HEALTH AND THE ENVIRONMENT

Health and Food in Europe: The Case of Aluminum

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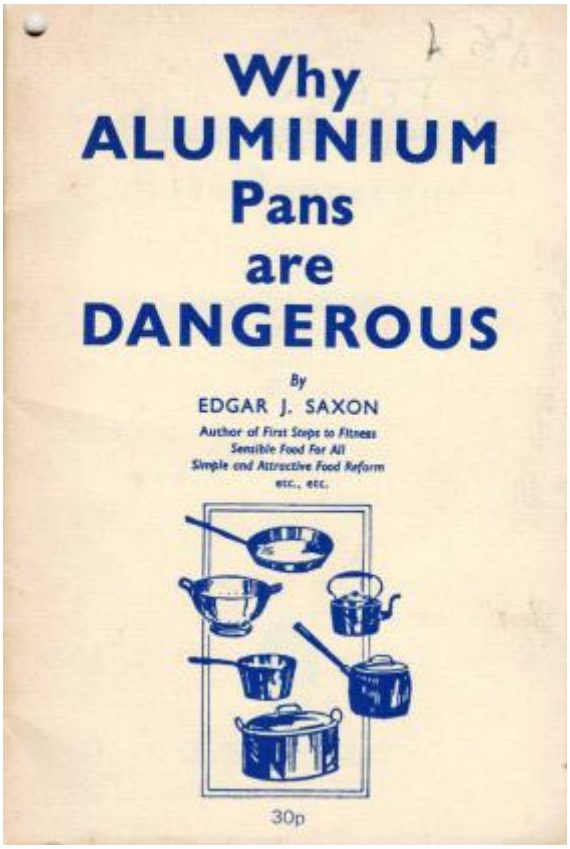
ABSTRACT

The innocuousness of aluminum was asserted in 1854 by the inventor of the metal's first production process, the chemist H. Sainte-Claire Deville. During the 1890s, this affirmation sparked great controversy in Europe and the United States as the use of light metals developed, especially in the form of food additives. The debate was revived during the postwar period by medical research on Alzheimer's disease.



English anti-aluminum pamphlet. Private collection, all rights reserved.

In February 1986, the British medical journal *The Lancet* published the work of British researchers on Alzheimer's disease. Their study showed that one of the characteristic elements of this pathology, the "senile plaques" found in the brains of patients, consisted of aluminum and silicon and were identical in distribution, although their origin remained unknown. The rumor emerged and spread: aluminum was responsible for Alzheimer's disease. The debate quickly expanded beyond specialized journals and scientific circles, sparking public polemics and rather alarming headlines.

The year 1986 was an indisputable turning point for suspicion surrounding the light metal. This was not a new phenomenon: since the late nineteenth century, aluminum's toxicity had regularly been investigated during various controversies, thanks to which a scientific community was gradually built, first in Europe, and later in the United States.

The Intermediate Metal

While Henri Sainte-Claire Deville developed the first aluminum production process in 1854, its oxide was known since the works of Claude Geoffroy the Younger in 1728, Louis-Bernard Guyton de Morveau in 1786, and especially Théodore de la Saussure who, in 1801, measured aluminum's quantities in plants. As soon as the metal became tangible, scientists—not only Sainte Claire-Deville, but also Justus von Liebig and Henry Wurtz—analyzed its physicochemical properties and concluded it was innocuous: it was a healthy metal, halfway in between iron and copper. Paul Héroult's 1886 electrolytic process and its industrial implementation in the 1890s allowed aluminum's everyday uses such as in kitchen equipment.

From the European Controversy Regarding the Metal…

The first controversy unfolded in a dual timeframe during the 1890s: it was based, in both Germany and France, on analyses of metal whose production was recent and poorly managed, and was applied to military canteens. The first controversy began in 1891 with an article by German chemists, who advised against its use. The European scientific community quickly refuted their research. In France, for example, Dr Joseph Balland, a military medical officer, submitted to the Academy of Sciences a series of analyses conducted on aluminum samples immersed in different liquids such as beer, wine, and water, and then published several articles on this topic. Another renowned scientist, Henri Moissan, a professor at the Science Faculty of Paris and the director of the Institute of Applied Chemistry, also published three articles on aluminum. Additional research conducted in Germany and Italy also concluded that it was innocuous.

