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PAPERS

Teachers Authors and Textbooks: Definition of Life in Natural History and Biology Compendiums (1930 – 1959) for Secondary Education[1]

Professores autores e livros didáticos: a definição de vida em compêndios de História Natural e Biologia (1930-1959) para o ensino secundário

Profesores autores y libros de texto: la definición de vida en compendios de Historia Natural y Biología (1930 - 1959) para la educación secundaria

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Abstract

In this study, an analysis of the life definition and the study of living beings in Natural History and Biology textbooks was performed, understood as the materialization of school subjects. The objective was to understand how the concept of life was approached in nine textbooks of Natural History and Biology (1930 - 1959) authored by Candido Firmino de Mello-Leitão, Lafayette Rodrigues Pereira, and Waldemiro Alves Potsch, teachers of these subjects in secondary education. The analysis pointed out that defining life was considered complex in Natural History and Biology education and that the main question was not the life definition but how the life process could be differentiated from physical processes or raw bodies through its characteristic properties. No changes were identified in the definition of life and the study of living beings in the analyzed textbooks of the two school subjects in this period.

Keywords: Textbook. School subject. Natural History and Biology. Secondary education.

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Resumo

Neste estudo foi realizada uma análise da definição de vida e do estudo dos seres vivos em compêndios de História Natural e Biologia, compreendidos como a materialização das disciplinas escolares. O objetivo foi compreender como o conceito de vida foi abordado em nove livros didáticos de História Natural e de Biologia (1930 – 1959) de autoria de Candido Firmino de Mello-Leitão, Lafayette Rodrigues Pereira e Waldemiro Alves Potsch, professores catedráticos destas disciplinas no ensino secundário. A análise apontou que a definição de vida era considerada complexa no ensino da História Natural e Biologia e que a questão principal não era a definição de vida, mas como o processo da vida podia ser diferenciado dos processos físicos ou corpos brutos por meio de suas propriedades características. Não foram identificadas mudanças na definição de vida e no estudo dos seres vivos nos livros didáticos analisados das duas disciplinas escolares neste período.

Palavras-chave: Livro Didático. Disciplina escolar. História Natural e Biologia. Ensino secundário.

Resumen

En este estudio se realizó un análisis de la definición de vida y el estudio de los seres vivos en los libros de texto de Historia Natural y Biología, entendidos como la materialización de las asignaturas. El objetivo fue comprender cómo se abordó el concepto de vida en nueve libros de texto de Historia Natural y Biología (1930 - 1959) escritos por Candido Firmino de Mello-Leitão, Lafayette Rodrigues Pereira y Waldemiro Alves Potsch, profesores de disciplinas en la educación secundaria. El análisis señaló que la definición de vida se consideraba compleja en la enseñanza de Historia Natural y Biología y que la pregunta principal no era la definición de vida, sino cómo el proceso de la vida podía diferenciarse de los procesos físicos o cuerpos crudos a través de propiedades características. No se identificaron cambios en la definición de vida y en el estudio de los seres vivos en los libros de texto analizados de las dos asignaturas en este período.

Palabras clave: Libro de texto. Asignatura. Historia Natural y Biología. Enseñanza Secundaria.

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Introduction

The term Biology, the 'study of life', was independently introduced around 1800 by Lamarck, Treviranus, and Burdach (MAYR, 2008). The science historically built in Europe since the middle of the 19th Century - Biology, asserted itself in Brazil from the beginning of the 20th century. During a time when the population suffered from poverty and diseases, Biology emerged as a science that could change this reality, having among its promoters, in the 1920s to 1950s, the anthropologist Edgar Roquette-Pinto, the arachnologist Cândido Firmino de Mello-Leitão and the botanist Alberto José de Sampaio (DUARTE, 2010). In this context of dissemination and modernization of Biological Sciences, the Brazilian school witnessed the constitution of Biology as a discipline when no higher education in Biological Sciences nor Biology existed as a profession.

Considering the etymology of the word biology - from the Greek *bios* (life), *logos* (discourse), and treaty, one can summarize that this science aims to study life or all its forms.

Although it is not difficult to find different definitions of "life" in the ordinary sense, this concept is usually not defined in Biology textbooks. Instead, characteristics are described to help differentiate a living being from inert or dead matter. Kawasaki and El-Hani (2002) found a similar result after analyzing eight Biology textbooks (from 1997 to 2000), selected among the most used by Brazilian schools in Ribeirão Preto, São Paulo.

In this study, we rely on the theoretical contributions of Goodson and Chervel on school subjects and of Choppin on textbooks. Ivor Goodson (2011, p.75) states that historical studies help us understand how school subjects were constituted in the past and "[...] mapping this evolution through time, into the present, gives us insights on how circumstances that we experience as contemporary 'reality' have been negotiated, constructed, and reconstructed"[2]. According to Chervel (1990, p. 204), school subjects "[...] are modified" following historical changes inserted in a specific context, which, in a way, also determines the contents being taught.

According to Choppin (2004, p. 552-554), textbooks can vary their function "[...] according to the sociocultural environment, the time, the disciplines, the levels of education, the methods and forms of its use". In addition, the textbooks can be conceived as historical documents, based on which researchers can write about not the history of the textbook itself, but about how specific knowledge was prioritized and legitimized at a specific time.

Although research has been conducted on the definitions of life in textbooks in Brazil, few have focused on the historical perspective, as is the case of this study, whose objective was to investigate such definitions in Biology and Natural History textbooks published in the first half of the 20th century.

For this purpose, we took as object of analysis nine compendiums by three authors of published textbooks, those being: Candido Firmino de Mello-Leitão - full teacher of Biology at the Instituto de Educação do Distrito Federal, Lafayette Rodrigues Pereira and Waldemiro Alves Potsch – both full teachers of Natural History at Colégio Pedro II. According to Dávila (2006, p. 304), the Instituto de Educação do Distrito Federal and the Colégio Pedro II were two important schools nationwide during the time we address in this study. The teachers' works were found in the Documentation and Memory Centre (NUDOM - Núcleo de Documentação e Memória) of Colégio Pedro II, in the Library of the National Museum of Federal University of Rio de Janeiro (UFRJ) or are part of the author's private collection. For analysis, we selected the works where authors address – in at least one of the chapters – the theme "life".

Historical research makes us understand how textbook authors interpreted the definition of "life" and whether it changed in the study period. The historical period covered the first half of the 20th century, when there were several socio-political, economic, and educational changes, besides initiatives in the dissemination of Biological Sciences in Brazil (DUARTE, 2009, p. 318). This change occurred mainly in the Vargas Era (1930-1945).

[2] All citations are from publications in Portuguese and translated specifically for this article.

