THE PHILOSOPHY

OF

RADIO-ACTIVITY

OR

SELECTIVE INVOLUTION

BY

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PREFACE

This book was begun as an introduction to the medical writings of the author, read before scientific bodies and published during the last two decades. The MS. outgrew the original purpose.

Radio-activity, while forcing a change in viewpoint in all the sciences, is chiefly identified in the public mind as in mysterious relation with malignancy.

Though this relation will be seen to be very close, both as to cause and possible cure, this forms but small part of the general importance of the subject.

Nevertheless, as this is the point on which false hopes might work harm, the following quotation is taken from the writer's book on this subject: (viz, "The Problem of Cancer; or the Philosophy of Malignancy").

"April 10, 1914, THE AMERICAN SOCIETY FOR THE CONTROL OF CANCER held its second meeting at the New York Academy of Medicine. Dr. Clement Cleveland presided, and the speakers were

Dr. William J. Mayo, President of the American Surgical Association; Mr. Frederick C. Hoffman, Life Insurance statistical expert; Dr. Francis Carter Wood, Director of the George Crocker Research Laboratory, and Prof. J. Collins Warren, President of the Harvard Cancer Commission.

"Briefly stated, the dictum of this recent and authoritative body stands: "SURGERY WILL CURE PRACTICALLY ALL MALIGNANCY IF ACTION IS TAKEN AT THE START; SURGERY IS THEREFORE ALWAYS FIRST; OTHER MEASURES SECOND."

PHILOSOPHY OF RADIO-ACTIVITY

I

The Selective Involution of Matter

The "stream which revivifies the universe"* no longer flows unnoticed by our doors. Radio-activity is the ebb of that stream of energy from its high point back to its source. Its facts are before the scientific world. True transmutation of matter, from denser to lighter, is now measured and timed in laboratory routine.

No less startling than radium—its ancestry and progeny—is the new concept that when the last but one of the helium atoms has escaped from the radio-active element, the remaining one will be helium.* In other words, the densest element is but the lightest element in more compact and involuted form. And the lightest atom is but an orbit of electrons.* And what is packed into the electron is repacked

*Notes will be found on page 141. The figures in the margin indicate the page and line to which each reference belongs.

into the atom, and again repacked into the denser atoms. Less than 100 different varieties of atom make up all that forms the universe. AND EACH VARIETY OF ATOM IS BUT A DIFFERENT MANIFESTATION OF SOMETHING WHICH CHANGES EVER IN ITS MANIFESTATION BUT CHANGES NEVER IN ITS OWN ETERNAL AND ELUSIVE MOTILITY.

What coils the great Elusive Motility from the lightest to the densest is the energy that revitalizes the universe. Radio-activity, uncoiling from uranium downward, one helium atom at a time, is the ebb of that energy. But what is coiled and what is uncoiled we still seek—though we know it by many names at its many points of manifestation.

As eternally constant as the boiling point of water at the sea level, is each manifestation for which we have measure and a name. These are our Eternal Constants, the only attributes of "the thing that changes" which never change—unless we except the eternal motility itself.

Recent enlightment has caused astronomers to accept Professor Chamberlin's view that glowing gases which were termed nebulae—the heated dust of collided and shattered dark objects in space—are present in spiral form, in process of being evolved into matter which forms the stars. The spiral coiling seems to be going on about us in celes-

tial regions with the same precision and by the same processes which built our world from nebula. Thus, new astronomy—the last science to accept radio-activity—shows the Changing Something coiling up for that terrestrial uncoiling now known as radio-activity.

The celestial coiling seems a far cry from the terrestrial uncoiling until we remember that the earth was in celestial process while as spiral glowing gas it was solidifying at its center. When cooling and habitable it became terrestrial. When its sun shall have lost its heat, and as dark object it collides with fellow dark object in space,—when its evolution is "finished"—it will again rejoin the celestial processes; again be recoiled; again become terrestrial; again evolve its radio-active energy; and again make the ever recurring cycle.

Some of the Lick Observatory photographs illustrating the Nebulae article in the Encyclopedia Britannica, well show these spirals with opaque centers in the arms and at the middle, which are conceived to be forming planets revolving around a central sun.

Photographs taken with the sixty inch lens, when compared with those taken with the forty inch lens —and then with the best previously known efforts —plainly show how much perfection of instrument

has to do with the new concepts of astrophysics. There have been counted 200,000 of these spiral nebulae, and it is estimated that there are more than a million. They are seen in all stages of development, from the primitive gaseous form in Orion to the well elaborated form in the Pleiades. The spectroscope has not only told us their composition, but also indicated with great positiveness which parts of the spiral are solid and which are gaseous.

Thus behind the electron of the atom of the nebular gas, glowing millionfold over the firmament, is the GREAT ELUSIVE SOMETHING THAT CHANGES, which is being coiled into denser and denser atoms, until—in million millions of years the celestial becomes terrestrial, and the densest of all atoms, uranium, stands as sire to the whole unrolling progeny of radio-activity.

The mystery of the coiling and the mystery of the uncoiling are finite when compared with the infinite mystery of the Great Elusive which is being coiled and uncoiled continually.

The concept of the coiling process is spiral motility, central contraction, outward impulsion colliding with drift to center, with heat and electricity engendered by compact and velocity. Velocity is the dominant.

This concept involves another of greatest importance: the sub-contained processes, which themselves sub-contain similar intra-orbital processes.

The concept of the uncoiling or radio-active process is a rythmic measured disturbance of equilibrium. The negative electrons rotate around the positive center of an atom in mutually conserving antagonism until an appointed time brings a fractional violation of ratio, when an explosion liberates an atom of helium, and a new ratio is established for a new rhythm. The duration before the explosion probably marks the life-span of an electron, or sub-electron factor.

The concept of velocity is linked with duration. Velocity is duration compressed into the present as truly as uranium is compressed helium.

And we see everywhere two opposing tendencies, meeting and holding a rest together, acquiring energy from their antagonism until they explode into another state; nevertheless both are subject to a third, ever-ruling force, itself as elusive as the very thing which changes.

These two antagonisms, and the third element which both must obey, are to be seen in the earth's condensed iron center; in the flow of rocks upon its surface—down to the very latest sociological forces which are changing the face of society.

This sketch is a suggestion regarding the existence of this secret of the universe: the Great Elusive, the Changing Something which is always the same, whether manifested as helium or uranium, whether disclosed as steam or water or ice —whether spiral nebula, habitable earth, or finished dark bodies seeking collision in space.

The selective intent of evolution is not so apparent in matter. Yet the relation of matter's mass to gravity, or to its crystal form selection, is not offensive to our intellect. Might there not also be a relation with time? If matter pass ceaselessly through the cycle from gas to density and back to gas, would it escape the influence of duration of its longest "rest"? Matter would have passed least duration as the scarce and precious (denser) elements, and most duration as common and plentiful elements. These later accumulate abundantly precisely because their long duration favors such plentitude. As no mysticism is implied in imputing response in matter to gravity, none should be in pointing to matter's answer to duration. For is not the tendency of matter from the denser to the lighter, from the scarcer to the more abundant? Is the love of a ton of lead for the Earth's center stronger than the nostalgia of matter for the "rest" period of its longest duration? The visible domi-

nant pendulum swinging lesser pendulums to its own unison, discloses compelling laws of re-inforcement and interference acting on matter. If we impute non-materiality to this force, does it affront the intellect to speak of the ATTRACTION OF DURATION FOR MATTER?

The selective intent of evolution is very apparent when life has indwelt matter. Life uses and reuses for its selective purposes atoms which have been in use millions and millions of years. It seizes enough matter to multiply many kinds of atoms, unfolding the tendencies originally contained in a single patch of color in a single cell. Each tendency takes more matter to multiply each of the many kinds of atoms. But there is a confine beyond which the differentiations may not go without monstrosity. There is a limit beyond which the multiplications may not go without malignancy. But scarce has the unfolding process begun, ere the selective coiling-up begins. Into the microscopic area of a few color bodies—the germinal chromosomes —are rewound selectively all the differentiating powers, all the multiplying powers, and all the powers for selecting a new color-patch which will again unwind into a new life. But this is not all: all the tendencies, instincts and intuitions which have been gathered by life since its beginning—the

capacity to "know without learning"—are also therein rewound—and rewound selectively into the potentiality for each differentation which shall emerge from the color-speck.

Thus the processes of the Cosmos are taken from the epochal calendar, and compressed into a new cycle—life. Man may therefore be the selective exponent of the whole.

II

The Eternal Constant. The Unwinding of Matter Into Space. The Transmutation of the "Stable Elements."

"A very strong new line in the ultra-violet" rewarded De Marcay, the expert, when seeking the spectrum of radium for Madame Curie.

Man had never before made call for this reply, yet it had always been there. Wherever radium had existed there had always been this Eternal Constant for it: *this very strong new line in the ultra-violet.*

The radio-active process at first seemed heresy to the established scientific order. Science and philosophy are now receiving from it their strongest confirmation.

While the atom of chemistry has been divested of part of its meaning by radium, the atomic theory, as a basis for philosophy, has had therefrom the most signal proof. Says Soddy:

"There have always been scientific men who have regarded the atom and the atomic theory with suspicion and have never tired of insisting upon its 'hypothetical' character.

"It may therefore be rightly regarded as one of the greatest triumphs of science that an observer can now actually sit down in front of a vessel and with the aid of a watch can count the number of atoms entering it every minute from a quantity of radium."

The geologists, forgetting their old strife with physics, were prompt to see radium's important relation to their science. Professors Strutt and Joly, and other leaders, worked successive rocks in the earth's surface, and found that not only was their radium measurable, but calculable enough to supply the whole of the heat lost by the globe to the outer space. The unexpectedly high temperatures found in the Simplon tunnel were proven by Professor Joly to be from the radium contained in the rocks.

In philosophy, the revolution to be wrought by radio-activity is even greater, and it is now seen as truth changing even our thought and language. For, until now, these have been unadapted to the new conditions just made known to us.

The old relations of language and thought will have to be used until we can get perspective on the new affronts to our logic and concept of the possible. We shall have to use terms as we have always used them, until thereby we see their inadequacy, and reach more definite description.

For example, we speak of the wonders of radium, as though they were to be ascribed to radium itself. This loose speaking proves the inadaptability of our language to our new state of knowledge. For properly speaking, it is to the *lineage* of radium—its ancestry, itself and its posterity, to the process of transmutation—that all the wonders of radio-activity must be ascribed. Therefore, when we say that α, β and γ rays are emitted from the radium, we mean that these are emitted by the totality of the process shown by the complete known series.

The radium has the α-particles, but contains only potentially the β and γ rays. The emanation contains only α-particles; but it, too, passes along the potentiality of the parent radium, for later products of its posterity give the β and γ rays which were potentially in the radium.

Thus characters inherent, but concealed, in the ancestors are given off further along the line. We have witnessed a real devolution, or unwinding of elements—from the heaviest known element down the line many steps of the total way. The total way is less than one hundred steps. Professor Rutherford says:

"In 1905 we knew twenty in the series of TRANSFORMATIONS of radio-active substances. 1913, we know thirty-two. There is evidence that some few still remain undetected."

Why do the authorities believe in transmutation of all matter, with rapid and detectible changes in the denser, the rare, the more valuable elements, and with slower, undetectible changes in the less dense, the more plentiful and least valuable elements?

The mystery of radium, with its disclosures of radio-activity, is the answer. "Nothing goes by itself in nature except apparently radium and radio-active substances—which year in and year out without apparent intermission or diminution, without the substance being in any way consumed or altered, perform the scientifically impossible feat of evolving a store of energy presumably out of nothing. This phenomenon, unparalleled in nature, has placed in the hands of science an energy 250,000—a quarter of a million—times more powerful than any energy heretofore known."

Through successive explosions—the atom being a perfect ripening mechanism up to the moment of its explosion—each element after uranium has come from a preceding and gone to a successor with an outburst of energy. The intervals may be long, but the outburst is always *explosive* when it occurs. But whence came uranium, and what is the proof that bismuth, gold, mercury, silver, etc., share lead's probable lineage?

Uranium has an atomic weight of 238. Helium has an atomic weight of four—which is four times the weight of an atom of hydrogen, the lightest atom known. Four is a number of great significance in tracing unwinding condition; it will be seen far beyond this in the unfolding of life. The α-particle is known to be an atom of helium, with atomic weight of four. And each step down the line of transmuting condition is an explosive escape of an α-particle, with corresponding subtraction of four from the atomic weight.

Below are the atomic weights of the first of the series:*

Uranium	238
Uranium X	234
Ionium	230
Radium	226
Emanation	222
Radium A	218
" B	214
" C	214
" D	210
" E-1	210
" E-2	210
Polonium, or radium F	210
Lead, or radium G	?

*The atomic weights of the lower elements are as follows:

Lead	207	Iron	56
Mercury	200	Potassium	39
Gold	197.3	Phosphorus	31
Iodine	125.85	Sodium	23
Silver	107.9	Oxygen	16
Arsenic	75	Nitrogen	14

"Later work has shown that radio-lead is an active material that has a slow rate of transformation, and is identical with the product of radium derived from the transformation of radium.

Potassium (atomic weight 39) is the only substance of small atomic weight which has as yet shown radio-activity. There is no certainty that all have been detected."

This regular order of descent has no relation with the duration "rests" of each element. They are very irregular:

Uranium	7,500,000,000	years
Uranium X	32	days
Ionium	?	
Radium	2,000	years
Emanation	5.3	days
Radium A	4.3	minutes
" B	38	minutes
" C	30.5	minutes
" D	17	years
" E-1	9.5	days
" E-2	7	days
Polonium	203	days

Let us not confuse the continual intra-orbital movement of an atom of uranium, the continual bombardment of its circumference by its center with its electrons—which continues during its entire life as an atom of uranium—with the explosive escape of *α-particle* which leaves it uranium X; that is, uranium minus the one single α-particle.

Nor let us confuse the life span of uranium and its respective progeny—whereat it should spontaneously yield its atom of helium and spontaneously transmute to its next lower condition—with what might happen if we could at will advance this explosion. Could we transmute instantly (were we apprized of the EXPLOSION SECRET), we could take the short cut on 7,500,000,000 years and make a given mass of uranium into so much radium.

We have seen that the violation of ratio which is the basis of radio-activity is probably the extinction of one of the sub-components of the electron. For the atom has been penetrated by radio-activity.

The atom is now considered a concentrated positive electrical charge at its center surrounded by a distribution of rotating negative electrons so placed as to render it electrically neutral. The "Saturnian" atom has been compared to a "central attracting mass surrounded by a number of concentric shells like the coats of an onion." As suggested by Perrin, the solar system gives us the gross model for the atom and its intra-atomic corpuscles, or electrons.

These electrons, or corpuscles, are nearly two thousand times smaller than the atom of hydrogen, the smallest previously known particle. The elec-

tron may be regarded as an isolated electric charge"; or, "an atom of electricity divorced from matter; however produced, it is always identical in its main characteristics."

Therefore, the electron may be ultra-material. But the orbital system of electrons making the atom is the first view of matter obtained by human conception. THE ASSOCIATIVE FORCE binding detached electrons into an atom will be considered later.

The Law of Orbital Inclusion: The Laws governing one orbital system likewise govern all included and sub-included orbital systems in precisely the same manner.

Therefore could we tap the equilibrium of the electron itself, we might instantly transmute matter—by thus removing or impairing the ASSOCIATIVE FORCE.

We had almost believed ourselves able to transmute radium into the emanation by "dissolving radium bromide in water and evaporating the liquid to dryness," etc. But the mystery is deeper. For 1/2000 part of radium is disintegrated each year. In 2000 years all will be gone. On the other hand, the emanation is constantly being formed and stored. At any time after this process has begun there exists a proportion of the original matter which is unchanged, mixed with part of that which

has undergone change. Our known process, therefore, may only be *releasing* a product of transformation. Nevertheless the fact that it reduces the radium itself to one-quarter of its activity, and the fact of the complete regeneration of the radium in thirty days, during which the emanation itself almost entirely disappears, is not only one of the unsolved mysteries of radium, but proves that we have done more than release. We may have partially, if not wholly, transmuted matter.

We need not wait 2000 years for radium to die completely, yield all its α-particles and become transformed into lower elements. The fragmentary nature of its demise, so as always to be co-existent with some part of its progeny, precludes that view. There are "rests," long or short; an explosion; and then a new element; in fact, two new elements, for we must not forget the helium which escapes. The "rest" variation is from seven and a half billion years to four minutes, in the life span relation. The disorder, the variation, the variety of velocity, of density, of form—is the very order of order in the cosmic plan. Our "disorder" is the very quintessence of cosmic order, for every change from crystal, from the known form, is by explosive eruption making what the mind thinks is disorder. The eruptive contour of the mountains is a precise

mould of an explosive order that was—an order that our mind as yet knows not—an order hiding the EXPLOSIVE SECRET that equalizes the "rest" periods, and unlocks the force coiled in matter—the EXPLOSIVE SECRET of transmutation.

That there is an order of EXPLOSIVE SECRET is sure, and it may act in celestial regions at remote periods as it acts constantly in organic life. But the relation of the sarcity of the rare elements to the life of their parents, seems to prove that the *usual* explosive escape of the α-particle in inanimate nature is only as the alloted time ripens.

But unquestionably there exists an adventitious force which takes short cut to the remote goal, and upsets the geometry we know—breaks the cycle—escapes the orbit—and with every appearance of scattered volcanic disorder*, liberates the α-particle

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*Disorder is the order our mind does not expect to find. The mind is adjusted to the crystal or geometric order, and seeks this form in matter, and is affronted and sees disorder in what is not presented in the geometric form. Vide Bergson's Creative Evolution. We shall recur later to this as THE UNKNOWN ORDER.

The poet and seer forestalled the philosopher:

"All nature is but art, unknown to thee;
All chance, direction which thou canst not see;
All discord, harmony not understood;
All partial evil, universal good;
And spite of pride, in erring reason's spite,
One truth is clear: whatever is is right."

Pope, "Essay on Man," quoted by Huxley.

and transmutes condition. When we can read the volcanic order of the hill's disorder, we may learn how to advance the explosion. When we can advance the explosion we shall have acquired power to transmute matter. This means the power to unlock the coiled energy in matter—in the case of radium, a quarter of a million times greater than ever before known.

