge (Titanium very unusually bonds with bone in a way no other metal does). We do not include metals used on their own in jewellery on Cosmokrator, even though several newly discovered metals provide enchanting colours – as is the case with Vanadium, named after a title for the Scandinavian Freya/Venus, who was often visualised as covered with gems. As Aldersey-Williams puts it, 'Preserved in the Berzelius Museum in Stockholm are some three dozen test tubes filled with the various Vanadium salts that the Swede had been able to make: the colours include bright turquoise, and pale sky blue, orange, maroon, chestnut and tan, various ochres, a sludgy green and black – many of the shades found in the tunicates'. Indeed, other more unusual metals coming to light from within the metallic mini-octaves such as Zirconium, Thorium or Beryllium provide glitter and colouring in jewellery while, astonishingly, it is Chromium that lies behind the intense green of emeralds and the deep red of a good ruby.

By wearing particular stones on particular days we can tune in into that Higher Order and work with its octaves. Yes, of course we continually lock in to the world of molecules when wandering through nature, doing housework with different substances or becoming involved in the world of cookery or medicine in hospitals – and in thousands of other ways. But wearing one, two, or many stones has both a grounding and a heavenly effect. We think back to the

ancient Zoroastrian Heptad (***Ill.5- 29***) – whereby Stone stood for the permanence of the Sky Order and the all-imbuing Aether – and most recently to events such as the Queen of Britain's

Ill.5- 101: Queen Elizabeth II in 1953 in full Coronation regalia

Coronation when she was literally covered in powerful gems to draw down and transistorise the powers of invisible Spirit that both fuel and protect her royal authority. She would not have been able to uphold her vow of duty to Britain without their power. The other crown worn by Elizabeth I is set with the famous Koh-i-Nūr diamond. It was originally made by Cartier's for her mother, Queen Elizabeth the Queen Mother, as consort of George VI at his Coronation in 1937 – and is entirely made of platinum. As Aldersey-Williams recounts, when Louis Cartier took over the business in 1898 he had already experimented with platinum as superior to either gold or

silver in setting off white stones such as diamonds, as well as being much harder – and thus durable in keeping its very large stones in place.

We can do the same to combat a tiring, complex and busy life in a more modest way, since using individual stones and making daily changes of jewellery (whether showy or discreet) guided by the Cosmokrator stones model is one particular way in which a person in everyday life can celebrate the Octave of Molecules as a way of linking up, through their power, to the ordered Cosmos of Planets and Stars. I will not spell out my allocation of stones to Cosmokrator until we can explore this particular model in detail in ***Book 12*** where the stone equivalents for planets and one or two key stars are given for a double fortnightly period to cover the two main halves of the Moon cycle – i.e. a whole month - in an inspiring meditation cycle that can become a permanent way of life. It is one way of using molecules as fuel to enhance awareness without risking one's health!

CONCLUSIONS

Stage by stage all our books have demonstrated the simple framework from which the main musical intervals and all energies arise (2:1; 3:2; 4:3; 5:4 and so on). We have tried to gradually move the reader forward to make fundamental shifts in awareness, here to understand how atoms really do equate to musical notes, each with its own frequency and set of overtones which pulsate outwards from their nuclei in all directions in measurable quanta rhythms or beats. These pulsations will be of a spherical nature in space and time – unless interfered with by some neighbouring counter-pulsations. Through resonance they exert influence far and wide in several octaves both above and below their own frequency. Andrews, describing the immense variety of waves, gravity, light, electro-magnetic, and colour, also believes that behind them all 'there exists and undulates a vast sea of atomic particle waves' and that in this ocean of activity as they combine into molecules 'the fundamental chemistry of our living is expressed'. Put another way, the basis of atomic activity within molecules is harmonic – hence the title of Andrews' book, ***The Symphony of Life***. He writes, 'The music of the universe is a cosmic symphony that is almost unbelievably intricate in its complexity. For in its totality this symphony embraces all the waves of light, visible and invisible; all the waves of gravitation, felt and unfelt; all the waves of atoms, explicit and implicit'.

In this book we have moved on to tune in to the music of the molecules, which may not necessarily be heard, but can still be experienced. 'It begins to look', says Andrews, 'as if the universe is made up, not of 'matter' but of music'. Guy Murchie stated that 'Every conclusion must be consistent with the harmonic model of the atom' – and since the harmonics are spiral in action that is why there are no straight lines in Nature. Einstein is said to have urged physicists to go back to geometry: and indeed, Werner Heisenberg always retained an interest in Pythagorean Number and the Tetraktys, stressing their importance in the fabric of life.

But is our life really any better by knowing that all this is going on under the surface? Are we any happier, having taken all this atomic and molecular knowledge on board, even after benefiting from better medicine or possibly even trying out a few hallucinatory drugs?

THE CULTURAL CONSEQUENCES OF MOLECULAR KNOWLEDGE: THE DOWNSIDE

The Caesium clock has measured standard world time since 1960 (losing only a second every three years). It operates on the basis of the accurate measurement of one of Caesium's transition frequencies, normally achieved by locking a crystal oscillator to the principal microwave resonance of a Caesium atom which has a higher resonant frequency even than Quartz – at 9,192,631,770 Hz (note again the mention of Quartz!). This momentous changeover from the Greenwich Meantime 0°Meridian as universal benchmark marks the moment when humans on Earth turned away from the stars and planets that surround them that up to then had been used to enable the calculation of time. Moving into the subatomic world in the name of greater precision (it loses one second only every three years) in many ways has cut mankind off from the macro universe in a way that has had drastic results spiritually – because in day-to-day life humans cannot see the atomic or molecular world tangibly at work in the same way one is tangibly aware of the Sun rising or the Moon setting against a backdrop of the stars.

