Cent. Eur. J. Biol. • 8(10) • 2013 • 931-942
DOI: 10.2478/s11535-013-0222-9

VERSITA

Central European Journal of **Biology**

microRNA in the control of stem-like phenotype of cancer cells

Mini-Review

Michal Wozniak*

Department of Molecular Biology of Cancer,
Medical University of Lodz,
92-215 Lodz, Poland

Received 04 January 2013; Accepted 04 June 2013

Abstract: Current therapies against metastatic tumors are still ineffective. Cancer stem cells - a small subset of cells inside the tumor that possesses a self-renewal capacity – might be responsible for the recurrence of the tumor after anti-cancer therapies. Their immortality and unique drug resistance impede their eradication during therapy. The 'stemness' of these cells is controlled by microRNAs. These molecules possess the ability to downregulate gene expression by binding to the target mRNA. It turns out that microRNAs control the expression of approximately 60% of the genes in human cells. MicroRNA aberrant expression can lead to cancer development and progression. Therefore, recent research has focused on unraveling the role of microRNA in maintaining a stem-like phenotype in malignant tumors and cancer stem cells. This review summarizes our current knowledge about microRNAs that control the self-renewal capacity of cancer stem cells and indicates the importance of profound research aimed at developing efficient miRNA-targeted therapies.

Keywords: *Cancer stem cells • Differentiation • miRNA • Self-renewal*

1. Introduction

Cancer therapies nowadays still cannot overcome the problems of tumor recurrence after chemo-, immuno-, or radiotherapy. This is mainly caused by ineffective eradication of cancer stem cells (also known as tumor initiating cells), that are responsible for tumor recurrence. These cells possess the capabilities of self-renewal, differentiation, and augmented resistance against conventional anticancer drugs. The stem-like properties of cancer cells are controlled by microRNAs (miRNAs), whose expression is usually disturbed during tumorigenesis. In cancer and cancer stem cells, several important miRNAs acting as tumor suppressors are downregulated, triggering proliferation and resistance to apoptosis, while several other oncogenic miRNAs are overexpressed, promoting self-renewal or dedifferentiation of cancer cells.

MicroRNAs are small non-coding RNA molecules with regulatory activity. They act as negative regulators of gene expression by binding to complementary sequences on the target mRNA. mRNA with bound miRNA cannot be translated and often, such an RNA duplex is degraded. Novel anti-cancer therapies currently being elucidated, benefit from the importance of miRNA for cancer maintenance, and intend to target aberrantly-expressed miRNA molecules in cancer cells.

This review summarizes recent achievements regarding miRNA-mediated control of cancer stem-like properties, and first attempts to provide miRNA – targeted therapies.

2. miRNA biogenesis, regulation and mode of action

miRNA are processed from precursor molecules of several thousand base pairs (pri-miRNA) that are transcribed by RNA polymerase II from independent genes, introns, or even exons of protein-coding genes [1]. A single pri-miRNA molecule has a stem loop structure and possesses up to six miRNA precursors (pre-miRNA) situated in hairpin loop structures of about 70 nucleotides each. Since they are transcribed by RNA

* *E-mail: michal.wozniak@umed.lodz.pl*