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Mote Technical Report No. 860

Coastal and Estuarine Data Archaeology and Rescue Program

Charles M. Breder, Jr.: Hypothetical Considerations, 1931 – 1937

November 2002

US Department of Commerce
National Oceanic and Atmospheric Administration
Silver Spring, MD

Mote Marine Laboratory
Sarasota, FL

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Mote Marine Laboratory

(Editors)

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Charles M. Breder: Hypothetical Considerations, 1931 - 1937

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Silver Spring, MD

ABSTRACT

Charles M. Breder Jr. “hypothesis” diary is a deviation from the field diaries that form part of the Breder collection housed at the Arthur Vining Davis Library, Mote Marine Laboratory. There are no notes or observations from specific scientific expeditions in the document. Instead, the contents provide an insight into the early meticulous scientific thoughts of this biologist, and how he examines and develops these ideas. It is apparent that among Dr. Breder’s passions was his continual search for knowledge about questions that still besieged many scientists . Topics discussed include symmetry, origin of the atmosphere, origin of life, mechanical analogies of organisms, aquaria as an organism, astrobiology, entropy, evolution of species, and other topics. The diary was transcribed as part of the Coastal Estuarine Data/Document Rescue and Archeology effort for South Florida.

INTRODUCTION by S. Stover

“Every great advance in science has issued from a new audacity of imagination.”
John Dewey 1859-1952 The Quest for Certainty [1929], ch 11.

Librarians and archivists love to find valuable unpublished documents. To them it is like discovering gold or a pharaoh’s untouched tomb. Once unearthed this material is then pampered until it is ready for display, transcription, printing, or in today’s electronic world, conversion to electronic format.

The Mote Marine Laboratory Library was bequeathed such a find in the mid 1980s. The family of noted ichthyologist, Dr. Charles M. Breder, Jr., donated twenty-six of his hand written journals dating from 1924-1974 to the laboratory. These journals included thirty years of meticulous field notes of data and scientific observations of nature including birds and marine life in various areas of New York, Mexico, Florida and the Caribbean. These detailed notes were the basis of many of Dr. Breder’s 160 scientific publications. Unfortunately, due to various complications including a shortage of library space and staffing the Mote Library had to store these materials for future use.

In the late 1990s two events lead to the retrieval and transcription of these journals. The laboratory hired a full-time professional librarian, and the library collection was moved to a substantially larger facility. This relocation enabled the library to enhance its collection with important materials that had been in storage for many years.

[Δ] NOAA Central Library, Silver Spring, MD.

[◊] Arthur Vining Davis Library, Mote Marine Laboratory, Sarasota, FL.

The journals that were donated by Dr. Breder's family ten years prior were finally retrieved. However, after relocating them to the new library it would be another three years before the opportunity arose to evaluate and transcribe the materials, and make the information available to the scientific community and the general public.

The NOAA Miami Regional Library started a grant project in 2000 titled Coastal and Estuarine Data/Document Archaeology and Rescue (CEDAR). The purpose of CEDAR was to collect unpublished data and documents on the South Florida coastal and estuarine ecosystem; convert and restore this valuable information into electronic and printed form, and distribute it electronically to the scientific community, academia and the public. Dr. Breder's journals were reviewed for data pertinent to this endeavor. Many of the journals contained information on studies and observations of the South Florida and Caribbean ecosystems. Based on this positive evaluation it seemed that these diaries would be an excellent choice for the project.

"Charles M. Breder, Jr.: Dry Tortugas 1929" (Cantillo, Collins and Clark, 2001) was the first journal transcribed and converted to electronic format. This publication includes Dr. Breder's biographic information and a reprint of his obituary from the journal, Copeia. The following passage from the obituary (Atz, 1986) is appropriate for this project, "Breder was truly a self-made biologist. He once was reported to have said that everything he knew about biology and ichthyology, at the time he got his first job, he had learned at the Newark Public Library." In this day of instant electronic information it is inspiring to learn that the ideas of this scientist, ichthyologist, administrator and mentor were first cultivated in a library.

Marine research librarians are aware of Dr. Breder's reputation and studies in fish taxonomy, fish behavior and biology, and his special interest in flying-fish. Through this project many readers, including scientists and the general public, will be enlightened about the details and elements of his investigations.

This "hypothesis" diary is a deviation from Dr. Breder's other journals. There are no notes or observations from specific scientific expeditions. Instead, the contents provide an insight into the early meticulous scientific thoughts of this biologist, and how he examines and develops these ideas. It is apparent that among Dr. Breder's passions was his continual search for knowledge about questions that besieged many scientists.

Hopefully, this publication will lead the curious reader online or to a library to further investigate the thought-provoking research of this voluminous scientist, and consequently the environmental history of early twentieth century Florida and the Caribbean.

NOTES AND TRANSCRIPTION

The handwritten diary of Dr. Breder's "hypothesis" diary was written in a bound black and brown notebook in ink.

The diary was transcribed by hand. Minor editorial changes, such as closing parenthesis were made. Indecipherable entries were noted with "[?]". Editorial comments such as current names of species were noted in brackets and/or capital letters. Numbers outside the margin of the transcribed text are the page numbers of the original notebook.

Myron Gordon and John T. Nichols worked with Breder from the late 1920s to early 1930s, and may be referred to in the diary using the initials of their names.

Scans of the diary pages are included as individual JPG files in the CD and can be referred to as needed.

ACKNOWLEDGMENTS

The editors wish to thank the Breder Family, M. J. Bello, S. Baker, L. Pikula, B. Hulyk, C. Simpfendorfer, and the staff of the Mote Marine Laboratory for their assistance on this publication. The transcription is part of the Coastal and Estuarine Data/Document Archeology and Rescue (CEDAR) project funded by NOAA/COP for the South Florida Ecosystem Restoration, Prediction and Modeling Program and the South Florida Living Measurements Resource Program.

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Hypothethical Considerations
1931 - 1937

A reexamination of Organizational Possibilities

General Considerations

1. Effects of chemical and physical interactions
2. Limits set by boiling and melting points of elements and compounds (9)

Effects of radiant energy

1. Significance under various conditions
2. Limits of receptors (especially visual and allied receptors)
3. Shifts in "transparency" to various wave lengths and corresponding shifts in receptorial abilities.

Astronomical data

1. Periodicity in the life of stars
2. Self radiant bodies
3. Gravitational effects
4. Origin of atmosphere (anaerobic life first) (13)

Biological effects

1. Effects of life on atmosphere (13)
2. "Vita" in series at different temperature ranges (9)
3. Life last of series (lowest thermal possibility)
4. Possible self perpetuating chemical systems
5. Complexity or simplicity in various "vita" series
6. Organic dissociation (5) Organic resurrection (11)
7. Evolutionary periodicity (recurrence of similar forms)
8. Mechanical effects of pigmentation (basic significance of coloration)
9. Consideration of radiant energy, mechanical energy and chemical energy on organisms

Mechanical effects

1. Locomotion compared in "vita" series
2. Symmetry and its significance (7)
3. Structural mechanics in "vita" series
4. Possible mechanical arrangements (wheel, etc.)

Psychic effects

1. Nth dimension (15)
2. Psychic possibilities in "vita" series

Data not mentioned in this listing has been developed subsequently. The basis it has here is evident.

