



**BIO**  
**MATH**

# **Geometry and scaling in the vascular system: Theory vs MRI**



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**ABSTRACT:** The geometry of vascular systems determines the cost of energy delivery, and thus constrains the growth and metabolic rate of individuals, cells and tumors. We develop an algorithm and software package for automatically quantifying the geometry of vascular trees from radiography images (MR, CT, etc.). We use this technique to compare measurements for human arterial networks to theoretical predictions and previous measurements in humans, pigs, and rats, in order to address basic questions in the optimality of vessel network structure and metabolic scaling theory. Our goal is to develop high-throughput angiography, which would make it practical to gather data at a faster pace, and with higher precision, than is practical with existing methods.

Master's Committee: Dr. Van Savage, Dr. Tom Chou,  
Dr. Ken Lange, Dr. Daniel Ennis