



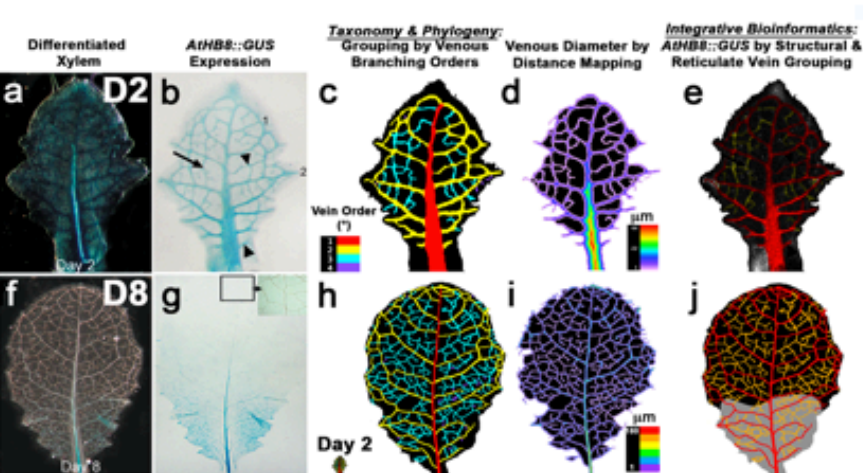
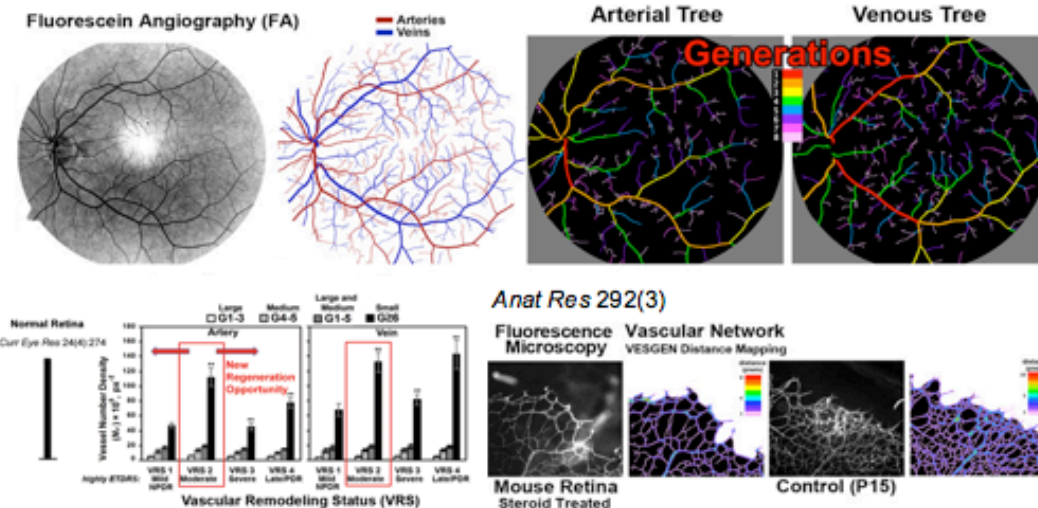
Fractal Branching in Vascular Trees and Networks

by VESSEL GENERATION ANALYSIS (VESGEN)