5 **Organic Dissociation**

Tissue culture studies have shown that cells are potentially immortal and will exist in face of bacteria. Conditions in tissue cultures favor the latter excessively. Naturally dislodged cells stand a better chance for survival just as fishes thrive better in a natural pond than in an aquarium. This may account for the origin of various forms of life not readily accounted for otherwise. See especial by Cowdry, E. V. General Cytology Univ. Chi. Press 1924.

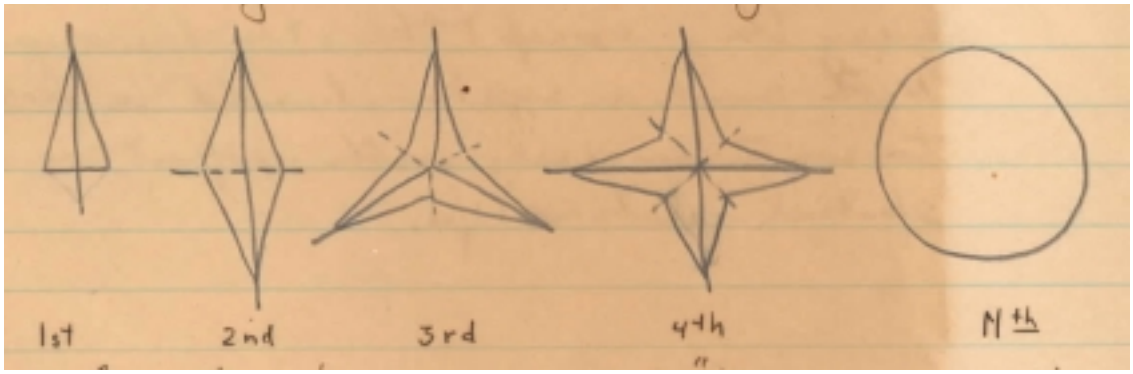
-- x --

A culture of cells in the presence of bacteria in sterilized sea-water (boiled). Bacteria dangerously increasing. Substituted filtered sea water (Berkfield) admitting virus (phage) to see if bacteria reduced to advantage of cells. (see page 19 et sub.)

Developed 1928 - worked out with help of M. G. 1930 In M. S. 1931. Pub. 1936.

7 **Symmetry and its significance**

Bilateral symmetry is a special form of radial symmetry which may be considered as of first, second, third, etc. degree dependent on number of duplicating parts each of which is a mirror image of every other. Symmetry of the Nth degree is necessarily a circle or series of concentric circles.



Another form, a sort of "pseudo-symmetry" is represented by the Swastika Cross in which each part is congruent with each other but not its mirror image. A similar series from 1 to N may be constructed.

Another phase, simple serial segmentations may be considered a form of "serial-symmetry" or "serial pseudo-symmetry" either rectilinear or distorted.

Considering 3-dimensional figures the same obtains with the sphere as the Nth degree. The number of constructions possible is limited but not to the number of possible regular polyhedrons only. 3-dimensional "pseudo-symmetry" is still more limited probably to less than the number of polyhedras possible.

8 Various interesting relationships are apparent such as above the 2nd degree two kinds of bilateral symmetry are always present. In even numbered degrees like axis are continuous thru the center and in odd unlike are continuous.

These relationships could be expressed in a system of terms more accurate than these now used and would include every thing except the strictly asymmetrical. With such a system it would be possible to write concisely with respect to all spatial relationships.

Developed 1926 In M. S. 1927.

"Vita" in series at various temperature ranges

9

Life as we know it is limited to a range of roughly from 0° to 70 °C. Is this a unique possibility or are other chemical combinations capable of perpetuating themselves possible at other temperature ranges. There are definite limitations. At the hot limit all substances are gases and at the cold all are solids. Between these two extremes are points where large numbers of elements find their melting or boiling points and others where few if any change their physical state.

It is obvious that either end possibilities cease and that temperature ranges where large numbers of possibly important substances shift their physical state present unlikely conditions. At least in the range of life no important elements shift. (The formation of ice checks life activity - some forms are simply able to survive in spite of such low temperatures by highly adaptive specializations.)

Plotting the elements on such a temperature scale shows six "laws" in physical activity. Tentatively these may be considered as possible "sites" for organizational activity. Postulating such possibilities they may be termed "vita" 1, 2, 3, 4, 5 and 6 beginning at the high 10
temperature. (The first "law" below the completely gaseous condition). In such an arrangement life as we know it is in the last "law", the last above absolute zero. The series "vita" would be confronted by the following primary conditions.

The first would be embarrassed by a paucity of solids and liquids. This would grade downward giving more and more solids and solvents with which construction and framework could be built to hold the fluid "chemical" machine.

The reverse could be true of gases. A much more varied atmosphere would obtain at the higher temperatures.

Greater chemical activity would obtain at the higher ranges. Our life is at the lowest possible ebb from this view point.

The design of such forms existing under other conditions would form an interesting speculation as other wavelengths would be necessary and correspondingly different receptors.

Accepting such a hypothesis and considering this world as a cooling sphere we would have a series of "vitas" each different from the rest and separated from each other by the "crests" of physical activity. We would represent the last of a series of "evolutions" on a dying sphere. The next step would be to the Moon's condition.

Little trace could be expected in a fossil state due to the great disintegrating effects of 11
contraction on a sphere subject to successive waves of solidification to say nothing of the formation of corrosive compounds. It is conceivable however that in the earliest rocks some remains might be found or even that some low and resistant forms were able to withstand their transitions and adapt themselves to the changing conditions to form the seed of life beginning a new cycle at a lower chemical level.

Whether this is true or not it may be that homoiothermy may be developed as a dying attempt to hold on to the descending temperature. At least it is better able to withstand low than high temperatures and poikilothermy is the reverse. Each "vita" series probably had this same evolution organization holding a given temperature following on forms developed when it was unnecessary.

Developed with M. G. 1931 M. S. 1941.

Origin of Atmosphere

13

On a cooling sphere oxygen would unite with a wide variety of substances to form oxides such as Fe, Al, H, C, etc. Long before a temperature was reached at which it was possible for life to exist all the O_2 would so combined and out of the atmosphere except as it might occur as CO_2. If any reducing reactions went on such as electrolysis of metals in contact with sea water the O would be quickly used to oxidize exposed surfaces due to erosion. The higher the temperature within limits, the greater would be this activity.

Thus the free O_2 in the present atmosphere is directly referable to the photosynthesis of plants. The forests especially tropical with layer upon layer of photosynthetic equipment, shallow waters with larger aquatics and the open oceans with a thick layer of diatoms all contribute to maintain the O_2. All save the two polar regions contribute.

The first forms of life must consequently been anaerobic - possibly bacteria. Not until a considerable amount of O_2 in excess of that consumable was turned into the atmosphere by such agents could aerobic forms develop and not until green plants developed could it be developed in
14 large quantities. As these in turn need free O_2 for respiration, progress must have been slow until a certain threshold was reached.

The studies and attempts to synthesize life have all been directed towards anaerobic forms. A reexamination of these studies and experiments under anaerobic conditions should be illuminating. It is conceivable that anaerobic forms must precede aerobic forms, i.e. in evolutionary terms it may be impossible to derive life of the latter type directly from chemical compounds. Anaerobic forms may be an intermediate step between inorganic material and aerobic forms of life.