The text was organized into five sections: the first addresses the definition of life according to Mayr (1998, 2008) and Emmeche and El-Hani (2001); the second discusses the historical and educational context of the Vargas Government; the third explores Biology and Natural History as school subjects in the first half of the 20th century; the fourth addresses the professional trajectory of three teachers who authored textbooks on these school subjects; and the fifth analyzes how these authors approached the definition of "life" in their textbooks.

1. The definition of life

Primitive societies believed that "something" in living creatures distinguished them from inanimate matter and left the body when they died. In ancient Greece, this something was called "vital breath," and it came to be known as a soul in the Christian religion. According to the biologist Ernst Mayr (1904 – 2005), this was one of the problems when trying to define "life" since there is not an independent "life" or "life" force in a living organism. The belief of a "separate life" that could extend itself to a soul was contested by scientists. For the biologist, life "[...] is simply the objectification of life processes" (MAYR, 1998, p. 95; 2008, p.19 – 20). For Roquette-Pinto, who discusses the development of ideas about the concept of life, the attempts to define life were varied and mostly lacked a scientific basis:

> The activity of living beings could not fail to suffer, in the past, diverse explanations according to current doctrines because such existences depend so much less on the surrounding influences the higher they manifest themselves, and the humblest were the last ones to reach the field of science... (ROQUETTE-PINTO, 1922, p. 18).

Mayr (2008, p.20) states that when biologists address "life" they are not referring to life as opposed to death, but to the life lacking in an inanimate object. Then, according to Mayr (1998), "life" consists of identifying the underlying properties of living beings that differentiate them from raw and inanimate matter.

> Attempts to define "life" have been made frequently. Such efforts are futile, as nowadays, it is evident that no special substance, object, or force can be identified with life. However, the processes of life can be defined. No doubt, living organisms have specific attributes that are not found - or are not found in the same way- in inanimate objects (MAYR, 1998, p.71).

All these characteristics of living beings, according to Mayr (2008, p. 46), "[...] categorically distinguish them from inanimate systems". Considering the analysis of eight Biology textbooks conducted by Kawasaki and El-Hani (2002), the authors highlighted in all the complexity of defining life, and in five of them, they identified characteristics of living beings, as mentioned by Mayr (1998, 2008). Emmeche and El-Hani (2001, p. 37-38) classify Mayr's approaches to the definition of life as a traditional view of its definition, in which:

1) Life as such cannot be defined.
2) The definition of life is not a relevant issue for biology.
3) The process of life can be defined or at least differentiated from physical processes or raw matter by a list of underlying properties.
4) Certain living things may not have all the characteristics mentioned, so the list does not correspond to a set of requirements, as occurs, for example, with viruses.
5) Although life is a physical phenomenon, biology deals with such complexity of systems that life cannot be reduced to physics.

Emmeche and El-Hani (2001, p.42–52), in opposition to Mayr (1998), stated that "[...] it is not only possible to define life, but also that this definition already exists in theoretical Biology". The authors present three theories to define life: life as a natural selection of replicators, life as autopoiesis, and life as a semiotic phenomenon, which have been developed after the historical period that comprises the analysis of the textbooks for this study, henceforth will not be discussed.

2. Historical and educational context

Between the 1920s to 1940s, there were several social, political, and economic transformations in Brazil. In October 1930, the first government of Getúlio Vargas began, a president elected by indirect vote who remained in power for fifteen years, first as head of an interim government and after that as a dictator. Deposed in 1945, he was re-elected by popular vote in 1950, but did not complete his term, as he committed suicide in 1954.

Regarding the educational context in Brazil, the 1920s were marked by the Enthusiasm for Education and the New School Movement. Also, in the 1920s, schools began replacing the humanist curriculum with the scientific curriculum, alongside replacing the French works used in secondary education at Colégio Pedro II with national books written by teachers from this institution. These teachers sought to adapt their works to the reality of Brazilian education during a period of difficulties importing books caused by the Great Depression of 1929. The publication of textbooks by Brazilian authors was intensified by the educational reforms of Ministers Francisco Campos, Decree No. 19.890 of 1931 (BRAZIL, 1931) and Decree N. 21.241 of 1932 (BRAZIL, 1932), and Gustavo Capanema, Decree N. 4.244 of 1942 (BRAZIL, 1942).

Getúlio Vargas, in his first government (1930-1945), created new government sectors: the Ministry of Education and Health, the National Institute of Pedagogy, and the National History and Artistic Heritage Service. In addition, several laws and decrees were enacted during the time. Appointed Minister of Education in November 1930, Francisco Campos remained in office until September 1932, focusing his work on higher and secondary education (FAUSTO, 2012, p.288). Campos was replaced by Washington Pires in September 1932, later succeeded by Gustavo Capanema on July 25, 1934, who remained at the Ministry of Education and Public Health from 1934 to 1945.

Francisco Campos led the reform of secondary education, with the promulgation of Decree N. 19.890, on April 18, 1931 (BRAZIL, 1931). In the reform, a serial curriculum was established, dividing secondary education into two cycles: elementary education, with a duration of five years, and complementary education, with a duration of two years; the latter was also a requirement for applicants who intended to enroll in higher education. In 1932, The Decree n. 21.241, on April 4, 1932 (BRAZIL, 1932) consolidated the provisions on the organization of secondary education.

The implementation of the Estado Novo in 1937 defined the role of education in the nationality project. The educational policy attested to the purpose of the school, "on the one hand, a place of moral and civic obedience, training, development of citizenship and for the workforce necessary to achieve managed modernization. On the other hand, a place subjected to the wills of the State" (SHIROMA; MORAES; EVANGELISTA, 2011, p.22-23). Education had the power to shape society through the development of critical thinking.

Social control through the nationalist character in the Estado Novo de Vargas was present in secondary education in Brazil, not only in Natural History and Biology but also in other school subjects (DALLABRIDA, 2009; MONTEIRO; SOUZA, 2003). In addition to constructing Brazilian national identity, government control occurred in programs and

textbooks, growing from 1938 with the creation of the National Commission of the Textbook, linked to the Ministry of Education and Health.

The reform of secondary education established by Decree-Law N. 4.244 in 1942 divided secondary education into two cycles: the first - junior high school, with a duration of four years, and the second - scientific course, with a duration of three years. After primary education, the student could enter Junior high school and then attend the scientific course, which was the requirement for admission to higher education.

Secondary education was greatly influenced by French education, which had a classical and humanist basis. For Silva (1969, p.91), in addition to the pedagogical purposes, there were interests related to values and ideals which contributed to the formation of the Brazilian elite, in "an organized school structure consecrated by tradition."

When children from the lower classes began to attend schools, there was a need to regulate it. As the primary goal of the reformed schools was to educate children and young people towards an ideal of society, it was necessary to adapt to it for all of those who "constituted an obstacle to social development." In this effort, low-income families, "representatives of the old country" that should be surpassed, were a priority.

