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Charting the Vasculome: Uncovering the Principles of Vascular Organization JACOB OPPENHEIM, MARCELO MAGNASCO, Rockefeller University — The efficient distribution of resources in any system requires a carefully designed architecture that is both space filling and efficient. While the principles of such networks are beginning to be uncovered in plants, they remain poorly elucidated in the case of higher animals. We have developed a high-throughput, easily implemented method of mapping vascular networks in mammalian tissue. By combining high resolution, rapid fluorescence blockface imaging with serial sectioning, we are able to map the vasculature of the rat liver at a resolution of 10 microns, revealing the structure above the level of the capillaries, constituting the largest vascular dataset yet assembled. We have developed algorithms for the efficient three-dimensional reconstruction from two-dimensional images, allowing skeletonization and investigation of its geometry and topology. We are able to calculate the scaling properties of these networks as well as the frequency of loops at each level. Using sophisticated topological tools, we are beginning to elucidate the principles of their organization. Ultimately, a greater understanding of vasculature is necessary for the success of efforts in synthetic and regenerative biology along with the better understanding of the growth and development of cancers.

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