It would also mean to discount the epochal calendar, to make the short cut, *to coil up time, to wind up duration in the present.*

We shall see that this digression is life itself: first vegetable life, and then by a further digressive short cut on the short cut, animal life.

We shall see the evolution of matter from denser condition to less dense condition, meeting an involuting antagonist—a rise from quality to quality. And as we study these antagonists always at their focal ratio—the quality perhaps the EXPLOSIVE SECRET—we may learn something of the purposes to which this philosophy is directed.

But it must be accented that that which is uranium at one condition of compression, and radium at another, and helium at another—and extended space as finality of extension—is the mobile something that ever changes, and ever eludes. The only changelessness we find is the ETERNAL CONSTANT;

i. e., the law of the ratio of compression at the portal of each successive condition.

And the law gives us, in these vibratory repetitions of movement, "a stable view of instability, a snap-shot glimpse at transition."

There is a sub-component of each present which fades to allow each future. *"Il faut sortir du present,"* and the particular sub-component which dies, and the time required for its demise, determine the violence of the explosion and the degree of variance to be shown by the future.

III

Quality Winding to Higher Velocity. Matter Unwinding to Lower Density.

The tendency of matter to descend in terrestrial process is the lesson of radio-activity. Its tendency to coil into spiral density is clearly shown in the celestial process.

But we have a tendency of mounting quality always before us, well known and measured in terms of this planet. To liken this to a celestial process is not strange until we forget that our earth is only relatively terrestrial. Its beginning and end are celestial, and it is always in relation with the whole cycle being traversed.

We know many of these qualities by name and measure as Eternally Constant. What happens between their moments, between their portals of change, seems related to the secret of radio-activity; that is, *the death of the sub-component which violates the equilibrium and causes the explosion*

which transmutes. But the difference is marked: quality is winding up to higher velocity; matter is unwinding to lower density.

The difference between one object and another, the "ultimate unit of consciousness," is a variation, one of which per second may be discerned by our tactile sense.

Sixteen variations per second make the lowest note we can hear. Broadly stated, forty thousand variations—or vibrations—per second limit our upper range of hearing.

The vibrations go on from one per second to infinity. Discerned first as movement, at sixteen per second we begin to perceive quality. The quality changes in rapidity as we climb; but beneath the change is the thing that changes and marks a new quality at each progress in rapidity. High C contains nothing more than was found in the first note except velocity; and the tendency to increased velocity was in the first note.

Between the last audible and the first visible—between forty thousand per second and the 400 millions of millions per second—there is a rising succession of qualities which our ears, our eyes, our instruments of precision, neither perceive nor record. In this unmapped, undesignated portion of infinity—a yet definitely enclosed fragment of in-

finity—it is probable that many of the secrets of life are held. We are much concerned with this well-cornered portion of infinity.

Tyndall records that the chirping of certain insects on the Wengern Alp, though so shrill as to be almost intolerable to him, was yet inaudible to a friend walking by his side. Attuned one quality higher, syntonic one grade more than his friend, Tyndall attested what danger would be involved were the syntonic receivers of living beings over-extended. For the pain of the intolerable shrillness, a further step higher, may have the power of wrecking the apparatus.

Though the smallest entrance into the realms of FENCED INFINITY involves the intolerable pain, well across the upper border thereof begins the pleasurable sense of color. For between 400 and 800 million millions of vibrations per second, lies the visible range of colors. In the definition of elementary physics, "that portion of radiant energy lying between these limits is called Light."

From the ultra-violet we touch the threshold of unfenced immeasurable infinity, where vibratory quality rises in steady velocity, until in the supreme vibratory expression of heat, in the spiral finality of motion, imagination beholds its disappearance towards the center of the sun.

The latest photographs of the sun spots plainly show the spiral torsion to a point—the involved point representing the journey from full evolution back to involution.

Thus, from the remotest circle of completed evolution, at the minimum of spent velocity in tranquil space, up to the vanishing point of the involved spiral—each degree of velocity marks a constant quality of the thing which changes; but the thing itself is ever mobile.

Time, or Duration, is one scant vibration in an eternity, until it is compressed as eternity into an astronomical sub-unit, a second. Then it rises in quality after quality—each with its Eternal Constant. A very few of these we know, have measured and have named. Trillions are unknown to us: radium's "strong new line in the ultra-violet" has just risen upon the horizon of our knowledge—a stimulating message from the infinity about us.

If Duration be "the stuff of which reality is made," velocity is Duration massed into the present. Matter, therefore, which is indwelt by this velocity of mounting quality at certain stages, may be termed *matter invested with compressed duration.*

The thing we call radium is that quality of "the thing which changes," showing "the strong new

line in the ultra-violet." Its velocity here is 800 million millions of vibrations per second. As velocity, it is only slow movement hurried into compressed duration. The quality of "the thing which changes" at the point we call radium, is equal to one vibration per second for 800 million millions of seconds. As there are 32 million seconds in a year, radium's index of compressed duration is therefore one vibration per second for twenty-five million years.

Therefore this philosophy conceives of duration compressed into velocity as the stuff of which reality is made and posits in the vanishing point of the completely involuted spiral all that has been wound up from the one scant variation.

Thus the base note, and the treble, the red, the violet, and a short step along the ultra-violet, are a few qualities of the mystic motility which living beings are able to perceive. All other trillions of possible variations to infinity we can not perceive, though we readily conceive them as ever-existent.

What selects and what excludes, respectively, the few and the many qualities (or changes) at each acceleration of uniformly accelerated motion? A syntonic adjustment in living beings.

The syntonic receiver of wireless telegraphy takes up its own vibrations and ignores all other

chatter. Stokes' law is: THE EMISSIVE POWER OF A BODY FOR ANY RADIATION IS EQUAL TO ITS ABSORPTIVE POWER FOR THE SAME RADIATION AT ANY ONE TEMPERATURE. The whole system of wireless receivers was contained in the fact of elementary physics that a musical note emitted near an open piano-forte will vibrate only those strings whose components are the same as the components of the note.

The spectrum shows the same law regarding the higher velocities: sodium heated until its vapor becomes luminous, emits the yellow light of wave frequencies 509 and 510 million millions respectively. This syntonic constancy is the basis of the spectral analysis, by which science now presumes to tell components of the distant stars.

Therefore, from the infinity of qualities presented by the elusive thing which changes—but rests ever constant at each given velocity—living beings are syntonic to but few needed for their existence. The limitation is in the syntonic receivers, not in the infinity of the changes, as quality follows quality in the uniformly accelerated velocity.

Syntonic relation is therefore the very basis of life, for it is thereby we are protected and nourished by the identical substances which kill other life—

as the oxygen which renews our blood kills bacteria, or consumes iron by rust and disintegration.

It is thereby we slowly disconnect from our fullest relation with infinity as our apparatus is gradually degraded, and we are deafened, blinded and deadened to what concert-pitched instruments of others at their best answer as quickly as once we did.

It is not hard to conceive that to lose syntonism with elements not needed for our existence, is to invite the intolerable pain—if not self-wreck—analogous to the pain of Tyndall's insect chirp, inaudible to others; or to snow blindness from the ultra-violet rays.

It is not hard to conceive that to lose syntonism with elements needed for our existence, is to lose the elements themselves, and to die thus of starvation because cut out at these points from infinity.

IV

CONDITION DESCENDING AS COMPRESSED SPACE UNWINDS. QUALITY ASCENDING AS COMPRESSED DURATION WINDS UP. THE INDWELLING RATIO. THE "GYROSTATIC REST" OR NOTE. THE DISAPPEARANCE OF INERTIA AS A PROPERTY OF MATTER.

We see, therefore, that rising quality is not alone a celestial process, but has many familiar manifestations here. We have spoken of the ATTRACTION OF DURATION FOR MATTER, and referred to a seemingly definite and associative law of equilibrium which calls to matter, and receives obedience from matter. For the present, however, these await consideration of the mere mechanistic form —the body of matter, so to speak, being prepared for this, its soul.

We have viewed uranium on its long journey to the outer limit of extended space, by successive transmutations, each a subtraction of four units

from the atomic weight. We have conceived the "one scant variation in eternity" winding itself up with increased velocity, quality after quality, until completely coiled with a finality of eternal energy ready for as complete an evolution.

At each condition down, at each quality up, there is a "gyrostatic rest," which we call a *condition-note* and a *quality-note,* respectively. This is the inertia period of the old physics, but to the new concept as far removed from inertia as anything could be.

The *condition-notes* of the known radio-active elements have widely variant life spans—from seven and a half billion years for uranium to 4.3 minutes for radium A. During these respective periods of "gyrostatic rest" each atom is in its own incessant orbital motion, bombarding with α-particles its circumference from its center, but not a single α-particle normally escapes the form of the respective condition until the ripeness of time for its demise.* The form holds until transmutation by

*The α-particle is not as light as supposed to be—vibrations of material ether; but it consists of emissions of excessively minute material particles, atoms and corpuscles, traveling with immense velocity—penetrating, and not reflecting or refracting. Soddy (page 59) and Rutherford (page 158) detail the beautiful calculation by which it has been shown that every second of time one thousand million of these radium atoms disintegrate, giving some small multiple of this number of α and β particles.

The speed of a cannon ball at the muzzle is a small fraction

ripeness, or until the vital advance by the EXPLOSION SECRET.

We have seen, too, that unless a fortuitous advance of the explosion ensues—*and we know one explosion-secret at least*—the atom apparently remains a perfect atom until the ripest moment of explosion. That this ripening may have its divisional periods will appear later.

The life-duration span of these "GYROSTATIC RESTS," therefore, varies from the epochal range to the life-twinkle of the ephemera. The oak of a thousand years and the morning glory of an hour have each a life limit in the table. As water, seeking its level, thrusts aside all before it in its eager rush toward equality, so may these inequalities of *duration* in the condition-notes lie under the EXPLOSION SECRET which precipitates immediate ripeness for transmutation. This is surmise; but we have proof that variations of velocities and densities in nature are daily available to us in making counter-movements against the very direction of opposing force.*

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of a mile a second. The speed of the α-particle is 10,000 miles per second.

The mind should sharply distinguish between the ordinary corpuscles which incessantly swing their orbit during each atom's life, and that specially selected α-particle which escapes by explosion—and transmutes.

*See the "Back-drilling zig-zag." Page 61.

That there is a "gyrostatic rest" in the *quality-note,* of course is obvious. We have no knowledge of it beyond the empirical uses we make of our few known quality-notes.

With our *eleven* octaves of sound notes, we vary duration—in full notes, half notes, quarter notes —and write the harmonies which call out their psychological reply from departments in our upper evolvements. And with the colors, in our *one* octave of color notes, we vary the succession, blend the chords and paint the pictures which likewise get syntonic reply from another phase of our same upper evolvement. All are familiar with the powers thus residing in sound and color. Beyond this empirical knowledge, however, we are not informed, though we must marvel at the small number of qualities we know out of the infinite number which must exist. But at the portal of the quality ascent we have, in music, the *octave effect* which, with the groups of seven, runs all through quality up to infinity.

As four is the mystic condition-descent number, seven is the more mystic quality-ascent number; and both will later be seen in striking significance in a fundamental life relation.

From *do* to *si* we have seven notes, and the eighth is a new *do,* a new octave, into which it requires an

effort not to enter, once we have run the scale to *si.* This terminal note of the octave and its urgent tendency toward the next octave, require special accent, for this bears directly on the quality climb. It is *as if* there were a mass collection up to a certain point—as a fleck of dust dancing in the sunbeam attracts mass to itself by its motion—and then the solvent danger, *at the multiple.* Once past in safety, once descending from the *si,* there is resumption of "gyrostatic rest," of mass collecting, until the multiple is approached again. And again the tendency is strong to enter the higher octave.

The terminals of the octaves are multiples. The intermediates are mass collectors, though in definite ratio, by additions of seven:

do	re	mi	fa	sol	la	si
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35
36	37	38	39	40	41	42
43	44	45	46	47	48	49

We have seven primary colors—the mnemologue is vibgyor—and the octave above the red is the *do* of the ultra-violet. The speed of light is probably a seven multiple, so also the relation of the number of seconds in a day to the solar speed.

THE CLIMB TENDENCY OF THE MULTIPLE TERMINAL OF THE OCTAVE—"THE OCTAVE MELT"—is a force which under the law of internal orbital inclusion* should persist up the line of infinity and become more powerful as velocity increases.

Perhaps—almost surely—the atom will be found to yield its explosively escaping α-particle (the uniquely significant transmuting α-particle) at one of terminal multiples. If so, the EXPLOSION SECRET selects the multiple presenting *in the present* for the distant one ordained in time's alloted ripeness, and we get a glimpse of what is happening *between* the moments. The sub-component death which upsets the ratio and changes the quality, we have seen also predicates the future. For the variance of the future from the present is determined by the violence of the explosion, and by the importance of the missing sub-component relation to the equilibrium it upsets.

The mass gathering and the solvent danger point make the SOLAR PARADOX now easier to our conception. The light ray from the sun has a pushing force which has been measured. It is diminished

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*See page 9, Chapter 1.

The same law would imply sub-octaves in the octave, and doubtless each note tends toward its next related in the same multiple ratio.

by the obstacles it meets. The push acts upon the extremely fine dust particles, until somewhere—perhaps in their gaseous finality—the push is exhausted, and the unpushed gaseous finality oscillates, attracts mass to itself—and then comes under the pull of solar gravity at a certain constant of mass. THE ETERNAL CONSTANT OF MASS WHEREAT SOLAR PULL EQUALS AND EXCEEDS SOLAR PUSH, is where the nostalgic dust driven particle starts homeward bound for the kernel of the sun.

The "present" is that brief concept of duration between the portal and the octave melt. Thus the life span of the sub-component is all that is underneath each "rest", and this is *each privileged moment.*

If condition, or the compression of space, is thus indwelt with relation to the terminal multiple quality* (or compressed duration), logic would also indwell quality with a similar relation to the mystic four so strongly linked with space.

For as spring, summer, autumn, winter—four seasons—complete the solar cycle, so the ripening of the atom, apparently perfect until its explosive-

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*The eluding octaves between the last audible and the first visible emerge with the red as *do;* the orange as *re;* the yellow as *me*; the blue as *fa*; the green as *sol*; the indigo as *la*; the violet as *si*;— and the ultra-violet would begin the next octave.

moment, will probably be found to be a similar four seasoned progression. In fertilization and reproduction we will see a significant re-appearance of the four and the seven, having vital relation to the reproductive, self-eliminating change in the individual equation.

Here will be discerned, then, the first view or idea of an *indwelling* of duration in space, and vice versa. We must enter into detail upon this conception so affronting to our logic—that two things may occupy the same point at the same instant. For therein we get our first glimpse of matter forming in extended space. Special emphasis is made here. We are not only near the origin of matter, but have uncovered the source of electricity.

We have seen that the new disclosures of radio-activity have proved the atom as an entity composed of intra-atomic corpuscles, or electrons. We have seen these diffused as ultra-material electric entities, not connected with matter until by orbital association and movement they form the atom. We do not know whether they have weight or obey gravity, or whether they have *sub-orbits* and still sub-orbits to infinity; or whether they are the ETERNAL CONSTANT AT THE PORTAL BETWEEN SPACE AND MATTER.

We do know that they are about 1/1700 of

an atom of hydrogen in size, and that they are negative charges of electricity. The atom of positive electricity has eluded the physicists. Some, among them Soddy, believe that there is no positive electricity in the same sense that there is no cold; only absence of heat. So positive electricity, in this view, is only absence of negative. Others, includ- Sir J. J. Thomson, are hunting the positive electron. Up to 1910 the atom of hydrogen positively charged (1700 times the size of negative electron), is the smallest known particle of positive electricity. Thomson says:

"It is a most remarkable fact that we get positively charged particles having this mass whenever we send electric discharges through gases at low pressure, whatever the kind of gas." *

The present conclusion is that atoms the size of the hydrogen atom are the natural units of the positive charge. Therefore these positively charged units form part of all matter. Therefore a compression of four of them, making an atom of helium,

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*The number of corpuscles to an atom is in relation to the atomic weight. Calculations vary. Some authorities say the atomic weight represents the number of corpuscles; others say four times the atomic weight gives the true number. Greater precision will follow the opening up of this subject—and this problem is here put in the INCOMPLETE TABLE, to challenge the eager pencils.

But if four be correct—the mystic four—this would seem to make helium composed of 16 electrons. It is four times the weight of the hydrogen atom, and would thus have 16 elecrons. But the electrons are not known to have weight. An electron's weight might thus be deduced at 1/16 of the hydrogen atom. Its *size*, we have seen, is 1/1700 of the hydrogen atom.

shows compression of space to this extent. And in our present state of knowledge it is unnecessary to postulate the existence of any thing besides these positive and negative units.

We have thus some of the implements for our purpose: velocity, duration, extended space, the negative unit of electricity, and the provisional positive unit. How shall we reach the source?

Let us first consider the modern doctrine of ether as an explanation of radiations. This problem, which has engaged the greatest minds of humanity, is made all the more difficult to comprehend by the new facts of radio-activity. The same additional difficulty has been placed before the human mind in understanding the real nature of light and the doctrine of the existence of *energy* as a distinct entity. Lord Kelvin has spent most of his life on this problem.

Nevertheless, "the necessity for the existence of an all pervading medium capable of transmitting energy, no one in these days of wireless telegraphy will deny; but on the question of its real nature, opinion is as divided as it well could be."

For our purpose, ether is space. Compressed ether is compressed space. An atom of radium is a compression of an equivalent of 226 atoms of hydrogen. Hydrogen, our lightest atom known, is

itself a compression of ether, or space in its ultimate extension. Matter is therefore made from ether (or space).

Let us next consider velocity. The speed of the α-particle, 10,000 miles a second, is an *ultra-material velocity*, rising above the friction line, and thereby acquiring the peculiar quality of *interpenetration of masses*, which implies the INDWELLING OF ONE ENTITY BY ANOTHER OF A DIFFERENT ORDER. For—as Bragg has proven—"the α-particle must go clean through the atoms of matter it penetrates as though they were not there, and therefore at the instant of penetration THE TWO ENTITIES DO OCCUPY THE SAME SPACE AT THE SAME TIME." This also requires emphasis for our philosophy.