Material poverty was synonymous with spiritual poverty, poor character formation, and antisocial behavior. Therefore, considering the bad habits associated with poverty (alcoholism, lack of hygiene, etc.), one of the proposed solutions was to use students as an intermediary between teachers' scientific knowledge and the poor habits in their households. They believed it would not be productive and lasting for the child at school if the pedagogical procedures were not well received in the domestic environment (CUNHA, 2015, p.457-461).

Changing the way of thinking of the population was fundamental to the desired change of habits. But another "tool" –the eugenic logic– was also used to universalize education in Brazil. When the democratization of opportunities in public schools started to be implemented in the first half of the 20th century, intellectuals and civil servants –who invariably came from the white elite– adopted racial ideology. Whiteness embodied the desired virtues of health, culture, science, modernity, and "Darwinian superiority." Blackness, in turn, symbolized poor health, laziness, and criminality. Several educators embraced this vision (DÁVILA, 2006, p.23 – 27). Regarding Biology's contribution to the controversial ideas of eugenics, Duarte (2010, p.48) states that: "Biology subsidized the eugenic arguments surrounding the debate on the inferiority or not of Brazilian people."

In the 1920s and 1940s, educators' hygienist projects involved health and public hygiene campaigns. During the Vargas Era, in the school environment in Rio de Janeiro, eugenics and education reinforced the ideal of the Brazilian man desired by Capanema, in which the key to citizenship was to be part of the white race. This also meant behavioral bleaching, that is, discarding African cultural practices (DÁVILA, 2006, p.56 and 92).

3. Compendiums and Natural History and Biology school subjects in the years 1920-60

The use of French books in secondary schools characterized the teaching in the Brazil of the 19th century. The French pedagogical influence continued until the 1920s. As of 1925, Colégio Pedro II replaced the French works used in secondary school with national books. At the end of the 1920s, there was an expansion of textbooks published in Brazil, many of those authored by the same teachers who taught in schools. This trend was intensified by the educational reforms established by Ministers Francisco Campos in 1931 and Gustavo Capanema in 1942, which stimulated Brazilian authors' preparation and publication of secondary school textbooks.

Circe Bittencourt (2008, p. 32) highlights the nationalist character of the textbooks published from the 19th century onwards as "[...] a local production capable of assisting the formation of 'nationalist sentiment' without subtracting the future generations of scholars from the feeling of belonging to the civilized Western world".

Gatti Jr. (2005) indicates that from the 1930s to 1960s, the textbooks: "had authors from cultured places, such as Colégio Pedro II" and "did not present a process of elucidation and adaptation of language that was appropriate to the age groups for which they were intended" (GATTI JR., 2005, p. 382). In 1952, in a presidential message, Getúlio Vargas addressed the National Congress and stated that "they could reduce the workload of school subjects, rectifying the excess of content that overloaded the minds of students"[3] in secondary education. This task was given to the teachers of Colégio Pedro II, given the terms of Ordinance N. 966 of October 2, 1951, Art. 3.

Among the textbooks of Natural History and Biology indicated for secondary education from 1920 to 1950 are those by Lafayette R. Pereira and Waldemiro Potsch, both full-register teachers of Colégio Pedro II (LORENZ, 1995) and the compendiums by Mello-Leitão, full-register teacher of the Instituto de Educação do Distrito Federal (SANTOS, 2013).

With the reform of Francisco Campos, Natural History was taught as a subject to the third, fourth and fifth grades of secondary education and in the complementary course, in addition to General Biology and Hygiene. In the 1930s syllabus for Natural History at Colégio Pedro II, the following textbooks were recommended for the fourth and fifth grades: *Botânica elementar* [Elementary Botany] and *Zoologia Elementar* [Elementary Zoology], both authored by Lafayette Rodrigues Pereira. In the 1934 syllabus, these two compendiums were again recommended to be adopted by the teachers of Colégio Pedro II and other educational institutions (SANTOS; SELLES, 2014, p. 54-55).

With the Capanema reform or the Organic Law for High School of 1942, the school discipline of Natural History was replaced by Biology, which was offered in the second and third grades of the Scientific course and the third grade of the Classical Course. In 1946, according to Decree-Law N. 9.054 (BRASIL, 1946), the school discipline changed again to Natural History, being definitively replaced by Biology only at the end of the 1960s (SANTOS, 2013, SANTOS, 2021).

Historical research on the school subjects of Natural History and Biology carried out by Santos (2013) demonstrated that knowledge of botany and zoology appeared in the school syllabus of Colégio Pedro II from 1849 to 1951. In the 1880s, notions of hygiene were included in the Natural History syllabus and excluded in the 1912 syllabus. After the Benjamin Constant educational reform in 1890, Biology was included as a subject in the curriculum of Colegio Pedro II, according to the syllabus for the subject in 1896, 1897, and 1898. In 1899, not Biology, but Natural History, was taught at Colegio Pedro II and remained in the curriculum until 1934. At Colégio Pedro II, in the 1940s, a discipline with the denomination of Biology was again established, and Hygiene contents were included in the Natural History and Biology Programs in the 1940s-50s (SANTOS, 2013, p. 42-46; SANTOS, 2021).

4. Teachers who authored Natural History and Biology textbooks and their professional trajectories

Until the middle of the 20th century, Colégio Pedro II was a reference for Brazilian secondary education. Schools were expected to adopt the curriculum of Colégio Pedro II to obtain equivalence. Colégio Pedro II teachers could use the school's name in their publications,

[3] The 1952 Presidential Message and Education. *Brazilian Journal of Pedagogical Studies.* Rio de Janeiro, v. 17, n. 45, p. 199-225, Jan./March 1952.

and other schools adopted their textbooks. In these books, the expression: "from Colégio Pedro II" was found below the author's name and, therefore, being a full-registered teacher at Colégio Pedro II meant guiding teaching in a given school discipline, not only in this institution but also in other institutions of secondary education (DÁVILA, 2006, p.302-304). The differences between the Colégio Pedro II teachers and the other schools' teachers were noticeable in other aspects, such as: "[...] in remuneration, stability in the position, and the legitimate monopoly of knowledge, since the school board, composed of those teachers, was responsible for the teaching functions of other members of staff" (CASSAB, 2011, p. 82).

According to Santos (2013, p. 66-67), liberal professionals such as doctors, engineers, and lawyers acted as education professionals, performing teaching functions in secondary schools. In the 1931 reform, the education of secondary teachers in the Philosophy Colleges became mandatory, and the trend of specialization emerged.

