

SL04 Seeing the Endothelium

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The endothelium is widely distributed organ system that forms the inner cell lining of vertebrate blood vessels, most of which are invisible to the naked eye. Today, it is widely recognized that endothelial cells are involved in most human diseases, either as a primary determinant of pathophysiology or as a victim of collateral damage. However, there exists a profound bench-to-bedside gap in endothelial biomedicine. While there are over 100,000 peer-reviewed publications related to the endothelium, the collective knowledge in basic science has failed to translate into significant improvements in patient care, with the exception of coronary artery disease. If we are to narrow the gap, we must first understand its origins. One consideration in explaining the bench-to-bedside gap is our inability to see the endothelium for what it really is. Far from being a giant monopoly or collective of identical cells, the endothelium comprises an enormous consortium of different enterprises, each with its own identity. Since the discovery of the endothelium in 1860, a series of technological advances, including intravital microscopy, histology, electron microscopy, cell culture and immunohistology, have opened up exciting new windows into the endothelium. However, each new technology has important limitations and falls well short of representing the reality of the “endothelial system”. A newer and more promising approach for “seeing” the endothelium is through the lens of dynamical systems theory and landscape topology. Dynamical systems modeling provides both a metaphoric and a quantitative platform for describing system-level features of the endothelium in health and disease. Such an approach may help to link theory with practice and to illuminate the endothelium as a clinically relevant organ.