See Lotka "Stage of Drama"

First M. S. Feb. 23

Developed with M. G. 1931 MS 1941

15

Fourth Dimensional Hypothesis

See Cowdry, E. V. General Cytology Univ. Chi. Press 1924. (Part by Mathews, A. P.)
Dunne J. W. An experiment with time. Black, London Second edition. 1929

Extension may be expressed in terms of dimension as follows (the remarks are subsequently explained)

Dimension	Remarks
0	Position in space
1	Length
2	Surface
3	Volume
4	Time
5	Consciousness
6	Telepathy & clairvoyance
7	- -
N	True infinity of extension

Time is considered the 4th dimension in the Einsteinian sense. Up to this point each extension contains all of those below it. As consciousness in a similar manner embraces time it may be considered as a 5th dimension. In order to measure any given extension the observer must be fully out of it (in the next higher dimension) (Dunne 1929). It follows that introspection must be in the 6th dimension, telepathy and such manifestations may even reach the 7th or 8th but it would seem to fade out at about that point. This is not in agreement with Dunne whose "serial observer" extends to the Nth dimension without apparent abatement. Thus his infinity and "immortality" collapses. As we are clearly limited in all the dimensions (by definition) each higher one has less complete extension. Above the 4th the limits seem to clearly become less and less.

16

The 5th dimension is thus synonymous with Mathew's "psychism" of atoms, his "hydrogen atom soul" etc. It would probably be better to regard the human entity (soul) as the sum of the 5th dimensions of the organism's atoms or the result of the interactions of them in this extension.

See Lotka - coordinates of reference

Aug. 11, 31 - First exp. evidence - Leaving of eye removal and eye puncture with catfish then 6 hours later their combination eye removal and puncture of retina to restore sight (on radio) --- ? ? ? ?

1931

17

Organic Resurrection

Nageotte, J. Virchow's Arch. Path. Anat. a. Physiol. 263(1):69, 1927 has fixed connective tissue with alcohol and formalin and found them able to reunite with living tissues and taken on all aspects of life including the histological. The best results were obtained with grafts fixed for a few days in 30% alcohol Rous, P. and Jones F. S. J. Exper. M. 23:549, 1916 could be digested with trypsin and survive for plating.

Morosow, B. D. Arch. Exp. Zellforsch. 7(2):213, 1928. Muncheuer Med. Wochensch 75(40):1713, 1928. desiccated heart to 70-80% less weight by drying over H_2SO_4 (human chicken frog) and obtained viable and normal cultures.

If these cases are true might not the following experiment be possible. If resurrection is possible if autolysis has not been allowed (i.e., by preservation in alcohol, formol, desiccation) the revived cells because of their protoplasmic constitutional make up would be expected to resume their original activity unless the new cells simply invade the "shells" of the old. Then, even the physical construction of the cell would be biased for certain functions.

Ex. Kill newly hatched fish in alk or formol. Produce cultures of first cleavage cells of eggs of same species. Present with dead fishes. If invasion took place each cell should take on its old
18 function. A single definite muscular contraction or heart beat would be the first true resurrection of life!

First M. S. Feb. 23. Developed with M. G., 1931

19

Pre-ultrascopic viruses

See page 13 - this a step in back of that hypothesis. Before the anaerobic forms, there may have been "fluid" forms of life similar to ultrascopic viruses of an anaerobic nature. The steps to present forms of life would then be somewhat as follows.

1.	Complex inorganic compounds	Anaerobic
2.	Pre-ultrascopic semi-living viruses	Anaerobic
3.	Ultrascopic viruses	Anaerobic
4.	Bacteria	Anaerobic
5.	Early full cells	Anaerobic
6.	Early full cells with chlorophyll	Aerobic
7.	Present types of life	Aerobic

Discussion of steps

1. Sea water, complex, stable, abundant might well form the sub-stratum as a complex inorganic compound. Sea water, essentially similar to plasma or even protoplasm itself in a less concentrated form might be thought of as almost meeting the requirements of a "nearly" living substance. Its high buffering and consequent ability to absorb a variety of substances without showing an active change, its ability to precipitate out, Ca for example, all show a similarity to protoplasmic activity. Could a series of inorganic solutions be arranged approaching the chemical reactions of protoplasm according to their equilibrium
20 and their ability to maintain it? i.e., the greater buffering a solution is the closer to living. Can sea water be "jelled" and if so how does such a "jell" compare with protoplasm?

2 The pre-ultrascopic virus would grade insensibly into some system as outlined above. Is our identifying of them on living organisms merely an inability to make exact chemical analysis? Similar to the identification of vitamins? What of toxins? Any poisons?

3. The true ultrascopic viruses would grade insensibly with above.

4. Bacteria, showing an ultrascopic phase in their life history would connect these clearly. Could not the first anaerobic forms be merely physical aggregations in phylogeny as they are in the ontogeny of known forms?

5. Full cells, considering bacteria as mitochondria would represent simply an investing membrane which such aggregations have gathered about themselves. Thus cytoplasm, a little less actively living than the nuclear material might be an exudate or "jelled" sea water.

6. All till now would be anaerobic. The necessary chlorophyll enters here but its origin is not clear - associated with lipids? Find out about its origin in ontogeny and chemical synthesis. (Phylogenetic series in chlorophyll and hemoglobin. Hematin as the active agent in remaining O_2 from the atmosphere.)

7. From this time on the evolution of present forms would be exceedingly complicated on a basis of classical evolution, and the hypothesis set forth on pages 5, 13 and even 17. 21

Carrying this further (into the future) the further accumulation of O_2 would make other readjustments necessary. Substances suppressing oxidation would be essential to life in atmospheres less diluted by an inert gas.

Viruses have been located in sea and fresh water. May not the inability of synthetic sea water to support life be based on the presence of a benign virus (bacteriophage) in the natural product? A small amount of the latter will "infect" the artificial product. Cannot the success of balanced aquaria be expressed in terms of the presence of suitable viruses? A large amount of organic debris in the average fresh water aquarium produces surprisingly little bacteria. An experiment tending to substantiate this would be as follows.

Developed with J. N. G. [?] 1931

Two sterile chambers; add the following. Material from an aquarium which has "gone bad". To one chamber add a small amount of fluid from an identical aquarium which has not "gone bad" (thus inoculating it with the controlling virus). Get count cultures from both. May not the bicarbonate treatment of sea water and the sodium phosphate (primary) of fresh water aquaria be conditioning things to make the life of beneficent viruses possible - (it may even be producing living viruses?) What is the essential difference between a bacteriophage and a chemical inhibitor? The ability to confer the same characteristics (by growth) to other solutions should establish a living phage - but if a catalyst is added would it not be mistaken for a phage by ordinary methods? In other words how can a phage be experimentally delimited from an enzyme? Is there a sharp delimitation? May a phage be an enzyme which not only induces a reaction without loss to itself but actually increases in bulk by virtue of the reaction it induces? Have any catalysts been known to do such? Is this life? - or is this where the boundary disappears? Can a technique be devised to determine these questions. 22

First M. S. Feb. 27 1931 [?]

Another experiment

23

Prepare two aquaria as follows.

