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Gene Section
Mini Review

MIR7-1 (microRNA 7-1)

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Identity

Other names: MIRN7-1 (microRNA 7-1); hsa-mir-7-1; mir-7-1

HGNC (Hugo): MIR7-1

Location: 9q21.32

Local order: Genes flanking miR-7-1 on 9q21.32 are:

GKAP1: G kinase anchoring protein 1; KIF27: Kinesin family member 27; C9orf64: Hypothetical protein LOC84267; HNRNPK (host gene for miR-7-1): Heterogeneous nuclear ribonucleoprotein K; RMI1: RecQ mediated instability 1.

DNA/RNA

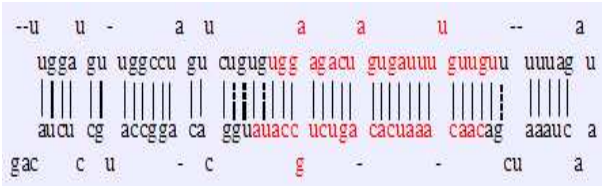

Figure 1: Stem-loop structure of miR-7-1.

Description

miR-7-1 is located within an intron of the HNRNPK gene, a ribonucleoprotein. There are two other microRNAs in the human genome that yield mature miR-7, with all three miR-7 loci found on different chromosomes.

Transcription

It is thought that most microRNA genes are transcribed by RNA polymerase II, though some are transcribed by RNA polymerase III. It is currently unknown which transcribes miR-7-1.

Pre-microRNA-7-1 (Precursor microRNA)

Accession: MI0000263
Length: 110 bp
Sequence:
5'-UUGGAUGUUGGCCUAGUUCUGUGUGGA
AGACUAGUGAUUUUGUUGUUUUUAGAUAACU
AAAUCGACAACAAAUCACAGUCUGCCAUAUG
GCACAGGCCAUGCCUCUACAG-3'

Mature miR-7
Accession: MIMAT0000252
Length: 23
Sequence: 24-uggaagacuagugauuuuguugu-46

Pseudogene

No pseudogenes have been reported for miR-7-1.

Protein

Note
N/A; microRNAs are not translated.

Mutations

Note
No mutations in MIRN7-1 yet described.

Implicated in

Brain tumors

Note
Three references have suggested roles for miR-7 in brain tumors. One report indicated tumor suppressor-like characteristics of microRNA-7 in glioblastomas. The results showed that miR-7 potently down-regulates the EGF receptor (EGFR) as well as upstream drivers of the Akt pathway and AKT activity. Additionally, miR-7 was found to be down-regulated in human glioblastoma samples relative to surrounding normal

brain, likely through a processing deficit at the pri-miR to pre-miR level. Transfection of miR-7 into established and primary glioblastoma cell lines significantly decreased cell viability, caused apoptosis, and inhibited invasiveness. Another report profiled microRNA expression in the NCI-60 panel of cancer cell lines and found miR-7 one of the most down-regulated microRNAs in brain tumor cell lines. A third publication assessed microRNA expression in medulloblastoma brain tumors versus that in adult and fetal cerebellum samples and noted decreased miR-7 expression in medulloblastomas versus normal adult cerebellar tissue.

Breast cancer

Note

Two reports have linked miR-7 to breast cancer. One reference indicated that miR-7 inhibited expression of p21-activated kinase 1 (PAK1), an invasion-promoting kinase that is up-regulated in multiple cancer types. The results showed that miR-7 and PAK1 levels correlated inversely in human cancer cells. Interestingly, it was found that the anti-invasive HOXD10 was found to drive miR-7 expression. In a cellular model of breast cancer with a gradient of invasive phenotypes, higher invasiveness was found to correlate with lower HOXD10 and miR-7 expression and higher Pak1 expression. Transfection of miR-7 into breast cancer cells decreased their invasiveness and tumorigenic potential. However, a second report found that miR-7 expression correlated with poorer prognosis in patients with breast cancer, suggesting that the role of miR-7 may be complex in this cancer type.

Radiation response

Note

MicroRNA profiling was performed on mouse spleen and thymus before and after radiation in male and female mice. In male mice, miR-7 was found to be down-regulated in the spleen in response to radiation. It was also found that miR-7 down-regulated lymphoid-specific helicase (LSH), a regulator of methylation and promoter of genome stability. LSH was found to increase in conjunction with the decrease in miR-7 expression following irradiation of male spleens.

Brain

Note

Early reports profiling microRNA expression in various normal tissues found miR-7 to have extremely high expression in the pituitary gland, presumably because miR-7-3 is located in an intron of pituitary gland-specific factor 1a (PGSF1). MiR-7 is also expressed to a lesser but still notable degree in the hypothalamus. One report linked miR-7 expression to a functional role in the hypothalamus in the mouse. The results showed that miR-7b is upregulated in the mouse hypothalamus after hyperosmolar stimulation and that miR-7b inhibits expression of FOS, an immediate-early gene and component of the activator protein 1 complex (AP-1).

Eye

Note

One report described a developmental role for miR-7 in a feedback loop regulating photoreceptor differetiation in the Drosphila eye. Normally progenitor cells express the transcription factor Yan and not miR-7, while differentiated photoreceptor cells have the opposite expression pattern. EGF receptor signaling is known to trigger differentiation of progenitors to photoreceptor cells, and these results indicate it performs this function by activating degradation of Yan and flipping the axis to miR-7 expression. Other reports have noted expression of miR-7 in vertebrate eye tissues. One report suggests that in zebrafish, miR-7 is highly expressed in neurons with sensory or neurosecretory functions. Other reports have noted miR-7 expression in human and rat retinas and in the rodent lens.

Pancreatic islets

Note

Two studies have found miR-7 to be highly expressed in pancreatic islets. One report found miR-7 to be the most highly-expressed in pancreatic islet cells versus acinar cells. Another report noted high expression of miR-7 and miR-375 in developing pancreatic islets, though expression of miR-7 seemed to be more specific to the insulin-producing beta-cells.

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