Indwelling velocities, beyond the friction line, interpenetrating masses, show no friction, but produce another very measurable effect. They *ionize* the ether they pass through, and pass onward, leaving behind a *negative electric charge*, which is an electron; which, when associated in orbital movement in proper number, around a positive charge of the size of the hydrogen atom, make the atom—*and velocity has made matter from space*. While we may no longer say that matter is never destroyed, *we may now speak with fuller assurance of the* INDESTRUCTIBILITY OF SPACE.

Energy, degraded into heat by friction, makes electricity when friction is abolished by interpenetration. Velocity abolishes friction at the portal of interpenetration. There is a region beyond the vegetation line; a region beyond the solvent multiple of the octave; a velocity beyond the friction point.

Thus the source of electricity is almost at hand, and may be diagrammed as follows:

(1) The velocity of the α-particle now revealed;

(2) Ionizing the gases—the ether, the space, —making electrons by the mere passing through;

(3) Thereby making a magnetic field.

Faraday has shown that the plane of polarization can be rotated by a magnetic field—rotated in the direction in which the current would have to circulate around a beam to produce the existing magnetism. (Rotation is right-handed when the reflection takes place from the north-seeking pole.) Therefore, we have seen velocity make space rotate as the first arm of the spiral, and this closely resembles the Associative Force which we will see later.

So we have named another ETERNAL CONSTANT at the portal of the interpenetrating velocity, as it passes beyond the friction line. We know there is interpenetration at 10,000 miles a second. We

know that as low as 5,000 miles a second it ceases to ionize the gas atoms in collision. *The Exact Point of Interpenetrability* is not known, but we have its upper and lower limits fixed.

This glimpse into nature's secret laboratory tells us this much: velocities below 5,000 miles per second do not ionize the gases through which they pass. Therefore we cannot detect them, and they may be—probably are—making their unrecorded flights below these figures. Soddy summarizes the importance of this as follows: "ANY OF THE APPARENTLY STABLE AND NON-RADIO-ACTIVE ELEMENTS MIGHT BE DISINTEGRATING AND EXPELLING α-PARTICLES, BUT IF THESE DID NOT ATTAIN THIS LIMITING SPEED WE SHOULD HAVE NO EVIDENCE OF THE FACT."

But we have another proof of what is happening under the measurable velocities for the elements of lower densities—which would naturally have the lower velocities: viz.: *"All the elements raised to incandescence or exposed to violet rays, can be made to emit negatively electric particles* (electrons 1/1700 of the size of the hydrogen atom); *and these particles are the same in mass and electric charge from whatever source derived."*

The molecular theory—the only one ever seriously advocated—supposed that "all visible forms

of matter are collocations of simpler and smaller portions." And we are beginning to see how much simpler and smaller are these portions.

V

UNSUBJUGATED NATURE. MISSING IMPLEMENTS. POWER TO TURN THE CRYSTAL AND CHANGE THE ISOMER.

In the gap between the mechanistic basis of life —between astrophysics and radio-activity—before we presume to suggest "the breath of life," or to do more than prepare the body, we note many missing implements.

We have at hand the implements of duration, space, velocity, compression, the unit of electricity, the unit of matter, the unwinding of matter, the coiling up of time, and the principle of *indwelling*. So we come very near the ETERNAL CONSTANT that stands at the portal of life.

But we are conscious of some needed tools. We know almost precisely what they are, and where they are. And as in the department of transmuting, here also "it is rash to suppose that we will always be impotent to produce them."

To know our lack helps fill the lack. And therein

lies the challenge-throwing value of our INCOMPLETE TABLE, which grows considerably in this section.

Electricity has been fairly well yoked to our purposes. The X-ray, itself, is now taken from the ordinary street current. By altering the relation between amperage and voltage, by changing the measure of its wave lengths, the entirely new character of *interpenetration* is given to the ray.

This puts it directly in relation with the solar energy, through the street current, through the coal, to the remote sun. But we have come even nearer the sun and the indwelling of one entity by another of different order. A storage battery has been charged directly from sun rays. This battery, by proper dosage, would give the X-ray, and thus put the sun ray through a density of matter formerly thought impenetrable.

Groping darkly, mankind in the past has been vaguely conscious of another, greater force, lying parallel with electricity, differing from it yet resembling it. But we get evidences of it in the dreams and legends, the hallucinations and hopes, in the philosopher's stone, the fountain of eternal youth: perhaps even the immortality of the soul, as a settled conviction of mankind, may have herein found some of the elements for its formation.

But consider isomers, solubility, insolubility, colloids, crystalloids, conductors, non-conductors, as altering and controlling life conditions. We know a few empirical facts about these; but we want the process, the tools, to make one the other—and return—for herein are the life values. These enter our INCOMPLETE TABLE.

We have seen the limpid liquid—at its point of saturated solution—turn solid at infinitesmal addition or subtraction. We have seen gas, liquid, and solid, as condition changes; but we stand partially—only partially—impotent at the portal of these changes in properties.

Life and death hang on the molecular quality difference in material—whether wood or steel—when we slip an umbrella into a trolley slot. The conductors we know: the non-conductors we know: the ETERNAL CONSTANTS between, we know not.

There is a process which will turn the conductors into the non-conductors and halt the death stroke: but we still seek it. There is the reverse process, which we have just learned. Radio-active bodies cause the air and the gases to lose the insulating power they normally possess, and become partial conductors.

Likewise there is a *process* which will make the soluble insoluble. We know where this is, and we

know its death-dealing results: but we have not yet brought it to use in our willed activities, "forwards and backwards."

As the color-change of lower animals for concealment is ascribed to the action of the central nervous system, so physiologists believe that nerve impulses alter the osmotic power of the cell walls toward the surrounding plasma and allow endosmosis and exosmosis for nutritive exchange. Perhaps rather than this change in basal physical laws, it is a distinct crystal turn by the central nervous system, which allows this process so important to Life. This probably explains the light effects wrought in animal color concealment.

That there is power to turn the crystal in the central nervous system, as readily as to focus the eye, seems probable. And though hard and fast physical laws govern this change ordinarily, here as elsewhere will be seen in organic life a hint of a transmuting power, and a suggestion of all the wonders newly unfolded by radio-activity.

Solubility, conductibility, osmosis are probably as dependent on the crystal turn as we know to a certainty digestibility is.

The diamond, the supreme carbon crystal, the sparkling emblem of vegetation's journey up Duration and down Space—is but an isomer of the other

carbon: the marriage of the sun-ray with vegetation, in a long "gyrostatic rest."

We have not yet turned the common carbon crystal into its rare isomer, the real diamond: but other isomers have been mutually turned.

The field is broad and almost virgin, and the importance is that of life and death. The phenomenom of isomerism is so important that it has even been urged by some as a better basis for philosophy than the atom. The isomer is a molecule of the same chemical composition having different properties—especially with relation to light. The theory is that the atoms are differently linked. Instead of c-c-c-c it is 

This is especially noteworthy in the carbon atoms which are so important in organic life. Carbon, ordinarily, has a valency of four—that mystic number which we see in the atomic weight of helium, in the transmuting difference, in the base of all organic matter, and in the number of spermatazoa produced by a single sperm cell.

It is thought that the carbon linkage with hydrogen must be so attached to the carbon in the same atom containing oxygen, that the hydrogen will be prevented from *burning—which is the main occurrence in an explosion of dynamite.*

So we speak of the "resistivity of the carbon

link," and we know that it is carbon that makes isomerism possible in the organic compounds, especially in its pentavalent linkage.

Otto Lehman discovered the laws of mutual transformation of some of these. For example, the transition point of sulphur is 95.4°. It is stable in rhombic form until it reaches this ETERNAL CONSTANT, where, without loss of homogeneity, it changes to the prismatic form. Light, meeting the rhomboid, is led to another focus of activity when the rhomboid turns over into the prism.

Life and death hang on the crystal turn, for what digests and what is digested depend upon this. The present writer has shown elsewhere:

"Pasteur discovered the dimorphism of the double tartrate crystal. One isomer in solution is dextro-rotary in the spectroscope; the other is levo-rotary. That is, one of these varieties of the same thing turns the polarized light to the right, the other turns it to the left. As a laboratory test, to separate these two diverging forms of the same thing, they were subjected to certain fermentative tests. *The yeast plant ferment was found to act on the left isomer, while the ferment of the mold acted upon the right solution.* Please stick a pin in this fact; it has a vital bearing on what follows. The left-hand isomer, susceptible to the yeast ferment,

is indifferent to the mold ferment; and the right-hand isomer, susceptible to the mold, is unacted upon by the yeast plant.

Another important point accented by Pasteur was the difference between the same thing—to use an apparent Hibernianism—according to its derivation. The difference between laboratory products and the same substances derived from organic compounds was this: the natural organic products rotate the polarized light either to the right or left according to quality—but always one way, to the exclusion of the other isomer. Or, as Duclaux, quoted by Beard, says: "Nature alone knows how to manufacture one isomer without making the other."

Fever can thus turn the crystal and stop not only digestion, but also the possibility of digestion; as we have seen in the sulphur crystal turn.

But our table of ETERNAL CONSTANTS needs many entries between the temperature of 96 and 110 F. If the writer had direction of a cancer fund he would entrust the study of the hormones with reference to the crystal turns, to several expert physicists, willing to sacrifice themselves to a sub-science. Perhaps even life length has its relation here, for as age changes the eye focus, so must it change the cell wall focus and thus lead the solar ray from

where its focus was during the years of youth and vigor.

Crystals have laws as complex as the interference figures in sand, shown in elementary physics, when drawing a violin bow upon a dampened plate, and varying the place and force.

When we realize that they lead the light to our cell centers or lead it away from them—putting our very essence in darkness as our *punctum proximum* recedes,—we begin to see that the importance of the crystal is almost the importance of the solar ray; for the crystal places the ray.

Commerce has seized upon the crystal's definite, attractive and repulsive force and *rectifies* and *intensifies* the receivers of wireless telegraphy by the use of the carborundum crystals. The crystal in the cell, no less than in the wireless receiver, must make the cell more—or less—sensitive to the exterior. And we who wish to control forces acting upon the cell must ultimately have the tools to turn the crystals.

There are many inviting trails to the unknown in the realm of the crystal. From the central nervous system to the skin by the way of the crystal turn, seems far-fetched when we do not know it. But it is not strange to us in cutaneous eruptions and furunculosis from certain nervous system lesions.

Curiously enough, when we see these we think of sugar; and when we think of sugar, our minds run to polarization, and when polarization is on the mind's screen, the inassailability of the wrong isomer by the digestive processes comes to us, and then—by association first laid by Claude Bernard's experiment of irritating the medulla oblongata, later clarified by Cushing—we connect up the stalk of the pituitary body with sugar, and the wrong isomer acting in the organism like granite, not food. We are then near the secret of Diabetes.

Something has turned this sugar crystal. There is a process of turning it back. It dares our search, and we must have it.

Lehmann has found that even liquids follow crystal forms: logic suggests, thereat, even gases. Most interesting studies have been made on the lens-forming abilities of certain cells, which thus lead the light where it counts.

Where the light talks—counts—works—transforms—informs—depends upon where the screen is placed. While sitting under the light beam of the cinematograph, it resembles any other light beam over our heads in the dark. The beam is as familiar as the sunlight, but only recently has the possibility been put to man that a given beam may carry the whole dramatic story of motion and life.

How to get the picture on and off the beam is the *problem of philosophy.*

For all the marvelous color printings by the sun go unread without form and screen—and proper distance. And the crystal leads light to the proper distance.

When we come to the ETERNAL CONSTANT standing between matter and life we shall see how vital this light question is. And when we reach the Eternal Constant at the portal of the digression of animal from vegetable life, we shall again see a process in the vegetable trying to get the light in the right place.

And when we come to follow the dominant animal advance up the species we shall see the dominant digesting the recessives by a "hemolytic" process—digesting the way to the front—by a process of crystallization as certain as that which permits the pancreas to digest itself—as it does in some cases after death.*

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*See Prof. E. T. Reichert's work on blood crystals.

Dr. Reichert's partial reports seem to indicate a discovery that the hemaglobin crystals of the blood have an Eternal Constant for each race, for each of the species, and for each of the botanical genera. The crystal essence of race individuality he hopes to narrow down even to the single individual, and the hope is to prove paternity by the hereditary blood crystal. This would identify the dominant, or disprove the disputed question of telegony—whether the later children of a "polarized" female resemble the first male possessor. The crystallography of starch grains from different

As with space, as with duration, the only thing that does not change is change itself. And change has an Eternal Constant at the portal of each crystal turn as well as for each quality and condition.

We need the implement—the process—connecting the central nervous system with the crystal.

We knew the vegetation line. We have learned of the friction line, the line of the octave melt at the multiple, and we know there is a crystal line. But the table is very incomplete.

These powers to turn the crystal and change the isomer are surely in the crystal process. Possibly they are in the unknown order. Undoubtedly they are part of certain diseased conditions. When we have only to change a rotary direction of light to enable the contents to digest a stomach wall—when one vibration missing from the million million, changes the quality; when an inscrutable quality change allows the backward "hemolysis" toward the vegetable, as man succumbs to bacterial invasion—we are justified in saying that the crystal form sets one of the directions of evolution.

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sources will lead possibly to an Eternal Constant between animal and vegetable digression.

It has already been proven that naturalists have erred in some of their classifications; as for example, the bear is related by blood crystal to the sea lion and the seal, and not to the dog, the wolf, or the fox, as conventional classification has joined him.

The decay of the sub-component which upsets the ratio and transmutes is as important here as in radio-activity. Perhaps it is part of the same process.

VI

THE GEOMETRICAL AND THE VITAL. ORDER AND THE UNKNOWN ORDER, CALLED DISORDER.

THE DIAGONAL RESISTANT OF ZIG-ZAG. THE PHYSICIST'S DISTINCT ENTITY OF ENERGY.

The human mind delights in the form, the supposed inertia, of the crystal and the sphere. Mathematical sequence and the octave multiple order, likewise give reply to it as an answer from a syntonic. The intuition is that we have been this way before. In other words, geometry and mathematics are immanent in the human mind as well as inherent in matter; and therein is the point of mutual focus when the seeking mind finds its desiderata in matter. "The automatic secures constancy of effect when there is wavering in the cause."

Disorder, "the order the mind is not seeking," is the UNKNOWN ORDER which is most pertinent to our philosophy.

Though an unknown order, it tells us something

of itself. It is not geometrical, it is not mathematical. It is nevertheless a precise record of a force —an explosive force—which once revealed itself and once left its print.

In the radio-active series, the mind finds itself distressed at the disorder of the duration sequences of the elements in their descent. If it could find a ratio, or a multiple, between the seven and a half billion years of one, and the 4.3 minutes of the other, it could leap with elation at reducing "disorder" to the mathematical order it knows and is affiliated with.

But this disorder is another unknown order. For when we can read this disorder of the hills in terms of the unknown order—making of a Vesuvius the alpha of our seismographic alphabet—we will read where the EXPLOSION SECRET acted in transmuting something else into the silicon of the rocks. The disorder is the order in which the special α-particle escaped to form the silicon atom, discounting the long, long duration of the very abundant and almost valueless element.*

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*Darwin and Lyell say that 300 millions of years would not suffice for the most recent geological history. Tait, the great physicist, says: "So much the worst for geology. It is impossible that more than 10 to 15 millions of years can be granted."

The new knowledge of radio-activity humbles both geologist and physicist, and puts both to school in the ancient controversy.

This much more we know. The *vital* which disturbs the form—the crystal, the sphere—*belongs to the unknown order*—which we call disorder. Also: as soon as the vital has given forth its transmuting explosion it, too, tends to resolve itself into form—geometry or mathematics—and enter a "gyrostatic rest."

Therefore in our hunt for the vital we must penetrate "disorder"—or the UNKNOWN ORDER, the higher order. And when we find the welcome crystal or mathematics dawning under our recognition, we are at the *Eternal Constant between the vital and the material.* (We may no longer say *animate* or *inanimate,* for there is perpetual animation in the gyrostatic rapidity of each "rest.")

We must recur to the question of velocities. Physicists call *ultra-material,* the velocity of the α-particle, 10,000 miles a second. But the α-particle is an atom of helium, and helium is material. Rather let us call this a *somatic* velocity. The velocity of light is 185,000 miles a second. But light has *two* velocities of different orders. The portion of radial energy between the red and the violet, called light, has a vibratory velocity of from 400 to 800 million million vibrations a second. The first is the *somatic* velocity of light; the second is its non-material, or *durational* or vital velocity. The

mind struggles hard with itself not to call this durational, or vital velocity, a *spiritual* velocity, in the sense that it is non-material. We have already identified it with the "celestial" process. But for this philosophy vital velocity (as indicated by the spectrum in the color octave) stands in contradistinction with somatic velocity. Every atom in the universe has a somatic velocity, and under the principle of indwelling may also have a vital velocity. The helium atom (the α-particle) has the somatic velocity of 10,000 miles a second when escaping from radium, and a vital velocity according to its spectrum in the color octave.

The vital velocity begins with the one scant vibration in eternity, climbing up quality line, increasing in velocity as it climbs, until in irresistible force it passes the friction line, penetrates and indwells. As the indwelt condition becomes denser and denser, atomic weight heavier and heavier, intra-atomic orbital movement faster and faster, vital velocity likewise augments in an unknown ratio —which must transcend the geometric ratio. How does vital velocity thus increase as the material opposition to it increases? This brings us to a new law.

THE RESISTANT DIAGONAL OR THE LAW OF THE ZIG-ZAG RETURN: or the process by which force

pushing in one direction makes a counter force pushing in precisely the opposite direction.

This is the distinct entity which the physicists call energy. It is an impossibility to our concept, an affront to our logic, until we realize that we have always been familiar with it at its rudimentary start. The sailor taking advantage of different areas, velocities and densities, by "tacking" drives his boat back into the teeth of the force blowing him away. The stronger the direct counter-force the stronger and more rapid the zig-zag return, up to the point of destruction of material. Change the returning matter, lift the velocity above the friction line to that of interpenetration, and you make the zig-zag back drill, or resistant diagonal, against matter. The compressed air in front of the locomotive would zig-zag right through it could the material velocity rise to a vital velocity.