1. Sterile H_2O + proper salts i.e. distilled H_2O and salts

2. Sterile H_2O (heated only to lethal point for bacteriophage)

Seal after plating with sterilized aquarium plants.

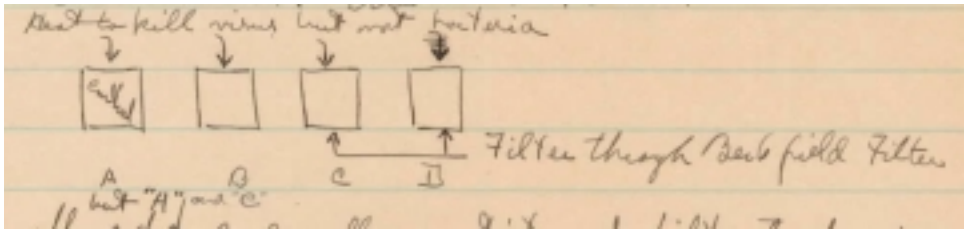
Prepare two identical but add some filtered H_2O from a "healthy" aquarium.

In the latter only the phage is added. Some bacteria are brought in on the plants.

Cultures from each should be interesting and in the "sterilized" series should be larger if a phage or enzyme is present in the second. How to separate phage on enzyme?

This has great potential importance for aquarium practice.

Take H_2O from a "healthy" aquarium. Separate into four containers. Treat as below



To all but "A" and "C" add a small quantity of filtrate of original sample. Then the conditions should be as follows.

A Contains bacteria but no virus.
B Contains bacteria with virus added.
24
C Contains virus added only (bacteria killed by filtering, virus by heat)
D Abundant virus and added virus (Bacteria filtered out).

Plating from these the colony count should be as follows.

A Most abundant bacteria
B Less abundant bacteria (preyed on by added virus)
C Sterile (bacteria)
D Sterile (bacteria)

Save a colony of each in slant for future work.

Save sterile (C & D) for future work.

Take plate from A and B and inoculate with solution from C or D (should discharge activity - reduce count)

Sea-water origin

25

Is the composition of sea water accidental or is its constitution necessary as a corollary of the formation of a spheroid such as the earth?

Why is it not more dense?

Organisms constantly removing elements.

Is there an equilibrium between extraction by organisms and the amounts going into solution from all causes?

Calcium is practically at saturation.

The traces (metals, etc.) are naturally small both because of their slight solubility in H_2O and their relatively scanty distribution.

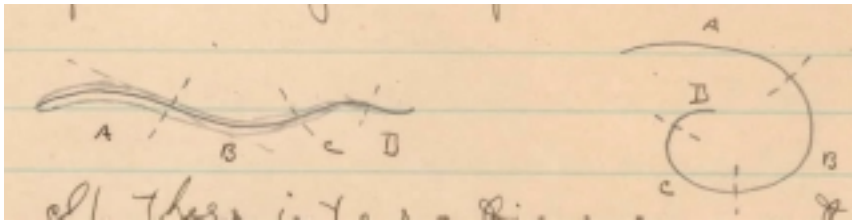
Sodium is not saturated but why not? Protoplasm and plasma being like sea water in proportions would be expected to remove the dissolved substances in approximately the proportions of their natural assurance. This would be true except for skeleton formation etc. Ca and Si selected out for such a purpose yet Ca is still nearly saturated. Is that why it is used so extensively for skeleton building? Why not Mg used more abundantly?

First M. S. Feb. 23
M. G. question Feb. 1931

Locomotor Equations

27

If an anguilliform fish be cut into segments at the targets of the reversing curves they can be reassembled as a spiral. The mathematical expression of this spiral can be obtained.



If these interactions come out in a straight line (or a characteristic curve) it can be rotated giving a translation of the backward movement of the points of tangency to a uniform rotational element.

At least this spiral should be characteristic for fishes progressing by bodily undulations and in the foreshortened (carangiform) types a segment of this spiral must be present. The expression should vary from the most elongate form to the most shortened. If an equation be designed it should have a variable constant directly [in] relation to the length of the spiral segment assumed. Consequently given a fish of normal type, its length gives an index of its constant and its formula may be approximated.

Consider this spiral in connection with the nature of spirals of the lake.
Developed with C. M.

Mechanical Analogies of Organism

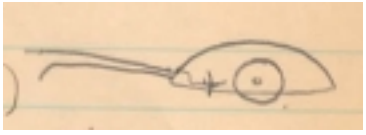
29

Collect all data on models of living criteria to see if all phases could not be reproduced. Make a self-making apparatus - would probably have to be chemical (see page 31).

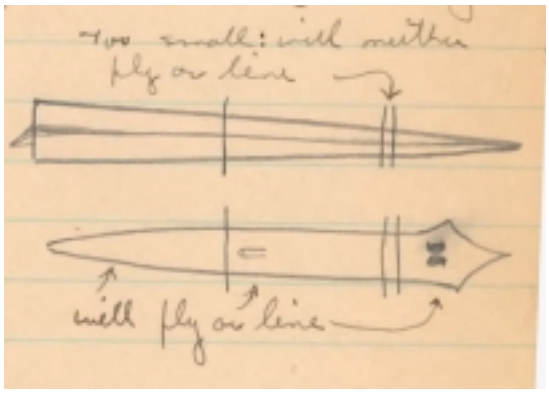
Some machines

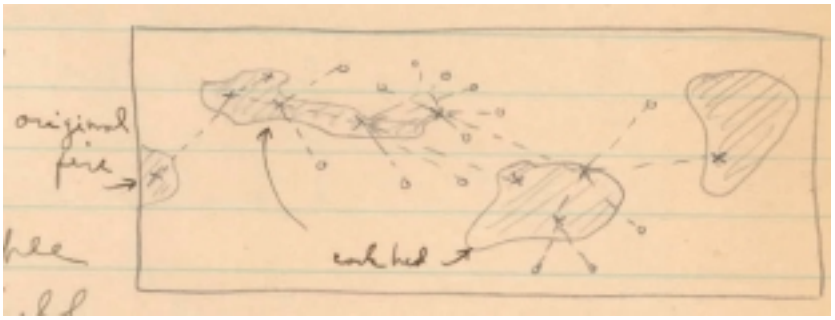
1. Beetle that saves itself (see Lotka)

2. Axial gradient (only mechanism of life that retains the orientation in all its parts). true of *Planaria*. Also true of paper arrows (see figure).



3. Gloss head in shellac and drop of ether. (Feeding) Adding from within.





4. Fires (cork fragments) carry and reproduce themselves consuming material and drying. That is if suitable environment is found. An oil fire spreads merely by constant [unable to express itself because of having fluid (without "tools")] (see 31).

All Life a Virus?

31

If dead protoplasm can be revivified as suggested on page 17. What happens? If sea water is a semi living fluid and protoplasm can be thought of as jelled sea water may it not be that in all a virus is the constant agent? In other words, protoplasm is merely the tools with which viruses work. When they are "living" in fluids they cannot express life for want of mechanical solidity but when once the abode of "life" is taken up in a "jelled substance such as the semifluid protoplasm organic manifestations are possible. This all fits with the concept of viruses living in sea water, gives a rational explanation of the revivification of "killed" tissues, the inability of synthetic sea or fresh water to support life, etc.

A crucial experiment would be to do the experiment on page 17 and then repeat with a filtered extract of the cells !

