MIR27A (microRNA 27a)

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Published in Atlas Database: May 2012


DOI: 10.4267/2042/48229

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Identity

Other names: MIR27, MIRN27A, hsa-mir-27a, miR-27a
HGNC (Hugo): MIR27A
Location: 19p13.13

DNA/RNA

Description

MiR-27 is a family of microRNA precursors found in animals, including humans. MicroRNAs are typically transcribed as ~70 nucleotide precursors and subsequently processed by the Dicer enzyme to give a ~22 nucleotide product. The excised region or, mature product, of the miR-27 precursor is the microRNA, miR-27. Herpesvirus saimiri expresses several non-coding RNAs (HSURs) which have been found to significantly reduce the level of miR-27 in a host cell. It has been proposed that miR-27 operates together with miR-23 and miR-24 in a cooperative cluster. This miRNA was previously named miR-27 but is renamed here to avoid confusion with the more recently described miR-27b (MI0000440).

Transcription

Mature miR-27a
The mature miRNA forms one strand of the RNA duplex. One strand is degraded and other is incorporated into a protein complex, RNA induced silencing complex (RISC), targeting a partially complementary target mRNA. MiR-27a is 22 nucleotides long. Sequence: 5’ - uucacagugguacguucgc - 3’.

Pseudogene

No reported pseudogenes.

A) Genomic localization of miR-27a gene on chromosome 19p13.13; B) Stem-loop structure of miR-27a.
Protein

Note
miRNAs are not translated into amino acids.

Mutations

Note
No mutations have been found in mature miR-27a sequence.

Implicated in

Breast cancer

Disease
MiR-27a was first implicated in breast cancer as an oncomiRNA. Mertens-Talcott et al. found that miR-27a was highly expressed in breast cancer cells. They inhibited this microRNA using antisense molecules in MDA-MB-231 cells, and found that cell proliferation decreased with the decreasing of the percentage of cells in S phase and increasing of the percentage of cells in the G2-M phase by regulating the potential targets Myt-1 and the Sp repressor ZBTB10. Li et al. found that both as-miR-27a and overexpression of ZBTB10 decreased Sp1, Sp3, and Sp4 mRNA and protein expression in E2-responsive MCF-7 cells, and this was also accompanied by decreased levels of estrogen receptor alpha (ERalpha) mRNA and protein. BA-dependent repression of Sp1, Sp3, Sp4 and Sp-regulated genes was partly due to induction of the Sp repressor ZBTB10 and downregulation of miR-27a, which identified a new cellular target for this anticancer agent. Recently, Liu et al. found that suppression of miR-27a together with miR-96 and miR-182 resulted in an increase in FOXO1 protein, which decreased the cell numbers of breast cancer through inhibition of cell cycle traverse and increased cell death. The single nucleotide polymorphisms (SNPs) in miR-27a also played a role in the breast cancer. The G-variant of rs895819, which located in the terminal loop of pre-miRNA-27a, might impair the maturation of the oncogenic miR-27a and is associated with familial breast cancer risk.

Gastric cancer

Disease
MiR-27a was up-regulated in human gastric adenocarcinoma. Suppression of miR-27a inhibited gastric cancer cell growth by targeting prohibitin. Subsequently, it has been reported that down-regulation of miR-27a could also confer sensitivity of drugs on gastric cancer cells, and might increase accumulation and decrease releasing amount of adriamycin in gastric cancer cells. Down-regulation of miR-27a could significantly decrease the expression of P-glycoprotein and the transcriptional activity of cyclin D1, and up-regulate the expression of p21. In Japanese male subjects, the miR-27a polymorphism was associated with the gastric mucosal atrophy and metaplasia, and the miR-27a genome region polymorphism may be an important definitive factor to develop the gastric mucosal atrophy. The same to the breast cancer, a common polymorphism (rs895819) in hsa-mir-27a, by modulating miR-27a and ZBTB10 levels, also acted as an important factor of the gastric cancer susceptibility.