There are still some of us around who are old enough to remember a youth in which we negotiated life *without* taking account of atoms or molecules. Vast alterations to the human mindset during the second half of the 20th Century and into the 21st have crept up on us, adopted and taken for granted in leaps and bounds without question – sometimes with alarming changes in human self-awareness of its position in the universe overall. Scientists and science journalists have started to take stock: thus Tom Wilkie[37] in reviewing R C Lewontin's ***The Doctrine of DNA*** cites his criticism of the recent manifestation of science as 'an ideology claiming that all or most of human existence is controlled by our DNA'. He also points out that 'many of the cleverest researchers are lifelong left-wing radicals', tending to take a more deterministic view of the entelechy of human society and its evolution. In a world looking to replace humans by robots, one could start to look at humans or animals as nothing more than the sum of their molecular computations - one philosophical danger stalking humanity as put forward by R C Lewontin in his book.

Yet the majority of humanity has a habit of reverting to its norms, simply because they are 'the factory setting' – and knowing more about the mechanisms of the Creation of the World should increase its wonder. Human beings may well be able to take it apart like a watch, but they could never have initially invented It. The Hindu and Christian doctrines of divinity coming down in human form express this cosmic mystery, and though Perfection may exist at the divine level, it does not necessarily remain perfect in its physical translation – as DNA-deficient diseases show us. The argument for DNA medical engineering (despite the counter-argument against the horrors of Nazi eugenics) is that humans have always promoted the development of the best models of anything by dropping any 'rejects' and promoting healthy or new prototypes that emerge naturally (this applies to the genesis of wheat by the Neolithic farmers, to the nurturing of different breeds of cattle or sheep or to the propagation by nurserymen of all kinds of new flower and vegetable types). Nonetheless, tinkering about with the actual nucleotides within the

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[37] Tom Wilkie 'Tatty genes and the grace of God' ***The Independent*** Science Books Reviews Section 27-11-1993

DNA molecule is not natural, but a deliberate artifice. It is exceedingly clever to have reach this point of mastery over the molecule, but there is no doubt that such activity constitutes interference, rather than working with natural selection, and we have not gone far enough into this new field to be able to see, yet, any unexpected (as well as expected) 'Brave New World' type consequences for human behaviour towards parenting and healing). As Peter Forbes in his review[38] of Danah Zohar and Ian Marshall's book on ***The Quantum Society*** put it, 'We're all Bose-Einstein condensates now'. Earlier, in the same newspaper (2-9-1993) Celia Hall describes the 'brave new world of "gene passports", predicted by Mark Ferguson of Manchester University's Cell and Structural Biology Department whereby everyone will eventually have access to their own personal health profile, held on disc or even stored on a microchip implant which doctors could use to pre-emptively read off, for instance, an individual's chances of developing particular diseases.

All through the Cold War, America and Russia competed to move the Periodic Table forward to the ever rarer and rarer Elements – though with undoubted participation by other countries such as Japan and Sweden. Aldersey-Williams well points out that 'The balance of the 20C super-powers was maintained by a nuclear arsenal based on Uranium and Plutonium…' – and, frighteningly, the non-use of dangerous chemicals that damage humans and environments rests solely upon the reliable moral fibre of a country's government.

But the accompanying benefits of molecular knowledge are so vast.

THE CULTURAL CONSEQUENCES OF MOLECULE KNOWLEDGE: THE UPSIDE

When it comes to giving an account of the Universe, there is no one language to describe it. There has been a tendency in Brave New World ideology to ditch the old icons and replace it with the Periodic Table. It really depends on how broad an education an individual is given. I personally have no problem in looking at the painting of the Host of Angels below by Fra Angelico and seeing it as a metaphor for the Periodic Table, in much the same way Kean likened it to the layout of the map of the USA. If one took the trouble, the effects of every neutron, proton and electron in their individual spheres that in their microtone numberings account for the separate atomic weight of each Element, could be the attestation of each angelic feather. Here, Kean is particularly good at explaining simply, through the number of subatomic particles each Element has within its internal spheres, the rationale behind the sequences of their ordering – and hence why particular Elements combine so well with each other, and others not (for the numbers involved, it is worth re-reading the material on the micro-tone ratios of atomic structure given in ***Book 3***).

As to the key Element or Molecule that might be represented by Christ, the Virgin Mary and the Saints, the outstanding ones could easily be allocated to each of these roles by thinking of the ones that have stood out as the main protagonists in this book. In the painting there is even a corridor for the Lantharides and Actinides – and a separate place for the poisons in Hell! But there are different visions to hand that may also help us.