See pages as follows for interrelation 5, 13, 17, 19 and 25.

First M. S. Feb 27

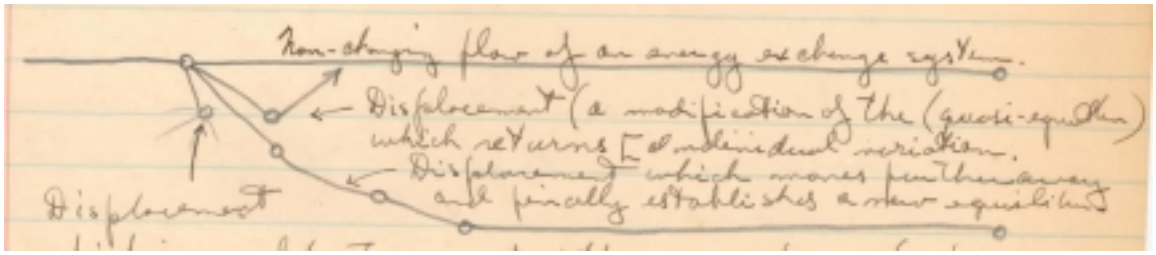
A Physical Basis for Orthogenesis

33

The disintegration of radium or other compounds from solar consolidation (possibly all matter) is a direct chemical process - step by step - an orthogenesis. Up to this time [origin virus-like first forms of life] evolutionary processes must have, of necessity, been in the nature of an orthogenetic process in the sense that chemical disintegration such as the radium series,

represents. Thus a basically, orthogenetic process would acquire an overlay of "selection" but it is also evident that here the distinction is more arbitrary than real. MS 1st draught on the Origin of Terrestrial Atmosphere and Life (see page 13 and 25).

Somatic (non-transmittable) and generic (transmittable) variations would then depend on whether the virus (quasi-equilibrium) was affected in a manner that would cause it to move further away from its original position or not.



Displacement which is unable to go further or return (J. T. N.'s non-adaptive variants).

34

By thinking of life in terms of energy exchange (i.e., equilibrium) and protoplasm and structure as the products of this activity which is frequently by lost sight of orthogenesis takes on a new meaning. The steady state continues until displaced (upset) by an environment change (Lamarckism?). Then any of the following 3 things may happen.

1. The displaced equilibrium may be incapable of continuing as a strain and be unable to return and disruption (death of the live [virus]) follows).

2. The displaced equilibria may quickly return to the normal and the resultant expression in a material may be individual variation.

3. The displaced equilibria may be forced to continue for purely chemical reasons to move further and further away [orthogenesis] and may continue indefinitely until some lethal stage is arrived at or it may establish a news equilibrium [another species is established].

These several matters are explained. Orthogenesis becomes the expression of a chemical series [many equilibria] of an energy exchange system.

Lamarckism becomes the fundamental immediate cause and the difficulty with which it is traced is due to the following reasons.

1. Only one of 3 possibilities allow of its full expression (1 brings death and the other a return to the average).

2. The effect of the environment acts on the same or rather the equilibrium of the organism and the equilibrium change is transmitted but fully to the germ cells which in the higher forms are clearly "buffered" against such minor changes as may not be valuable but temporarily. 35

3. The result in the change may or may not harmonize with the environment (There is no particular reason at this time to supposed other than a fortuitous harmony).

4. The result may strike out in any direction - may keep going to eventual death by orthogenesis or return if the swing of the equilibrium is a long one and accounts for competition of closely similar species.

Vital Gas

37

Organisms to be able to express themselves in mechanical ways are of necessity constructed of solids or "gells".

Viruses being fluid can only express "chemical" activity (lytic action, et cetera). Never-the-less they do exist and are capable of self perpetuation.

See 17, 19, 25, 31

On earlier pages "fluid" life has been considered and demonstrated abundantly. Carrying it a step further what of gas? Looked at from a physical standpoint the definitions of solid, fluid, and gas should be useful. Viruses are close if not identical with enzymes. Look then to active physiological gas of more unstable and complex character. What of marsh gases, coal mine forms and general "heavy" gases. Their proper environment would be "pockets" the diffusion (distributional edge) being usually suicidal (as are even higher animals). We look on gases as products of decomposition. (Also did a bacteria and frogs once). Why not consider methane (e. g.) as a form that modifies its environment to make more of itself?

What is life - only a point of view? A definition?

March 5

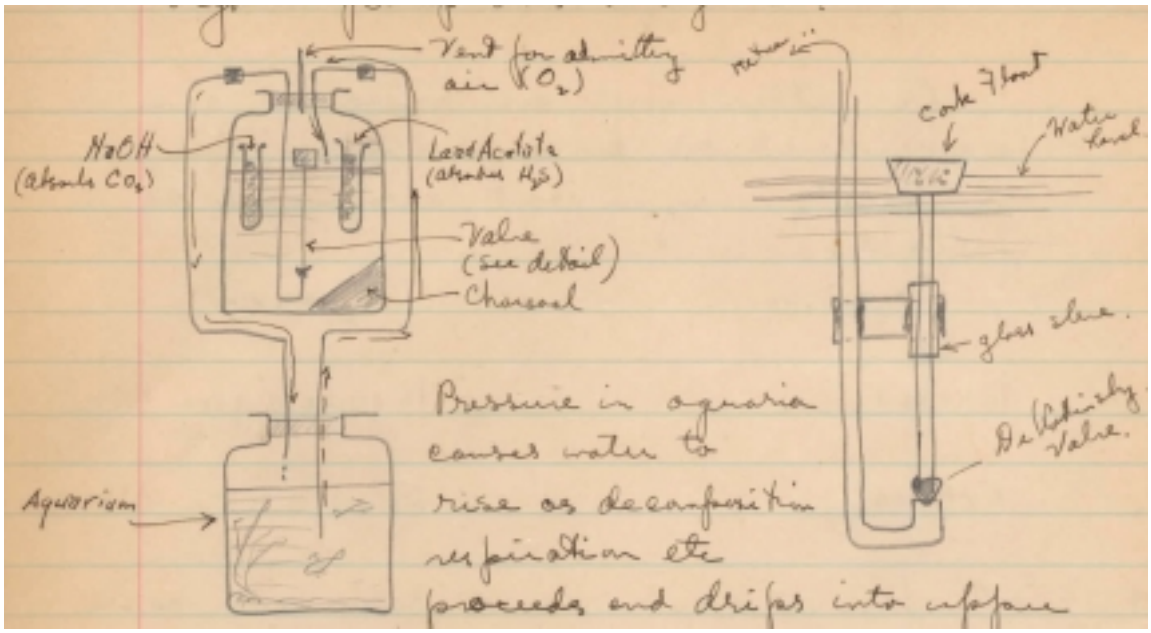
39

Aquaria Compared with Organism

In certain ways an aquarium can be considered as an organism. This similarity may in part be expressed as follows.