Pancreatic cancer

Disease
Using the technique of microRNA arrays or real time PCR, studies have shown the deregulation of miR-27a in pancreatic cancer tissues. Further study showed that down-regulation of miR-27a suppressed the growth, colony formation and migration of these two cell lines by targeting Spry2, which played a role as an antagonist of Ras/MAPK signaling pathway in several malignancies.

Prostate cancer

Disease
MiR-27a was an androgen-regulated oncomiRNA in prostate cancer, acting via targeting the tumour suppressor and AR corepressor, Prohibitin (PHB). Androgens, therefore regulated miR-27a expression both transcriptionally (via AR binding to the cluster promoter) and post-transcriptionally (accelerating primiR processing to the mature form). Moreover, it has been shown that a miR-27a anti-sense oligonucleotide, by opposing the effects of mir-27a, has therapeutic potential in prostate cancer. Upregulation of miR-23a, miR-27a, miR-24-2 cluster induces caspase-dependent and -independent apoptosis in human embryonic kidney cells. Bioinformatically, FADD, one of genes involved in apoptosis, is predicted to be the direct target of hsa-miR-27a.

Various cancer

Note
Therapy resistance: In colon cancer cells, CDODA-Me acted through downregulation of miR-27a which is accompanied by enhanced expression of ZBTB10 and Myt-1. In leukaemia cell lines, the expression of miR-27a was inversely correlated with the expression of P-glycoprotein (P-gp), a drug-resistant factor. Transfection of the K562 and HL60 DOX-resistant cells (a human promyelocytic cell line, HL) with miR-27a resulted in the increased sensitivity of cells to DOX. Down-regulation of miR-27a could also confer sensitivity of both P-glycoprotein-related and P-glycoprotein-non-related drugs on esophageal cancer cells with the decreasing of Bcl-2 and the transcription of the multidrug resistance gene 1, but the increasing expression of Bax. The expression levels of miR-27a and P-gp were up-
regulated in paclitaxel-resistant ovarian cancer cell line A2780/Taxol as compared with its parental line A2780. Transfection of A2780/Taxol cells with miR-27a inhibitor decreased the expression of MDR1 mRNA and P-gp protein, increased HIPK2 protein expression, enhanced the sensitivity of A2780/taxol cells to paclitaxel.

**Differentiation:** MiR-27a was demonstrated to modulate β-MHC gene regulation via thyroid hormone signaling and to be upregulated during the differentiation of mouse embryonic stem (ES) cells or in hypertrophic hearts in association with β-MHC gene upregulation.

MiR-27a played a regulatory role in megakaryocytic differentiation by attenuating Runx1 expression, which is an important cell lineage-specific regulator of hematopoiesis. Moreover, Runx1 and miR-27a were engaged in a feedback loop involving positive regulation of miR-27a expression by Runx1.

**Cell division:** MiR-27a was also reported as a novel factor fine-tuning the periodic events regulating cell cycle progression by regulation of FBW7. MiR-27a was identified as a key regulator of p44 mRNA. Moreover, miR-27a was shown to destabilize the p44 subunit of the TFIH complex during the G2-M phase, thereby modulating the transcriptional shutdown observed during this transition.

**Oncogenesis**

MiR-27a was upregulated in SV40 ST-transformed human bronchial epithelial cells (HBERST). Suppression of miR-27a expression in HBERST cells or lung cancer cell lines (NCI-H226 and SK-MES-1) that exhibited high levels of miR-27a expression led to cell growth arrested in the G(0)-G(1) phase by suppression of Fbxw7, the possible target of miR-27a.

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**References**


Ben-Ami O, Pencovich N, Lotem J, Levanon D, Groner Y. A regulatory interplay between miR-27a and Runx1 during megakaryopoiesis. Proc Natl Acad Sci U S A. 2009 Jan 6;106(1):238-43


Ma Y, Yu S, Zhao W, Lu Z, Chen J. miR-27a regulates the growth, colony formation and migration of pancreatic cancer cells by targeting Sprouty2. Cancer Lett. 2010 Dec 8;298(2):150-8


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