Thus seems clearer the disruption of the form, the explosion through the sphere, the turn of the crystal, as the vital velocity—the vital energy; the compression of duration—reaches the solvent octave multiple, or the mutually blending focus, of the given element's atom. Condition indwelt with vital quality, has its period of "gyrostatic rest." When the carbon meets the oxygen before the dynamite explodes, there must be an infinitesi-

mal "gyrostatic rest" period. The process must go from portal to solvent point—or multiple, or mutually blending focus—and then comes the transmutation, after the explosion.

The law of reinforcement and interference is shown by simple experiment in elementary physics. It is in commercial use in the wireless telegraphy receiver to "intensify and rectify." The rising quality vibrations have only to reinforce their kind, and interfere with their unlike, *to destroy a subcomponent, upset the ratio and transmute one element into the next.*

We have already had a hint of a transmuting quality in organic life. When the highly coiled duration reaches just the indwelling quality, when vital velocity is at the point, ready, like the buzz of wireless, to explode the distant charge—when it has passed from portal to solvent point—then matter is transmuted. This is the physicist's "energy." It is the EXPLOSION SECRET of radio-activity.

We see "energy" coiling up duration in matter, as we see organic processes doing the same thing. We see two similar results rising near the unknown ETERNAL CONSTANT at the portal between duration, space and life. And we are very near the *Eternal Constant at the portal of life itself.*

We are familiar with matter's answer to the call

of gravity. We have just seen the ATTRACTION OF DURATION FOR MATTER. We have often looked without understanding upon the lust of matter for certain crystal form. And now we say that vital velocity (durational) acts *"as though it had been there before."* The disembodied spirit in the interstellar spaces would seek its orb as surely as the thoughts of the wanderer fly home. Quality climbs *as if* it were seeking the call to which it might reply, or the reply to which it might call. THE HUNT FOR THE SYNTONIC is as immanent in quality as the hunt for geometry and mathematics themselves are inherent in matter. This is the triune order that so strongly stands over against the unknown order, *which we call disorder.* And we emphasize it as one of the props under our philosophy.

Let us return again to the question of velocity. A railroad train moves 1/60 of a mile a second; the earth's speed on its axis is 1/3 of a mile a second, a cannon ball at the muzzle less than a mile a second, and the α-particle escaping from radium, 10,000 miles a second.

These are somatic speeds, relatively slow and relatively constant—except in the case of radium's α-particle, which we see is in uniformly retarded motion. Even these relatively slow speeds carry some atmosphere with them. The layer of the

earth's atmosphere, condensed from the interstellar ether by the earth's velocity, is an example. And we have made liquid air—perhaps, solidity—of this compression of space.

So it becomes less trying to the mind to conceive of space being compressed into greater density as it is carried along by the uniformly accelerating velocities which must characterize our one octave of color—from 400 million million to 800 million million vibrations per second. When we think of the annealing properties of the heat engendered by these velocities the hot blast knives which cut our steel beams in industry seem instruments blunt and crude.* Thus the vital velocity, in mechanistic diagram, starts the one scant vibration in eternity at an extended space, and rolls up and anneals with it, the detached electrons into orbital atoms, the atoms into orbital elements, which become denser and denser until we reach our known finality uranium.

We spoke of increased velocity rising in heat until vortexed into the sun kernel. But this we now

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*The heat of the unknown infra-red region, or the known chemistry and heat into the ultra-violet, would destroy life instantly were it conducted and focussed. Dispersed, unfocussed—some huge protecting crystal, some cosmic non-conductor intervening—it vibrates about us in infinite reservoir, into which we lightly dip with our syntonic receivers.

see, could only be when indwelling in matter. And even then, as we consider the power of the orbital swing—as orbit and outer orbit,and still outer orbit revolve resistlessly—this could only be as accidental, as fortuitous, as the escape of a meteor to the earth from the star dust.

The sun may be "nourished" by the orbital detritus reaching it. And there is another explanation which likewise, under the LAW OF SUB-ORBITAL INCLUSION, runs down to the smallest atom.

"The sun loses heat by radiation; as the mass contracts therefrom its approaching parts set energy free as heat again, and more is made than is necessary to compensate for radiation."

The sun may be the SUPREME ATOM, and as model for even the sub-atoms, we see by analogy the electrons drifting to center as heat is lost by radiation. We see the central-drifting electrons collide with the bombardment from the center, and in their elastic impact—as nadir and zenith meet—we get some idea of the atom during its "gyrostatic rest" period*—the old state of inertia in the obsolete physics.

What may be the fate of the vital coil, which

*Stephens' law makes the temperature of the sun 6500C. Rutherford says 99% of radio-activity is lost at 1460 C. Here is a natural thermostat. Many of these we find in organic life. Fever is frequently a natural thermostat. The bacillus-making lactic acid is killed by what it makes when too acid, etc., etc.

does not reach the sun's center as detritus? It is the internal energy of the atom. It is the indweller in the indwelt. And so tightly is it involuted, and so densely is matter packed, that its natural evolution is epochally slow by the escaping helium four steps at a time.

Therefore, it takes 7½ billion of years before uranium can *naturally* evolve its first step—and so on down the table.

We are now prepared to understand what syntonisms, what goals, ascending quality—which we shall hereafter call vitality—is hunting. The new vitality of fresher start may be seeking to unlock a former coiled vitality in the elements. It is hunting† the eternal energy in matter. And this explains why it seems "to have been there before." Where it dwelt in longest "gyrostatic rest," perhaps is the nostalgia secret of the nitrogen or carbon hovering around the chlorophyll of the leaf, trying to get again into life.

Uranium's slow journey, 7½ billion years for its first step—and all the balance of the journey

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†The spectrum of radium contains not a single helium line; on the contrary, it closely resembles the nitrogen spectrum, though distinct from it. 1913 Rutherford, page 303. Nitrogen and carbon can not be taken directly by animal life. Our whole supply of nitrogen and carbon, as indispensable as it is, comes primarily through the vegetable chlorophyllian activity, whereat the atmospheric nitrogen enters life.

through the other elements to extended space—may be discounted by the short-cut of transmutation. The *gradual* short-cut may be further discounted by a shorter cut of cataclysmal return—which would be represented by the abrupt leap of uranium to extended space with no intermediates. The latter would imply the operation of the UNKNOWN ORDER. In the realm of organic life perhaps there is also a glimpse of the UNKNOWN ORDER in premature death. As the sun never sets without changing the process in the chlorophyll of the leaf—as this change varies animal life's supply of oxygen, carbon and nitrogen, the known order connects life tightly with the universe. When the ripened moment is discounted, the rhythm interrupted, and the "cell-bridge" connection with the universe cut off, we are facing the UNKNOWN ORDER, which we must know would we conquer death.

VII

THE WILLED RESISTANT; THE DIAGONAL BACK-DRILL AGAINST GRAVITY. IS THE CAUSE IN THE THING WHICH CHANGES OR IN THE PERMANENCY OF THE PORTALS OF CHANGE?

THE DETACHMENT OF THE LAW MAKER.

Dealing for the present solely with the mechanistic basis for life, it is yet surprising how much energy seems available in the strictly mechanical aspect of matter. As Rutherford states:

> "It would appear that the greater part of the energy of the α-particle is acquired in traversing the atomic field, and only a small part is due to the original energy of motion."

Therefore, energy is born of the opposing tendencies inherent in matter. The umpire of the strife is the third factor which controls even the energy made by the other two.

It may not be said that "nothing acquired a rapidity of movement and made something." It is impossible for the human mind to conceive of

"nothing," or of "void"; these are mere words denoting *something of which we cannot conceive*, hence "nothing." There are many things our finiteness can not conceive, yet it is capable enough to tell us that though we are limited regarding such things they are far from being non-existent.

We therefore know what tools we lack, We have, also, more tools.

We have a clear concept of space compressed and indwelling vitality (or duration, or energy) coiled so tightly that the evolution proceeds with great deliberation. Step by step, subtracting four from the atomic weight of each softening atom, the hardened store of time and space is gradually softened for use as decay softens the hard log, preparing it for the fire. The axe, making the immediate softening into kindling that will burn, might represent the EXPLOSION SECRET in the fresh vitality, or in organic life. While the fire, returning it directly to the bosom of the infinite, is a fair analogue of the cataclysmic operation of the UNKNOWN ORDER we call disorder.

Life, like the nitrogen at the leaf border, also acts as though it had been there before. *The fresh vitality*—the new duration—acts as if it were a willed resistant, under the back drilling zig-zag, to the gravity, to the gyrostatic stability, to the unrolling

process of matter. It is as if the "celestial" process, willed and made resistance, uniformly increasing, against the "terrestrial" process. Thus the new vitality sings its song, is welcomed at the portal, re-inforces or interferes, passes to the solvent multiple, and transmutes to the next condition—freeing an helium atom with its own busy orbit to join the bosom of infinity as extended space—and suffer its own re-creative nostalgia for the high spins. So turns the circle, so rolls the sphere. The only stability is the busy gyrostatic stability. The only permanent thing is change. But the ETERNAL CONSTANTS at the portal of each change—as eternal as any concept possible to science—speak of what always have been and what always will be without "variableness or shadow of turning."

The immutable laws of change are the alphabet of the theologian's "Ancient of days," and we must block the letters into syllables—for who can do the will who knows not the unchangeable law?

But do we read creative design as immanent in life or death? Shall we find the Cause in the extended space, or in the scant vibration, or in the velocity, or in the Eternal Constant, or in the ark-escaping dove of an α-particle?

The greatest organizations in human affairs, the most complex movements of the human organisms

are reduced to geometry—to an automatic crystallization—to the continued automatic obedience in present and future to a past will and purpose. The brain is detached from the movements of the spinal cord though it may resume control at will. Every human organizer seeks the geometry for his organization. But if the organizer becomes himself part of the organization there is no head. He must start the laws in the inter-relations and stand off from them in detachment; or he becomes as much of a crystal as the rest. He is then no longer fresh vitality to unlock, soften and use the store of vitality in his crystals. We shall see this exemplified all up the line of life in the necessity for the established INTERMEDIARY between the quality grades: as the vegetable kingdom is the Intermediary between the animal kingdom and its carbon and nitrogen supply; as the antibody connects the "side chain" in cell life.

Less wisdom is not imputable to the Cause.

We do not find the Organizer in the organization, as a "Principle immanent in matter"; but we may read therein the indwelling of His genius and the pleasure of His mind.

We do infer that the universe is from a transcending Principle whose manifestation is in the matter and life therein contained.

Thus when less than 100 different kinds of atoms, each composed from the scant vibration and extended space, are storing vitality—energy or duration—in different areas, densities and velocities, to form the worlds, the plan must have been to run the entire scale of Eternal Constants. If plan, then the Planner, not accident—indulged in the pleasure of a perfected organization.

Not only the Hebrew tradition, but many of the legends of other peoples, are so near the latest disclosures of science as to seem either revelations, or remnants of lost knowledge with the ancients. "God breathed the breath of life into the dust of the ground" says the tradition, and science checks this up in the twilight of comprehension with the *spore,* a sexless spherical association of some of the "softened" atoms of lower densities, which having caught color from the color octave, stand as the Eternal Constant at the portal of vegetable life.

Sir William Thomson, 1871, suggested that a meteorite from another star bore the first germs of life to this Earth. As Profesor Schaefer, in 1912, pointed out: this "simply banishes the investigation to some conveniently inaccessible corner of the universe." If the earth be the only planet supporting life at present, and if it has taken a billion of years to prepare it for this passing phase—and if other

planets are just starting as masses of burning hydrogen; and others are just ending as disintegrating dark objects—the dignity of humanity, as the exponent of the whole, is the dignity of the whole design. (And many astronomers so calculate from the temperature conditions made necessary by "the square of the distance." *The heat supplied by radium injects a new condition into the problem.*)

We have seen space merge into matter. We have seen the source of electricity. We have seen energy coiled up for slow unwinding. We have seen fresh energy tap these reservoirs for immediate uses. We have seen the potency in different areas, velocities and densities when rightly opposed. BUT THE ETERNAL CONSTANT AT THE PORTAL OF THE SPORE may not be as chemical as salt fertilization of sea-urchins eggs. Yet it is probable that all the processes are at work for the continual originating of life at all times on this planet, and that fresh life is always being made. It is not wise to conclude that we shall never find this Eternal Constant.

VIII

COLOR THE ESSENCE OF LIFE. ELEVEN OCTAVES OF SOUND TO ONE OF COLOR. THE SPECTROSCOPE SUGGESTING BILLIONS OF SUB-OCTAVES.

"That portion of radiant energy lying between 400 and 800 million millions of vibrations per second, is called Light."

And the division of light into one octave of color is as familiar to us as light itself. And color is as important to life as the solar ray itself, and yet we are profoundly ignorant regarding it.

The great intellects of humanity have pondered this problem, and left their average conclusions. A fair dictionary definition is: "Tint or hue depends upon the number of vibrations of etheral stimuli." Brewster's theory of color is: "A body appears permanently of any given color, simple or compound, because it absorbs the remaining spectrum of the complete white ray, reflecting those

which constitute the color of which it appears." White substances were those which reflected the whole ray, and black substances were those which absorbed the whole ray.

Spencer says: "That redness exists as such out of the mind is a primitive belief. Color is not an inherent property. All things are colorless in the dark."

That the green of the chlorophyll of the plant, that the red of the evening glow, are the only colors that the things are not; that they seem to be of the colors they reject—that they reject the light we think they keep—is the best conception science has had for us.

Prof. J. R. Cotter, Department of Physics at Cambridge, said:

> "We may still speak of white light as compounded rays of the spectrum PROVIDED WE MEAN THAT THE TWO SYSTEMS ARE MATHEMATICALLY EQUIVALENT, AND NOT THAT THE HOMOGENEOUS TRAITS EXIST AS SUCH IN THE ORIGINAL LIGHT."

The idea of the mathematical sum total of all the colors being white light is more in accord with the idea of radio-activity. The question of black is left aside. And, provisionally, COLOR AS DEFINED OBJECTIVELY, IS SIMPLY THE VIBRATION FREQUENCY REQUIRED TO PRODUCE IT. And that its 800 million millions of sub-octaves are elusive for us, and yet

less illusive to others, is humanly proven by the inherited skill of little Indian yarn sorters who pick shades and sub-shades that escape most of us.

Color is inseparable from the solar ray, and the solar ray's importance to life is everywhere apparent to us. For example, bleached earth gives no wheat. The bacterium which rejects the stain is dead. When chromatin escapes from the nucleus to the cytoplasm it loses its color.

In pernicious anemia, blood cells instead of taking the normal red take some bastard tint like dull purple, dusty gray or slate color.

There is loss of staining power and shrinkage in a cell nucleus in artificially produced fatigue and during secretion. There is recovery of nuclear color with rest.

Color has given us a knowledge of the substance of the stars, through the spectroscope. But for the perfection of the photographic plate we should have lacked our readiest method of detecting radio-activity, and it probably would not yet have been discovered. It also gave us clue to argon, helium, neon. The whole macrocosm—the big world—has thus been revealed to us. For even the telescope is a crystal conquest of color, and a light-guiding device.

And as solar energy in the big tree, color has

gone through to coal, and then to coal-tar dye; and so has revealed to us the microcosm. Bacteriology rests upon the stainability of the different bacteria. Thus the distant color of primeval forest calls through the coal-bed to the sub-sub-octave in the bacterium, and gets uniform answer. There is an ETERNAL CONSTANT in the stainability of each. And the medical student, quoted by Metchnikoff, who spoke of the tubercle bacillus as a "little red bacillus" showed the tendency of our thought to seize upon the Eternal Constant and call it the name of "the thing that changes" at its given quality. No one knows the color of this bacterium—but all know its response to certain stainings.

It is hard to realize that our routine in bacteriological work, is making a force contained in the solar ray countless years ago—stored as coal for geological epochs—get syntonic reply from the syntonic bacillus: a present answer to a call from remote infinity.

When we learn new keys we will stain and know new colonies of bacteria. The most important, the most beautiful and delicate, may be the inimical to be thus quenched, while grosser forms blare out. Conversely, the iridescence of supreme beauty may stand revealed by the syntonic, as the uglier primaries are quenched, or combined.

But color has even keener aptitude for animal than for vegetable derivatives. Cotton is the hardest to dye, while wool is the easiest, silk being the intermediate.

"There must be marked affinity, physical or chemical; dyeing varies with each fabric—it is not immersing all things in red to get red—what makes the difference is still unknown; the differences have been ascribed to the differences in atomic arrangements."

As animal must go to vegetable for carbon and nitrogen, so vegetable must come to animal for color—made from the self-same nitrogen—for albumen must be used to fix chrome yellow in the cotton.

Each nation has its color, each race has its color predilection, doubtless influencing its own coloring from within as the sun does from without. Even each individual may have his personal color, if Prof. Reichert is correct.

The best clue we have to the essence of a vegetable—its alkaloid—is to photograph the color of its vital compression.

Hartley, in 1872, proved that the spectra of alkaloids "offer a ready and valuable means of ascertaining their purity and particularly of establishing their identity."

The doom of the white man has been foretold on the score of color deficiency. Lacking pigment to protect protoplasm under it, makes tropical sojourn dangerous to him, whereas the rapid increase of the colored races suggests his ultimate fate.

All know that there is more growth in the light months; that Cretins inhabit the dark valleys; that animals in the dark get rudimentary eyes; that pigment protects against burns, and negroes are remarkably resistant to intense light—and conversely very susceptible to tuberculosis, which light destroys in uncurtained quarters. The color represented by the X-ray in fibroid treatment induces a sterility for three or four months, or permanently under long exposures. And the color represented by radium will cure some cancers and will cause some cancers—according to dosage; according to whether it quenches an inimical or replies to, and augments, a syntonic.

Therefore, from the first digression of the spore, as life emerging from matter, until man's bones finally whiten and disintegrate on the sand-hill in the sun, all life is in definite and continuing relation with color, and with the crystal which leads the ray and varies the color. It is as hard to separate color from light, as to separate light from the solar energy itself.

Lead, now a known step from radium; and the coal-tar dyes—a known derivative from the solar source—are the almost exclusive "inorganic" color sources. And chromatin at the center of living nucleus, is color.

And antiseptics which quench the color at the center of bacterial life, are usually metals of high atomic weight. Sudborough showed yellow phosphorus made red by Becquerel rays. The Curies showed oxygen made ozone thereby. Berthels, Bordas, Doelter, brought change in the color of many minerals. The slowly healing burn made by the radium carried in Becquerel's pocket—and the burns and frequent cancers in pitchminers, chimney sweeps, and coalminers—point to latent destructiveness in forests.

