The microRNA cluster miR-106b~25 regulates adult neural stem/progenitor cell proliferation and neuronal differentiation.

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Public Summary:
In adult mammals, neural stem cells (NSCs) generate new neurons that are important for specific types of learning and memory. Controlling adult NSC number and function is fundamental for preserving the stem cell pool and ensuring proper levels of neurogenesis throughout life. Here we study the importance of the microRNA gene cluster miR 106b~25 (miR 106b, miR 93, and miR 25) in primary cultures of neural stem/progenitor cells (NSPCs) isolated from adult mice. We find that knocking down miR 25 decreases NSPC proliferation, whereas ectopically expressing miR 25 promotes NSPC proliferation. Expressing the entire miR 106b~25 cluster in NSPCs also increases their ability to generate new neurons. Interestingly, miR 25 has a number of potential target mRNAs involved in insulin/insulin like growth factor 1 (IGF) signaling, a pathway implicated in aging. Furthermore, the regulatory region of miR 106b~25 is bound by FoxO3, a member of the FoxO family of transcription factors that maintains adult stem cells and extends lifespan downstream of insulin/IGF signaling. These results suggest that miR 106b~25 regulates NSPC function and is part of a network involving the insulin/IGF FoxO pathway, which may have important implications for the homeostasis of the NSC pool during aging.

Scientific Abstract:
In adult mammals, neural stem cells (NSCs) generate new neurons that are important for specific types of learning and memory. Controlling adult NSC number and function is fundamental for preserving the stem cell pool and ensuring proper levels of neurogenesis throughout life. Here we study the importance of the microRNA gene cluster miR-106b~25 (miR-106b, miR-93, and miR-25) in primary cultures of neural stem/progenitor cells (NSPCs) isolated from adult mice. We find that knocking down miR-25 decreases NSPC proliferation, whereas ectopically expressing miR-25 promotes NSPC proliferation. Expressing the entire miR-106b~25 cluster in NSPCs also increases their ability to generate new neurons. Interestingly, miR-25 has a number of potential target mRNAs involved in insulin/insulin-like growth factor-1 (IGF) signaling, a pathway implicated in aging. Furthermore, the regulatory region of miR-106b~25 is bound by FoxO3, a member of the FoxO family of transcription factors that maintains adult stem cells and extends lifespan downstream of insulin/IGF signaling. These results suggest that miR-106b~25 regulates NSPC function and is part of a network involving the insulin/IGF-FoxO pathway, which may have important implications for the homeostasis of the NSC pool during aging.