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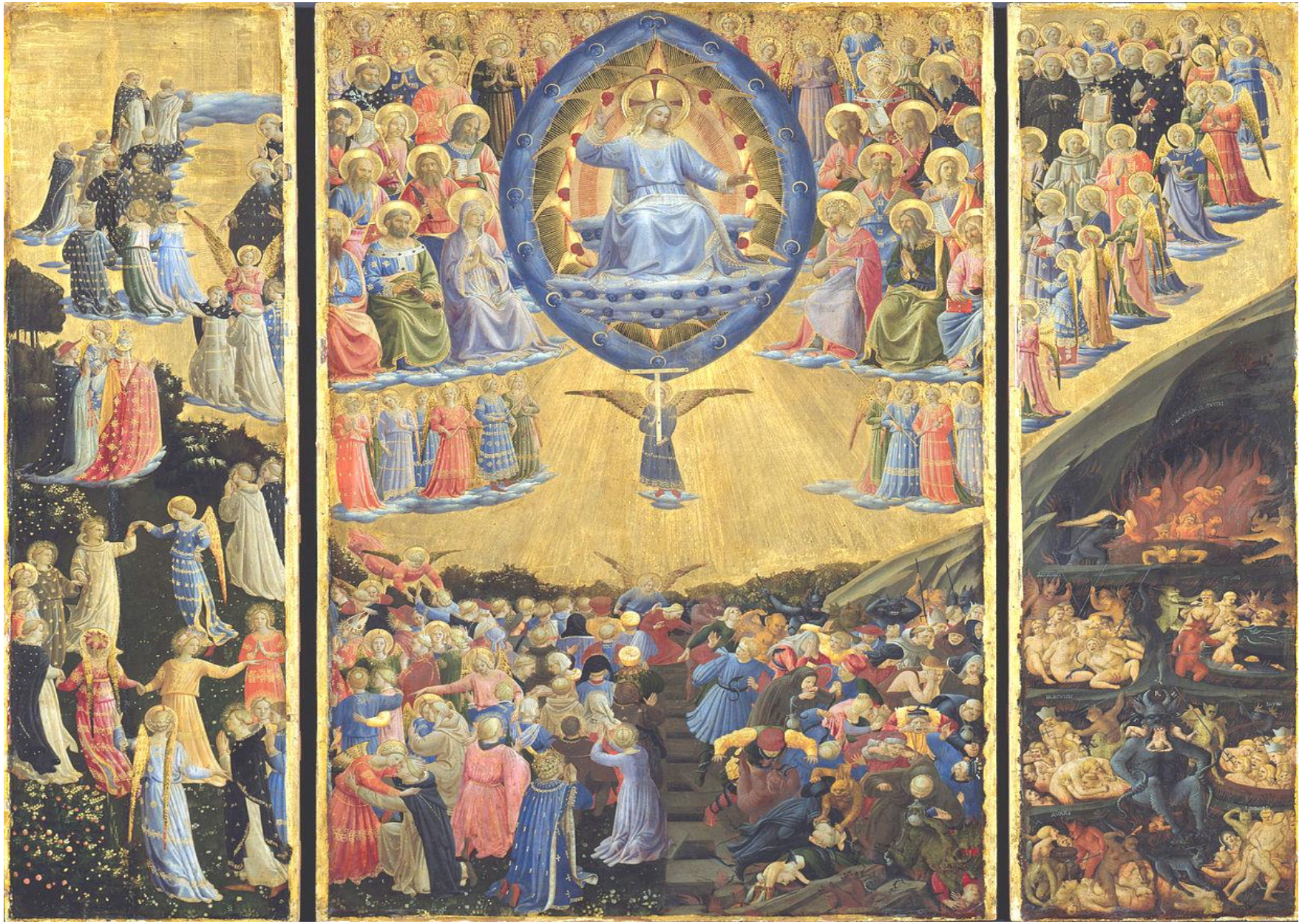
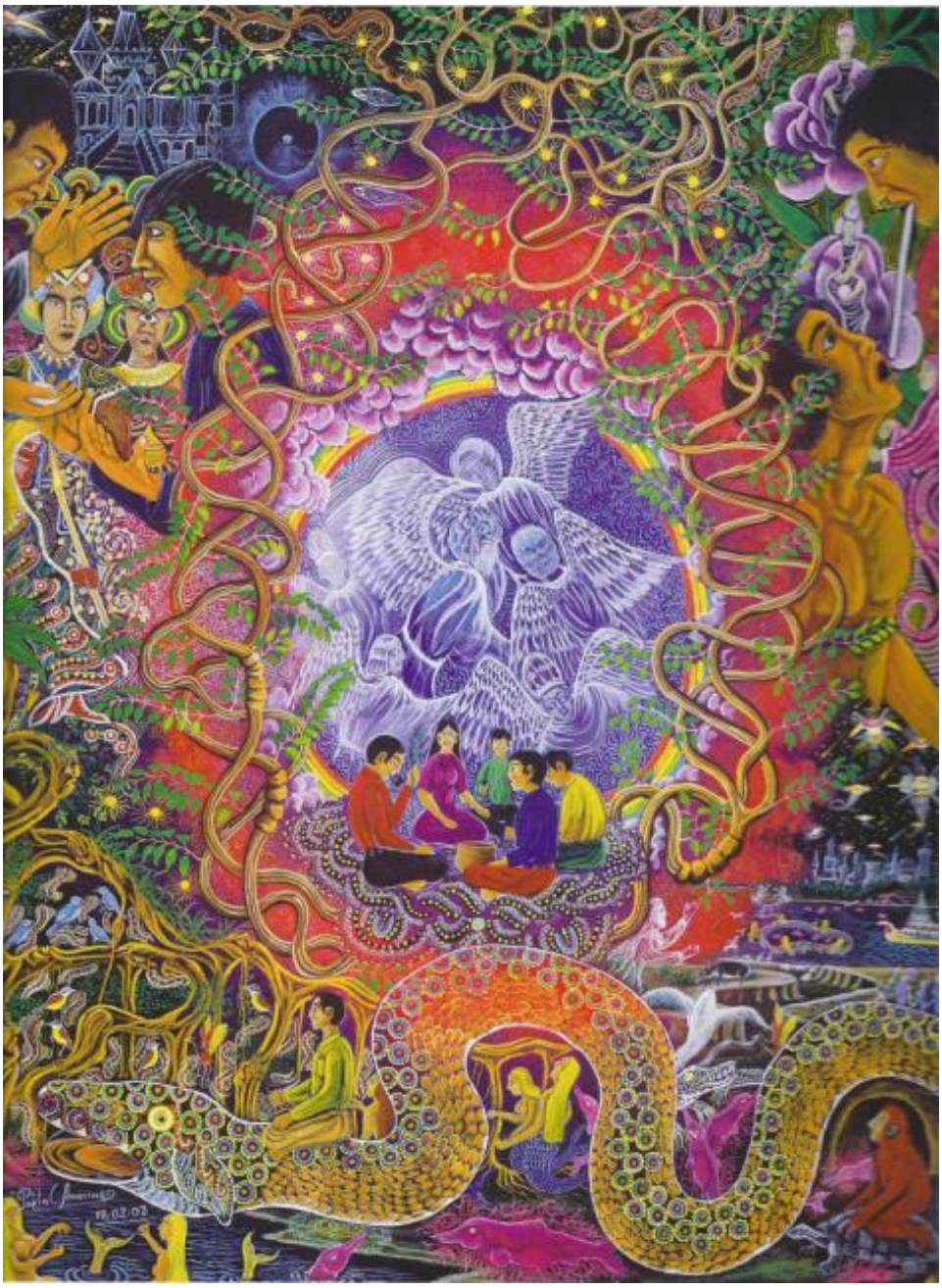
[38] ***The Independent*** *27-11-1993*