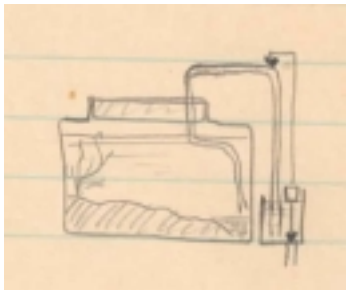
	Organism	Aquarium
Oxygen	Inhaled	Invaded from Air
CO_2	Exhaled	Evaded to Air
Food	Gotten from exterior surroundings in both cases	
Excretion	Expelled	Removed manually
Water	Gotten from exterior surroundings in both cases and lost by evaporation etc. in both cases	
Organic units	Leucocytes Bacteriophage Parasites (internal)	Protozoa Bacteriophage Fishes etc.
	Normal chemical constituents in both cases. In an effort to design an aquarium sharing the more detailed connections the following "organic pump" was designed.	

40



Pressure in aquaria causes water to rise as decomposition, respiration etc. proceeds and drips into upper chamber. Here CO_2 and H_2S is removed and O_2 added. When cork float is lifted the weight (head) of upper chamber causes return flow until seated again. If pressure is too great in aquaria air will bubble out until flow is started. If too little other line will siphon back thereby maintaining equilibria. The period of action depends on the activity in the aquarium. A temperature change or outside barometric change likewise insures a constant circulation.

This could be so built that the take would carry the accumulated feces (in one corner) out and drop it in the upper chamber. A cataphoresis [?] apparatus might be used to cause an electrochemical removal of dissolved waste? How about artificial differential osmotic membranes?



This device with a double valve will void an aquarium of feces and some fluid and automatically shut off. 41

In these schemes plants do not necessarily enter.

March 22 '31

Phage and Vitamins 43

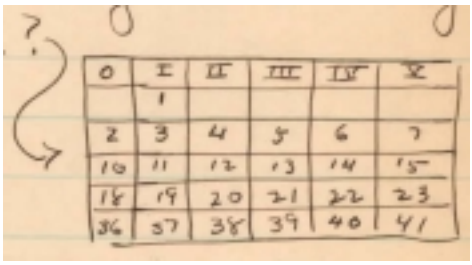
If vitamins in sea water may be dissolved proteins activated by UV irradiations may not they resemble phage or be identical with it? An over dosage of UV on ergosterol will inactivate it? I. E. can phage be created by UV in water?

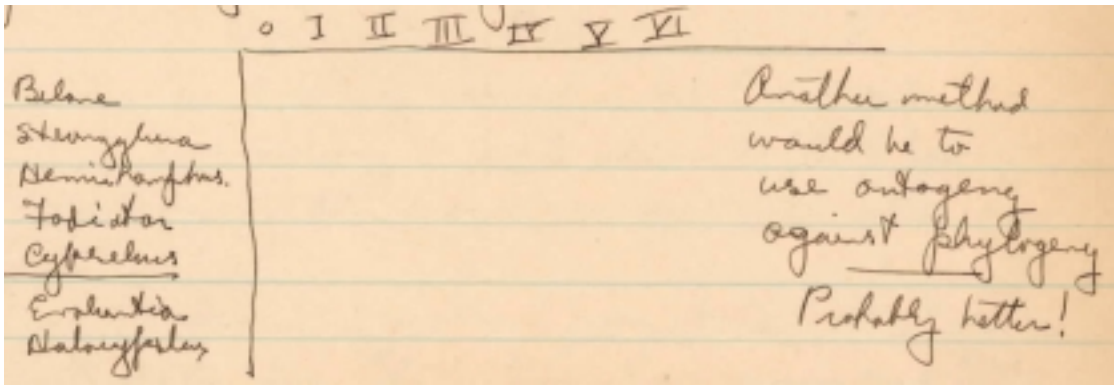
March 22 '31

45 **Evolutionary Periodicity**

In Synentognath evolution a certain curious trail of form and especially mandibular barbels makes itself evident. This is not orthogenesis in the ordinary sense but may be associated with the basic atomic periodicity in an indirect fashion. Considering the equilibria of Lotka and not mere adaptation in the ordinary sense some plausible hypothesis might be developed. The question of paired species? The two equilibria of Lotka (stable and unstable)?

Consider the periodic table of chemists. Might a form of this be brought in? Substituting for the common numerals (valences) increase in complexity (fin ray number, scales, etc.) and along the horizontal lines the genera possibly some periodicity could be found.





47 **Astro-biology**

Many of the subjects preceding this give suggestions as to extra-terrestrial biological possibilities. With the development of astro-physics and astro-chemistry the always following biology should follow. Already many fanciful suggestions as well as more reasonable probabilities go to build up such a subject - a single good evidential proof of some extra-terrestrial life activity would make a book on such a subject of value if only for its use as a background for suggesting angles of approach to life on earth.

Chapter headings might be as follows.

I - Introduction

II - The Data of Astronomy
Beliefs of Astronomers
Spectroscopic data
Conditions of planets

III - The Data of Chemistry
Limits of Life as we know it
Chemical conditions

IV- The Data of Physics
Temperatures
Radiations
Radioactivity, etc.
Electrical effects

V - Organizational possibilities

VI - Hypothesis

Data to Collect

Gravitation on bodies of various mass (diameter)
Gravitation necessary to hold elements (Earth holds H)
Bibliography of all suggestions on extra-terrestrial life
Get compendium of notions from fanciful stories
Get all data for "Interplanetary societies"
Design forms for various gravitational effects
See these books. [BIBLIOGRAPHICAL INFORMATION IN INTRODUCTION.] 48

Wells, H. G. The Outline of History. Garden City Pub. Co., N. Y.
Lull. The Evolution of the Earth. Yale Univ. Press
Osborn, H. F. Origin and Evolution of Life. 1921
Church, A. H. Botanical Memoirs. No. 183 Ox. Univ. Press.
Stopes, Marie Monograph on the Constitution of Coal
Chamberlain, T. C. The Origin of Earth. Chicago 1918
Johnstone, J. The Mechanism of Life. London 1924
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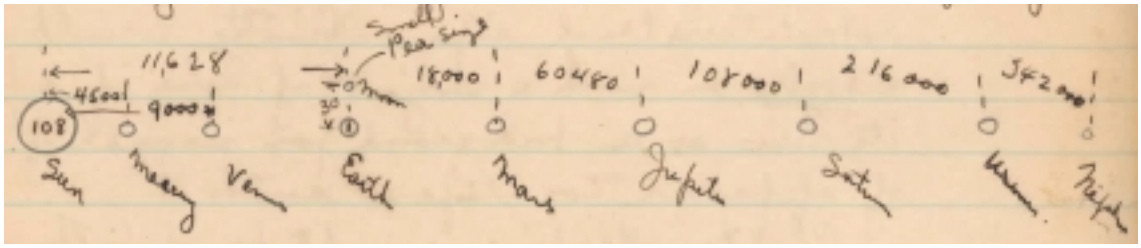


Nearest fixed star on this scale over 40,000 miles away. The above with the earth as an inch.

Preceding sections more intimately touching these subjects page 3, 7, 9, 13, 17, 19, 25, 31, 33, 37, 43, 45

March 22 '31

Evidences of space and time travel 49

One approach to the problem of intelligent extra terrestrial existence (in the sense of human intelligence) could be as follows. If such exists we might expect some sign of it. To date there has been no hint of interplanetary travel from other planets. This could be interpreted to mean that

1. No nearby body supports life sufficiently advanced for such attempts.

2. No nearby forms of life are interested in interplanetary travel which may mean

   a. A too superior knowledge and detached attitude to be interested in physical travel or a complacent satisfaction with distant observation and the planet adequate

   b. A real insurmountable difficulty inherent in astro nautic travel.

