

CONCEPTS IN BIOLOGY

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Ou va l'homme sur la Terre?

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DEDICATED TO PROFESSOR

D. ENRIQUE C. RÉBSAMEN

DIRECTOR GENERAL OF NORMAL EDUCATION

With my deep respect and gratitude.

The Author

INTRODUCTION.

Professor Henry C. Rébsamen, General Director of Normal Education, as proof of his great efforts for the advancement of the youth education, started the class in Concepts in Biology, doing us the honor of proposing a class in this interesting subject, and obtaining from the Ministry of Justice and Public Instruction their gracious respective appointment.

As we do not know of a biology text suitable for our current program, it was necessary to compose the one here published today, almost as it was dictated to the students, the works as listed below having served to prepare our lessons:¹

“Biology,” by Letourneau.

“Darwinism,” by Ferriere.

“Concepts of Biology,” by Conn.

“Principles of Biology,” by Spencer.

“The Origin of the Species,” by Darwin.

¹ This little book is in fact a summary of our studies since the year 1888.

"The Descent of Man," by Darwin.

"The variation," by idem.

"Darwinism," by Wallace.

"The Evolution of Sex," by Geddes and Thompson.

"Animal Life," by Jordan and Kellogg.

"The Cell," by Henneguy.

"The Protozoa," by Calkins.

"Botanisches Centralblatt."

"The History of Creation," by Haeckel.

"Anthropogeny," by the same.

"Experimental Science," by Bernard.

"Form and Life," by Housay.

"The Human Species," by Quatrefages.

"Biochemisches Centralblatt."

Other consulted authorities are mentioned where appropriate.

* * *

We have taught, with the best of faith, what seems most accepted among the plethora of opinions of leading biologists. We have treated our own personal ideas as tentative and speculative, leaving students the burden of judging them, and rejecting them if necessary.

With regard to the beliefs and philosophical tendencies of the students themselves, we made efforts that they not suffer, because we are amazed by the inaccessible, and for our part we have been reserved to an exaggerated degree, in the treatment of everything not derived from observation and experiment.

It is likely that this first attempt will soon undergo a series of corrections and be followed by another less imperfect edition, which will be published as soon as possible, happily taking the advice and censure of biologists into account.

Before concluding this brief introduction, we would like to express our gratitude to General Don Manuel González Cosío, Secretary of Development, Colonization and Industry, who arranged to have this little book printed in the typographic workshops of their important ministry, and Professor Don Enrique C. Rébsamen, our dear and wise director, who provided the necessary elements for photographic reproduction of the figures, the paper, the most valuable and accredited reference books, and in a word, everything that was thought to be conducive to our proposed goal, that a print run of 200 copies of "Concepts in Biology" be made and that they be dispensed free of charge among the students and national teaching facilities.

Mexico, October 4, 1903.

PLAN OF THE WORK.

BOOK ONE.

FUNDAMENTAL PROPOSITION.

All material phenomena of organisms, in the past and present, have been or are caused by known physico-chemical forces.²

Biology is the science of these phenomena.

BOOK TWO.

DEMONSTRATION.

- A. Facts of fundamental unity.
- B. Facts of cellular life.
- C. Facts of evolution.

BOOK THREE.

CONCLUSIONS.

- 1. What is the future of man on Earth?
- 2. What is the future of matter in the Universe?

BOOK ONE.

FUNDAMENTAL PROPOSITION.

All material phenomena of the organism in the past and present, have had or are caused by known physical and chemical forces.

Biology is the science that studies these phenomena.

DEFINITION, PURPOSE, AND UTILITY OF BIOLOGY.

The term biology was first coined by Lamarck and Treviranus: it is the important science of life, a beautiful and profound science, which underwent remarkable development in the 19th century, being called upon to explain the origin, form, variety

² We refer to material phenomena, without denying or affirming the existence of the intangible.

and structure of beings, colloidal minerals that have inhabited the planet for millions and millions of years, and perhaps, why not admit it, of those which should inhabit distant celestial bodies, and that astronomy together with spectroscopy suggest as a kind of chemistry of the Universe.³

Auguste Comte gave the word biology a vast, encyclopedic meaning, as it had to cover an impressive group of sciences, including anthropology.

Letourneau, as noted above, limits it to the explanation and coordination of all the great facts and laws of life, almost like what is commonly understood by general physiology, applying that designation to the two organic kingdoms, "how organized beings nourish themselves, how they grow, reproduce, move, feel and think."