Ill.5- 102: THE LAST JUDGEMENT by Fra Angelico 15C San Marco, Florence, Italy


H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba 57-71 Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra 89-103 Rf Db Sg Bh Hs Mt Ds Rg Cn Nh Fl Mc Lv Ts Og
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr
Alkali Metal
Alkaline Earth
Transition Metal
Basic Metal
Semimetal
Nonmetal
Halogen
Noble Gas
Lanthanide
Actinide

Quite near the end of writing this, when I reached *Molecular Note 7* I started doing some background reading on DNA and covered the analysis of its structure and workings in a straightforward way quite speedily. But after I gone some way into Narby's ***The Cosmic Serpent*** I was so struck by what he had to say that I remained stunned for several days, unable to do any more writing – just as he had when he realized the situation. His book describes the switchover from knowing *about* the DNA molecule to realising some people on this planet in a heightened state of awareness actually *see, hear and know it directly* as it swims through the Creation. Below is a painting by Pablo Amaringo[39], one such shaman able to translate his visions into paint, where twisting snakes often take centre stage - as well as the Rainbow Anaconda depicted earlier, seen as inhabiting the brain with its Quartz crystal power.



Ill.5- 103: Pablo Amaringo ALLI MARIRI – gouache 2003

[39] Howard G Charing, Peter Cloudsley & Pablo Amaringo ***The Ayahuasca Visions of Pablo Amaringo*** 2011

I had in the months before been working on the iconography of the pair of twisted snakes in Ancient Near Eastern Art, alongside the Mitanni concept of winged angels/ancestors and the Snake Lady[40]. These all now fall into place as corroborating evidence of a closely similar Central Asian shamanic view[41] with choice of imagery fitting surprisingly closely with Amazonian practice four millennia later! To find that the twisting snakes, often understood as a ladder, chain, twisted rope or undulating vine tree, could also have molecular relevance was exciting, to say the least, and a quick look at it is a suitably high note to end this book on.

THE NATURE OF THE DOUBLE SNAKE VISIONS

There is only room here to pick out some salient points from Narby's account – enough, I hope, for the reader to see that in fact doors can open onto the molecular world in a more direct way than we initially believed was possible – which is why, for instance, the Amazonian Indians have identified forty different versions of the *curare* nerve agent in different plants where modern laboratories only use one or two in synthetic form, because the former have *seen* them (transmitted to them, they believe, by disembodied spirits/ancestors beyond life – often known as 'the mothers' - who desire to help them - the winged beings in Amaringo's painting above). Amaringo himself has said, 'A plant may not talk, but there is a spirit in it that is conscious, that sees everything, which is the soul of the plant, its essence, what makes it alive'.

I earlier referred to Narby's comments concerning the link made by shamans with their guiding spirits through music – as he puts it, 'for the *ayahuasqueros*, it is almost inconceivable to enter the world of spirits and remain silent'. In the very earliest stages of his work when he started to realise there was a link between their visions and DNA, he turned to the anthropologists Angelika Gebhart-Sayer's work that mentions 'the visual music projected by the spirits in front of the shaman's eyes: it is made up of three-dimensional images that coalesce into sound [which] the shaman imitates by emitting corresponding melodies'. Here Narby made a note to himself to 'check whether DNA emits sound or not'. Certainly when he showed Amaringo's paintings to a friend who understood molecular biology, the latter reacted immediately, saying

> *Look, there's collagen… And there, the axon's embryonic network with its neurites… Those are triple helixes… And that's DNA, from afar looking like a telephone cord… This looks like chromosomes at a specific phase… There's the spread-out form of DNA, and right next to it are DNA spools in their nucleosome structure… [Taped recording]*

Details of the image areas referred to in the paintings are given on Narby's p.70 and the full account of this conversation goes on to p.72, worth reading in full. Being an anthropologist, up to this point Narby knew little about the properties of DNA: he now read intensively on the subject, starting with Francis Crick himself[42].

CONCEPT OF THE TWIN

In picking up Amazonian mythology from his guide and comparing it with similar myths from other cultures worldwide, Narby was struck by how often the God in such visions is a twin in

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[40] See also my *Spectra Newsletter 5*: **EVE AND THE SERPENT: THE SNAKE LADY OF CENTRAL ASIA** on www.layish.co.uk .