3. Astronautics not as yet developed in solar system. Other systems too remote to hope of earth being picked out even with a galactic "combing". Chances all against this.

Consequently we may either confidently imagine that no intelligent solar system life has been successful in interplanetary travel or is uninterested. This does not deny planet-satellite travel or extra solar system travel of even an extensive sort.

50 Interplanetary communication however may be battling at our doors perpetually however. The fault may be entirely our own. What of the geometrical "canals" of Mars? Might they have significance of an intelligible sort - geometrical with the Martians assumption of too much intelligence on our part? "Pathyograms" was suggested as a start for reverse conversation layed out in lights.

What of travel in time. Surely no one out of the past or future has ever appeared. May not our "psychic" life be here involved as suggested by Dunne. His 4th dimension as discussed in "15"
51 is strongly suggestive of this. Consider psychic manifestations, premonitions, etc.

What of travel up and down in size (e. g., enlargement to size in which suns become atomic nuclei etc. and vice versa). This while fascinating is probably impossible as the transition could not permit the passage of life even if physical objects could which seems unreasonable.

What of travel into planes of other "vibration". This a fantastic idea based on the energetic nature of matter allows many existences going on at the same time in the same place without interference. If such is sound physics it is probably impossible to translate one to the other as in magnitude travel but may have a suggestion of possibility by psychic on 4th or 5th dimensional extension - a meeting ground of the wave travel.

Summing up then the possibilities that have been suggested may be tabulated as follows.

I. Astronautics: No evidence of attempts. Not tried in solar system beyond satellites. Outside system?

II. Astrotelegraphy: Scant evidence, but man may be unable to intercept messages.

III. Chrononautics: The evidence of Dunne, psychic life. The only new road on which there is sign post.

IV. Micro & Meganautics: No evidence or reasonable suggestions.

V. Vibronautics: No evidence or probability but may be associated with Chrononautics.

Apr. 5 '31

Classification of Biological Fiction 53

Biological fiction may be classified as follows. There are a surprisingly few variables and all are based on physical and chemical probabilities (the "stage of the drama" of Lotka varied by current inanimate theories).

I. Terrestrial
  a. Undiscovered forms
    1. Obscure places on face of globe
    2. Interior subterranean forms
    3. Revived forms from past ages
    4. Forms of extra-terrestrial origin
    5. Machines (not organic)
  b. Newly developed forms
    1. Due to an accident of nature
    2. Due to laboratory discoveries
      a. Surgical operations
      b. Chemical and physical operations

II. Extra terrestrial
  a. Planetary and galactic travel or communication
    1. Satellite
    2. Planet
    3. Extra solar system
    4. Extra galactic
  b. Time travel (4th dimension usually)
    1. On earth
    2. In space
  c. Wave travel (any place)
  d. Increase or decrease in size
    1. Sub atomic 54
    2. Super universal

These or their combinations seem to be the limit of the imaginations of present day writer's of such stuff. The biology is usually pretty terrible. Below are some suggestions not seen so far in story form.

Organic dissociation and its effects
Distinctly other ranges of life in detail with reasons
Intelligent phage and virus

Apr. 5 '31

Reframing Biological Questions 55

It is undeniable that many questions of a scientific nature have caused confusion by their poor or misleading question form. This is in part due to an attempt to put a problem pithily and partly to a failure to think all around a given subject by the framer.

It would be interesting to examine the classical questions and attempt to reframe them in a paper of general circulation.

E. S. - "What is life"? Rather "What is occurring"?
- "What is heredity"?
- "What is environment"?
- "What is organism"?
- "What is behavior"?
- "What is instinct, reason"?
- "What is an individual, a plant? an animal"?
- "What is natural selection"? (a distinct paper that stopped question but answers nothing). See Lotka - the framing of definitions, etc.

May 28 '31

57 **Mitogenetic Rays**

As their effect is similar to that of UV may they not be in the nature of fluorescence - some change in wavelength due to the chemical nature of the growing substance. There effect on a photographic plate has not been formed. Even if they can be propagated in the darkness they may be a "hang-over" luminescence of weak sort of similar nature. As their wave length has been determined the problem seems to refer to Physics and Chemistry directly the biological element being simply a question of what bio-physical activity produces what quantity and quality of radiations.

See Quant. Rev. Bio. - summer 1931

May these have to do with the rays of vitamins of A and B and their reputed active power of Sophie Botcharsky and Anna Foeringer?

June 6 1931

59 **General Data to Classify**

Folders on the following subjects must be made in order of properly classify all subject matter pertaining to data in this book.

1. Energy exchange systems

2. Chemical reactions under various conditions

a.	Higher pressure	
b.	Lower pressure	t. p. relationship
c.	Higher temp.	to reactions
d.	Lower temp.	

3. Astro-physics

a.	Conditions on planets (tabulated)	
	temp range	
	pressure range	these to be
	chem. conditions	related to #2
	gravity conditions	
	light (wave length) conditions	

4. Extra terrestrial organisms

   a. Theoretical
   b. Astronomical observations
   c. Meteorological observations

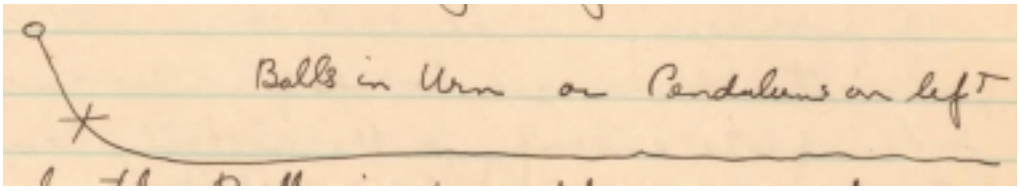
5. Mathematics (4th et sub dimensions)

   a. Time flow and travel

July 1931

Entropy or Periodicity 61

Lotka 1925 shows the similarity between an evolving system (increasing entropy) (more probably state) p. 30 et sub and receives the same type of curve



In the Balls in Urn the original state should be reached sometime theoretically and in the pendulums (his system by calculation) it is in 7385 years. What is the essential difference except that by definition we know in advance the status of the system at any time? (Like a tide predicting machine - a good practical case that actually works on natural phenomena - and nothing but a mechanical integrator - Could it not be done for biological phenomena). Taking evolution as "the history of a system undergoing irreversible change" (increasing entropy - more probable state). If this is all true should not all evolutionary processes be periodic over immense stretches by sidereal time? Is an evolution not now (organic - terrestrial) at about x 62
in above chart now? Thus an evolving system slows down in its speed of attaining a "stable" condition. Does geologic data suggest this? System is meant above not some organic fragment of it.

See page 45 - could this have anything to do with it?

The return period should be some like a passage from the heat stage with all matter a gas to absolute zero (complete entropy for the system) then raised again to absolute heat passing through all the stages outlined on page 9. This aids the hypothesis for a physical basis of orthogenesis on page 33.

Aug 10, 1931

Books to Write
with full Bibliographies 63

1 - The Reproductive Habits of Fishes
    Full Bib and Philosophy

2 - The Development of Fishes (Life History)

Similar and a companion to 1

2 - The Care of Aquaria - "Aquarium Biology"
All Bib and results of years study.
(Mechanical, chemical, biological)
Or Aquarists Vade Mecum (or two books?)

