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Bernardino Ramazzini (1633–1714)

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Physicians started to identify and study the effects of metals on the central and peripheral nervous systems during the nineteenth century, when the Industrial Revolution caused a widespread exposure to neurotoxins in the western world. In 1805, John Pearson (1758–1826) coined the term “mercurial erethism” in England, while in 1836 the French physician Louis Tanquerel des Planches (1810–1862) used the term “encéphalopathie saturnine” to indicate neuropsychiatric manifestations of lead-intoxication; 20 years later August-Louis Delpêch (1818–1880) first described the neuropsychological effects of occupational exposure to carbon disulfide [1]. During the twentieth century, the studies of neurologists, occupational physicians and experimental psychologists contributed to the development of occupational neurotoxicology, as an autonomous discipline.

It is less known that the first observations on the effects of metals on the nervous system can be found in the “De Morbis Artificum Diatriba” by the Italian physician Bernardino Ramazzini (1633–1714) [2, 3]. In chapter VII (“Diseases of glass-workers and mirror-makers”) of his masterpiece, Ramazzini described the effects of mercury on motor function and mood, stating: “Those who make mirrors, using mercury, become palsied [...]. These workers with grim expression (torvis oculis) contemplate the reflection of their suffering in the very mirrors they have made with their own hands and curse the profession they have had to follow” [4]. Furthermore, in chapter IX, he explained that painters were afflicted by palsy of the limbs, caused by colors of mineral origin containing pigments of mercury, lead and copper [4]. These statements indicate a first medical and scientific acknowledgment that exposure to toxic agents can cause both physical and behavioral alterations; therefore, Ramazzini can be considered as a pioneer of neurotoxicology.

Bernardino Ramazzini (Fig. 1) was born in Carpi, Italy, in 1633. After his medical graduation in 1659 in Parma, he started to work as physician in Rome and in the Duchy of Castro, a vassal state to the Papal States. He was forced to leave Rome and return to his hometown, because of a severe malarial infection he contracted. In 1682, he was appointed

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no competing interests.

as Professor of Theoretical Medicine at the University of Modena by the Duke Francesco II d'Este (1660–1694). During this period, he wrote several medical works, especially focused on population studies. His Hippocratic approach and his studies on the relation between nature and human health seem to have been inspired by the English physician Thomas Sydenham (1624–1689) and by the French scholar Guillaume de Baillou (1538–1616). Ramazzini was very familiar not only with the ancient Greek and Roman medical authors but also with coeval physicians and intellectuals, as demonstrated by his correspondence with the German philosopher Gottfried Wilhelm Leibniz (1646–1716). While he lived in Modena, he first described the artesian aquifers, made observations on natural history, and conducted studies on the influence of atmospheric agents during the course of epidemic diseases. In regards to malaria, Ramazzini was one of the first to support the use of the quinine-rich bark cinchona. He was also a poet and often alternated the writings of poem to his medical works [5].

At the end of the seventeenth century, Ramazzini started to investigate the influence of occupations on workers' health, teaching a class on this subject at the University of Modena. He published the treatise “De Morbis Artificum Diatriba” in 1700, in which he first listed work-related health problems in different occupations. Each chapter of the treatise contains a description of the disease associated with a particular work activity followed by a literature analysis, workplace description, and questions for the workers, disease description, remedies, and advice. He advocated that the rulers should protect the health of workers to preserve the workforce and the productivity of their states. In detail, he analyzed the effects of chemicals, dusts, repetitive motions, and awkward postures on the health of different classes of workers, including the effect on the nervous system. As aforementioned, he not only acknowledged the effects of some metals on the peripheral nervous system but also described behavioral modifications. In 1700, his fame led Ramazzini to move to the University of Padua, where he was appointed as professor of Practical Medicine. In the last part of his life, he continued to teach students about his clinical methodology and edited a new version of “De Morbis Artificum” (1713), including new occupations. After his death in Padua in 1714, his work had an immediate and lasting effect, so inspiring the studies on neurotoxicology of metals in the nineteenth century.

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Fig. 1.
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