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# A METHODOLOGY TO GENERATE A RANDOMLY ORIENTED CAPILLARY NETWORK ON ALVEOLUS

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**Summary:** Alveoli are covered by a dense capillary network for the gas exchange between outer air and blood. The alveolar capillary network is also known as a site of the marginated pool of neutrophils where neutrophils retain with a high concentration for the host defense against infectious substances coming from the outer air. The authors have numerically investigated behavior of neutrophils in a simple lattice capillary network, and found that geometry of the meshwork could affect spatial distribution of the cells. Therefore, it is crucial to generate a more realistic randomly oriented capillary network with a variety of capillary length for investigation of the neutrophils behavior.

The proposed method is based on the babble mesh method (BMM) to generate finite element meshes. In BMM, a computational domain is filled with nodes with a finite size and the mesh is generated by the Delaunay triangulation which connects centers of the neighbor nodes. We generate a capillary meshwork by edges of the Voronoi diagram which is the geometric dual of the Delaunay triangulation.

We first generated a capillary network on a spherical alveolus with this method. The capillary network, however, did not have experimentally measured variation of the capillary length reported in a literature. We then interposed irregular nodes with a variety of the node size among the regular nodes of BMM and replaced the Voronoi vertices by weighted centroids of the Delaunay triangles taking into account the node size, to give more variety to the capillary length.

We investigated contributions of the concentration of the irregular nodes and variation range of their size to the variations in the capillary length and bifurcation angle. It was found that they both increase with the increase in either of the concentration and the range of the node size. Determining a square of the inverse of the node radius as the vertex load to obtain the weighted centroid of the Delaunay triangles, 75% of the concentration of the irregular nodes with ±75% of the variation in the node radius from that of the regular nodes reproduced the reported variation in the capillary length.