Therefore we have an unknown connection between color, life, and malignancy, death and radio-activity. When we know which sub-component in malignancy needs re-inforcement and which needs interference—and which ray of radium will do it —we will know why radium cures some cancers and causes some cancers—and adjust the dosage.

—seizing upon matter to indwell with special characteristics for this purpose. Another set of processes—sub-contained within each sub-contained—is winding back into another color patch (germinal chromosome) all that was unwound from the preceding—and more.

The process that seizes matter to indwell with all its sub-processes, can not be matter. The attraction of gravitation is not matter. The attraction of duration for matter is not matter. The law of proportion or ratio—inviolable without change—is not matter. The durational "rest"—and the busy intra-orbital revolutions—the associative ratios binding elementary matter in atoms—these are entities related to matter which yet are as unlike matter as time is unlike space.

Living protoplasm is as constantly changing as duration itself. Each of its many atoms is intent upon its own gyrostatic orbit, as well as its relation to its next governing orbit. The hint we have had of transmuting power in organic life, suggests that each quality and condition of each component atom is tending toward each solvent multiple whereat the sub-component may be presumed to die, or speed the tendency. There is, therefore, a tendency toward an extreme of complexity and a slow resolution therefrom, toward the simplicity of dead pro-

toplasm—which is something vastly different from living protoplasm.

Fixation for analysis, therefore, becomes impossible, for fixation is death. But science has agreed upon a mean formula for the molecule of protoplasm.

The biophoric molecules of proteins of living substance are calculated to contain about

C	H	N	O	FeS
680	1008	210	240	2

The average molecular weight is 15,000; the weight of hydrogen's atom being 1.

Complexity at its highest point seems to be life at its greatest vigor. The electrons, the atoms, the qualities, the conditions—the octave mounts, the four-step descents; the friction and the crystal lines set and passed; the potent sun-rays led to the required screens by the proper crystal turn—the whole mathematical and geometrical array, so grateful to our minds—is there. We have seen the bubble anxious to escape from the water into which it has been compressed by the falls. But the most significant hint in this marvelous mixture of compressed space and duration, which makes life, is the *disorder of the mixture.* Our crystals, our geometry, our mathematics are taken and mixed in a

HEMIN CRYSTALS. (Simon.)

To demonstrate crystalline form of a protein.

Protein, which forms the framework of human structure, in contradistinction with Carbohydrates — in which form its force is stored—is in crystalline form as above. To **turn the crystal** from prism to rhomboid, therefore, would unquestionably modify color, light, focus,—and thus probably make a relation with ageing, if not with malignancy itself.

disorder which resists our efforts at form-making therefrom—and life results.

Our concept of life before the secrets of radio-activity were appreciated, may be seen in Ehrlich's "side-chain" theory.

"We had best conceive of the central ring, resembling the benzol ring, of assorted carbon containing molecules of which each member has side-chains capable of being satisfied. The peculiar feature of a vital system is that IT IS NEVER SATISFIED, and so is constantly interlacing, and has the capacity to act upon and be acted upon by the surrounding medium.

Life is a state of persistent and incomplete recurrent satisfaction and dissatisfaction of certain protein molecules; and metabolism is the constant action and reaction between these molecules and the medium in which they exist. When food stuffs are assimilated they are not taken up in unaltered form and directly combined with the cytoplasm, but on the contrary undergo a disintegration into more elementary substances, and it is these which the biophoric molecules attract and combine." Herein lies the problem of immunity and anaphylaxis. "Desire shall fail," quotes the funeral service, describing death. And real death may never be assumed while the scant vibration in extended space

pines for its highest spin; or the nitrogen still wooes the chlorophyll at the leaf edge, trying to get back into life; or matter yet lusts for the crystal form of its longest "rest"; or there still lurks in the ton of lead its love for the center of the earth. *Whatever causes desire lies very close to the secret of life.*

We have had a hint of the detachment of the Organizer from the organization, and of the UNKNOWN ORDER in premature death, or in cataclysmal destruction. There is also a suggestion of the UNKNOWN ORDER at the threshold of Life. It is as though, into the smoothly automatic mechanism of the cosmos, the UNKNOWN ORDER interposed and mixed life.

It was the pleasure of the DESIGNER'S mind extended to a completion of harmonies already begun. It was not something accidentally evolved from a detached and sportive creative whim.

At the core of the electron, at the core of the atom, at the core of the molecule, there is a force which associates electrons into atoms, atoms into molecules, molecules into cells, cells into organisms, and organisms into communities and communities into States.

There is a moment when association itself begins a process of disassociation.

The Unknown Order and the Associative Force must be known if we would find the secret which has tormented humanity since the beginning.

X

THE ANIMAL DIGRESSION FROM THE VEGETABLE LINE. REUNION AT THE CARBON GOAL.

Duration, as expressed in velocity, may be THE DETERMINING REALITY. The death of each sub-component which overturns the equilibrium and causes the phenomenon of radio-activity, happens at a fixed time, invariable for each special element. A definitely allotted amount of duration has, accordingly, been invested in each sub-component. The same purpose, or reason, which fixed upon 365 days as the duration of the earth's swing around the sun, and related thereto the distance to be travelled—(hence setting the velocity)—also fixed the duration and distance of each orbit and sub-orbit, down to the SHORT ORBIT itself.

It is, therefore, precise mathematics when a given sub-component will enter the short orbit. When

we can put this problem successfully we will be able to cipher well into the future.

The short orbit is the final orbit on the central-drift (by heat loss and contraction) whereat the elastic outward propulsion from the center meets the central driven spiral, and the radio-active explosive change occurs.

What happens between the other moments of climbing quality is not so apparent. Perhaps a still further intra-content of the sub-component reaches its sub-short orbit when the sub-component itself is at the octave multiple. A certain over-speeding of the tendency of the sub-component would surely be made by the explosion of one of its own sub-included orbits. This may explain the increased intensity between the moments which varies the energy of the magnetic field—at the solvent octave multiple—and lifts it into the next higher quality. So while the finality of sub-division is on the short orbit, the next outer process may but be at an octave multiple. There is no universal death, or birth, at one given moment. The radio-active processes are *fractional;* the duty of fading away is divided. While the innermost is on the short-orbit, all the way outward, to the widest ring of gaseous nebula, different parts of the BIG SPIRAL are being traversed. The relation of

each component and sub-component to place on the big spiral, and to each other, is as fixed and invariable as any other law of matter and life.

FRACTIONAL DURATION, up the "celestial" and down the "terrestrial" process, seems to be the entity determining all.

As some fixed law is in fulfilment by the precise duration taken by each orbit and sub-orbit in the molecular activities of the universe, FRACTIONAL DURATION *of each sub-component* is an obedience to fixed law of definite purpose. The purpose is that the universe may be continuous and society never die; but the ASSOCIATIVE BASIS for the varied durational awards escape us. *But Duration only becomes fractional when indwelling space.*

These activities closely resemble the molecular processes of life itself.

Life may be defined as the attempt of duration to crowd the future into the present. If radio-active processes are actually concerned in organic life, life is then a short cut to the future; a mutual struggle between the "terrestrial" process trying to unwind, and the "celestial" process trying to wind up—with the third phase always present and always having its rule. The selective rewinding is under this third phase which controls.

The molecule is assembled into protoplasm. The

protoplasm is assembled into a cell. All cells at first resemble one another. It is only as they show tendency toward their respective goal that we begin to see a different relation between cell parts. Thus the animal and vegetable cells have a start so similar that it is only by considering their destination that we may *calculate*—not otherwise distinguish—which are vegetable and which are animal.

What is the goal of the vegetable cell? The vegetable kingdom, rising in slow progression to its highest form, the tree, is pointed directly to the carbon—and we see the cell wall taking more and more importance, and the production and storage of starch and cellulose increasing, for the epochal goal—coal and coal oil. These are rarely found in the animal cell walls. This reservoir of force in the coal mines is not a goal in the sense of finality, but in the sense of a relay station for a new departure—when this force is unlocked.

Whither points the animal cell? By an infinitely shorter cut, across the brief life span, to the same force reservoir—as whale blubber; as oil to burn, as force for the new departure. Even humanity's tendency to globularity—almost making pseudopodes and "buddings" of members and head, as contour grows rounder and rounder—seems directed toward the same storing of fat, related to

the similar carbohydrate accumulation of the vegetable kingdom.

We have seen that velocity is like compressing radium's one scant vibration a second for 25 million years into 800 million million vibrations in one second. The whole process is to wind up duration, or vitality, by thus bringing the last second of the 25 million years to the present. *It is investing matter with more duration.*

We may get an idea of the shorter cut on the short-cut by the paradox of the eastbound traveller around the globe. A fast steamer gains nearly an hour in the twenty-four. In a total transatlantic voyage it "manufactures" five hours of time. Imagine such a traveller moving with the velocity of the α-particle. In $2\frac{1}{2}$ seconds he would have circled the globe, and "manufactured" or wound up twenty-four hours less $2\frac{1}{2}$ seconds. Travelling with the velocity of light he would complete the circle in about 1/3 of a second, and make three days of the sun's time in one second.

The vegetable cell was in this sense an investing of matter with duration, a short cut to the carbon store instead of the long passage down the transmuting line. The animal cell is therefore an investment of vegetable life with more duration; a shorter cut on the short cut.

Thus, too, sex was an apparent digression. Asexual life increased the number of individuals of *the same kind.* Sexual life increased the *number of kinds* of individuals. So a mount toward complexity is seen in the appearance of differentiations of individualities based upon sex life. But the sex digression was apparently given off before the animal line departed from the vegetable stock.

We are brought, therefore, abruptly to a new portal: the Eternal Constant at the diverging instant of the animal from the vegetable. We have come through many portals: from space to the electron, to the atom, to the element, to the association of elements in the molecule of the protoplasm, to the association of such molecules in the cell.

We face the first disassociation, sex: an attribute related to the self-sacrificial act of reproduction, which had heretofore completely sacrificed its individuality by surrendering itself to its offspring by subdivision.

Complete disappearance by scissiparity, which was the first method, gave place to a partial surrender of individuality to reproduction, but *the retention of a residue,* the individual, for a brief period. The bare leavings of energy—until now only sufficient to live and surrender all in reproduction—show a little surplus, what we shall call

an ACTUARIUM.* And in the growing Actuarium of life will be found the secret of many quality mounts, as life rises higher in the scale.

THE LAW OF INCLUSION of an original—and not abandoned—process is here shown. For up the line of life to the human female herself, the force gained by INCLUSION is very obvious. Less and less of the individual is sacrificed to reproduction, but *within the outer and more evolved individual still is the original process*: the ovum is subdivided, and re-subdivided to complete extinction in bringing the new life, as was the original cell when it disappeared in favor of the new generation.

Sex, therefore, gave the evolving line a new power, an actuarium, with which the "brood care" of the present might lean over and influence the new generation. For in the "brood care" shown even by the plant for its seed, we see slowly gathering another force in the upward impetus.

What is animal or what is vegetable protoplasm is almost impossible to distinguish at first, and yet there is an ETERNAL CONSTANT for this portal.

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*The actuary is the Life Insurance expert who figures the life expectancy and the rate required to buy insurance protection based upon it. "Actuarium," for our purpose, is the surplus from the bare leavings of energy which is available, after living and reproductive expenditures, to aid the lift to the next higher order.

Scientists are chary of definiteness here. Reaction to K O H verbally suggested by Ballion, would be simple if as reliable as arbitrary. But it is more fruitful to study the processes pointing to the end results. We see cell wall lessening and nucleus growing in importance in the animal cell. We see cell wall becoming more and more starchy and of growing importance in the vegetable cell, and the nucleus is less marked. The vegetable cell is slowly storing starchy energy in its cell wall for future kinetic activity—as the remote forest, carbon-bed and coal oil. The animal cell is enlarging the nucleus, adding its inclusions—more rapidly preparing an assimilative product as though for immediate activity. It begins to assume the secretory functions which will fall to it when joined with other cells in effective association.

Activity, a different goal direction—*the suggestion of a shorter cut;* a differentiation of parts adapted to the quicker journey—these are easily discernable once well along the digression.

Have we any concept of the parting instant, and the forces leading thereto?

It is well known that plants seek the sun for their color. Banking the celery keeps the stalks white up to the chlorophyll of the top. The chlorophyll cells have a wonderful power of liquid crystal for-

mation, that their internal arrangement may help if the external presentment fails to lead the sun ray to the proper place. Vasodilator and vasoconstrictor stuffs tend to spread to the limit in the sun, or roll into balls to make vacuoles.

It is also well known that in daylight the chlorophyll gives off oxygen in exchange for CO^2, with which the thickening cell wall enriches itself with carbon; whereas, at night, like an animal cell, the vegetable cell gives off CO^2.*

Given these properties of the plant cell, and let the exuberance of its multiplication bring the noonday darkness of the overgrown jungle, and what follows? Absence of sunlight keeps the cell yielding its CO^2 perpetually like an animal cell. In this functional respect it becomes an animal cell. Its cell wall is thinned by continual loss of its carbon, the incessant strain of its crystal turnings—in the internal effort to catch the sun beam and warm the central color: turning convex, or concave, rhomboid, or prismatic, backward and forward in frantic search—not only develops its internal crystal activity, but by reflex on the nucleus which directs the activity, enlarges the nucleus. So the vine, losing

*See Gautier's Chemistry, Vol. II, page 50, for experiment extracting oxygen from cresson, by sunlight, leaving glucose.

its chlorophyll as it runs through its jungle-night to the sunbeam, finally pushes out into the tropical sun its tip cell: a cell with thin wall and big nucleus and a special internal crystal-forming development. We have seen the crystal turn at less provocation. The sun glass focus of the color octave upon the center of a cell thus prepared for its digression is an "indwelling" force perfectly available from our known syntonic order. We know the machinery for re-inforcement and interference. Or is a touch of the UNKNOWN ORDER decipherable upon this Portal?

The new digression, adjusted to the shorter cut, had but to be caught in the busy orbits, and the forces that have been stored for epochs were at hand for the new phase.

We see the common antagonisms: lethargy, activity, fulfilled requirements and unfulfilled; stability and motility. When all components of the vegetable found complete common interest in immobility, there was scant tendency toward the animal digression.

But when one of the sub-components advanced to a quality which required something it could not get at rest, a necessity for motility evolved into the animal digression.

XI

LIFE A SHORT CUT ON MATTER. ANIMAL LIFE A SHORTER CUT. THE SEX DIGRESSION AN IMMENSE GAIN FOR EVOLUTION.

Life, as vegetable, appeared as a short cut to the future. Sex digression, before the animal line started, was a great gain in force for evolution. The inner process of complete self-sacrifice was continued, but complete sacrifice was delegated, as "a division to labor" to this inner process, while the outer process retained approximately as much for itself as radium retains—and regains—after the formation of its emanation. Fractional demise, as shown by radium, is in contradistinction with the "celestial" process of selective involution. That is, the universe contains sub-components at all points on the cycle's curve—from gaseous nebula winding up, to coiled and unwinding dark body seeking a pulverizing collision. There are always processes

of all stages and ages on the measured way. The amount of duration contained in each determines its position on the BIG SPIRAL.

The animal line was a shorter cut on the short cut. The sex life brought a new power to evolution, and the separation of the sexes, later, arose from the same conflict when mutuality of interest was outgrown. When the mother had no longer to disappear by scission to give birth to two new beings, but carried a male process within herself which enabled her to save part of herself from the sacrifice—though there was still a completely sacrificed subself to yield—an immense gain of energy was made. All the "bare energy"—the life—of the individual theretofore had been exhausted in the reproduction. Now there were leavings of individuality, an Actuarium, to push forward the quality mount.

We have seen the tip-cell of the vine, by internal crystal stress and cell parts preparation, finally finding its needed color ray and sun-glassed into the animal digression. Perhaps the same jungle darkness stressed the two-sex bearing individual at a later period. The same color starvation may have induced similar internal stress at crystal turn, similar adapting of parts. The most active part would take greatest rapidity of stress, and break away from the part retarded by reproductive processes,

just as one sub-component is invested with greater velocity than its fellow sub-components when entering the short orbit; and another quality is reached thereby.

The zoologists say: "One gamete is distinguished by its smaller size, its great activity and its comparative poverty in granules of reserve food material; hence it is called the micro-gamete. The other gamete is distinguished by its greater bulk, its pronounced sluggishness and inertness and its tendency to form and store up in the cytoplasm reserve nutriment; it is termed the macro-gamete (cocidea, zorozoa). This condition becomes practically indistinguishable from the sperm and ova of the metazoa.

A given species may consist of three different types of adult individuals, male, female and indifferent, each multiplying its own line. Complicated alterations of generations occur, asexual and sexual. It is interesting to note *sexual forms produce more resistant forms capable of braving adverse conditions or violent changes.*"

There is proof that sexual generation brought more chromosomes, *i.e.*, color bodies. The moss plants and ferns still show an alternate generation of the asexual and the sexual. And the sexual doubles the number of color bodies.

The male element when freed from the female element, doubled the color at the center of life, increased the capacity for resisting adverse conditions and violent changes, and brought as great a gain to the evolutional movement as did the fact of sex. THE GREAT GAIN TO EVOLUTION FROM SEX AND SEX DIGRESSION IS ACCENTED.

With this evolutionary step we get first hint of a new force in the cosmos, an "overspace" lien, as strong as self-preservation, yet acting across measurable space, with pertinent relation to duration.

XII

The Associative Force and the Cell Bridges.

Some hint of the THIRD ENTITY which governs the two opposing processes may be found in what we call the Associative Force.

The electrons would escape us were they not impelled by a controlling force to associate themselves into an orbit as an atom. There may be anti-social, disassociated electrons adrift in space. But those associated in atoms are in unquestioned relation, one with the other. The experimental orbit made of magnets proved that an odd number was the more favorable for stable motion. An even number resulted in great instability.

Therefore at the start, and all the way up the complex line of life, is seen the inter-relation between all the components.

Disassociated vibrations would exhaust their scant solitude in eternity and store no energy.

The bacterial drift to center—colonization—is what betrays bacteria on the color plate. Between

bacterium and bacterium must exist a bond or law or force which puts them in the colonized order that delights the seeker's eye at the other end of the microscope.