But Pascal has claimed that definitions are an illusion of our spirit and this phrase should be remembered when trying to define the word biology or even set its limits, without first defining the term life.

What is life? No one can say yet. We can provide an entirely physico-chemical explanation of vital phenomena, but if we are honest, it is our duty to caution that until the synthesis of a living being is accomplished, nothing can be certain, no assurance can pervade the scientific world, which is not content with words such as biogen,⁴ chromatin or plastin, which in fact explain absolutely nothing.

Our theory that inorganic protoplasm is an osmotic electrolithic device, could resolve this difficult question, but it has still not received the necessary confirmations by competent researchers and thus we can only present it as provisional.

It is thus worthwhile to discuss here the definitions that have been given for life and the place Biology may hold in the updated classification of sciences.

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Definitions of life.

According to Bernard (Fig. 1) the following principle definitions have been given:⁵

Life is the resistance of organized matter to the causes which constantly tend to destroy it.-*Pelletan*.

Life is a force that resists to the laws governing inert matter.-*Cuvier*.

Life is a combustion.-*Bernard*.

Life is a decomposing material.- *Mitscherlich*.

Life is death, the destruction of tissues by combustion.-*Bernard*.

Life is a minotaur, which devours organisms.-*Buffon*.

Life is a defined combination of heterogeneous changes, both simultaneous and successive.-*Spencer*.

Life is the opposite of death.-*Encyclopédie*.

Life is organization in action.-*Béclard*.

Life is the special activity of organized beings. -*Duges*

It is a principle within action.-*Kant*.

³ The density of the Moon is very similar to that of certain manganese or iron phosphates. Meteorites contain phosphorus and calcium, which are necessary for life [*Guillemin. Le Ciel*, p. 4171]. According to Huggins, calcium exists in the Sun. ("Nature." 1898, p. 182.) Apatite, impure calcium phosphate, has been found in the Juvinas meteorite. (*Daubrée. Les eaux souterraines*, t.3, p. 339.) Silicon is not an exclusively terrestrial element.

⁴ O. Loew. Zur Theorie der Primären Protoplasma-Energie. "Biologischen Centralblatt." 15 Nov. 1902, p. 736.

⁵ Bernard. *La science expérimentale*, pp. 149 to 212.



Fig. 1. Claude Bernard.-French philosopher and physiologist. He was born July 12, 1813. He died February 11, 1878. He demonstrated the unity of the phenomena of life and established the main principles of life's natural physico-chemical explanation.

* * *

Bernard criticizes all of these definitions and concludes that life cannot be defined and that *its principle characteristics are the creation and destruction of organic matter.*

In our concept a formula, rather than a definition, can be proposed, which is entirely positive:

Life consists of the physico-chemical activity of protoplasm or a specially constituted emulsion with a fundamental condition: osmotic flows.

If these are permanently paralyzed *death* results.

If these are slowed for a short time, *sleep* results.

If these are slowed by cold, *hibernation* results.

If they are slowed by dessication, *dormant life* results.

If they are slowed by excessive heat, *aestivation* results.

In full activity, this is called active or manifest life.

Note that other definitions do not mention the *protoplasm*, the physical basis of life, without which all definitions are inadequate, thus they begin by considering life as an extraordinary phenomenon without primordial basis.

Fig. 2. Active life-Circulation of liquids and gases in the plant. Roots absorb water and dissolved salts, the leaves take CO_2 and O from the atmosphere and O and emit CO_2 , O and H_2O . All these phenomena are due to the protoplasm; within each plant or animal cell protoplasm is the only living part.



In effect, the transformations of various organic and inorganic materials that the being contains, and their organization itself, is subordinate to the presence of protoplasm and *without it there can be no life*. That is why the fundamental aspirations of the biologist can be reduced to the study of this curious and unique substance.

In summary:

Life is the activity of protoplasm.

Later we will explain the details of this activity, which seem to be rather simple, but since then, and as a logical conclusion of the above, we can say that:

The object of *biology* is the study of protoplasm, in all its manifestations. It could also be called general plasmology.

These are physico-chemical manifestations, and biology is the science of the phenomena of the organism, which in the past and present have been and are due to known physical and chemical forces, a principle which will be demonstrated in the second book.

To give a metaphorical notion of life and manifest instability, it could reasonably be stated:

Life is a prolonged agony.

