Chez Pierre

Presents ...

SPECIAL CHEZ PIERRE SEMINAR

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"Design principles in the plant kingdom: Loops, optimality and the architecture of leaf veins"

Leaf venation is a pervasive example of a complex biological transport network that is necessary for the survival of land plants and thought to be highly optimized. Distribution networks optimized for efficiency have been shown to be loopless - yet, the architecture of the leaf vascular networks is dominated by loops. We consider possible reasons for the emergence of loops in biological transport networks and study optimizing functionals that can account for their ubiquity. We show that loops can emerge for a number of reasons, each with a unique signature in the network architecture. We sketch the development of a mathematical framework that is suitable to characterize planar redundant networks, dominated by (hierarchically nested) loops. Finally, we examine the metric topology and transport properties of the resulting optimized networks and compare them with exemplars of their real life counterparts, dicotyledonous leaves.