"CELL BRIDGES" is the name of that which binds cell life in association. But this does not name the force which makes the tie that binds. "CELL BRIDGES" are "fine protoplasmic threads piercing cell walls and bridging the intercellular spaces when present." And while there is cellular independence, there is yet a mutual dependence as shown by the "cell bridges." One α-particle escaping from the gyrostatic orbit of a single one of the atoms making up the complex molecule of protoplasm, causes transmutation of matter. Perhaps this is the *living of the life,* the slow transmuting from the more complex to the simpler form. But that it sends its influence along the cell bridges to other mutually interdependent sections there is perfect proof.

We have seen orbit within orbit, reproductive process within a self-conserving outer process. So force within force will be seen acting up the complex line; but acting so the outer force may direct the complete and exhaustive application of the inner force, and yet reserve an *Actuarium* of its own (outer) force.

In this view life and age would signify multiplying parts of the same kind, in each differentiation, up to the ordained limit; then, by transmuting the atoms in the molecules, beginning the journey from complex to simpler form—the journey of ageing process to complete dissolution. Growth would imply adding to each different order of cell more of the same kind by cell reproduction, each atom of each component maintaining its gyrostatic state. Age would imply the gradual change in each atom by abstraction, leaving simpler and simpler forms until dissolution. The adult evolves, dissolves. Does the infant do other than multiply differentiations already inherent in the fused chromosomes? Either this, or the growth from youth to prime is an increase in molecular complexity. Is it?

This is sure: The ASSOCIATIVE FORCE which works, apparently, through the "cell bridges" determines form and mass.

The power of the ASSOCIATIVE FORCE to modify the mass and form—in the human being, the latest evolution—is being proven with startling force in the last few years. And this power seems to reside in part in the DUCTLESS GLANDS. The disposition of nature to preserve her averages—witness the mating of the "pituitary tall" with the "thyroid

small"—tells us of a definite law, or definite purpose regarding mass and form. And this may be the first known fact in solving the problem of the ASSOCIATIVE FORCE.

As differentiation is a different and higher process than multiplication, and must proceed from a different source, reproduction, therefore, is a progressively sub-included process. The parent cell of each differentiation must first emerge from the fused chromosomes starting the new individual. Then each such cell must have more of its own kind, up to the ordained limit. The first step would seem to be the making of the differentiations; the next, making enough of each kind. If the first be called a multiplication, the second process must be a sub-multiplication.

The experiments of Carrel have proven the "activating" qualities in the thyroid gland substances, for example. The clinical experiences of physicians who have changed form and mass with gland therapy, likewise have shown powers in these ductless glands hardly dreamed in former years. The unfathomed relation of malignancy of cell reproduction (cancer) to glandular disorder, has been discerned with sufficient clearness to draw study, at least.

While we believe that the "activating" forces are

in the ductless glands, and that they work their influence on cell reproduction by transmissions through the cell bridges—and send back by the same cell bridge route, their storing of differentiating energy in the germinal cell, concentrating thus in the chromosomes all the hereditary potentialities for the new journey—we are still far from seizing the ASSOCIATIVE FORCE, which determines proportions of mass and form.

Definite mass and form are in the design. There is unquestioned interdependence. The innermost precincts of all the cells are connected by cell bridges, but the proportional adjuster, the ASSOCIATIVE FORCE, is as elusive as when it began linking electrons into atoms, or atoms into molecules.

But we know it is wound into the chromosomes of the germinal cell. And these bear imprint from each cell of the outer orbit, conveyed along the line of the cell bridges.

The cosmos had already all the processes, all the routes canalized and directed. New ones would not be made when the old were direct and perfect. Even the epochally-old method of mere cell multiplication by division and subdivision was ready at hand—facile as routine. The only new need was the *differentiation*: and now we see it, being stored along the route of the cell bridge in the same old

method; only that possibly each new center had a new chromosome.

There is an inter-relation between electron and electron, between atom and atom, between molecule and molecule, between cell and cell—an ASSOCIATIVE FORCE which controls Mass and Form. And it eludes us as surely as the elusive "thing which changes," at each ETERNAL CONSTANT.

It is non-material. It is selectively coiled into each center of differentiation in each color-body—therefore, carried along from generation to generation; or it exists as an ETERNAL ENTITY acting from without upon matter which yet does not contain it.

Nature requires neither measure nor count; time and space are prodigally disposed; and contact is nowhere requisite for contiguity. There is no marvel in the space between the electrons which cluster to make an atom; nor at the "light years" distance between the sun and the last driven dust particle, turning to collect its mass for the sun-pull home. The yearn of the exiled male element for its former home shows that it too is in relation with an Associative Force somewhere—the greater the distance, the more difficult the journey back, the stronger the force.

This force is a biological "over-space" force; not

matter, yet requiring matter for its revelation. It is probably the differentiator as well as the color-doubler at the center of life. Its relation to the glands is as well known as the glands' relation to mass and form.

XIII

THE ATTRACTION OF LIFE FOR MATTER. THE EXPLOSIVE MOMENT WHEREAT LIFE'S SELECTIVE INVOLUTION BEGINS EVOLVING.

Virgin space, just ionized, might behave differently from space escaped from matter, as bubbles escape from the water which catches air in falling. If there be an ATTRACTION OF DURATION FOR MATTER, the first generation of matter—the initial spiral nebula—may be presumed to have differed from the following generations in not having been there before. Remagnetized space may "know without learning" its coiling direction, with even less wonder than life shows in "knowing without learning" everything instinctive and intuitive regarding itself in its former experiences in previous generations.

As fantastic as this may seem with matter, as common as it is known to be in the microscopic color-patch of life—yet the revelation of radium

makes it evident that matter has been there before. Soddy says:

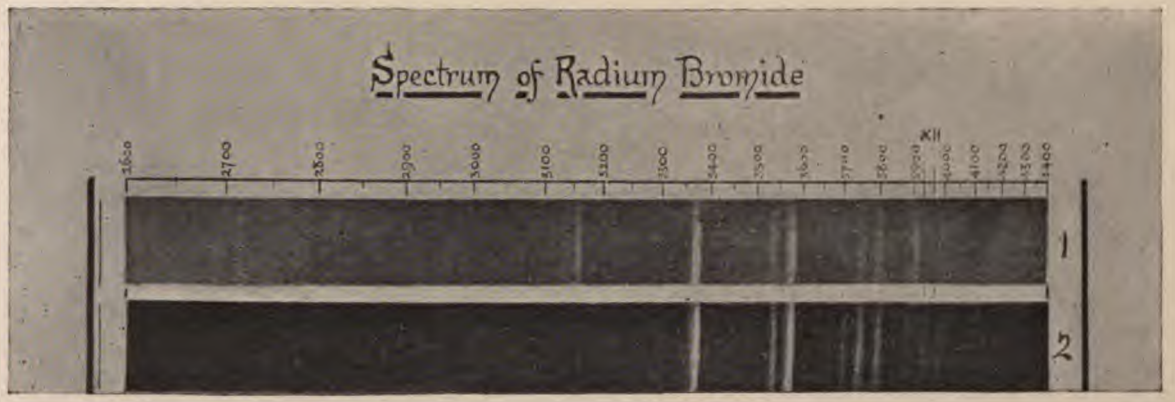
"Other atoms may have existed and been weeded out; unstable ones may be being created always, but fail to accumulate. Among the less than one hundred now known our rarest atom has required for its formation 1000 million years, our commonest, one billion years."

The matter indwelt by our life, therefore, has been used and re-used millions of times, from star dust to spiral nebula—up and down the processes—perhaps even for previous lives, many times before.

Matter feels the call of gravity, of duration—perhaps of life. The nitrogen cooing at the leaf edge, trying to get back into life, may be reality beyond our imagery. Indeed there is a strange resemblance between the spectrum of nitrogen and that of radium.

What is inference and what is proven both show that the thing which passes is more important than any change or state passed. What was vibrating at nitrogen's speed and again at radium's speed, is the elusive that discloses its characteristic when it associates so much future into a second of the present.

Evolution, the ratio disturbance, could only unwind what was there. Involution must wind it back selectively if followed by similar unwinding each



1. Spectrum of Radium Bromide. 2. Nitrogen : Band Spectrum.

"Nitrogen cooing at the leaf edge, trying to get back into life, may be reality beyond our imagery. Indeed there is a strange resemblance between the spectrum of nitrogen and that of radium." See Page 110.

It will here be seen that the "vital" velocity is not necessarily in relation with density, or atomic weight.

time. The slight variation at each unwind determines progress or recession.

Life and its reproduction show this at its highest value.

As Prof. Adami has pointed out, the nature of procreation has been known to us for scarce a generation. In 1875 was fusion of the nuclear material first made out. From then dated the knowledge that from "a single call from the male united with a single cell from the female" began the life history of the individual.

Voluminous data on the subject is now available to the biologists, though many of the assured findings are still uninterpreted. The bodies in the nucleus of the tissue cells of the genera and species which have stainability—a relation with the color octave—are the *color bodies* or chromosomes. The striking constancy of the number of these for each of the genera and each of the species, shows us that we have another distinctive series of Eternal Constants, which, when properly read, will tell us much of the history of evolution. This color relation is even more strikingly manifested in the cells presiding over reproduction, so that scientists now hold that "all living things are what they are because of difference in the manner of cell division at their reproductive period."

We would put it the other way. *"The differences in the manner of cell division at the reproductive period are shown because into the color of the nucleus of these cells have been selectively involuted the causes which make all living things what they are."*

Packed into the atoms which form the molecules of germinal protoplasm, are stored the potentialities of the evolving individual. And each such color magazine of stored energy is primed and ready for syntonic call to evolve. Each, when set off, will evolve in an absolutely constant time and manner, precisely according to what has been coiled into it.

Man is supposed to have 16 chromosomes in the tissue cells.

The mouse is supposed to have 24 chromosomes in the tissue cells.

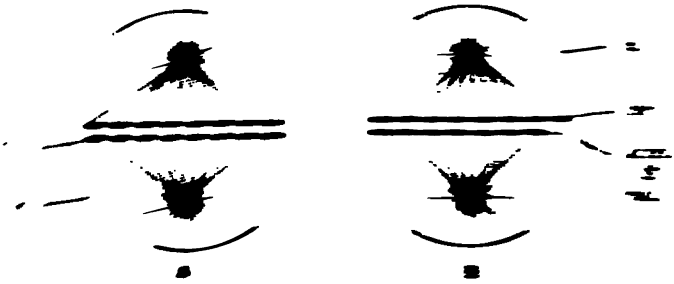
The lily is supposed to have 24 chromosomes in the tissue cells.

Ascaris megalocephala is supposed to have 2 chromosomes in the tissue cells.

Crustacean Artemia is supposed to have 168 chromosomes in the tissue cells.

The germinal cells have half the number contained in the tissue cells. As we looked into the sun to study the drift to center in the atom, so we may study the smallest orbit of sex manifestation in the most complex—the human male and female (although the work on the chromosomes has been done on plants and insects).

Eleven to fourteen days after human coitus, the



[illegible] of the Chromosomes

[illegible] the eight pairs of chromosomes which [illegible] normally [illegible] cell, [illegible] eight are [illegible] the "sex chromosomes" [illegible] the [illegible] of the human ovum, while "missing" [illegible] Human cells [illegible] supposed to contain 24 chromosomes, [illegible] human germ cells [illegible] contain eight chromosomes in each set.

[illegible] eight [illegible] eight from each set, from which [illegible] combination [illegible] the [illegible] form [illegible] if [illegible] male normally results [illegible] one chromosome [illegible] missing—formerly called the *accessory* chromosome, from which [illegible] number [illegible] a male [illegible] a female normally results.

[illegible] the "resting" period [illegible] result is said [illegible] be passed [illegible] "maturing" the [illegible] male element [illegible] the [illegible] [illegible] required [illegible] [illegible]. [illegible] be seen [illegible] equilibrium, [illegible] rearrangement [illegible] interference [illegible] which [illegible] sex may [illegible] with [illegible] chromosome, [illegible] missing chromosome.

fertilized ovum has just reached the womb from the ovary, whereat conception took place. During this time, the mystery of fusion has ensued. The male element has made its way to the ovary, entered it and sought the ovum. Relatively, as a "pin-head to St. Peter's dome," in size, it has made a hungry journey through the stored nutrition to the nucleus of the huge ovum. Conception is still unachieved.

Carrying its half quantum of 8 germinal chromosomes, it ranges them opposite the 8 germinal chromosomes of the ovum, as if in battle array. This is the bright color line about which has centered most of humanity's love, ethics, religion and law—the "quadrille" or "contradance" of the chromosomes, in their mitotic field before fusion.

Eight female color bodies face the eight of the invading male. There is a period of mutual "rest"; there is the fading of a sub-component, as in radio-activity; an equilibrium is overturned; there is a final explosion, and fusion along the lengths is completed. Conception has now taken place. A new individual has been selectively involuted into the color-patch at the center of a single cell, *and evolution begins at the moment of the explosion.*

The light color bodies in each opposing line carry the tightly wound finalities of two races, with

[illegible] instinct, emotion, personality—from brain [illegible] to race [illegible]. There are reinforcements and interferences along the "resting" nerve lines, which settle [illegible] retention and recession.

There are many reasons for believing that this is the period of determination of sex and also of hereditary type. The sub-impulses which incite, and that which is reinforced, are but re-enacting here the "terrestrial" process down and the "celestial" process up—under the rule of the governing NERVE ENTITY.

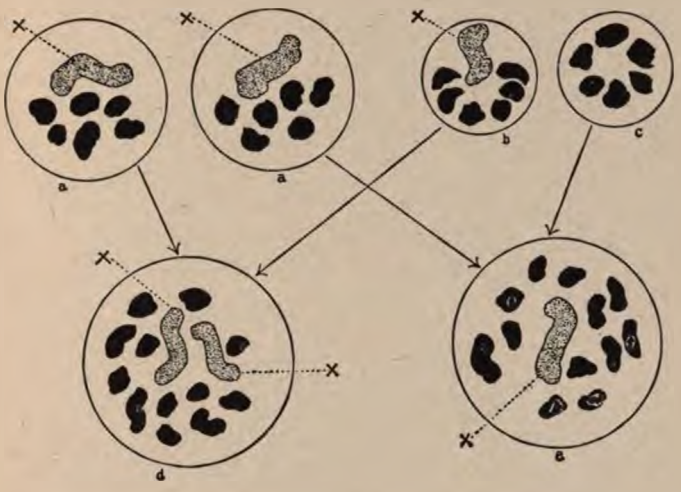
The figure on opposite page, taken from "The Mechanistic Conception of Life," Loeb, page 9, presents another view of the unpaired chromosome.

"In many insects and in man the cells of the female have two sex Chromosomes. In a certain stage of the history of the egg one-half of the Chromosomes leave the egg in the form of the "*polar body*" and it keeps only half the number of Chromosomes. *Each egg*, therefore, retains only one X or sex Chromosome.

During the critical, so-called maturation division of the sexual cell of the hybrid, a division of the Chromosomes occurs, whereby *only* one-half of the sex cells receive the hereditary substance in regard to which the two original pure forms differ. This is what takes place *directly* in every male animal. * * * According to *Guyer* the sex in the human species is determined by the Spermatazoon.

Of the pigment chemical substances in the Chromosome which are *responsible for* the hereditary transmission of a quality:—"It is *known* that *for* the formation of a certain black pigment the *co-operation of* a substance—tyrosin:—and of a ferment of oxidation—tyrosinase—is required."

"The hereditary transmission of the black color through the male animal must occur by substances carried in the Chromosomes which determine the formation of tyrosin or tyrosinase, or both."



DIAGRAMMATIC PRESENTATION OF SEX DETERMINATION IN AN INSECT. (Protenor.)

a.a are the nuclei of unfertilized eggs. Each contains one sex chromosome marked **X**; the other six dark spots are the chromosomes which are supposed to transmit hereditary characters not connected with a sex. **b** and **c** represent the two different types of sperm; **b** containing a sex chromosome **X**, **c** being without such a chromosome.

d represents the constitution of the egg nucleus after it is fertilized by a spermatozoon of the type **b** containing a sex chromosome. This egg now has two sex chromosomes and therefore will give rise to a female. **e** represents a fertilized egg after a spermatozoon of the type **c** (without a sex chromosome) has entered it. This egg contains after fertilization only one sex chromosome **X** and hence will give rise to a male.—(After E. B. Wilson.)

—From this also it may be deduced that there is a sex determining element in the male sperm which meets reinforcement and interference,—rejection or acceptation,—during the "rest" period of the contra-dance of the Chromosomes.

See notes.

The writer has elsewhere written of the control of the sub-component—augmenting or repressing—and thereby, if not absolutely controlling sex, at least modifying mass and form. The giant trees of California and the dwarf trees of Japan are, respectively, products of sub-component reinforcements and interferences.

It may not yet be given us to place the sub-component on the short orbit at an appointed time; to alter duration, velocity, or intensity; but there are some hints that these are alterable by external conditions.

XIV

The Intermediary. The Sub-Components with Impaired Duration. Malignancy.

The duration allowed the sub-components, therefore, is a question of vital import. Compressed, or extended—reinforced or subjected to interference—the equilibriums of life and matter are thereto vitally related.

That "the thing which changes" is benign at one quality and malignant at an infinitesimal difference in quality, is one of the secrets of the universe with immense bearing on our existence.

And the power of the Associative Force—or the THIRD ENTITY—to make this infinitesimal vibratory difference, explains how easily a climbing organism can "hemolyse," or make food for its advancement of any enemy in its road. This is one of the most important factors in the evolutionary rise of genera and species.

Though the higher represents a successful digestion—cytolysis, or "hemolysis"—of the lower or-

ders all the way up the line, the higher order is instantly and always at the peril of destruction by reversal of the process by the lower orders, animal and vegetable. The plasmodium, the bacterium, the differentiational defect in the Associative Force which we call malignancy—all are threatening an unwind back to extended space.

Disease seems to be an effort of the vegetable kingdom to re-establish its sway; its first effect being to immobilize the animal.

