Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Characterizing Loopy Biological Distribution Networks in Three Dimensions CARL MODES, The Rockefeller University, ELENI KATIFORI, Max Planck Institute for Dynamics and Self-Organization, MARCELO MAGNASCO, The Rockefeller University — In order to develop useful predictive models for vascular or other biological distribution networks that include the effects of network architecture, development, and topology some set of tools must be chosen to characterize vasculature in a physically relevant, mathematically compact way. Few such tools are extant. To address this issue we have generalized the existing two dimensional leaf venation characterization to a fully three dimensional setting, from whence it may be brought to bear on many problems in human and mammalian vasculature, particularly where that vasculature is extremely complex, as in the organs. The new algorithm rests on the abstraction of the physical 'tiling' from the two dimensional case to an effective, statistical tiling of an abstract surface that the network may be thought to sit in. Generically these abstract surfaces are richer than the flat plane and as a result there are now two families of fundamental units that may aggregate upon cutting weakest links – the plaquettes of the tiling and the longer 'topological' cycles associated with the abstract surface. Upon sequential removal of these weakest links, two characterizing trees emerge that condense most of the relevant information from the full network.

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Date submitted: 14 Nov 2013 Electronic form version 1.4