

The Rhizosphere: 'soil compartment influenced by the root'

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The contents of this Rhizosphere Thematic Issue were mainly contributions at the International 'Rhizosphere Congress 2004' in Munich, Germany from 12–17 September 2004. This congress was dedicated to the centenary of Lorenz Hiltner's definition of the rhizosphere in 1904. Dr Lorenz Hiltner was director of the Royal Agriculture-Botanical Institute in Munich (later Bavarian Institute of Plant Growth and Plant Protection) from 1902–1923 and Professor of Soil Bacteriology at the Technical University, Munich. At a meeting of the German Agricultural Society (Deutsche Landwirtschaftliche Gesellschaft) in Eisenach (Thuringia) in April 1904 he was invited to present a lecture on recent advances in soil bacteriology. There, he defined for the first time the term 'rhizosphere' as the 'soil compartment influenced by the root'. Based on extensive and thorough investigations into the germination and growth of different crop plants (legumes and non-legumes) he was convinced that roots support the development of different bacterial communities. The influence of e.g. rhizobia on plant nutrition is obviously also much dependent on this community. He concluded 'that the plant attracts on one hand beneficial bacteria through its root exudations, but it also attracts uninvited guests'. Hiltner reported observations of high incidence of plant sickness when certain crops are planted consecutively over years. He explained 'soil sickness' by the development of pathogens in these soils and even reported on the phenomenon of induced resistance after several years of consecutive growth of the same crop. In analogy with the 'mycorrhiza', he called the bacterial community closely associated with roots 'bacteriorhiza'. Despite much less sophisticated microscopic equipment than currently available, he also described bacterial colonization of the rhizodermis of healthy roots – an amazingly modern aspect of rhizosphere research.

The scientific life of Lorenz Hiltner (1862–1923) was always characterized by both cutting-edge basic research and dedication to solving practical problems in agriculture. He graduated from the Friedrich-Alexander University of Erlangen in 1885. Already in his doctoral thesis, which he

submitted in 1891, he worked on the plant pathogen *Botrytis cinerea* in horticultural and agricultural plants and strategies for plant protection. At that time Hiltner was an assistant of Prof Dr F. Nobbe at the plant physiological research station in Tharandt near Dresden (Saxonia) and worked also on the physiology of root nodule bacteria in legumes and alder trees. They must have been thrilled by the final unequivocal demonstration of nitrogen fixing by root nodule bacteria in legumes reported by Hellriegel and Wilfarth in 1888. Already in 1891, Hiltner and Nobbe formulated a *Rhizobium* inoculum, called 'Nitragin'. After several improvements, and the most important discovery of host specificity in the *Rhizobium*-Legume symbiosis, these inocula performed very well in agricultural practice. His institute provided farmers with these inocula; guests from all over the world came to his institute in Munich to learn more about this important rhizotechnology. Unfortunately, the First World War, the anarchy in Munich after the war and his sudden death on 6 June 1923 due to a stroke while working in his office, hindered further developments and rapid dissemination of his achievements.

One hundred years later, our knowledge of the rhizosphere is very much advanced. However, we are still facing the very same challenges to understand the interactions of microorganisms and roots in different soil and management scenarios. The methodological approaches are much advanced, but implementation of basic knowledge into practice lags behind. This issue of *FEMS Microbiology Ecology* on 'The Rhizosphere' demonstrates the state of the art in field as it contains peer-reviewed articles related to the topics presented at the 'Rhizosphere Congress 2004' and submitted by authors who attended this symposium. On behalf of the Organizing Committee we are very grateful to *FEMS Microbiology Ecology* for providing the opportunity to publish this Thematic Issue on 'The Rhizosphere'.

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