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HOW SENSITIVE IS MICROCIRCULATORY FUNCTION TO THE DETAILS OF ITS MICROVASCULAR NETWORK DESIGN? #16

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Conceptually it is possible to view each well defined organ system (skeletal muscle, myocardium, etc.) as comprised of an assemblage of tissue volumes each of which have their own metabolic demands. Though these demands are in general variable both with time and conditions the circulatory requirements to meet these are in part dependent upon the topography of the network of vessels that lie between a specified source of supply and each of the demand sites. The obvious requirements imposed on this network are that there be a sufficient number of exchange vessels (capillaries) available for each tissue volume unit and that a clear and continuous pathway be present from source to demand site. In view of the very large number of different possible configurations which could apparently meet these requirements, it is natural to inquire as to how strongly microcirculatory function is dependent on the topographic details of the vascular network design. As an example in this regard we might ask whether the ubiquitous small artery and arteriole arcuate patterns are a functionally significant characteristic or merely an innocuous distinguishing feature? Similar questions may be posed as to a variety of topographical properties including the hemodynamic impact of dichotomous as compared with side branching patterns and the number and spacial distributions of arterial branches. Since for any given microvascular field the topography of the vascular network is relatively fixed, it is difficult to probe these questions solely on an experimental basis. However it is felt that significant insight may be obtained using a mathematical approach which allows one to compare the effects of a variety of topographical variations on key microcirculatory parameters. It is the intent of this communication to utilize appropriate theoretical constructs drawing on available experimental data to assess the extent to which these prominent topographical properties of the microvascular network may affect intrinsic microcirculatory hemodynamics.

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