3 - Handbook of Ichthyology
Taxonomy. Experimental. Field. Lab, etc.
Not unlike Shelfords "Ecology"

4 - A Monograph of the Synentognathi
Flying Fish and their Relatives

All my present work and plans lead to the above except for the philosophical data in this book of "pipe dreams".

64 **Card Index**

(1) Reproductive habits.

[Life history (2) included for most part under this after "reproductive habits" is finished clear up for (2).]

(3) Aquaria

Practical data and all physical, chemical and biological data.

(4) Handbook

Most for this can be picked out of (1), (2) and (3) as technique. Other data listed here until ready for revise.

(5) Synentognath

Full taxonomy and everything else.

(6) Locomotion

Kept going for possible revision and check up.

(7) Local fishes [same as (6)] included in fishes from Lab. to Florida.

(8) New species and subsequent fate and references to them.

65 **The Too Successful Species**

Studies usually consider survival abilities. What of forms that survive and increase greatly? They may fail eventually by any of the following items.

1. Outgrow and outnumber food supply

2. Conflict with each other on other basis

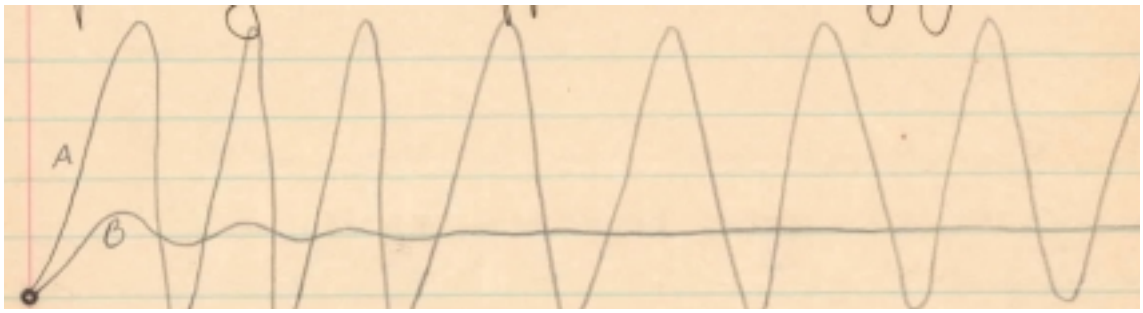
3. Greater opportunity to epidemics, etc.

4. Destroy the environment that made them possible.

The third and fourth may represent animals showing periodicity.

What is success? How to be measured? Great efficiency leads to the above. Less efficiency "just enough to get by" leads to a stable state. Is this success? Is the moral in this - avoid too much excellence?

Probably all animals are more or less periodic in nature, only those suspiciously so being noted by man. A low and high coefficient of reproduction probably is the differential limiting factor.



Above 2 species of such nature starting from a low point B (low coefficient) causes little immediate disturbance to the balance of other things and soon smoothes out to a "steady state". A produces great numbers with a corresponding upset, the oscillation of which continues - or increases. But both are "successful" according to their kind. How does the details of their mechanism work.

Mar 26, 36

Size and mass of food in reference to predators appetite 67

Size, number and breeding rate of prey should be compared with volume of food necessary for predators. Different types of relationships should give very different ecological relationships and perhaps have important effects on evolution.

Abstract examples should be worked out, e. g.

A predator needs 1 lb of prey per day. Then the prey population must have to slough off 1 lb per day per predator for a stable equilibrium. If the prey weighs $^1/_2$ lb. the 2 individuals a day must go and the reproductive rate must be replacement plus 2 per day or assuming there is one rep. season per year +730 per annum or 1460 lbs.

This carried out and compared with other relationships say 10 prey per day should lead to interesting conclusions.

August 15, 1937

Oct. 30, 1919

[LOOSE PAGES FOUND INSIDE DIARY.]

Axiom I

Life is a property of matter

1 - As such it should come under the laws governing such properties.

2 - Force can not be dissociated from matter.

3 - Matter is only acted upon by force.

4 - All actions of matter living or inert therefore act according to the external pressure laid upon them at the moment of action or previous to it (Matter thus storing it has the potential properties of such action as caused it to be stored) (cause and effect).

5 - The so called "free will action" of the mind is but the liberation of the effects caused by the sum total of all heredity and environment.

Axiom II

Man is not a "free agent"

1 - A property of matter has not voluntary causation (i. e. a rock does not fall because it wishes to, but by gravitational attraction) Axiom I

The apparent "free will" of man is only evident by its effect. If the cause is traced out it will be found to be possible to lay each action to some previous action which in the final analysis is traceable to the blind forces of nature. The "free will" idea arises from our short length of life and the impossibility to follow the intricate and highly complex forces action upon us. To try to trace one soon convinces us of its futility. Take for example the writing of these thoughts. It is my firm belief that if we could trace the prime moving factor of this action it would include not only every act of every part of me and all my ancestry back to the original cell (if there ever was any) and that all the forces that acted together to form that prototype of all life but the very action and composition and electoral change of each ion in the universe of which there is no number as they extend out into space of no dimension and always have thus making all have no origin. But now we are unsound ground which our feeble intellect refuses to accept only because of its very finite limitations. It is true that we cannot ably conceive of that which our senses can not tell us about. But we started to speak of this penning of these musings. To begin with the present and thread our way backwards skipping here and there grasping the prominent events that lead up to this (that alone is impossible). Here let it be agreed that these "prominent" points are no more important than the (to us) most insignificant ones. Before coming to my room I talked real estate to Mr. Higley which will be as far back as we will go. If he had been especially interesting in his conversation I would no doubt have staid longer and not done this or if I had it would have been different than it is. Also if different things had happened to him in his lifetime (such small matters as tying a shoe lace I would have never met him or it would have delayed him so much that he would have been killed by a skidding automobile or what not). (All this is just to exemplify and amplify the preceding axioms.) Or on the other hand, if someone had not failed to send a certain telegram things would be different, possibly I would be in jail now for murder or some other seemingly impossible thing. Again if some one had not asked me to join I would not be here now, as I would not have gone to the beach and if I did and

had watched the breakers or something a moment longer I would not have met my wife on the train as it pulled out or if I had watched them a little less I would have found out it was the wrong train and waited for the right one and so on ad infinitum. How with the self evident facts before us can man be thought a free agent?

Possibly this is an unhealthy way to look at things but no doubt as everyone's bony case surrounds the brain touches it in a more or less different way and affects it one way or another a Christian not be blamed for thinking as he does or I for these notions. Possibly a carefully trepanning of my cranium would make me a more devout Christian.

A carefully made up contradiction of the above would be highly interesting and possibly make happier some people by placing them in the sound belief that nature and its laws are not their complete master. Master is a bad word as nature as used is all inclusive and therefore just interaction with no regard to the master and slave idea !

To all effects in daily life we are totally unconscious of this subservience to natural law and if we were not it would be an unfortunate thing to believe continually and consciously in predestination for undoubtedly the above is such. It would make life unbearable for some and is chiefly interesting to "the man in the street" as a "parlor argument" even if its truth can not be assailed with any degree of success.