The influence of vimentin on actin dynamics

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The cytoskeleton is a network of polymers which extends inside the cytoplasm to form and maintain the cell shape. It is composed of three main types of filaments: microtubules (MTs), actin filaments, and intermediate filaments (IFs). Vimentin belongs to the family of IFs and is involved in fixing organelles in the cytoplasm and regulating cell migration. It forms non-polar filaments and has, therefore, no known molecular motor directly interacting on it. Vimentin is linked via plectin protein cross-linker to MTs and actin filaments as well as to itself. Vimentin has been further shown to colocalize to actin stress fibers (SFs). These are bundles of actin filaments assembled by the myosin II molecular motors and crosslinker proteins. Actin SFs play a key role in cell contractility and cell migration. In earlier works, we investigated the effect of vimentin in processes like cell migration, which are known to be initiated by forces generated by actin filaments and the molecular motor myosin. To understand how vimentin IFs are involved in these processes, we study the dynamics of the actin SFs in Retinal Pigment Epithelial (RPE1) cells with different amounts of vimentin. We also consider the role of plectin on SF dynamics. We demonstrate that actin SFs are less dynamic in vimentin depleted cells compared to SF in vimentin wild-type cells. We could further show that the dynamics of actin SFs is not influenced by plectin, suggesting a role of vimentin itself on actin SF dynamics. Since myosin motor molecules are, together with actin involved in cell migration and force generation, we were motivated to additionally investigate the amount of myosin in RPE1 cells with and without vimentin by immunofluorescence and western blot techniques.