In this study, we selected textbooks written by three teachers who taught Natural History and/or Biology in secondary education in Rio de Janeiro. Waldemiro Alves Potsch and Lafayette Rodrigues Pereira were full-register teachers of Natural History at Colégio Pedro II and Mello-Leitão was a full-register teacher of Biology at Instituto de Educação do Distrito Federal. Besides the prestigious position, they used the names of the institutions in their publications. Candido de Mello-Leitão, Lafayette R. Pereira, and Waldemiro Potsch had medical education and worked for many years in the educational field.

4.1. Cândido Firmino de Mello-Leitão

Born in 1886 in Campina Grande, Paraíba, Cândido Firmino de Mello-Leitão graduated in 1909 from the Medicine School of Rio de Janeiro. In 1913, Mello-Leitão held a public tender for the position of professor of General Zoology at the High School of Agriculture and Veterinarian Medicine of Rio de Janeiro, where he was the principal from 1915 to 1919 and remained until his retirement. He was a Zoology professor at the National Museum of Rio de Janeiro from 1931 to 1937 and at the National Faculty of Philosophy of the Universidade do Brasil from 1939 to 1941 (SANTOS, 2013). He held the position of vice president (1937 – 1939) and president (1943 – 1945) of the Brazilian Academy of Sciences and served in the Ministry of Agriculture (1930 and 1940) as a member and president of the National Council of Fishing and Hunting and as a consultant for Zoogeography matters of the National Council of Geography (FRANCO; DRUMMOND, 2007).

Mello-Leitão specialized in the study of arachnids and described new species, publishing around two hundred scientific articles in specialized journals on Arachnida taxonomy between 1915 and 1951. To honor Edgar Roquette-Pinto, he named a new species of spider *Roquettea singularis.* Also, to honor his friend and botanist Alberto José de Sampaio, he named a scorpion *Tytius sampaiocrulsi.* Throughout his life, Mello-Leitão cataloged 59,000 species of invertebrates (DUARTE, 2009; 2010).

Mello-Leitão stood out for his activism alongside other intellectuals to promote the association of Biology with Education, relating it to the conservation and protection of fauna and flora and to aspects that linked to the hygiene of the population. Acting as a researcher at the National Museum of Rio de Janeiro and as a professor at Instituto de Educação do Distrito Federal, Mello-Leitão sought to disseminate scientific knowledge to the lay public (DUARTE, 2009). According to Spiguel and Selles (2013), in times of popularization of scientific knowledge, we understand that Mello-Leitão defends Biology, proposing changes in the teaching of Natural History in school education.

4.2. Lafayette Rodrigues Pereira

A former Colégio Pedro II boarding school student, Lafayette Rodrigues Pereira had the highest scores in the selection exams to be the Natural History chairperson of Colégio Pedro II, being sworn in as a full professor in 1918.

The Brazilian physician and writer Pedro Nava (1927 – 1984) narrates in his memoir, *Chão de Ferro*, his experiences during sessions taught by Professor Lafayette Rodrigues Pereira during the years he spent as a student at the Colegio Pedro II boarding school – where he remained from 1916 to 1920.

> Natural history was previously taught only in the fifth grade until one class before mine. Then it was decided that from 1919 the subject would be split into two academic years. On this occasion, Leite took office, and we saw him prepping with Ennes de Souza to start his classes. But death did not allow it. His position was open for dispute. Preparation and luck favored Lafayette Rodrigues Pereira, a young doctor who, despite his name, had no kinship to the counselor's family. [...] When the school year began, we found Lafayette excited and ready to start sessions. The first one he taught us was his debut as a teacher at Colégio Pedro II. At the appointed time, we stood up and saw a young man with a protruding forehead enter the room, brown hair thrown back in studied negligence, blue eyes like two turquoise beads, light brown skin, an upturned, well-made nose with twitching nostrils, and a Bel Ami mustache. [...]. Thus and wearing a high collar, plastron, striped pants, gaiters, and varnish shoes – Lafayette impressed us deeply (NAVA, 2012, p. 286-287).

Lafayette R. Pereira also held the positions of vice-principal and principal of the boarding school, retiring after 33 years at this institution.

4.3. Waldemiro Alves Potsch

Waldemiro Alves Potsch (1892 - 1968) graduated in Medicine and began his career at Colégio Pedro II, in 1917, as a Geography teacher in a supplementary class for the 1st grade of day school and later applied for the position of professor of Natural History in 1918, second best after Lafayette Rodrigues Pereira in the selection exams. As a substitute teacher, Waldemiro Potsch taught Natural History and Portuguese. He was the Natural History chairperson in the day school of Colégio Pedro II in 1925 and joined the school congregation from its inauguration until the 1960s. With an extensive publication of textbooks from the 1920s to 1970s, Waldemiro Potsch's intellectual production is mainly related to the school subjects of Natural History and Physical and Natural Sciences (SANTOS, 2013).

Several of his didactic works were recommended in the curriculum of Colégio Pedro II, and possibly other educational institutions, indicating his influence on the history of the subject Natural History in Brazil (SANTOS, 2013). Waldemiro Potsch fathered three children who later became Biology teachers at Colégio Pedro II: Paulo Potsch, Carlos Potsch, and Sylvio Potsch (CASSAB, 2011).

5. The definition of life and living beings in Biology and Natural History textbooks

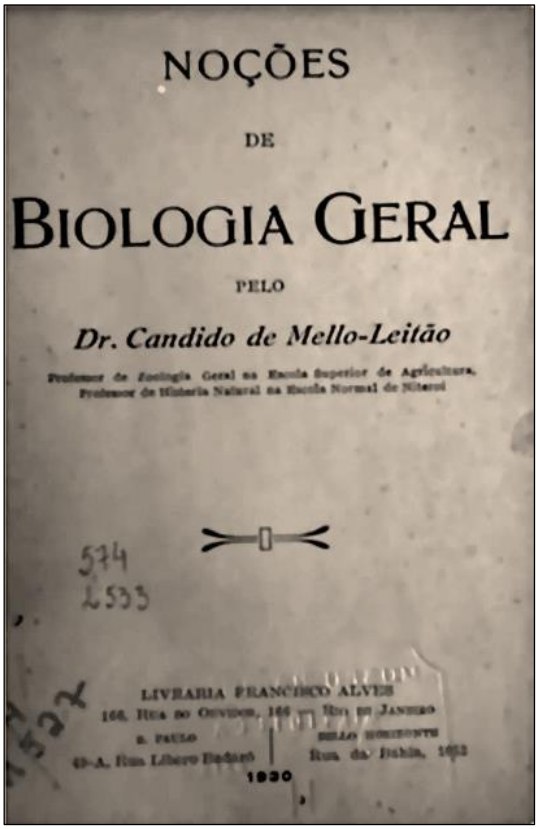
The way the three authors dealt with the definition of life and living beings was analysed in nine compendiums published between 1930 and 1959: three by Mello-Leitão, two by Lafayette Rodrigues Pereira, and four by Waldemiro Alves Potsch.

