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NEURAL NETWORKS VERSUS IMMUNE NETWORKS: INTERESTING OBSERVATIONS AND NEW QUESTIONS

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Abstract *The mathematical analysis of the information processing and learning capabilities of the adaptive immune system has become an increasingly active area of research in recent years. This was not in response to the present Covid-19 pandemic, but in fact started already earlier, following mounting evidence for the relevance of the adaptive immune system in many aspects of human health, progress in structural biology and genomics, advances in our understanding of auto-immune disease, and the spectacular recent successes of cancer immuno-therapies. In this presentation I give a brief introduction to the adaptive immune system and immune networks, and discuss the remarkable similarity between mathematical models of immunological signalling in immune networks and models for information processing and memory in recurrent neural networks. I show in particular how progress made in the last two decades in the analysis of stochastic neural processes on finitely connected random graphs has led to a fruitful transfer of mathematical tools and intuition to the field of mathematical immunology.*

Short Bio *Ton Coolen did his PhD in Theoretical Physics at Utrecht University in 1990, followed by postdoctoral positions in Nijmegen (1991) and Oxford (1991-95). He then moved to King's College London, where he became Reader in Applied Mathematics in 1995, Professor of Applied Mathematics in 2000, and Head of the Institute for Mathematical and Molecular Biomedicine in 2012. He left the UK in 2000 and is now Professor in the Biophysics Department of Radboud University. Coolen specializes in the development and application of mathematical methods for solving models of large heterogeneous and stochastic many-variable systems in various disciplines, with focus on non-equilibrium techniques. He has worked on (natural and artificial) neural information processing systems, disordered magnets, coupled oscillators, market models, cellular signalling systems, protein structure generation, complex networks and graphs, mathematical immunology, medical statistics and high-dimensional inference, and quantum annealing. He published three books and around 170 research papers.*