[41] See www.layish.co.uk . From the Home Page click on the Centre Square, then on the Centre Square again and go to ***Catalogue E.*** Part I contains the visual material and Part II the commentary on it (including an enquiry into the semi-precious stones of Central Asia referred to earlier).

[42] See footnote 4.

some form or another – whether of male to male, or male to female (as in the case of Adam and Eve) – or is even androgynous, ever-changing but remaining the same, present in all living cells. Most closely related culturally is the Aztec Quetzalcoatl 'who symbolises the sacred energy of life[43] and has a twin brother Tezcatlipoca – both of whom are children of the cosmic serpent, Coatlicue' – in fact the Aztec word *coatl* means both 'serpent' and 'twin'. As we know, the DNA molecule is a single long chain made up of two interwoven ribbons, a thread of it 120 times narrower than visible light and in its usual stable spiral shape it does indeed look like a spiral staircase (the word *twist* has the same root as *two* and *twin*). Schrödinger has termed it an 'aperiodic crystal, the constancy of whose duplicating mechanisms goes back to the very beginnings of life on earth: 'no stone, no mountain, no ocean, not even the sky above us, have been stable and constant for this long: nothing inanimate, no matter how complicated, has survived unchanged for a fraction of the time that DNA and its machinery of replication have coexisted'. Narby quotes biologists Margulis and Sagan: 'The biological transition between bacteria and nucleated cells.. is so sudden it cannot effectively be explained by gradual changes over time'. And to sum up, 'DNA is a snake-shaped master of transformation that lives in water and is both extremely long and small, single and double - just like the cosmic serpent.'

TURN ON, TUNE IN, TAKE PART

Throughout this book we have often been able to point up contrasts between human self-identification with the natural world and all its structures – and the approach of the modern scientist who, for all his admirable detachment in cutting up the butterfly, kills it in the process. Narby's book shows how he and others seek a reconciliation between the two approaches – and that through generous shared experience it is possible to reach such a position. I certainly encourage the reader to embrace the double view the DNA molecule has opened up for us. Although it can be done through dreams (which is where Kekulé comes in[44]) or by taking mind-enhancing substances, some humans already have a subliminal sense of connection to that world: I know from now on I shall never treat my garden in the same task-based, showing-off mode ever again (what an insult to the sung messages the plants must be trying to send me). What we do know, says Narby, is that DNA 'traps and transports electrons with efficiency and that it emits photons (in other words, electromagnetic waves) at ultra-weak levels currently at the limits of measurement… more than any other living matter' – which means the entire global network of DNA-based life – the biosphere - is doing this all the time (the end-notes for Narby's Chapter 9 fill in crucial detail here). Experiments show the human brain in particular emits photons - though of course every cell in our body emits electromagnetic waves – so it is a matter of realising we are in it, starting to take part and learning to join in.

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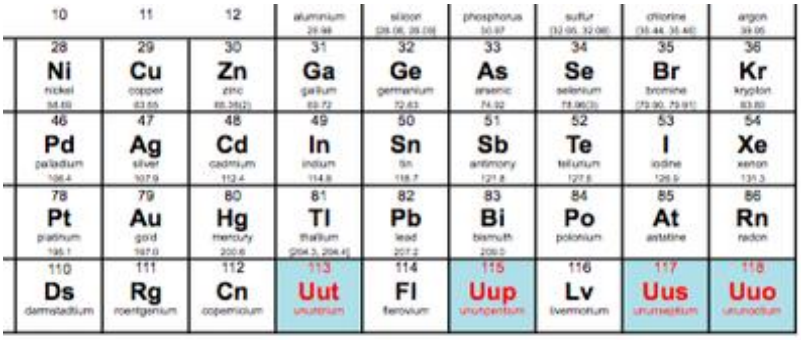
[43] This quality explains why Quetzalcoatl is also identified with Venus, the life-bestowing planet, who at different points in her cycle can rise in the morning, or in the evening (see our papers on Venus worship in the Ancient NME).

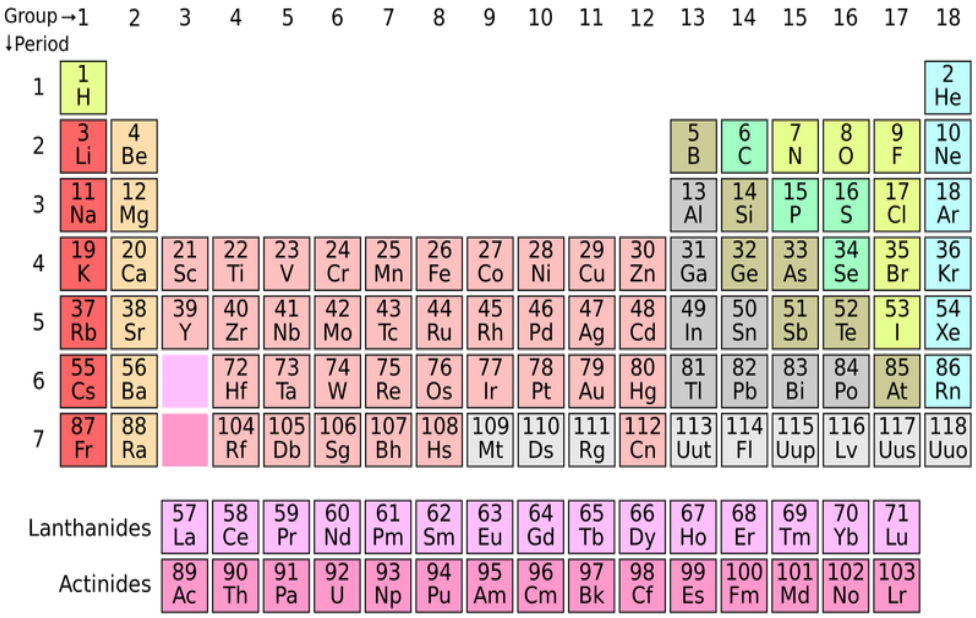
[44] In footnote 16 for chapter 8, Narby quotes Kekulé's own account: *I turned the chair to the fireplace and sank into a half sleep. The atoms flitted before my eyes. Long rows, variously, more closely, united; all in movement, wriggling and turning like snakes. And see, what was that? One of the snakes seized its own tail and the image whirled scornfully before my eyes…*