5.1. The compendiums by Candido de Mello-Leitão

The analysed books authored by Candido de Mello-Leitão in this study were: *Noções de Biologia Geral* (1930) **[**General notions in Biology] (Figure 1), *Curso elementar in História Natural* (vol. 4, 1935) [Elementary Course in Natural History] (Figure 2), and *Compendio Brasileiro de Biologia* (v.1, 1943) [Brazilian Compendium of Biology] (Figure 3).

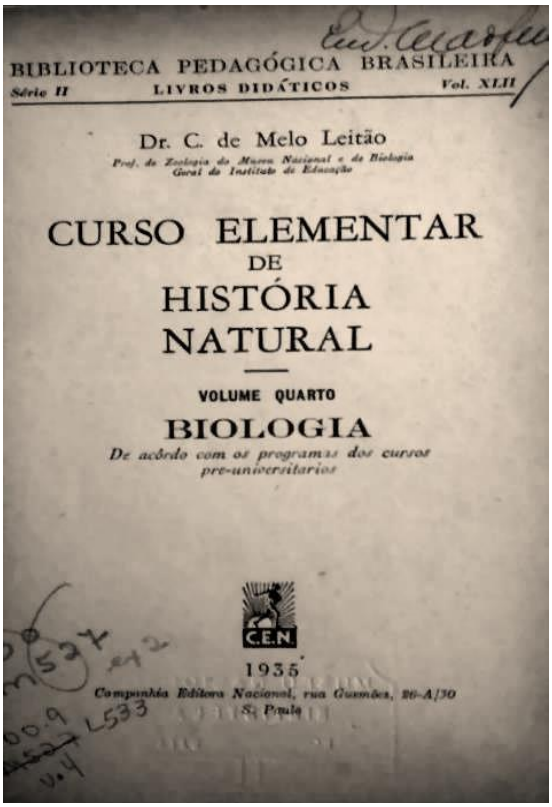
Mello-Leitão's book *Noções de Biologia Geral*, published by Livraria Francisco Alves, has 339 pages in the format 14 x 22 cm (Figure 1). The definition of life is discussed in the first chapter, comprised of six pages (p.7-12). Mello-Leitão begins chapter 1 entitled "Definitions, Domain, and Method of General Biology" stating that Biology "[...] is the science that studies living beings", enumerating some among so many other divisions of this field of study. Then, referring to the term "Biology," the author states that this "[...] has no exact meaning of its own", attributing to this the fact that the study of life involves very different points of view (ibid, p.7).

Figure 1 - Front cover of *Noções de Biologia Geral* (1930).



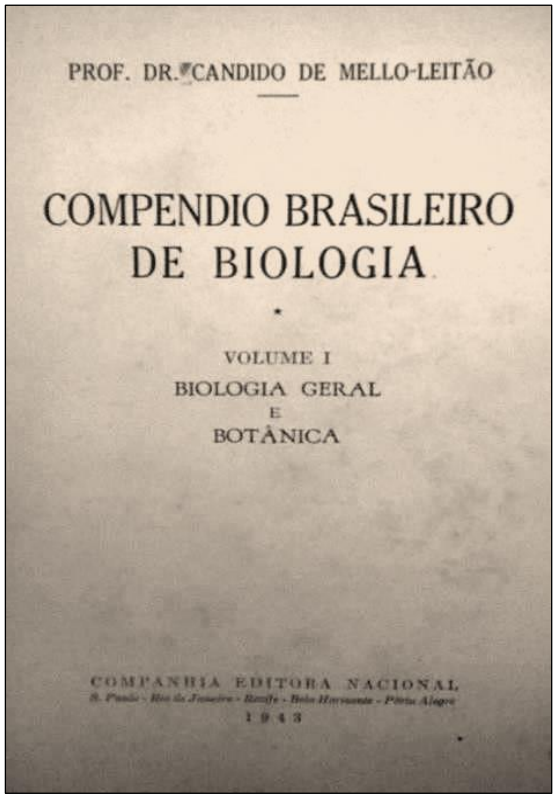
Source: National Museum of Rio de Janeiro collection.

Figure 2 -Front cover of *Curso Elementar de Historia Natural* (vol. 4, 1935).



Source: National Museum of Rio de Janeiro collection.

Figure 3 - Front cover of *Compendio Brasileiro de Biologia* (v.1, 1943).



Source: Author's private collection.

"LIFE" is the title of the third subsection (from a total of six) in chapter 1. In it, the author states that "by studying living beings, biology begins to meet the idea of what life is." However, it readily clarifies that "in the present state of science, this definition cannot be more than an essay." Soon after, the author mentions the possibility of life being defined as the relationship between living beings and the environment, characterized by two essential phenomena: self-regulation and the continuation of the species (ibid, p.9). Mello-Leitão concludes that:

> Each living being has its own chemical individuality and a specific, microscopic, and ultramicroscopic architecture. They also have the ability for growth, reproduction, and development. Finally, they have their own conduct, a record of excitations or experiences [...] and variability (MELLO-LEITÃO, 1930, p.9).

In these excerpts from the third subsection, Mello-Leitão highlights that, although the study of living beings can bring answers to what "life" is, such definition "cannot be more than an essay," referring to its complexity.

Regarding the possibility of life being defined as the relationship between living beings and the environment, having as essential factors the self-regulation and the continuation of the species, we can understand that the idea of "self-regulation" is directly linked to the definition of autopoiesis, while the "continuation of the species" is closer to the definition of life as the natural selection of replicators.

While concluding the subsection **"LIFE,"** enumerating some characteristics of living beings, Mello-Leitão used a common practice in current Biology textbooks, which was to differentiate living beings from inanimate beings using a list of characteristics. This is another element of the traditional view on the definition of life, in which life can be defined or at least differentiated from raw matter through a list of underlying properties.

The book *Curso Elementar de Historia Natura*l (vol. 4, 1935), published by Companhia Editora Nacional[4], has 424 pages with a 14 x 22 cm format (Figure 2). In chapter 5, entitled **Life and living beings** (p. 43 -55), we find content from the first chapter of Notions in General Biology (1930). This chapter was revised and expanded to a total of 13 pages to include topics not present in the initial chapter of the former book. Mello-Leitão begins the chapter with the definition of Biology:

> Biology is the science of life. In its broadest sense, it includes all the knowledge that has been accumulated, referring to living beings. By a curious coincidence, the word biology was used independently by two naturalists – LAMARCK and TREVIRANUS - in the same year of 1802, as an appropriate definition to designate the science of living organisms. It is much easier to define the science of life than life itself. [...] efforts to define life are as futile in improving our knowledge as the diligence to define space, time, matter, and many other common phenomena of our daily experience (MELLO-LEITÃO, 1935, p.43).

