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Essay

A Possible First Use of the Word *Astrobiology?*

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Abstract

The word *astrobiology* was possibly first used in 1935, in an article published in a French popular science magazine. The author was Ary J. Sternfeld (1905–1980), a pioneer of astronautics who wrote numerous scientific books and papers. The article is remarkable because his portrayal of the concept is very similar to the way it is used today. Here I review the 1935 article and provide a brief history of Sternfeld's life, which was heavily influenced by the tragic events of 20th century history. Key Words: History—Pioneers. Astrobiology 12, 1154–1156.

The possibility that life exists elsewhere in the Universe is related to the question of multiplicity of worlds and probably dates back to Greek philosophers. This question has taken many forms over the centuries, and it is fascinating to ask how it evolved into a new science known by several names such as *astrobiology, exobiology,* and *bioastronomy.* I will attempt to answer this question by reviewing an article in which *astrobiology* was probably initially used in the modern sense of the word.

On July 1, 1935, the French popular science magazine, *La Nature,* existing since 1873, published a cover article by Ary J. Sternfeld entitled "La vie dans l'Univers" ("Life in the Universe") (Sternfeld, 1935b). The article begins with a historical description of Greek philosophy and covers a range of beliefs and hypotheses about life in the Universe, particularly the observations of Mars' canals, which the author considered to be highly implausible. The second part of the article is entitled "Origin of life," and begins "The development of both the natural and astronomical sciences has led to the birth of a new science whose main objective is to assess the habitability of the other worlds, this science is called *astrobiology*." This is certainly one of the oldest and perhaps the first definition of the word *astrobiology* with its present meaning. The next sentence is "A comprehensive definition of life does not exist as far as we know, hence we leave this to the reader's intuition." Sternfeld then reviews various theories of the origin of life and discusses transfer of life between planets, or panspermia. He also describes life in extreme conditions.

Sternfeld considers the possibility of planets orbiting other stars in terms of the solar system formation model of Kant-Laplace or the near-collision hypothesis of Jeans. In the model of Kant-Laplace: "Owing to the infinity of planetary systems, the probability of finding some celestial objects compatible with life, would be very high." On the other hand, in the Jeans model, the probability of finding other planetary systems is very low. The article also reviews the properties of the atmospheres of various planets and states that Titan, the largest satellite of Saturn, probably has an atmosphere. This prediction was remarkable in its prescience. Seventy years later, the Huygens probe detached from the Cassini spacecraft and landed on Titan to analyze its atmosphere and topography and to research hypothetical traces of life.

At the end of his article, Sternfeld wrote: "Our main conclusion is that all possibilities remain open and that nothing has been proved. Despite the considerable effort of famous astronomers, and advances in astronomical instrumentation, the question of whether life on other planets exists remains unanswered. Can we ever hope to reach any conclusion?"

Sternfeld's article took into account the very latest scientific discoveries, presented several original ideas, and did not engage in imaginative extrapolation. This article was written 77 years ago, the same time interval as between the publication of the *Sidereus Nuncius* by Galileo Galilei (1610) and *Conversations on the Plurality of Worlds* by Fontenelle (1686), yet Sternfeld's discussion of life in the Universe is remarkably similar to the way we view astrobiology today.

A few years later, Lafleur (1941) defined *astrobiology* as "the consideration of life elsewhere than on Earth." Lafleur's paper is often taken to be the first use of the word *astrobiology,* but Sternfeld's 1935 article predates Lafleur's essay. In 1945, Tikhov, a Russian astronomer, coined the word *astrobotany* to describe the search for vegetation on Mars. He also used the word *astrobiology,* and *cosmobiology* as a generalization for research about life on other planets, particularly planets orbiting stars other than our Sun. The first American symposium in astrobiology was held in 1957 (Wilson and following papers, 1958), but at that time the sense of the word *astrobiology* was not as restricted as its present

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meaning. The papers presented concerned not only life in other celestial bodies but also problems common to astronomy and biology, for example, physiological problems of astronomical observations. In 1965, Mamikunian attributed to Joshua Lederberg (1960) the creation of the word *exobiology.* A more detailed study of the use of the word *astrobiology* is given in another paper (Briot, 2012).

Ary Sternfeld's Life

The article "La vie dans l'Univers" is so ahead of its time and relevant to research performed today that the author deserves greater recognition for his contributions. His 1935 paper is signed *Ary J. Sternfeld—prix international d'astronautique* (International Astronautics Award). Sternfeld is considered to be a pioneer of astronautics, and he provides biographical information in one of his papers (Sternfeld, 1965). Further information is presented by Lucius (1981), particularly in the book *From Astronautics to Cosmonautics* by Gruntman (2007).