APPENDIX A

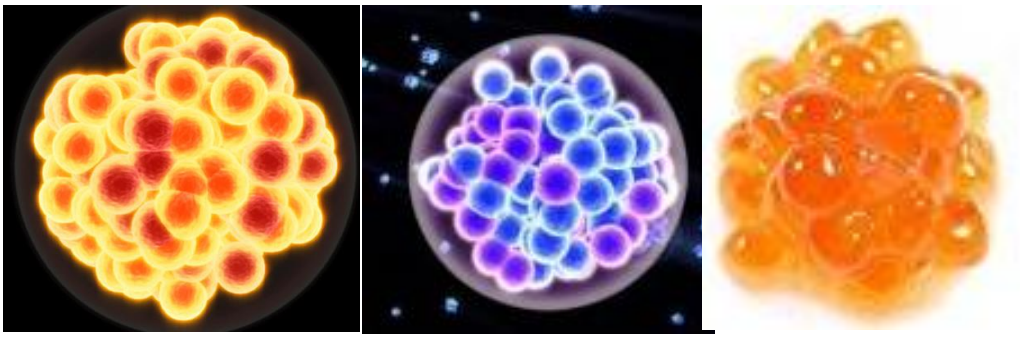
SEVENTH ROW OF THE PERIODIC TABLE COMPLETED: NEWS RELEASED 4 JANUARY 2016

Four new Elements have been added to the periodic table, finally completing the table's seventh row and rendering science textbooks around the world instantly out of date.





The Elements with atomic numbers 113, 115, 117 and 118 will get permanent names soon, according to the International Union of Pure and Applied Chemistry.



An artist's illustrations left and centre by Kwei-Yu Chu/LLNL depicts Element Ununseptium (117), now officially added to the Periodic Table (compare with the photo on the right showing a lump of salmon caviar!)

"The 7th line of the periodic table of Elements is complete," according to the IUPAC. The additions come nearly five years after Elements 114 (Flerovium, or Fl) and Element 116 (Livermorium or Lv) were added to the table. The Elements were discovered in recent years by researchers in Japan, Russia and the United States. Element 113, discovered by a group at the Riken Institute, Japan, is called "the first Element on the periodic table found in Asia." Kosuke Morita, who was leading the research at Riken, said his team now planned to "look to the uncharted territory of Element 119 and beyond." Ryoji Noyori, former Riken president and Nobel laureate in chemistry said: "To scientists, this is of greater value than an Olympic gold medal".

Three other Elements were discovered by a collaborative effort among the Joint Institute for Nuclear Research in Dubna, Russia, the Lawrence Livermore National Laboratory in California. That collaboration has now discovered six new Elements, including two that also involved the Oak Ridge National Laboratory in Tennessee. The working group includes members of the International Union of Pure and Applied Physics. Each of the discovering teams have now been asked to submit names for the new Elements,

Classified as "superheavy" — the designation given to Elements with more than 104 protons — the new Elements were created by using particle accelerators to shoot beams of nuclei at other, heavier, target nuclei. The new Elements' existence was confirmed by further experiments that reproduced them — however briefly. Element 113, for instance, existed for less than a thousandth of a second. "A particular difficulty in establishing these new Elements is that they decay into hitherto unknown isotopes of slightly lighter Elements that also need to be unequivocally identified," said Paul Karol, chair of the IUPAC's Joint Working Party, when announcing the new Elements.

The Elements, discovered by scientists in Japan, Russia and America, are the first to be added to the table since 2011, when Elements 114 and 116 were added. The four were verified on 30 December 2015 by the US-based International Union of Pure and Applied Chemistry, the global organisation that governs chemical nomenclature, terminology and measurement.

A Russian chemist was the first to draw up a successful periodic table. But it wasn't until years later that its far-reaching predictions were proved correct. With the additions, the bottom of the periodic table now looks like a bit like a completed crossword puzzle — and that led us to get in touch with Karol to ask about the next row, the eighth period. "There are a couple of laboratories that have already taken shots at making Elements 119 and 120 but with no evidence yet of success," he said in an email. "The eighth period [row] should be very interesting because relativistic effects on electrons become significant and difficult to pinpoint. It is in the electron behavior, perhaps better called electron psychology, that the chemical behavior is embodied."

Karol says that researchers will continue seeking "the alleged but highly probable 'island of stability' at or near Element 120 or perhaps 126," where Elements might be found to exist list enough to study their chemistry. International guidelines for choosing a name say that new Elements "can be named after a mythological concept, a mineral, a place or country, a property or a scientist," according to the IUPAC.