Among the ideas that characterize the traditional view on the definitions of life, two can be identified: (1) life cannot be defined; (2) the definition of life is not an important issue for biology. Next, the author describes (ibid, p. 44-49) the characteristics specific to living beings that differentiate them from raw matter: complex and heterogeneous chemical constitution; variability; growth; regeneration; development; reproduction; sensitivity and mobility. We also found a third idea about the traditional definition of life: (3) The process of life can be defined or at least differentiated from physical processes or raw matter through a list of underlying properties.

[4] Companhia Editora Nacional was created in 1925, in partnership with Octalles Marcondes Ferreira and Monteiro Lobato, who later sold their shares in the Publishing company to Octalles (HALLEWELL, 2012).

In the view of the author of this compendium, if life cannot be defined or if conceptualizing it is irrelevant, the important thing is to characterize the "living" through attributes or particularities that differentiate it from the "non-living." Such ideas remained in the 20th century and are treated as a traditional view of the definition of life (EMMECHE; EL-HANI, 2001).

The work *Compendio brasileiro de biologia* (vol. 1, 1943), published by Companhia Editora Nacional, has 423 pages with a 14 x 22 cm format (Figure 3). In chapter 1, entitled **Biology: treatise of living beings** and comprising 18 pages, Mello-Leitão discusses basic concepts of Biology and clarifies that this "[...] is the science that studies living beings". Next, the author refers to the definition of life: "Life has not yet found a satisfactory definition, and so we prefer to define Biology as the science that studies living beings, instead of giving the etymological notion of the science of life" (Mello-Leitão, 1943, p. 7).

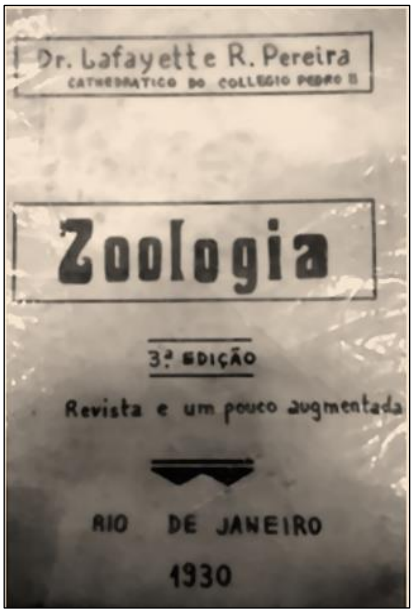
If for the "science of life" there is the challenge of finding a definition for its object of study - life, the same is not valid for the "science that studies living beings," which enumerates and describes the particularities common to living beings which allows them to be differentiated from raw matter: cell structure, complex chemical constitution, metabolism, irritability, reproduction, evolution, among others. Mello-Leitão deals with the science that studies living beings in 15 pages of this chapter, approaching the third idea of the traditional view on the definition of life. The remaining part of the chapter deals with issues surrounding the origin of life.

5.2 The compendiums by Lafayette Rodrigues Pereira

The analysed compendiums authored by Lafayette Rodrigues Pereira were: *Zoologia* [Zoology], published in 1930 (Figure 4) and *Botanica* [Botany], published in 1931 (Figure 5).

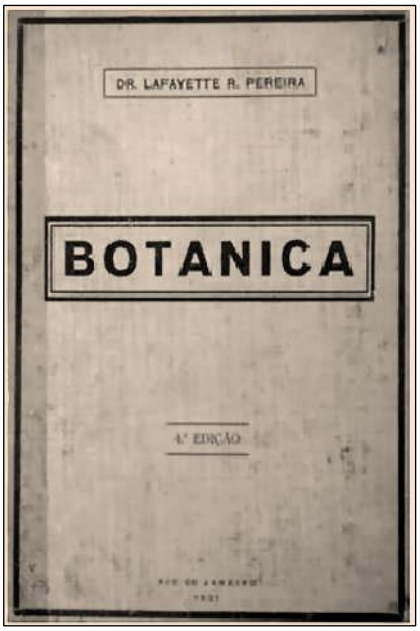
Zoologia (1930), authored by Lafayette Rodrigues Pereira and printed by Tipografia A Encadernadora S. A., has 805 pages in a 13 x 18 cm format (Figure 4). In the introductory chapter – Prolegomena, the author states that "[...] it is customary to divide the beings studied by Natural History into two kingdoms: - the living and the dead, or the organized and the inorganic" (PEREIRA, 1930. p.7). In this case, when discussing the "realm of the dead," Lafayette is referring to minerals.

Figure 4 - *Zoologia* Cover (1930).



Source: NUDOM Collection.

Figure 5 - *Botanica* Cover (1931)



Source: Author's private collection.

In Prolegomena, a subsection entitled: **General laws of life**, comprised of 11 pages (ibid, p. 10 – 20), the author discusses the science of life:

> Numerous are the differences between living bodies and inorganic beings, or, in other words – there are biological properties that do not allow for confusion between living organism and inorganic beings. Physiology is what describes and analyses these properties; it is the science of life (PEREIRA, 1930, p.10).

The "inorganic beings" to which the author refers are the raw minerals and matter. Lafayette continues: "What is life? This is a difficult question to answer" (ibid., p. 10). First, the author clarifies that "[...] countless thinkers, biologists, philosophers and attentive observers of nature, have tried to explain the notion of life in a short proposition. However, efforts are fruitless, and criticism often dismisses the defining arrangements" (ibid., p.10). Next, the author presents a metaphysical view as an answer to the question:

> As Claude Bernard said, life is not a principle that demands an objective existence; the word does not correspond to an entity; it is a metaphysical expression. In fact: the term life expresses, in a laconic way, the synthesis of the work of organized matter and... nothing else. All vital phenomena are linked to certain physicochemical conditions; if these conditions are met, life remains; otherwise – it does not (PEREIRA, 1930, p.11).

This author's statement that: "[...] the term life expresses, in a laconic way, the synthesis of the works of organized matter, and ... nothing else" is similar to Ernest Mayr's idea when he claims life to be "[...] simply the objectification of the processes of life" (MAYR, 1998, p. 95; 2008, p.19-20). If such physical-chemical processes occur, life remains; otherwise, life ceases to exist. Lafayette Pereira (1930, p.11) continues stating that attempts to define life are old and have existed since Hippocrates. Some consider it a principle, while others, a result but "[...] all definitions are erroneous, or insufficient", reinforcing the idea that life cannot be defined. Pereira, in his article "Life," published in the Journal Humanidades, reaffirms that life cannot be explained while discussing the ideas of different scientists and concludes:

> There are no hypotheses or materialistic theories that can be accepted as an explanation to the origin of life in our planet. At most, we could speculate about the environment in which life began, in light of the evolutionary history of the Earth, as well as the study of the structure of beings or their traces found in the first stratifications of the lithosphere (PEREIRA, 1947, p. 63).

