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The physical principles underpinning the emergence of structure in plants, and their application in the development of new biopolymer based materials

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Based on laboratory based growth of plant-like structures from inorganic materials, we present new theory for the emergence of plant structures at a range of scales dictated by levels of ionization (charge density), which can be traced directly back to proteins transcribed from genetic code and their interaction with external sources of charge (such as CO_2) in real plants. Beyond a critical percolation threshold, individual charge induced quantum potentials (driven by dissipative systems) merge to form a complex, interconnected geometric web, creating macroscopic quantum potentials, which lead to the emergence of macroscopic quantum processes. The assembly of molecules into larger, ordered structures operates within these charge-induced coherent bosonic fields, acting as a structuring force in competition with exterior potentials. Within these processes many of the phenomena associated with standard quantum theory are recovered, including quantization, non-dissipation, self-organization, confinement, structuration conditioned by the environment, environmental fluctuations leading to macroscopic quantum decoherence and evolutionary time described by a time dependent Schrödinger-like equation, which describes models of bifurcation and duplication. Evidence for macroscopic quantum phenomena has previously been reported in photosynthetic systems. The theory and evidence presented in the current work suggests that macroscopic quantum systems are not an exception in plant systems, but actually play a key role in the emergence of structure. Based on these insights, we consider how the fundamental principles underpinning self-assembly can be used in the manipulation and control of molecular and nanometer scale systems in the development of new biopolymer based materials.

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