Indeed, the inevitable aging of tissues, the obliteration of certain channels, the disappearance of fetal characteristics, then infantile ones, then adult ones, are so many more deaths which occur in our body. Everywhere there are dead faculties, white hair, defunct sexual organs.

We are slowly dying. Even in the brain facts and figures are forgotten, and the old person that relates with difficulty his monotonous stories, pausing with every step to remember and even to despair for his lost memory, suggests the idea of an old machine, broken by the wear of gears and shafts.

And what about faculties in general, illusions, activity, love, patriotism! Everything is irretrievably dying.

A true science cannot stop there. *Even a cadaver has its biology*: these phenomena will be explored in more detail later, using more vast and general science, which doesn't make an absolute distinction between life and death, similar to the various chemical reactions due to the action of the atmosphere and water on rocks.

* * *

The utility of biology.

The utility of biology is undeniable.

"Know thyself" is the motto of the truly wise and as yet we only know ourselves in a very imperfect manner.

Medicine is the science of the ignorant, ironically, though it should be the sovereign science, because everything, absolutely everything that man does depends on nutrition, at least from the modern physico-chemical point of view.

Lately, in effect, traits which appear less than material have been associated with the constitution, including those such as character, passions, crimes, temperament. It has been argued that the murderer is sick, atavistic, anemic, degenerate, and that study of hygiene and rational practice, and scientific regulation of marriage in order to prevent harmful unions, will lead to the regeneration of humanity, if only future biologists penetrate deeply enough into the mysteries of life, in order to modify our development.

The applications of biology are also crucial to agriculture. The detailed action of fertilizers remains uncertain, and all cultural practices, which were once so empirical, are being perfected according to modern scientific principles.

"The problem of food and its increasing scarcity will also have a definitive, practical solution, when protoplasm can finally be imitated in such a way that the nutrients are produced on a large scale, using highly economical, natural processes, which are much cheaper than a general chemistry lab."⁶

And without going back to those applications of biology *in the future*, we can be sure that its present utility is considerable.

As we shall later, one of the chapters of biology, the study of fundamental unity, it seems, is the necessary foundation for a new philosophy, as almost all the former are based on details and trifles, without encompassing *all of nature*. It is likely that the new path is coming to discern something of the origin and purpose of things, something like a new kind of light.

⁶ Berthelot. Les aliments synthétiques. Revue Scientifique, 1896, p. 132.

The naturalist philosopher Haeckel, gradually ascending the scale of his meditations, which began by considering the Monera, very simple organisms, has come to other great ideas and deep as that of monism or a single explanation for all phenomena in the Ether, which gives a kind of total awareness.

For his part, the noted astronomer Newcomb, has dared to publish a dissertation on "the Universe considered as a living organism."

Archibald Geike, Meunier and ourselves, in our modest series of investigations, have also considered the Earth we live on as a body endowed with endless motions and transformations.

Biology is a new science.

Biology is a new science, not because the objects with which it deals are new, but because they are being considered from a new point of view. Animals and plants have long been studied, but not as they are today. The difference between the old and modern methods could perhaps be explained graphically, saying that before organic beings were studied at rest, and now they are studied *in action*. Zoologists and botanists of past ages were limited to looking at plants and animals as specimens for museums,⁷ where they were ordered and classified with arbitrary names. The biologist of our times sees the same objects as active, as part of a whole that is always being modified and changing. Researchers of fifty years ago were dedicated to natural history, organic realms were made up of individuals that *had to be classified*: for the biologist of today, individuals *must be explained*. (Conn.)

In summary:

The usefulness of biology is the following:

- (1) *Medicine, the deep understanding of the organism.*
- (2) *Agriculture, scientific cultivation of fields and the perfecting of farm animals.*
- (3) *Sociology, the vices and solutions of society considered as an organism. Educational anthropology. The study of temperament and tendencies.*
- (4) *The problem of food and food shortages.*
- (5) *The unitary or monistic philosophy.*
- (6) *The study of organisms in motion.*
- (7) *The explanation of living beings.*

THE PLACE OF SCIENCE IN BIOLOGY

The unity of purpose in all knowledge.

All sciences are instruments focused on the same course, at the same star: *the truth*.

They all fundamentally investigate *quantification*, since everything tangible is reduced, according to Stallo, to mass and movement.⁸

⁷ See: A. L. Herrera. Les Musées de l'avenir. Mémoires de la Société Alzate, t. IX, p. 221.

