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Life in the soil inner space

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The biological, chemical and physical interactions taking place between roots, microorganisms and soil particles contribute to the formation of the rhizosphere, a region of the soil where biological activity is thriving. The rhizosphere is central to the productivity of cropping systems, but its complex physical structure is limiting our ability to understand how it functions.
In this talk, I will present our approaches to characterise how the rhizosphere is formed. We have developed transparent soils and constructed light sheet microscopes for imaging at large field of view, assembled pressure chambers to mimic the deeper soil physical environment, and proposed label free detection of nematodes using laser dynamic speckle. Our systems are now able to track biological activity in the pore space with dynamic image data currently being used to test models of interaction at root, microbe and particle interfaces.
Soil remains a very challenging biological system. Ongoing work on a new generation of smart transparent soils indicates such systems could soon be used to scrutinise soil processes at unprecedented level of details, with applications in pest management and high-throughput screening of root phenotypes and fertilisers products.