The compendium *Botanica* (1931) by Lafayette Rodrigues Pereira was printed in 1931 in Officinas Graphicas ALBA, with 627 pages and in a 13 x 18 cm format (Figure 5). On the cover, it is written: "Elementary compendium adopted at Colégio Pedro II and in numerous educational establishments of the Republic." In the introductory chapter -*Prolegomena***,** there is a subsection entitled: "Characterization of living beings; differences between living and brute beings" (p.10-20). Lafayette opens the subsection by discussing living beings:

> Those who begin the study of biology immediately feel the need to deal with the assumption related to the morphological and dynamic characterization of beings endowed with life, establishing the differences between organized beings and inorganic or crude matter (PEREIRA, 1931, p.10).

Throughout ten pages (ibid, p. 11-20), the author addresses particularities of living beings and contrasts them with the non-living. Unlike his work *Zoologia* (1930), the definition of "life" is not discussed in the compendium *Botanica*. In this work, he discusses the characteristics of living beings, approaching the third idea of the traditional view on the definition of life.

This author did not publish Biology compendiums, possibly because the books were published until the early 1930s and Biology only emerged as a school subject for secondary education in classical and scientific courses in the early 1940s, according to the Decree-Law 4.244 of April 9, 1942, and educational programs of 1943 (SANTOS, 2013).

5.3 The Compendiums by Waldemiro Alves Potsch

The examined compendiums authored by Waldemiro Alves Potsch were: *Botanica* [Botany] (1933) (Figure 6), *Historia Natural para a 4ª serie* [Natural History for the 4th grade] (1937) (Figure 7), *Zoologia* [Zoology] (1957) (Figure 8) and *Compendio de Biologia Geral* [Compendium of General Biology] (1959*)* (Figure 9).

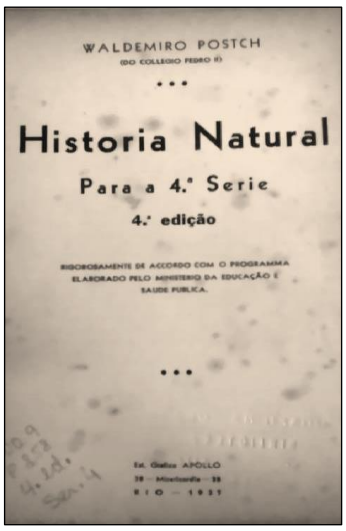
Botanica (1933) was printed by the typography A Encadernadora S.A. The work has 384 pages and a 16 x 23 cm format **(**Figure 6). In the introductory part, entitled "Characters of living beings" (p.1-5), Potsch begins the paragraph by stating that: "[...] nature, at the simplest inspection, presents beings divided into animals, vegetables and crude or mineral bodies" (ibid, p.1) and goes on to explain how to differentiate these three types of beings:

> When beginning the study of botany or zoology, the first inquiry of our spirit is to know the characters that allow us to establish a differentiation between them. Generally speaking, it is easy to point out the characters that make it impossible to confuse a living being, animal or plant, with any mineral of nature. [...] there is no way to hesitate in its classification, which is within reach of any primary school child. There is a set of characters in living beings that are not present in minerals (POTSCH, 1933, p.1).

Figure 6 - *Botanica* Cover (1933).

Source: National Museum of Rio de Janeiro collection.

Figure 7- Front cover of *Historia Natural para a 4ª serie* (1937).



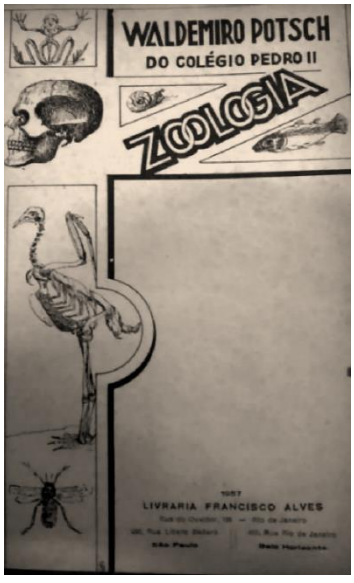
Source: National Museum of Rio de Janeiro collection.

Potsch describes characteristics present in living beings (animals and plants) that are not observed in minerals: cellular structure, permanent activity, absence of shape and geometric dimensions such as observed in minerals, complex chemical structure, nutrition, respiration, reproduction, self-regulation, and limited duration of life, concluding with the differentiation between animals and plants. Neither in the introductory chapter – nor throughout the *Botanica* compendium – does the author address the definition of "life"; he refers to living beings, describing the characteristics that differentiate "that which has life" from "that which has no life," aligning himself with the third idea of the traditional definition of life.

*Historia Natural para a 4ª serie (*1937*)* was printed by the Estabelecimento Gráfico Apollo in 1937, with 376 pages and a 14 x 19 cm format (Figure 7). The first chapter, entitled **Characters of living beings** (p.7-15), gathers knowledge explained in the *Botanica* (1933) compendium. Potsch (1937) states that nature "presents beings divided into animals, vegetables and crude or mineral matter" (p.7) and describes in six pages (p. 7-12) the set of characters of living beings not found in minerals: cellular structure, permanent activity, absence of shape and geometric dimensions as seen in minerals, complex chemical structure, nutrition, respiration, reproduction, self-regulation and limited duration of life. Next, the author describes the differences between animals and plants (p.12-15). As in B*otanica* (1933), the author does not discuss the definition of life, and the introductory chapter is intended to describe the characteristics that differentiate living beings from raw matter.

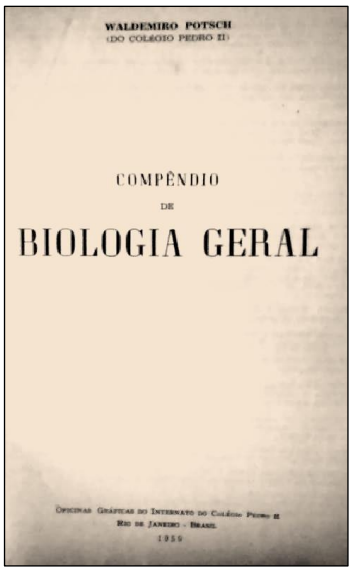
In the work *Zoologia* (415 pages) (Figure 8), with a 16 x 23cm, published in 1957 by Editora Livraria Francisco Alves, the definition of life was not identified, as in the other two books - *Botanica* (1933) and *Historia Natural para a 4ª serie* (1937). Potsch described the characteristics that define living beings and that are not found in raw matter without defining the concept of "life" in these compendiums.