The army was one of the first to use aluminum, in order to lighten soldiers' kits, and envisioned its use on a grand scale. For the Madagascar Expedition in 1894-1895, French troops were equipped with 30,000 aluminum objects (canteens, tumblers, cooking pots, etc.) in an effort to study the metal's behavior under tropical conditions. Analysis of these objects gave rise to the second challenge to aluminum's innocuousness: in 1898 and 1899, Alfred Ditte, a chemistry professor at the Science Faculty of Paris, published three papers in *Comptes rendus de l'Académie des sciences*, in which he affirmed its toxicity. This time, it was Henri Moissan himself who objected and dismantled Ditte's arguments, prompting him to ultimately revisit his own conclusions. The polemics were quickly reported in popular science magazines, but with no subsequent reaction in terms of public opinion.

… to that of additives in the United States

The second—and much larger—controversy occurred in the United States beginning in the 1890s, in connection with baking powder. The American agri-food industry began using additives made from aluminum compounds during the 1870s. Alum (double sulfate of aluminum and potassium) was first used, before being replaced by sodium aluminum sulfate. The rivalry among yeast producers—who either included aluminum in the formula or did not—gave rise to the longest food-related scientific controversy in US history, which was fought out in the courts

from 1879. An important scientific community emerged, and was divided between those who were in favor of aluminum and those that were against its use. Two renowned scientists supported arguments for toxicity: Harvey W. Wiley, the director of the Chemistry Division of the US Department of Agriculture, one of the pioneers of food chemistry and food security in the United States; and William J. Gies, a professor at Columbia University whose laboratory was very active in aluminum research. In 1908, two years after the enactment of the Pure Food and Drug Act, amid great public suspicion toward industry, President Roosevelt created a committee of experts tasked with examining the question, and thereby circumventing the constraints imposed by the new law. The Remsen Board's conclusions led to the authorization of aluminum in baking powder, but also triggered new independent studies. A vast scientific community developed at the time, with or without support from industrial actors. Among the scientists favored by the industry was Ernest E. Smith, who had received financing since the late 1890s. A fellow and former president of the New York Academy of Sciences, he published in 1928 *Aluminum Compounds in Food*, a book that became a historical milestone in the literature on aluminum and health, despite its numerous biases and non-scientific positions. While the debate, as in Europe, was covered by the mainstream press, a new type of actor emerged in 1928, serving as a representative of public opinion: Charles T. Betts and his publications supported by the Anti-Cancer Club of America, along with Jehovah's Witnesses, began a crusade against aluminum as part of the "Natural science movement."

British Resonance in the 1930s

The US polemic reached Great Britain in 1931 with the publication of a small booklet entitled *The Danger of Contamination by Aluminium*, written by Robert M. Le Hunte Cooper, an English general practitioner. Starting from empirical observation of his patients, the doctor then consulted the literature on the subject, and conducted clinical trials that confirmed his doubts regarding aluminum's innocuousness. In 1932, the book *Aluminium and Food: A Critical Examination of the Evidence Available as to the Toxicity of Aluminium*, written by the director of pharmacological laboratories of the Pharmaceutical Society of Great Britain, J.H. Burn, took the opposing view of these affirmations, and tried to discredit the doctor. However, the book was financed by the aluminum industry, and Burn's selection of the scientific literature as well as his conclusions raised questions regarding his work's objectivity, for a number of his arguments were more in keeping with activism and political persuasion than scientific reasoning.

The innocuousness of aluminum has been challenged ever since its appearance in the form of a metallic mass in the mid-nineteenth century. Researchers still suspect it in a number of pathologies such as Crohn's disease, breast cancer, autism, and macrophagic myofasciitis. The way it operates in organisms remains a mystery, especially as a vaccine adjuvant: the use of new analysis methods should bring about advances in this area, on the condition that adequate financial resources are allocated.

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