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Multilevel X-ray imaging approach to assess the sequential evolution of multi-organ damage in neurodegenerative diseases

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The 3D complexity of biological tissues and intricate structural-functional connections call for state-of-the-art X-ray imaging approaches. Unlike other imaging techniques, X-ray phase-contrast tomography (XPCT) offers a highly sensitive 3D imaging approach to investigate different disease-relevant networks at levels ranging from the single cell through to the whole organ. We present here a concomitant study of the evolution of tissue damage and inflammation in different organs affected by the disease in the murine model for multiple sclerosis, a demyelination autoimmune disorder of the central nervous system. XPCT identifies and monitors structural and cellular alterations throughout the central nervous system, but also in the gut, and eye, of mice induced to develop multiple sclerosis-like disease and sacrificed at pre-symptomatic and symptomatic time points. This approach rests on a multiscale analysis to detect early appearance of imaging indicators potentially acting as biomarkers that can predict the disease. The longitudinal data obtained permit an original evaluation of the sequential evolution of multi-organ damages in the murine model showing the disease development and progression, of relevance for the human case.

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