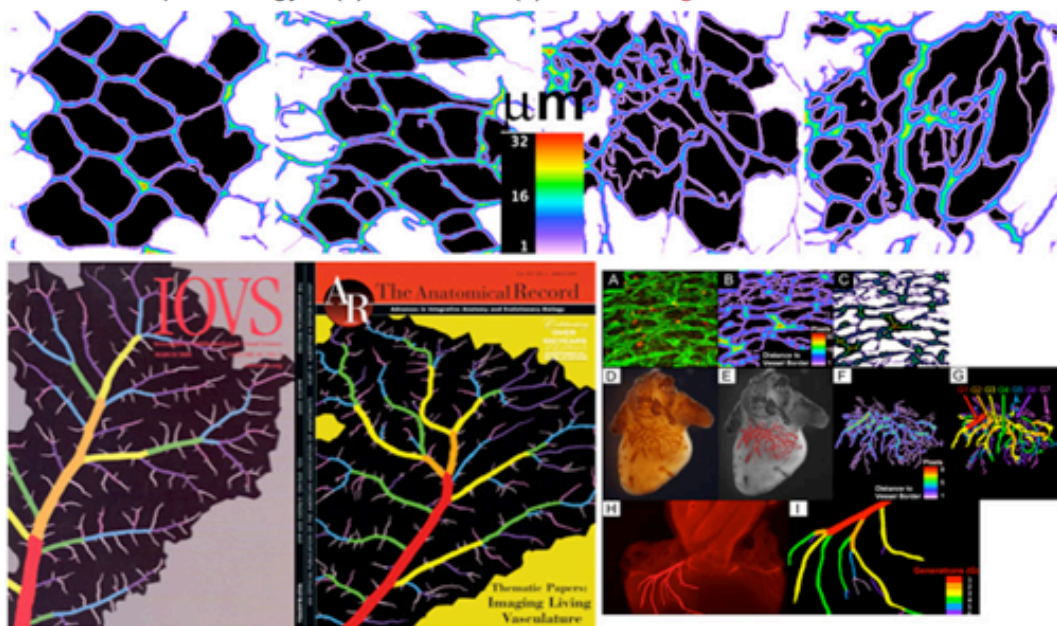


IOVS 51(1) Measuring Vascular Retinal Impairments for Application to Human Space Exploration

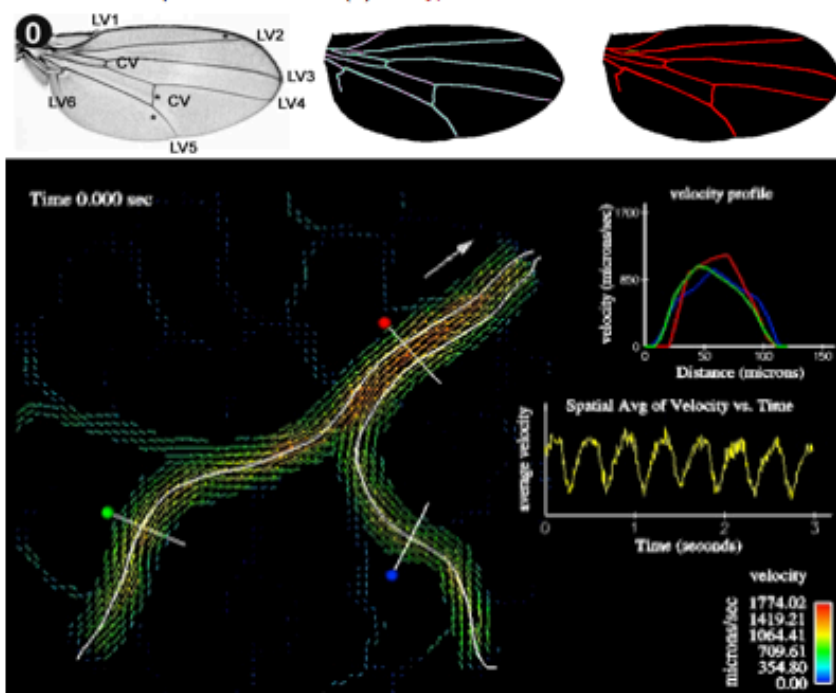
Gravitational Space Research 2(1) Developing *Arabidopsis* Leaves



Gravitational Space Biology 26(2) & PloS One 8(5):e64227 Progressive Vascular Inflammation



Gravitational Space Research 3(2) Wildtype *where veinlets arise in H-C2 mutants



Vascular patterning offers an informative multi-scale, fractal readout of regulatory signaling by complex molecular pathways. Understanding such molecular crosstalk is important for physiological, pathological and therapeutic research in Space Biology and Astronaut countermeasures. When mapped and quantified by NASA's innovative VESSEL GENERATION ANALYSIS (VESGEN) software, remodeling vascular patterns become useful biomarkers that advance our understanding of the response of biology and human health to challenges such as microgravity and radiation in space environments. CONTRIBUTING ARTISTS, approximate clockwise order: Peter K. Kaiser MD, Jon Sears MD & Quteba Ebrahim MD, Cole Eye Institute, Cleveland Clinic, Cleveland, OH; Krishnan Radhakrishnan MD PhD MPH, US Dept of Veterans Affairs, West Haven, CT; Mary Vickerman MS & Mark Wernet PhD, NASA Glenn Research Center, Cleveland, OH; Patricia Parsons-Wingter PhD, NASA Ames Research Center, Mountain View, CA; Michiko Watanabe PhD & Monica Montano PhD, Case Western Reserve University, Cleveland, OH; Hans-Christian Reinecker MD, Harvard Medical School & Massachusetts General Hospital, Boston, MA