The great difference made by slight variation of the sub-components is illustrated in the recent studies in pneumonia. A proper increase of effective leukocytes will destroy the pneumococcus and a cure results. Winternitz and colleagues at Johns Hopkins have compared the influence of two related substances in pneumonia. One, benzol, not only destroys leukocytes, but attacks bone-marrow and other blood-making sources. Tuluol, closely related, does not touch the leukocytes, yet attacks bacteria. Animals with pneumonia succumb to the *conjoined cytolysis* when given benzol, but show no lessening of leukocyte resistance under the *selective cytolysis* of the closely related toluol.

So by slight syntonic variation a destructive becomes constructive in the progress of life up the species.

ing intermediary puts the sub-component at the mercy of the exterior. One vibration meeting reinforcement or interference may be potentially the start upon the retrograde journey—*a bit of duration lost from an important sub-component.*

That the glands are the intermediaries between the animal kingdom and the vegetable storehouse of solar energy, seems proven by recent experiments. In the same sense, the chlorophyllian function of the vegetable is probably an analogous intermediary in tempering solar energy to the vegetable. The chlorophyll is therefore an *intermediary to the intermediary,* and first temperer of solar energy, for its safe and final entrance into the animal kingdom.

It has been said that life need not have fixed carbon and nitrogen as its choice; but having identified its form with this choice—rather than other possible forms involved in a different selection—it has been found necessary for the chlorophyll to store something that would otherwise have flown away; to save solar energy for future explosion.

As the vegetable kingdom alone gathers solar energy and stores it for the animal kingdom, *the animal kingdom is thereby usurping a vegetable kingdom function when receiving direct impressions from the solar energy.* We saw the animal digres-

sion arising when the vegetable tip cell was made to usurp the activities of an animal cell.*

The animal kingdom is reverting to a vegetable kingdom function when it absorbs iron, for example (as it may do), directly from the mineral kingdom, or receives the solar energy without proper intermediary, or requisite pigment covering. The excess pigmentation in pregnancy and at the climacteric, and pigmentation as a threshold to malignancy, deserve study. *It is not inconceivable that malignancy may start as an inharmonious pigment deposit in a cell center.*

The color relation of arterial and venous blood to iron and the solar ray is well known. So there may also be a reversion, by anaphlaxis, to the vegetable cell function in malignancy when there is a missing intermediary—as when glands are invalid.

It would seem that the proteins, being a vegetable kingdom derivative, are selectively adjusted by the glands while valid—whereas glandular in-

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*The fungi feed like animal cells on already formed organic substances. "Renouncing vegetable alimentation they have been brought to a standstill, these children of the vegetable world." As disease is the process of bacteria feeding on already formed human organic substances, all the infections may be considered the result of this missing Intermediate,—the reason for anaphylaxis. (The Drosera and Dionaea are also insectiverous plants.)

validity allows access to the animal of an unadjusted material.

It seems paradoxical to say that *meat* eaters are partaking of a vegetable derivative. Yet as with milk and eggs, these proteids are but the nitrogen and solar energy packed by the chlorophyll of the fields for future explosions. Vital glands adjust them to animal organisms. *For without glands, what determines that the contents shall not "hemolyse" the container?*

The intolerance of the system to nitrogenous products, (as during pregnancy when the glands are employed with the new life unfolding; in Grave's disease and at the climacteric, when they are becoming invalid) has in it a suggestion of an anaphylactic reversion in function to the lower kingdom because of the missing INTERMEDIARY. Even in cancer there is a strong tendency to regard the perversion of cell growth as due to faulty metabolism, principally of the protein elements.

The Intermediary between the vital part and the exterior is as important as the brain pan cover for the cerebral convolutions.

XV

THE GLANDS AND THE ASSOCIATIVE FORCE. INSTINCT, INTUITION; NON-MATERIALITY, THE ONLY NEW ENTRANT INTO GENERA AND SPECIES.

The ductless and other glands of the organism, including the brain, are in proven relation to mass and form. Their relation to malignancy of mind as well as body seems close enough to invite serious study.

As early as 1908 the writer wrote of the relation between the glands, radium and malignancy. In 1913 Medical Congress at London the question of radio-activity of the glands received public recognition. They may contain a new radio-active element in the progeny of radium, *and the assumed "δ-ray" therefrom may explain personal magnetism.*

They are as related to duration as is the solar swing. Indeed in human menstruation—in nocturnal and diurnal "alkaloidal" variation of secretions —they attach themselves to cosmic rhythm. They sprout and fade with average duration—*though*

they show individual variation enough to suggest sub-components whose investments of duration are lengthened or shortened by exterior conditions. They gather force and expend it by explosion, retaining a small fraction of the original charge until new force has been stored. The definition of radium, its emanation, and its recovery of full radio-activity, precisely fits the glandular process. Soddy says:

"A radium salt is dissolved in water, and the imprisoned emanation, *which was formed but stored during the previous month* through the whole mass of the substance, is thereby liberated and escapes.

"The radium left to itself continues to produce fresh emanation at a steady rate. The released stores of emanation begin to lose their radio-activity, and in a month have lost all, while in the identical time the radium (which only gave ¼ as many α-particles as normal until now) has been restored to its full quantum."

This regeneration in thirty days is more mysterious than any other fact, and seems almost a secretion, or like a cerebration.

That the glands are the Intermediary between the vegetable and animal kingdom—as the chlorophyll is Intermediary beween the organic and inorganic kingdoms—seems illustrated by removal of the thyroids from meat-eating dogs, and feeding half of them on meat and the other half on milk. Those fed meat die; those given milk live. The

absent thyroid makes the difference; and milk is shown to be an "Intermediary" food, with its small proteid contents.

Carrel and others have proven that glandular stuff "activates" growth. If so, opposing glandular stuff—vaso-constrictor as compared with vaso-dilator—should inhibit growth. Therein, we have equilibrium, sub-component reinforcement and interference, a disturbance of ratio, and an explosive change: the whole radio-active picture. The "third entity" of proportion seems presiding even in the brain, which has a radio-active analogue of thought production (or secretion). Sex has been changed by transplanting glands from the opposite sex. Maternity has come to a woman in glands transplanted from another woman replacing her own glands removed by surgery. Even mental disorders, recently *have been adjusted to the law of proportion and cured* by glandular feeding, and patients with dementia precox are having glands transplanted to them for the cure of insanity. What lacks in mental malignancy of mania but an unchecked multiplication of thoughts? The whole past tries to get into the present at the same moment. The control, the correlator—the Associative Force, the Mind's Core —is gone, temporarily or permanently. What keeps out the irrelevant is not there.

The *mental age* in other disorders of the mind, depends not on the childlike vividness and exactness, but upon the correlating capacity. The "adult age" of the sound mind may have much duller impressions than the vivid and exact person of young "mental age;" but the proportional sense shows which is competent and which is incompetent.

Competence may imply even dimness in some of the details; whereas the vivid details of the low mental age lack proportional adjustments.

The Associative Force at the core of all being is the named elusive which baffles our search. This is the one triune power, not only to produce quantities of cells of the same kind, but to produce a precise proportion of different kinds and then further proportionately multiply these different kinds into more of their own kind. This power to segregate an all-consuming function and make it a directable sub-function, and regulate its mass and form—*this power to exist in the outer orbit and control the internal ultimate through all intermediates,* is what sets the border between different kinds of tissue—a ratio which is only violated in malignancy.

Fat seems to be the only tissue in the human body which is not strictly limited by contiguous relation. Nor does the fat cell seem to be connected with any center in the chromosomes of the germinal cells.

Nor does the fat cell seem to possess a hormone—though its retrograde breaking up produces an acidosis which is very harmful at times. And the fat cell is, nevertheless, in direct relation with the ductless gland cycle, as is routine demonstration in gland feeding. *Obesity seems in dim relationship with malignancy.*

All the other cells of the body have hormones, and are not only limited as to form and mass by contiguous cells, but have an inherent power to protect their own tissue frontiers. The lip must never grow too far down the face. All such valid cells are believed to be connected by cell bridges with color centers in the chromsomes of the germinal cells, receiving influence therefrom, and transmuting influence thereto for the next generation.

If the thyroid be an INTERMEDIARY, we may understand, when we consider the close interdependence of all the glands in the cycle, why the decay of the reproductive glands would so affect the thyroid that one thereafter digests meat with difficulty. All the metabolic disturbances of gout, arterial hardening, renal insufficiency which come from meat eating after the climacteric, seem to show the relation to the glandular cycle—especially as it is for the stimulation of the ptomaines of the meat to replace

the zests formerly supplied by the gland cycle, that recourse is had to the gamiest meat by the *bons viveurs*. This may partly explain high arterial pressure at the advent of sex failure. It may explain the dangers of proteins in pregnancy, when the woman's gland cycle is otherwise employed, and a meat diet frequently leads to eclampsia.

The frequency of malignancy at the time of the wane of the gland cycle also shows a relation between it and the glands. For what is cancer but an unlimited multiplication of cells of the same kind, and showing but half the number of chromosomes normal to the tissue cells. It is as if, disconnected from normal Associative Force, a cancer showed cells from which all the maleness or femininity, respectively, had been dissolved, allowing unchecked multiplication of undifferentiated half-quantum cells, such as might have grown in a maternal organism in asexual generation—as in the alternating generation of the Algæ.

The glandular cycle, acting through the central nervous system, apparently governs mass and form, and also stores instinct and intuition. There are many reasons for believing the glands contain the body's radial store—not radium itself, but an unknown quality lower down in radium's lineage, under the same transmuting laws, tied to a similar definite time relation.

Matter replies with mathematical changelessness to gravity. Matter seems to answer the call of duration. The intensity of the sub-components may be altered by increase or repression: as the male voice is low and the female voice high in vibratory quality, and we alter both when removing the glands presiding over reproduction.

The duration of life rests in the glandular cycle, and life (like radio-active substance), *proceeds to the end by fractional demise.*

"Instinct" and "intuition" are the syntonic keys by whose unerring selection what is needed for our existence is taken from infinity about us. When our receivers reduce their velocity, unwind their duration, lose their sub-components—and change to a less vital grade—the process of aging, or fractional demise, is apparent.

We may, therefore, date the beginning of the aging process from the moment the many kinds of cells have made their allotted number of each kind, and the transmutation of the atoms in their molecules begins.

The privileged moment is youth, while the sub-component lives. The problem is to prop the faltering sub-component. And nature's solicitude for the thoroughfare of life, and her indifference to the *terminal individual past the reproductive period,*

make the problem almost unsolvable. Life, in the terminal days, seems almost in defiance of the purpose of nature. Yet it is the antagonistic aim of the individual.

Man usually does not start his journey back to space until the end of his reproductive period. Apparently, the highest spins of his mind (wherewith he might store the chromesomes of his germ cells with higher mentality for the next generation), are not made until *after* this period. This is one of the means by which Nature's averages are kept. The intellectual giants of a race are less gigantic and nearer the general average in their reproductive period; otherwise there might issue supermen.

The best treasure of the line may come from the blind alley of non-reproductive life from whence proceeds the "brood care" of statecraft and civic contribution to future generations. Tree-planters, posterity comfort planners, forest conservators, foundation layers for duration—are principally in the blind alley, wherein *there is no further coiling in the germinal chromosomes.*

The variation in the unwind—the slight gain of duration—*is the point whereat all the improvement is made.* Evolution has been coiling higher, an almost imperceptible advance, covering wide

stretches of time. It may be possible to spin velocities even higher.

This takes full cognizance of all work done to prove that artificial mutations are not transmissible. Mutations resulting from *habits* arising from ancestral *tendencies* may sometimes seem to show a physical basis in posterity. But only non-physical tendencies are transmissible. Otherwise, a human biologist could write *his* will in a line of guinea pigs.

The nostalgic tendency may no more cross species than may the blood—which constantly hemolyses. The vigilant guard at the portal only admits non-materiality, and non-materiality apparently seeks only the ordained channels, in lawful ratio, and scorns freakish disproportions. *Even efficiency meets its curb when it violates a ratio of justice and proportion.* It is therefore, not "the survival of the fittest," but the constant dominion of the THIRD ENTITY which adjusts overgrown proportions, and ordains what shall be reinforced and what shall meet interference; which shall digest and which shall be digested.

And the possible VARIANT in the glandular subcomponents is the only point upon which life may concentrate a willed purpose for self-extension.

XVI

THE SHORT ORBIT. THE SUB-COMPONENT ON THE SHORT ORBIT INDICATING THE FUTURE. MAY WE IDENTIFY AND REINFORCE IT?

If ratios are so sacred that even efficiency may not violate them, opponents who may violate ratios are implied. A MUTUALITY OF INTEREST FOR THE OPPONENTS UP TO A CERTAIN POINT IS ALSO IMPLIED.

Even the energy of the α-particle itself arises, not from internal propulsion, but from the resistance overcome in its flight. *This implies a necessity for antagonism in the cosmos wherewith to generate its forces.* "The sweet uses of adversity" are cosmic as well as individual.

The solar system itself which acts as though it were being pulled in a certain direction, as a single entity, we now reason is acquiring energy traversing its atomic field and is tending toward a fixed portal, whereat will ensue a transformation when its duration is spent.

It must follow that there is more than duality, and more than limited mutuality, and more than counter resistant. A LAW OF JUSTICE AND PROPORTION MUST HAVE BEEN ETERNALLY PRIOR TO ALL PRIORITY; and we are as near to the *logos* at this point as finite mind may come.

Whatever placed a positive charge at the core of the atom to neutralize the negative charges of its rotating electrons, not only bound both in mutuality, but set the ratio which might not be passed without transformation.

The THIRD ENTITY is therefore constantly obeying the Cause and always compelling each of the many changes upon whose rapid succession life depends. But the THIRD ENTITY is an obedience to the Cause, not the Cause itself.

* * * * * * * * * *

The very bestowal of duration itself seems under the proportional law. Each sub-component is probably given a duration related to the diameter of its orbit. The orbit of the forming nebula was space along a diameter of "light year" distances. The diameters of the contracting orbits became successively and proportionately less, the velocity greater. Therefore, velocity, duration and space are constantly and continuously changing relations.

The central drift of each orbit in the spiral, with

uniformly accelerated motion in some lawful relation with each uniformly contracting diameter, tends resistlessly to the appointed orbit at the limit of its duration.

This final orbit, THE SHORT ORBIT—where the central-drift meets the elastic outward propulsion from the center,—is reached at the eventful moment. The particular sub-component on the short orbit has spent its last duration; the explosive moment is entered and transmutation occurs. We might trace a brightly marked log swing surely toward the short orbit of the maelstrom. But what spiral sub-component is entering its short-orbit in radio-activity, eludes us.

But the IDENTITY OF THE SUB-COMPONENT, in larger relations, may be made all the way up the line of evolution. In all the departments—from genera and species dominance to the vex of the latest sociology at our church doors—may be discerned the analogue of radio-activity's two opponents, the THIRD ENTITY, the final short orbit, the spent duration—and the change.

In one year 1/2000 part of radium will have died; but twelve different generations of the emanation will be born, stored therein and will transmute their progeny and die. This is a Fractional Demise, always partially co-existent with some of

the progeny—a process which gave "brood care" its force in evolution. So the cosmos has worlds of all ages, coming and going, that all will never expire together; and yet every unit of duration marks a sub-component upon the short orbit. But the universe continues and society never dies.

But when time is ripe and the identified sub-component is entering the short orbit, if we may not prop the faltering sub-component and postpone the change, we may at least estimate if the explosion will be earthquake or quiver. What part of the present enters the short orbit may tell what sort of future is about to be made.

XVII

NEW LIFE CONSTANTLY BEING FORMED. THE ULTRA-MATERIAL RESERVOIR IN THE UNIVERSE AND ITS SELECTED IDENTITIES. THE ALTERABLE VARIANT.

We have, therefore, newly fallen upon an energy measured to be 250,000 times greater than any before known. We see it in the incessant detachment of duration from space as sub-components fade, and radio-activity ensues. We see duration incessantly rewound upon space, and the "celestial" becomes "terrestrial."

Radio-activity has thus disclosed many new secrets of nature. We trace "the thing that changes" through many constant portals of change. We name the manifestations; but a million millionth part of a variation may turn the known manifestation into an unknown malignant; and a similar variation again make it benign as it passes onward beyond

the ultra-violet to infinity. And this is the path selected by the Cause for the pageant of life.

* * * * * * * * * *

Whether fertilizing a sea-urchin in salt water*, or abruptly transmuting radium to its emanation and beyond*, or turning a rhomboid to a prism*, or harassing a cell nucleus till it changes its kingdom*, or transferring a sex*, or changing dwarf to giant* —nevertheless science is still only traversing the path.

To unlock the eternal energy of matter, to hold the secret of reinforcement and interference of respective colors at the nucleus of life; to determine sex; to mould form and mass; to trace the route from the fused chromosome to the solar drift through space—is to come hot upon the trail of the Cause—but not to come upon the Cause itself. The trail, the path, the thoroughfare may show the Cause is passing or has pased—but the Cause itself still eludes.

We find a physical basis for radio-activity; it is proportionate to the mass. So also in chemistry and physics. But there is no such proportion, no such materiality, for instinct, intuition, intelligence, for the core of the atom, the tendency of the gland,

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*Notes will be found on page 141. The figures in the margin indicate the page and line to which each reference belongs.

the controller of the mind—or the Associative Force.

There is no relation to mass.

The impulsion that is in the seed is not matter. The differentiations involuted into the chromosome are not matter. The push outward from the fused chromosomes to the many finalities—not a moment misjudged, not a form transcended, not a mass overgrown—is a non-material power only related to matter when it has selected, massed and indwelt it. The Cause in the seed may multiply its sub-causes which collect other matter to indwell; but it never is at any time itself material.

It is an overpowering thought that the identical matter which our non-materiality gathers to indwell—to pass across—pre-existed and will survive the organization; it has been used and re-used many million times before.

The tendency took precisely enough of the pre-existing atoms of the universe to manifest all *the subdivisions the tendency itself sub-contained*: for we are now familiar with the process of life whereby the outer controls the included and sub-included.

We may say that the ultra-material is the Cause which orders the Associative Force and marks the Eternal Constants; and tendencies of unerring sureness and justice are retained in the non-material

reservoirs of the cosmos. What the tendency passes to the sub-tendency, and to the still further sub-contained—each preserving its precise difference of duration, its precise multiplying of mass, its precise proportional relation to the others—is more important than any mass of matter indwelt and moulded thereby.