In 2013, Swedish scientists at Lund University confirmed the existence of the Russian-discovered Ununpentium (atomic number 115). As the Two-Way described it, the Element was produced by "shooting a beam of calcium, which has 20 protons, into a thin film of americium, which has 95 protons. For less than a second, the new Element had 115 protons." While you're not likely to run into the new Elements anytime soon, they're not the only ones with have short existences. Take, for instance, Francium (atomic number 87) and Astatine (atomic number 85). As Sam Kean, author of a book about the periodic table called *The Disappearing Spoon*, wrote of those Elements: "If you had a million atoms of the longest-lived type of Astatine, half of them would disintegrate in 400 minutes. A similar sample of Francium would hang on for 20 minutes. Francium is so fragile, it's basically useless."

As to why scientists keep pursuing new and heavier Elements, the answer, at least in part, is that they're hoping to eventually find an Element — or a series of Elements — that are both stable and useful in practical applications. And along the way, they're learning more and more about how atoms are held together. Live Science reports: "Scientists hope that by creating heavier and heavier Elements, they will find a theoretical 'island of stability,' an undiscovered region in the periodic table where stable super-heavy Elements with as yet unimagined practical uses might exist."

For a full description of the properties of each Element in the Periodic Table, see John Emsley ***Nature's Building Blocks: An A-Z Guide to the Elements*** *Oxford 2011*

APPENDIX B

THE NOVICHOK MOLECULE

The Russian whistleblower who exposed the country's secret chemical weapons programme has revealed the horrific torturing effect of the Novichok nerve agents on their victims. [It is hundreds of times more drastic in its effects than VX Gas – another of May and Cotton's 'molecules that amaze us'). Vil Mirzayanov described the use of the lethal toxins as a 'brazen' attack by Vladimir Putin. Mr Mirzayanov says a large dose of Novichok 'paralyses' victims before 'it causes convulsions - you can't breathe and after that you die'.

The exiled scientist shocked the world in 1992 when he revealed that promises by the Soviet Union to reduce its chemical weapon stockpiles were hollow. He worked in the top-secret Moscow laboratory where a new generation of even more potent poisons was being perfected. These gruesome chemical weapons, named 'Novichok' after the Russian for 'newcomer', were designed to be even more lethal than VX or Sarin.

Describing his work, Mr Mirzayanov said: 'They were normal laboratories, they were not underground or anything. They were testing and developing. 'There were around 1,000 people working on this, it was a big deal. You have to test it on animals and after that you have to study the chemical properties... so many laboratories were involved.' In 1987, one physicist at the laboratory was saved despite being exposed to the chemical when a ventilator stopped working. Witnesses described how he staggered out of the room, describing seeing bright hallucinations before collapsing and being rushed to hospital by the KGB. He was left with permanent injuries after being critically ill for ten days and unable to walk for six months.

At the time, one former top Soviet military adviser described these poisons as 'political weapons', adding: 'They have a powerful moral and psychological effect.' Shockingly, they can be created from common, unrestricted and undetectable industrial and agricultural chemicals available worldwide. As a result, weapons inspectors fear other rogue nations, including Syria and North Korea, could have their own lethal stockpiles of the powerful nerve agents.

Speaking from his home in New Jersey last night, Mr Mirzayanov, 83, described the top-secret laboratory as a 'criminal enterprise'. He said, 'Putin thinks he can use everything to kill enemies. They don't tolerate any opponents… They should be punished. It's an open demonstration of this Russian terrorism. 'The Russian government is telling people who are thinking about revealing more secrets that they can expect the same fate.'

Asked how the nerve agent works, he added: 'It's real torture, it's impossible to imagine. Even in low doses the pain can go on for weeks. You cannot imagine the horror, it's so bad.' The Novichok family of nerve agents were secretly developed over two decades at a research facility 50 miles outside the Russian capital. A series of poisons, known as Novichok 5, 7, 8 and 9 to identify them, were produced amid conditions of complete secrecy. Many times more potent than other better known chemical weapons, Novichok agents can render gas masks and protective equipment useless. Sometimes described as 'gases' they are in fact liquid, intended to be delivered as a fine spray. They all kill the same way, by inhibiting enzymes that control nerve receptors in the brain. One expert said victims simply 'forget to breathe'. A tiny drop, almost undetectable, placed on the skin or inhaled can cause death within minutes.

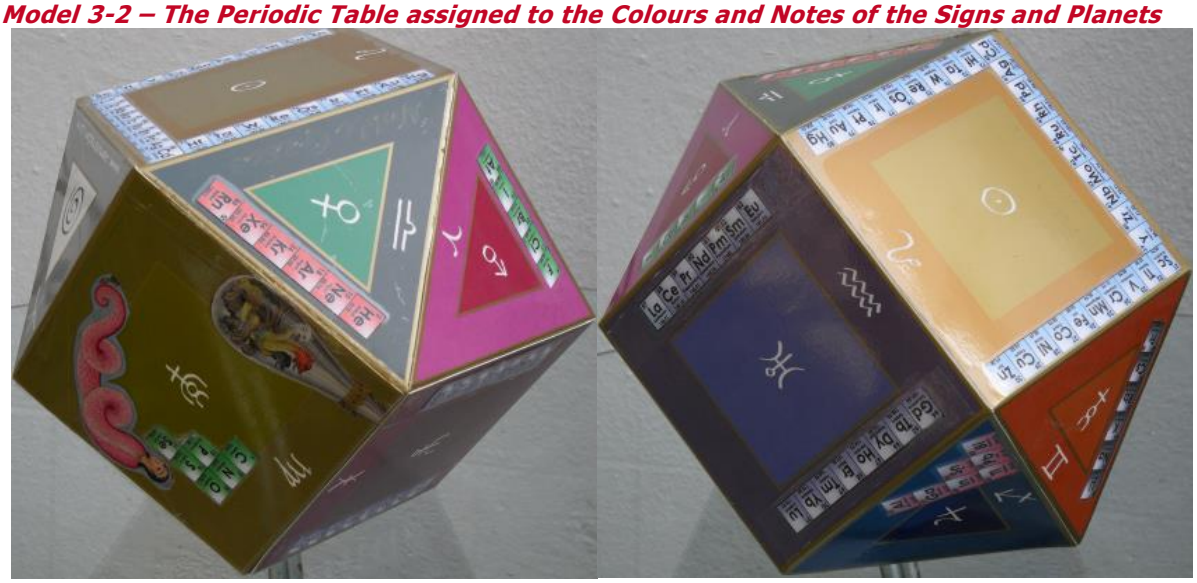
Last night experts described nerve agents such as Novichok as second only to the 'atom bomb' as the most deadly weapons ever made. They said that because the ingredients were so common, the poison was ideal for use in an assassination, as well as a weapon of mass destruction. Pharmacology expert Professor Gary Stephens said: 'This is a more dangerous and sophisticated agent than sarin or VX and is harder to identify. It causes a slowing of the heart and restriction of the airways, leading to death by asphyxiation… One of the main reasons these agents are developed is because their component parts are not on the banned list. It means the chemicals that are mixed to create it are much easier to deliver with no risk to the health of the courier.'