Sternfeld's life was spent in several different countries, so his name took various forms: Ary Jacob Sternfeld, Arje Jakob Stzernfeld, Ary Abramovič Šternfel'd, Ario Abramovich Shternfel'd, Arii Abramovich Shternfel'd, Ary Chternfeld, Arieh Sternfeld, Штернфельд.…The word *Sternfeld* in Yiddish and German means "Star Field." Ary Sternfeld was born in 1905, in Sieradz, a small Polish town, in a Jewish family. Even as a young boy, he was strongly interested in astronautics and spaceflight. Because of a *numerus clausus* for Jewish students, he could not attend the Polytechnical School in Warsaw but instead was a student at the Jagellon University in Krakov. He came to France in 1924, expecting that he would have more freedom to undertake scholarly activities. He spent several months in Paris to earn money to finance years of study at a university. He initially worked in a food market and then in various factories in both Paris and its suburbs. In October 1924, he moved to Nancy, in eastern France, where he was accepted as an engineering student at the Mechanical Institute of the Nancy University. Because he did not speak French, he had a difficult time at first, but he soon made rapid progress. He placed second in his class in his third and last year at Nancy. His living conditions as a student were incredibly harsh. He could eat only the cheapest food and worked throughout the holidays to earn money to live. After graduating from Nancy in 1927, he returned to Paris, where he again worked in various factories as an engineer and machine designer. He applied to do a doctorate in astronautics at the Sorbonne, Science University in Paris, but his proposed thesis subject was rejected because he was far too ahead of his time! This was long before the first artificial satellite, Sputnik, was launched in October 1957. After a brief visit to Russia in 1932, Sternfeld spent one year in Poland, where he wrote a book in French: *Initiation à la Cosmonautique* (Introduction to Cosmonautics). In his book, he coined the word *cosmonautics,* to be used instead of the word *astronautics,* which itself was coined by the French Robert Esnault-Pelterie (see Gruntman, 2007). His 490-page manuscript was completed in November 1933 and contains calculations relevant for predicting velocities during spaceflight. Years later, in 1962, Sternfeld published a review of his calculations in the Bulletin de la Société Lorraine des Sciences, edited in Nancy, the city where he had been a student and graduated (Sternfeld, 1962). His original calculations of trajectories for spacecrafts were within 1% of the actual trajectories of the first four artificial satellites. One of the orbits he calculated is now named the Sternfeld orbit.

In December 1933, Sternfeld returned to France with his book manuscript ready for publication. In 1934, he sent two notes to the French Science Academy (Sternfeld 1934a, 1934b). He won the International Astronautic REP (Robert Esnault-Pelterie) Hirsch Award of Encouragement. From December 1933 to June 1935, he published a number of articles in popular and professional publications in France, at least six in 1934 and seven in 1935, among them his article about life in the Universe. A partial list of his publications is given in the book by Gruntman (2007). Some months before his 1935 article appeared, he published an article in another issue of the same popular science magazine, entitled *Signalisation Interplanétaire* (*Interplanetary Signals*), in which he discussed possible ways for communicating between planets by using luminous signals reflected by mirrors or by using radio waves (Sternfeld, 1935a). As reported by Gruntman (2007), he said also that he was publishing a novel within a weekly magazine, demonstrating that he was able to write in a field other than science.

Sternfeld perceived that there was insufficient interest in France for astronautics. He and his wife were communists, and the Soviet Union was therefore appealing to them, particularly when a position was offered to Sternfeld. They went to Russia in June 1935, where he joined the Jet Propulsion Scientific Research Institute. While working there, he also prepared the Russian translation of his manuscript *Initiation à la Cosmonautique.* His scientific activities in the Soviet Union remained unknown in France. One explanation is that his activities were considered to be a state secret, as suggested in a paper by the director of the Nancy Electricity and Mechanics Institute (Lucius, 1981). The reality, however, was very different. Since Sternfeld had graduated from a French university and won a French research prize, both in a capitalist country, and perhaps also because he was a Jew, he was dismissed in 1937 from his institute, then in 1938 from another institute where he had found temporary employment. After that, he was never able to work in any Russian institute specializing in space technology. This unfortunate circumstance may have saved Sternfeld's life. A few weeks after he was dismissed, Stalin's infamous purge began, during which scientists at the institute were arrested, deported to labor camps, and often executed.

Sternfeld continued his research by working at home. He was amazingly prolific, considering the circumstances, writing 30 books and 400 popular and scientific articles. His books were very successful, particularly after the launch of Sputnik, the first artificial satellite, in October 1957. His books were published in 39 countries and translated into 36 languages. Since the Soviet Union had never signed any international agreement about author copyright, Sternfeld was unable to gain royalties for any of his books that were published abroad. He was able to travel to Poland several times because Poland was a Socialist country behind the Iron Curtain, but he was never able to obtain a visa allowing him to return to France, even when he was awarded an honorary doctorate by Nancy University in 1961 or when he won the Galabert Astronautic International Prize in 1962. He died in 1980, even as his colleagues at Nancy University continued to hope that he would be granted a visa to return to France.

Sternfeld had a very hard life but miraculously survived Stalin's purge of intellectuals. Because he did not remain in Poland or France during the Second World War, he also escaped the Nazi program to exterminate Jewish people. A crater on the far side of the Moon bears his name, as does the Sternfeld planetarium and observatory in Łódź. A "people's museum" in a Russian boarding school for children with impaired hearing also bears his name. In fact, Sternfeld became deaf later in life. A special tribute was paid to him when the NASA New Horizons spacecraft was launched in 2006, toward Pluto. A small plaque on board was engraved with the names of pioneers of spaceflight; among them is Ary Sternfeld (Gruntman, 2007). Although Sternfeld was clearly a pioneer in astronautics, he also deserves recognition as a pioneer of astrobiology.

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