Figure 8 - *Zoologia* Cover (1957).



Source: NUDOM Collection.

Figure 9 - Front cover of *Compendio de Biologia Geral* (1959).



Source: Author's private collection.

The *Compendio de Biologia Geral* (1959) [General Biology Compendium] (Figure 9) is a publication of Colégio Pedro II, with 263 pages and a 16 x 23 cm format (Figure 9). In this work, the author holds some lines at the beginning of the second chapter (entitled **LIFE** – p. 15 - 20) to discuss the definition of "life":

> It is easier to talk about the phenomena that characterize life rather than to define it. Philosophers and biologists across time have always sought to define life. Aristotle's definitions – "life is the set of organic movements of the bodies that possess it," Bichat's – "life is the sum of functions that oppose death," and so many others, are flawed and immediately challenged when proposed. If we cannot define it, we know that life is an attribute of a specific category of beings, which is why we call them living beings. Just as physics studies light, heat, and electricity as forms of energy whose properties are known independently of the bodies that produce, contain, or transmit them, so biology can consider life as an autonomous entity, as a form of energy. Physical and chemical laws are not the creators of life but their instruments, such as matter is only the host of life (POTSCH, 1959, p.15).

Quoting Morales, Potsch refers to "life" as being a form of "energy" or an autonomous entity. Therefore, the living being is the "instrument" or "host of life," and "life" is an attribute of living beings.

Without going into detail on the type of "energy" in which "life" consists, Potsch (1959, p.15-16) addresses the nature of vital phenomena: Vitalism, Mechanism, and Neovitalism. In Vitalism, life is "[...] the result of the action of a force or principle acting on organized matter"; in Mechanism, "[...] it seeks to explain the vital manifestations by the physicochemical forces inherent in matter," being, therefore, the physiological phenomena subordinated to the physicochemical processes occurring in the organism; and in Neovitalism, the author states that "[...] the physicochemical forces cannot be the only factors that regulate vital phenomena" but are also "essential to the existence of an immaterial principle that provides the vital character to organic matter." Finally, Potsch concludes the chapter with the general characters of living beings (p.16-18) and the differences between animals and plants (p.18-20).

The analysis of the works of the three authors shows they did not explain their own definition of "life" but transcribed definitions by other authors, indicating the complexity of defining it and understanding it as an "attribute of living beings" – carriers of life – and that are not found in raw matter. Roquette-Pinto (1922, p.19) also points out this trend in the thinking of the time when he states that the focus is not to understand what life is, but what a living being is: "But true progress could only be assigned with the displacement of the initial question. It is no longer a question of conceptualizing life, but of verifying **what the living being is**" (emphasis added).

Three ideas about the definition of life can be found in the analysed compendiums: (1) the complexity of the definition of life: "It is easier to discuss the phenomena that characterizes life than to try to define it" (POTSCH, 1959, p.15); (2) the debates about the definition of life have not led to advances in the teaching of biology: [...] "the efforts to define life are so futile and barely improve our knowledge" (Mello-Leitão, 1935, p.43); (3) the process of life can be defined or at least differentiated from physical processes or raw matter through their underlying properties: "Whoever starts the study of biology immediately feels the need to deal with the assumption related to the morphological and dynamic characterization of beings endowed with life, establishing the differences between organized beings and the inorganic ones" (LAFAYETTE, 1931, p.10).

Potsch (1959), citing Morales, states that, just as Physics studies light, heat, and electricity as forms of energy whose properties are known, Biology can also consider life as an autonomous form of energy, pointing out an idea of life that reinforces Biology as an autonomous science (MAYR, 2008): "Although life is a physical phenomenon, biology deals with systems of such complexity that we cannot hope, in practice, to reduce it to physics" (POTSCH, 1959, p.15).

The concept of life remained unchanged in these three decades in the compendiums of Biology and Natural History analyzed. According to Choppin (2009, p. 74), as an intellectual construction, the textbook "[...] varies according to the places, times, supports, levels and subjects of education, sometimes with political, economic, social, cultural, aesthetic contexts, but also, and above all, due to the scientific problem in which it is inserted." Therefore, one can understand that despite being works of different authors, books are texts produced simultaneously and in the same scientific context regarding understanding the phenomenon of life and living beings.

The historical context and socio-political purposes of an era determine the traditions of school subjects (GOODSON, 2011; CHERVEL, 1990). Thus, the knowledge and the way they are explored reflect the time they are inserted. These teachers who wrote textbooks adapted the contents about life and living beings in their books for the two academic-branded school subjects, with references to foreign authors and scientists. According to Gatti Junior (2005), textbooks in the 1930s-1960s were aimed at an elite and academic audience and written with an elaborate vocabulary. Regarding the way the three authors discussed the definition of life and living beings in the analyzed compendiums, Chervel (1990) understands that:

> In each age, the teaching provided by teachers is roughly identical for the same subject and level. All the manuals, or almost all of them, say the same thing, or almost so. The concepts taught, the terminology adopted, the collection of rubrics and chapters, the organization of the corpus of knowledge, even the examples used, or the types of exercises attempted are identical, with approximate variations (CHERVEL, 1990, p.203).

Mello-Leitão, Lafayette Rodrigues Pereira, and Waldemiro Potsch wrote the compendiums in a socio-historical context of educational reforms and significant development of Biological Sciences. Although Mello-Leitão and Potsch dissent about the subjects Natural History and Biology in secondary education (SANTOS, 2013), the analysis of the compendiums in this study indicated that their ideas were similar when approaching the definition of life, considered complex by the three authors, and on the underlying properties of living beings. In previous studies on textbooks authored by Mello-Leitão and Potsch, approximations were noted in relation to the nationalist character of the works and differences concerning the elucidation of knowledge (SANTOS, 2013; SANTOS; SELLES, 2014). Different perspectives for the analysis of textbooks are fruitful in historical research, revealing nuances in changes and permanence in school subjects.

Final considerations

This study contributes to an analysis of how the definition of life and the study of living beings were presented in published compendiums of Natural History and Biology authored by three teachers, from the 1930s to 1950s, in the historical and sociocultural context of this period.

Historical research with textbooks indicated that in the teaching of Natural History and Biology, the main question was not the definition of life but rather how the process of life could be differentiated from physical processes or raw matter through their underlying properties. In these three decades, no changes were identified in the definition of life, and the study of living beings in the analyzed books.

This study highlights the relevance of different perspectives of textbook analysis in research on the history of the school subjects Biology and Natural History. The analysis of textbooks by other authors can broaden the understanding of how the definition of life and the study of living beings were approached in this historical period, as well as connections between studies of the History of Education and the History and Philosophy of Biological Sciences can help understand the debates of the time in future research.

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