We know each process when in contact with matter; but they all escape us when minus their materials—as light would escape us without the intervening particles by which it is manifested. That non-materiality should be wound selectively into the microscopic color-patch of a single cell—as unerring controller of forms and duration, as knowledge that has "never been learned" by the individual indwelt; as racial intricacy, instinct, intuition, even aspiration—indicates that there is about us this reservoir of powerful non-materiality with which we have definite, measurable relation.

The definite purpose with which it winds up suggestions a surely selected identity. We conceive detachment from the mechanism in the WILL which the THIRD ENTITY obeys—which allots DURATION to the sub-component. We conceive a purpose as definite in the measure of the short orbit as in the space and duration involved in the Earth's orbit around the sun. We conceive as definite a reason

in the selective designs shown in each differentiation, in each division of labor and the ratio set therefor, as in the measure of the long or the short orbit. Identity, synchronosity, velocity, rhythm—these are what make the syntonic wireless receiver ignore all other chatter and vibrate only with its own. The ear picks its known word in the polyglot hubbub, and the eye lights with joy when its own stands out from the otherwise homogeneous crowd.

DURATION, INDWELLING FRACTIONS OF SPACE, IS THEREFORE THE DETERMINING REALITY, the syntonic key which non-materiality compresses into the color patch, attuned to ignore all other chatter, and draw from about it, its precise necessity of reinforcement.

Therefore, we no longer view change and decay in a spent and dying universe. The newly revealed universe, definitely related to time, contains all the forces for its own regeneration, and is forming new life about us at every moment.

Non-materiality apportions and winds up. It aims, through a color-patch, at a definite unfolding design. There are identities that it seeks with the sureness of an acid for its base.

It leaves to life a small VARIANT between the generations, and in the Duration within the glands,

whereat alone willed purpose may concentrate to alter.

This fleeting VARIANT, seemingly negligible, is yet exactly the measure of life's opportunity for self-determinism. Evolution is the record of the use of this VARIANT.

FINIS

NOTES

CHAPTER I.

Page Line Note

5. 3. 1. Soddy, (Interpretation of Radium).

13. 2. Rutherford, 3rd Edition, 1913, "Radio-active Substance," 141.

16. 3. Rutherford, 3rd Edition, 1913, "Radio-active Substance," 56-76-et seq.

6. 3. 4. Soddy, (ibid-214).

22. 5. Prof. Frank D. Adams, (McGill) Columbia College Lectures, Feb. 25, 1914; and Prof. Jacobi, of the Chair of Astronomy, Columbia College, lecture of March 14, 1914.

Dark Objects Seeking Colision in Space: The astronomers still think the earth will eventually grow cold and become a "dark object." Of course actual collision is not necessary for disintegration, for masses are torn away toward heavier objects even when there is no collision, and the heavier body may then go off in space, after having scattered the mass of the adventitious "dark body" which temporarily deflected it into an orbit therewith.

The Chamberlin-Moulton theory is based upon observations made twenty years ago by Keeler at the Lick Observatory. Moulton thinks all the nebulæ are spiral. These views are shared by the majority of modern astronomers, though some—with them apparently Professor Jacobi—prefer to think that some systems may be formed in other ways,—not seeing "why it must be assumed that all must develop in precisely the same way."

Soddy refers to the reluctance of astronomers to accept Prof. Joly's calculations that the Earth's rocks contain enough radium to supply all the heat lost by radiation,—and more.

Page Line Note

Theoretically there should be as many "dark bodies" as light bodies in space. Being dark, of course they can not be seen. Prof. Jacobi, March 25, 1914, showed at Columbia College, for the first time, a photograph taken by Prof. Parker, which was apparently a dark object between the earth and a nebula.

The Philosophy of Radio-Activity points to the probability that there are not as many dark bodies seeking collision as the astronomers infer.

Prof. Perrin says: "We are sure the sun has not cooled in a billion years, and has heat enough for another billion." The age of the Earth is calculable by the radio-active process.

7. 7. 6. Compare Chapter VII.

8. 3. 7. Prof. Harrington, Columbia College Lectures, 1913-1914:

The spectrum tells us whether the stars and nebulæ are gaseous or solid, and whether they are moving to or from us, in this way disclosing many twin stars on small orbits. Sirius, for example, shows the F-line, and is disclosed to be a new star,—a mass of burning hydrogen gas in a compressed state. Many astronomers believe the Earth is the only planet containing life at the present time.

6. See note 5.

26. 6. Whetham, p. 321.

9. 7. 9. Rutherford, ibid, p. 619

19. 10. Rutherford, ibid, p. 621.

26. See notes 5 and 7.

10. 7. 11. Soddy, 151.

15. 12. Soddy, ibid, 125-128-133, 139, 170.

11. 10. 13. Soddy, ibid, 221.

CHAPTER II.

13. 4. 14. Rutherford, ibid, 16.

19. 15. Soddy, ibid, 65.

14. 7. 16. Soddy, 82, 171, 235, 236, 237. Also see note 5.

15. 12. 17. Soddy, 108, 191.

25. 18. Rutherford, preface to 1913 edition.

Page Line Note

16. 18. 19. Soddy, ibid, 224. **Four** is a significant number in Radio-activity and Biology. The radio-active descent is by subtraction of four from each atomic weight. The emanation of radium halves itself in every four days. Compare the four spermatozoa in reproduction—three of which are rejected as "polar bodies." This rejection is a sign of a selective and affinitive relation during the "Chromosome Contradance."

18. 8. 20. Rutherford, 21, 598—see page 458: "The average life of radium is about 1800 years, and half the radium is transformed in 1300 years."

15. See note 20.

19. 18. See note 9.

20. 2. 21. Whetham.

4. 22. Soddy.

21. 10. 23. Rutherford, 256.

22. 9. See note 12.

23. 3. See note 19.

24. 11. 24. See Chapter XV., p. 123.

CHAPTER III.

26. 7. 25. Herbert Spencer, Principles of Psychology.

27. 4. 26. Barker's Physics, 241.

21. 27. Ibid, "Light."

28. 17. See note 14.

21. 28. Bergsen's Creative Evolution.

30. 15. See notes 5 and 7.

26. 29. See Chapter XIV.,—Malignancy.—As pulp is lost from our glands, it is replaced by fibrous tissue, as though Space were trying to repair Time.

27. 30. See Experiment of Richet and Portier in Anaphylaxis. Burnett, "Microbes and Toxins," pp. 233 et seq.

31. 5. See note 29.

31. See Chapter XV.

11. 32. Winternitz, M. C., and Hirschfelder, A. D.: Studies on Experimental Pneumonia in Rabbits, Jour. Exper. Med., 1913, xvii., 657. Hirschfelder, A. D., and Winternitz, M. C., ibid., 666. Kline, B. S., and Winternitz, M. C.: ibid., 1913, xviii., 50, 61.

Page Line Note

CHAPTER IV.

32. 12. See note 26.

34. 5. 33. Soddy, 105-109-112-128.

22. 34. See "Back-drilling Zig-zag," Chapter VI.

35. 22. See note 19.

36. 8. 35. Compare dust driven by the light beam; See Chapter XIV., "overspeeding the tendency."

37. 5. 36. Burnet, "Microbes and Toxins," page 244. "The immunity to a toxin does not appear until after 8 days."

15. 37. See Chapt. IV., page 32.

38. 10. 38. Compare Chapter XIII.—The gas carried along and condensed by the big projectiles kills birds within a measurable radius.

39. 3. See note 19.

40. 2. 39. The positive charge at the center of the atom, (see note 9) supposed to be surrounded by negative electrons in equilibrium, must be the positive electron. Sir J. J. Thomson believes the atom of hydrogen, positively charged, is the smallest known particle of positive electricity. Would such an atom of hydrogen, therefore, be its own positive center without negative electrons? This would make it the unit of compression, as well as the lightest known atom, and the only known atom without electrons!

41. 23. 40. Soddy.

24. 41. Jose Yglesias, with infra-red rays developed by a wireless apparatus, has lighted fifteen electric lamps in a house 600 yards away.—(N. Y. Sun, April 6, 1914.)

Ulivi, an Italian army engineer, claims to have similarly detonated distant explosives.

42. 3. 42. Sir Oliver Lodge, Jan'y 31, 1914, in an address "Ether of Space", delivered at Bedford College for women, said: "We have reason to believe that the density of ether would be equivalent of 1000 tons per cubic millimeter of terrestrial matter, when compared with it. It is of gossamer-like construction—mere cobweb."

By his own experiments he had been able to show there was friction between ether and matter. He "believed the connection electrical, and that it would be proved later that matter was composed of ether."

10. 43. Soddy (Int. of Radium) 88.

18. See note 36.

Page Line Note

23. See note 9.

43. 12. 44. Rutherford, 39 et seq.

14. 45. Barker's Physics, 857.

27. 46. Rutherford, 543.

44. 20. 47. "Matter" in Encycl. Brit.

CHAPTER V.

50. 21. See note 19.

51. 15. 48. "The Cancer Problem," Med. Record, May 2, 1908.

52. 18. 49. Robbing the organism of its "Intermediary" (Chapter XIV.) of gastro-intestinal process, is like injecting foreign albumins hyperdermatically.

Richet says: (Burnet, page 240) "The anaphylactic reaction is a defensive function . . . to prevent foreign albumins from entering the protoplasm of the cells so as to modify their specific chemical structure." (See note 89.)

53. 16. 50. Carbon and crystals of silicon.

54. 8. 51. See Harvey Cushing's "The Pituitary Body." The bruise of the stalk of the Pituitary body by cerebral over-activity, or congestion, has been seen by the writer again and again to throw sugar in the urine, promptly followed by skin-reddening (or pruritis). This may be the remnant of an abandoned faculty, thrown aside as useless in our evolution. Also, sugar suggests starch, and the whole idea of starch production suggests reversion to the parental vegetable origin of life.

The precise nature of "five carbon sugar" excreted as pentosuria, though discovered twenty years ago by Salkowski, is not yet well understood. This pentose has been shown to be a constituent fragment of some of the nucleic acids.

16. 52. La Nature (Paris), Feb'y 19, 1909.

55. 17. 53. "Eyes of Plants," Macdougal, director of Botanical Research Department, Carnegie Institution, America, Oct. 17, 1909.

56. 16. See note 48

18. See note 30.

21. See notes 49 and 32.

19. 54. Adami and Nicholi, 501. See also notes 48 and 49 above.

57. 3. See note 43.

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CHAPTER VI.

58. 15. 15. Bergson, Creative Evol. 190.
60. 25. 56. Barker's Physics.
61. 13. See note 46.
15. See note 5.
63. 12. See note 36.
17. See note 38.
64. 27. See note 40.
66. 13. 57. Whetham, page 321.

CHAPTER VII.

69. 10. 58. Rutherford, 621.
17. 59. See Chapter XII.
70. 1. 60. Bergson's Creative Evolution.
25. 61. Compare Chapter I, page 7.
71. 6. See note 35.
72. 19. 62. See note 71.
74. 9. See notes 20 and 42.
14. See note 46.

CHAPTER VIII.

17. See page 136.
75. 6. 63. Barker's Physics.
76. 5. 64. Herbert Spencer's "Principles of Psychology," 141.
8. 65. Ibid, 205.
16. 66. Light, Color. Encycl. Brit.
77. 8. 67. Adami, 55, 242.
10. 68. Da Costa, 285 (Clinical Hæmatology). Iron, the color bearer of the blood, is the most magnetic of all the metals. The suppression of one sub-component may change the coloring.
15. See note 67.
18. See note 5.
79. 10. 69. Prof. Hümmel, Chair of Dyeing, University of Leeds (in Encycl. Brit.).
80. 7. 70. Maj. Woodruff's studies on the bane of the solar ray. Osler says: "The case against the sun is not yet fully made out."
17. See note 48.

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81. 5. See note 91..
23. See note 48.

CHAPTER IX.

83. 6. 71. See Chapter XVII., page 137.
23. See note 35.
84. 6. 72. Adami, 46 et seq.
85. 5. See note 67.
86. 25. See note 39.

CHAPTER X.

88. 17. See note 57.
89. 4. See note 57.
12. See note 35.
21. See note 35.
24. See note 37.
90. 14. 73. See Chapter XVII.
17. See note 67.
92. 6. 74. Page 29.
93. 27. 75. Compare Chapter XV.
94. 1. See note 71.
7. See note 75.
95. 2. 76. Prof. of Botany, University of France.
20. 77. P. C. Mitchell, Secretary Biol. Soc., London.
S. H. Vines, Prof. of Botany, Oxford.
A. Sedgwick, Prof. of Zoology, London.
96. 3. See note 52.
5. 78. See Prof. Oliver Osborne's article "Inter-glandular Relations," Journal A. M. S., Feb'y 26, 1910.
15. See note 91.
97. 5. 79. See page 96.

CHAPTER XI.

98. 6. See note 74.
11. 80. See page 123.
18. See note 5.
99. 8. 81. See page 131.
17. See note 75.
100. 5. See note 77.
22. 82. E. A. Minchin, Prof. Protozoology, London University. Encycl. Brit. XXII., 487.

Page Line Note

24. 83. P. C. Mitchell, Sec'y Biological Society, London.
S. H. Vines, Prof. Botany, Oxford.
The Red Algae show 20 chromosomes in the nuclei to which they give rise asexually, and 40 are produced in the cystocarp as the result of fertilization.

CHAPTER XII.

102. 3. 84. Whetham, page 257.
18. See note 9.
103. 26. See note 75.

CHAPTER XIII.

104. 25. See note 78.
27. See note 51.
105. 22. See note 51.
26. See note 48.
108. 3. See note 83.
5. See note 78.
109. 4. See note 44.
9. See note 5.
110. 2. 85. Soddy (Int. of Radium) 221.
13. See note 38.
24. See note 17.
111. 1. See note 104.
13. 86. Adami in Osler's Medicine, Vol. I., Introduction.
27. See note 77.
112. 13. See note 19.
23. See note 77.
113. 16. See note 19.
114. 7. 87. Mendelian laws favor the idea of the rhythmic durational interferences and re-inforcements.
115. 5. The following is further quotation from Jacques Loeb's "The Mechanistic Conception of Life." Page 19, et seq.:—

"These discoveries have solved a series of other difficulties. Certain types of twins originate from one egg after fertilization. Such twins have always the same sex, as we should expect, since the cells of both twins have the same number of X-Chromosomes.

Page Line Note

In plant lice, bees and ants, the eggs may develop with and without fertilization. It was known that **from fertilized eggs in these animals only females develop**, males never. It was found that in these animals the eggs contain only one sex Chromosome, while in the male are found two kinds of Spermatozoa, one with and one without a sex Chromosome.

For **Phylloxera** and **Aphides** it has been proven with certainty by Morgan and others that the **Spermatozoa which contains no sex Chromosomes cannot live**, and the same is probably true for bees and ants. If, therefore, these animals are fertilized it is always done by a Spermatozoon which contains an X-Chromosome. The egg has, therefore, after fertilization in these animals always two X-Chromosomes, and from such eggs only females can arise. In bees and ants **the unfertilized eggs can also develop, but such eggs give rise to males only.** This is due to the fact that the eggs of these animals contain only one X-Chromosome."

115. 9. **88.** Heape (Sex Antagonism, 214): "A bull with marked Feminine characteristics is often found specially capable of producing fertile heifers with ample milking capacities, which latter will in their turn produce Masculine bulls.

14. See note 57.

CHAPTER XIV.

117. 4. See note 95.

7. See note 30.

15. See note 32.

118. 7. See note 30.

13. See note 67.

22. **89.** The digestive process in the animal—analogous to the chlorophyllian process in the vegetable—is the Intermediary which prevents foreign albumins from entering the protoplasm of the cells. See 49.

25. **90.** The relation of proteins to malignancy at the time of gland failure is well known. (Note 95.)

27. See note 48.

119. 14. See note 60.

27. See notes 48 and 70.

Page Line Note

120. 16. 91. "Uncurtained blood cells (note 48) from anemia and digestive impairment—as a 'lost Intermediary'—allow sub-components in the blood to be under more direct influence of the solar ray (note 70) and to usurp the vegetable function (note 79). Compare Chapter VIII.

18. See note 79.

121. 8. See note 93.

12. See note 49.

17. See note 32.

20. 92. L. D. Bulkley, Med. Record, Nov. 23, 1913.

CHAPTER XV.

122. 19. 93. Bouchard "Auto-intoxication in Disease," Philada, 1906, page 62.

123. 9. 94. Soddy (Int. of Radium), 157.

21. See note 89.

27. 95. Breisacher ("Untersuchungen uber die Glandular Thyroidea" Arch. f. an. and Phy., Vols 158, 162) has shown that meat-eating dogs from whom the thyroid gland has been removed may be kept alive by feeding on milk, but promptly die when given meat.

124. 7. See note 78.

14. 96. Steinhold, quoted by Cushing, Pituitary Body, page 276.

17. 97. R. T. Morris, Adami, P. of P., 581.

21. 98. Lydston, Chicago, March 9, 1914, transplanted glands for cure of dementia precox, on women confined in Duning State Hospital for Insane.

125. 23. 99. "Cancer" by the author. Am. Jour. Obstet., Vol. LXII., No. 2, 1910.

126. 5. See note 78.

6. See note 51.

11. See note 48.

20. See note 78.

22. See note 95.

127. 4. 100. "Hysterectomy" by the author, Med. News, Dec. 24, 1904.

7. See note 92.

16. See note 91.

19. See note 83.

Page Line Note

25. 101. Bashford, London Medical Congress, 1913, and others, discussing cancer.

128. 14. See note 29. As pulp is lost from our glands, it is replaced by fibrous tissue,—as though Space were trying to repair Time.

129. 26. 102. See Chapter XV., page 123.

130. 8. See note 49.

13. See note 49.

CHAPTER XVI.

131. 6. 103. See Chapter IV., page 37.

10. See note 58.

132. 8. See note 9.

27. See note 9.

CHAPTER XVII.

135. 4. 104. See Chapter XV., page 123.

7. See note 19.

16. See note 32.

136. 3. 105. Jacques Loeb, "The Mechanistic Conception of Life," 1912.

5. . . . . beyond (see note 94); . . . . prism (see note 49).

6. See note 79.

7. . . . . sex (see note 96); . . . . giant (see note 78).

137. 18. See note 85.

140. 3. See note 102.