APPENDIX C: COSMOKRATOR 3-D COLOUR ZODIACS FOR BOOKS 3,4 & 5

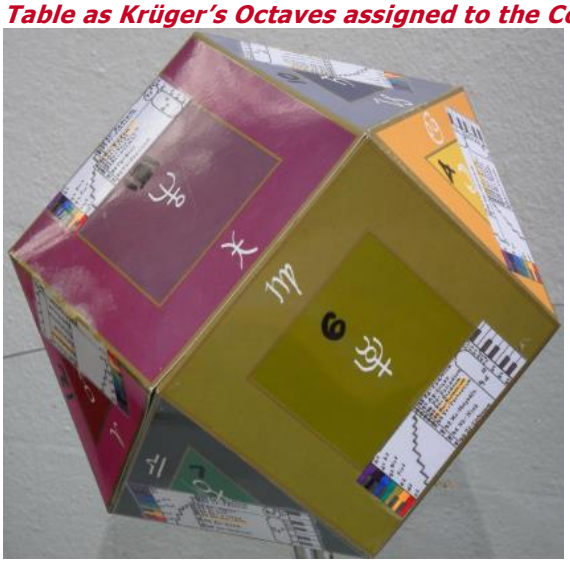
BOOK 3: ATOMS

Model 3-1 – Key Elements aligned to the Colours and Notes of the Signs and Planets, based on Hauschka (see Ills 5-74, 5-75, 5-66, 5-67 and 5-68):

Model 3-2 – The Periodic Table assigned to the Colours and Notes of the Signs and Planets

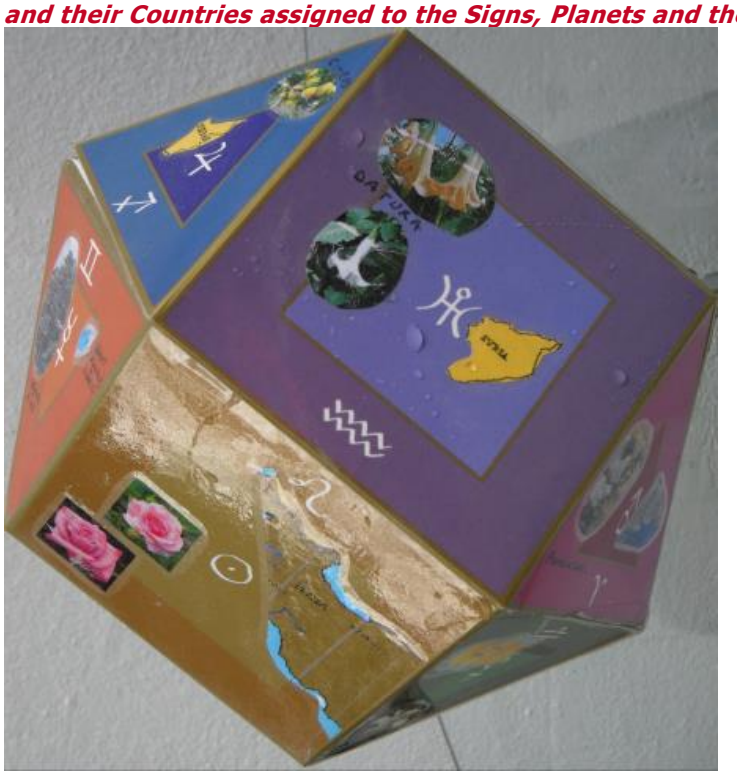


Model 3-3 – The Periodic Table as Krüger's Octaves assigned to the Colours and Signs



BOOK 4: PLANTS

Model 4-1 – Plants and their Countries assigned to the Signs, Planets and their Colours



BOOK 5: MOLECULES

Model 5-1 – Semi-precious/precious stones assigned by Colour to the Signs and Planets:

Model 5-2 – Key molecules in our life aligned to the Colours and Notes of the Signs and Planets, based on Hauschka

In preparation

To understand the Law of Correspondences as practised in the ancient world going back to as early as the First Millennium BC readers will find the ***Cosmokrator Book 7A*** of great interest, and relevant to the models in the choice of metals, stone and plants.

Duplicates of all Cosmokrator models other than the initial standard one available on the Cosmokrator website can be supplied on request at asia@cosmokrator.com for an agreed price.

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