Molecular regulation of stem cell quiescence

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Adult stem cells are unique in their ability to produce differentiated daughter cells while retaining their stem cell identity by self-renewal. The quiescent state of stem cells has long been viewed as a dormant state, but our understanding of the molecular regulation and physiological significance of this state remains limited. Dysregulation of quiescence results in the depletion of the stem cell pool. Deciphering the molecular mechanisms regulating the quiescent state will enable us to better devise approaches for stem cell therapies for degenerative diseases such as muscular dystrophy. Muscle stem cells, or “satellite cells”, are a population of adult stem cells that are primarily quiescent in the absence of injury, making them an excellent model to study stem cell quiescence. We hypothesize that the state of quiescence is a poised state awaiting extrinsic signals for activation. Our data showed that the state of quiescence is actively controlled at the post-transcriptional level by microRNAs. Interestingly, we have identified microRNA-dependent pathways that regulate stem cell quiescence and underlie the functional heterogeneity of adult stem cells. Collectively, our data provide strong support for the hypothesis that the quiescent state is an actively regulated state.