⁸ In regard what is called matter, there is nothing in the brain that has not been first in the senses, and what operates in these is always a vibration, or a movement (light, sound, shock).

Determining the direction balloons will move is equivalent to studying the amount of force needed to hold them static, or rise in the atmosphere given the volume and weight of such a device. Calculating the orbit of a comet is equivalent to studying the magnitude of their attractions, distance, and speed. Investigating the toxicity of strychnine, per kilo of a poisoned animal, or the toxicity according to molecular weight is also a matter of quantity.

Various instruments and apparatus are used to estimate relative quantities:

Clinical thermometer and other species.

Barometer.

Pneumograph.

Balance.

Esthesiometer (to measure the sensitivity of the skin).

Dynamometer.

Micrometer.

Cathetometer.

Calorimeter.

Gasometer.

Blood cell counter.

Manometer.

Hematoscope.

Biology studies, for its part, a problem of quantity, because consists of chemical reactions behaving according to the laws of the combinations.

It is the mathematics of colloidal bodies, of protoplasmic emulsions.

It is a sub-field of chemistry that carefully considers phosphates, albumins, and the inorganic and organic bodies that form protoplasm.

Going further in this direction, we can ensure that, as it is a sub-field of chemistry, itself a sub-field of general mechanics, as it studies the movements of atoms carried by the eddies of combinations, biology becomes a sub-field of general mechanics.

In the not too distant future, the differences now considered to be essential between the various sciences will disappear, the truly wise will cover their highlights, and chemists, zoologists, physicists, who are blind and exclusively devoted to a single specialty, will no longer dominate, but there will be many generalists dedicated to the fundamental, the study of the linkages of the major hypotheses to experimental demonstration of the principle of universal unity.

The classification of sciences.

All classifications are imperfect, because everything is tied to fundamental unity.

Nevertheless, in practice it is necessary to establish some groupings, in ideas, in objects, in science, bearing in mind that any grouping is necessarily human, artificial and imperfect.

There being in the knowable world only mass and movement, it is absurd to seek absolute separations in its more or less transient modulations or aspects, and say, for example, that a bird is absolutely, completely and definitely different from a meteorite or a light beam; bird, aerolite, light beam, are varieties of movement,

modes of the ether. Matter is nothing but condensed force and all forces depend on movements of the ether.

* * *

40 years ago *botany* was considered as a science very different from *zoology*: today they are both *biology*.

Man wanted a separate kingdom for himself, the human kingdom: since Darwin we are now classified among the primates, the class of mammals, the vertebrates, the Animal Kingdom. Therefore, anthropology, with its entourage of auxiliary sciences, sociology, ethnography, linguistics, archeology, history, becomes a sub-field of zoology.

In short: *Zoology, Botany, and Anthropology, form a single science, Biology.*

But this is not fundamentally different from *anorganology or the science of inorganic bodies*, go ahead say what are the assumptions that may arise about the necessary link between the living and inorganic bodies. Inorganic bodies probably form the basis of those, of organized beings.

Biology is clearly a branch of physicochemical science, because life is reduced to physico-chemical phenomena, but actually chemistry is not only the investigation of certain atomic movements, subject to the laws of physics, and every day the tendency of scholars to restrict the movements that take place in simple combinations to electrical causes is accentuated.

Physics also covers terrestrial and astral matters, chemistry and biology, sub-fields of general mechanics.

That is to say, we have returned to our starting point: *mass and motion*. (Fig. 3.)

Subdivisions.

Ethereal Science or General Mechanics or Etherology	{	Mechanics	{	Mechanics.	{	Mineralogy. Biology or Plasmology.	{	Zoology. Botany.
		General Physics.		General Chemistry.				

SUMMARY OF THE FIRST BOOK

Fundamental Proposition.

All material phenomena of organisms in the past and present, have had or are caused by known physical and chemical forces.

Biology is the science of these phenomena.

Life consists of the physico-chemical activity of protoplasm, or a specially-constituted emulsion, and its current exo-osmotic and endosmotic conditions.

If they are slowed by fatigue, for a short time Sleep.

If these are slowed by cold, for several days or weeks, Hibernation.

If these are slowed the drying, Dormancy.

Herrera's 'Plasmogenia' and Other Collected Works
Early Writings on the Experimental Study of the Origin of
Life

Cleaves II, H.J.J.; Lazcano, A.; Ledesma Mateos, I.;

Negrón-Mendoza, A.; Peretó, J.; Silva, E.

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