Cardiovascular diseases are the most common cause of overall morbidity and mortality in Western societies. Their progression is rooted in the atherosclerotic process developing within the aorta and peripheral arteries, which is associated with changes in cellular signaling that promote an inflammatory response. This process involves at least two different systems composed of endothelial and vascular smooth muscle cells and their mutual interactions. The initiation of a constitutive inflammatory state is linked to endothelial dysfunction. Adhesion molecules on the surface of endothelial cells bind to integrin ligands on monocytes as a result of chronic inflammatory response. This process leads to the secretion of pro-inflammatory cytokines by endothelial cells, promoting the accumulation of immune cells within atherosclerotic lesions and contributing to their destabilization. It has been observed that the activation of the inflammatory response within the vascular endothelium of arteries also leads to the formation of extracellular membrane vesicles. This phenomenon is believed to be directly related to the high migratory potential of cells activated by inflammation and the remodeling of their actin cytoskeleton.

The subject of the research presented in this doctoral dissertation was the evaluation of the capacity to form extracellular vesicles of endothelial origin under pro-inflammatory conditions. The mechanisms of their formation were studied, and their biological functions were explored, particularly in the context of the formation of new blood vessels and the remodeling of existing vascular structures. The hypothesis was proposed that high expression of inflammatory cytokines, such as TNF-α, in the cellular microenvironment may increase the migratory potential of endothelial cells, leading to the reorganization of their actin cytoskeleton. These changes may promote the intensification of mechanisms responsible for the formation and secretion of vesicles, which could serve as indicators of the initiation and progression of the inflammatory response.

The process of forming new blood vessels, known as angiogenesis, is closely linked to enhanced cell movement in response to the expression of inflammatory activators. In response to growth factors such as VEGF, endothelial cells undergo reorganization of actin cytoskeletal proteins, which correlates with the movement of endothelial cells to areas requiring oxygen and nutrient support, ultimately forming complex networks of blood vessels. This process is critical in the pathogenesis of inflammatory diseases, providing a foundation for developing modern therapeutic methods. From the perspective of the primary topic of this dissertation, increased migration leading to the formation of new vessels is associated with the release of migrasomes by endothelial cells, indicating a significant involvement of migrasomes in intercellular communication.

Understanding the role of endothelial cells in the context of inflammatory cell migration and the activation of the inflammatory response in cells lining the vessel walls

and the consequent secretion of extracellular vesicles is essential for developing new diagnostic and therapeutic strategies. Inhibitors of signaling pathways that regulate inflammatory cell movement and endothelial cell functions could be particularly valuable in the treatment of inflammatory and neoplastic diseases, where excessive or abnormal inflammatory responses play a crucial role.