The scientific and clinical concept of microribonucleic acid (miRNA) in human diseases

(Essay)

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بسم الله الرحمن الرحيم

قال تعالى : "{قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ}

[سورة البقرة أية(٣٢)]

Abstract:

Keyword: microRNA

MicroRNAs are single-stranded RNAs of 19–25 nucleotides in length. MicroRNAs have emerged as central post- transcriptional repressors of gene expression. MicroRNAs have been implicated in regulation of cellular processes such as differentiation, proliferation, apoptosis, metabolism, haematopoiesis, cardiogenesis. MicroRNAs represent a class of genes with a great potential for use in diagnosis, prognosis, therapy and are a new frontier for molecular medicine.

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List of abbreviation

A	Adenine
Ago	argonaute proteins
ALD	alcoholic liver disease
AMO	anti-miRNA oligonucleotide
aP2	Adipocyte protein 2
ARE	AU-rich 3`UTR regulatory sequence
ASO	antisense oligonucleotides
AT1R	angiotensin II type 1 receptor
Bcl-2	B-cell lymphoma 2
C	Cytosine
C/EBPα	CCAAT-enhancer-binding proteins alpha
CAT-1	cationic amino acid transporter-1
Cav2	caveolin 2
CD4	cluster of differentiation 4
CDK2	cyclin-dependent kinase 2
CLL	chronic lymphocytic leukemia
CNS	central nerve system
CNV	choroidal neovascurization
CP	capping protein
CREB-1	cAMP-response-element binding protein
CTGF	connective tissue growth factor
CYP1B1	cytochrome P450, family 1, subfamily B, polypeptide 1
DCP2	decapping enzyme
DGCR8	DiGeorge Syndrome Critical Region 8
DNA	deoxyribonucleic acid
DNMTs	DNA methyl transferases
dsRBP	double-stranded RNA-binding protein
dsRNA	double-stranded RNA
ED	endothelial dysfunction
eIF	eukaryotic initiation factors
eNOS	endothelial nitric oxide synthase
ER	Endoplasmic reticulum
ERKS	extracellular-signal-regulated kinases
ES	Embryonic stem
Exp 5	Exportin 5
Fab	fragment antigen-binding

FMR1	fragile X mental retardation 1
FMRP	fragile X mental retardation protein
FOS	FBJ murine osteosarcoma
FoxA2	fork head box protein A2
G	Guanine
Gag	group-specific antigen
GAX	growth arrest homeobox
GK	Goto-Kakizaki
GLUT4	insulin-sensitive glucose transporter,
GM-CSF	granulocyte-macrophage colony stimulating factor
GSIS	glucose-stimulated insulin secretion
Hand2	Heart- and neural crest derivatives-expressed protein 2
HBV	hepatitis B virus
HCV	hepatitis C virus
HDAC4	histone deacetylase 4
HDL	High density lipoprotein
HIF	hypoxia inducible factor
HIV	Human immunodeficiency virus
hnRNA	heterogenous nuclear RNA
HOXB8	homeobox B8
HSC	hepatic stellate cells
HSL	hormone sensitive lipase
IFN-beta	interferon beta
IL	Interleukin
Insig1	insulin-induced gene 1
IRAK1	interleukin-1 receptor-associated kinase 1
IRES	internal ribosome entry sites
IRS	Insulin receptor substrate
KATP	ATP-sensitive potassium channel
Kir6.2	inwardly-rectifying potassium channel
LATS2	large tumour suppressor homologue 2
LDL	Low-density lipoprotein
Limk1	LIM domain kinase-1
LNA	Locked nucleic acid
m7G	7-methylguanosine
MAFB	v-maf musculoaponeurotic fibrosarcoma oncogene homolog B
MAPK7	mitogen-activated protein kinase 7
Mef2	myocyte enhancer factor-2
miRISC	miRNA induce silencing complex
miR-	miRNA Mimic technology

Mimic	
miRNA	MicroRNA
miRNPs	miRNA containing ribonucleoprotein particles
mRNA	messenger RNAs
Mtpn	Myotrophin
MyoD	myogenic D
NAFLD	non-alcoholic fatty liver disease
ncRNA	non-coding RNA
NFI-A	nuclear factor I/A
NF-κB	nuclear factor κ B cell
NMD	nonsense mediated decay
NO	Nitric oxide
Noc2	nucleolar complex protein 2
nPTN	Neuroplastin
Nt	Nucleotid
Onecut2	one cut homeobox2
p53	protein 53
PABP1	poly(A)-binding protein 1
PACT	protein activator of the interferon-induced protein kinase
PAZ	Piwi, Argounate, Zwille
PBC	Primary biliary cirrhosis
Pdx1	pancreatic and duodenal homeobox 1
PEG	polyethylene glycol (
PFV-1	primate foamy virus type 1
PN	peripheral neuropathy
PNA	peptide nucleic acids
Pol II	polymerase II
PPAR-2	peroxisome proliferator-activated receptor
pre-miRNA	precursor miRNAs
pri-miRNA	primary miRNA
PTEN	phosphatase and tensin
PTGS	post-transcriptional gene silencing
PVD	peripheral vascular disease
Ran-GTP	RAs-related Nuclear protein-guanine triphosphatase
RISC	RNA-induced silencing complex
RNA	ribonucleic acid
RNAi	ribonucleic acid interference
RNases	Ribonuclease
RNAs	Ribosomal RNAs
SGs	stress granules

siRNA	Small Interfering RNA
SLITRK1	Slit and Trk-like 1
SMA	Spinal muscular atrophy
SMN	survival of motor neuron
snoRNA	Small nucleolar RNA
snRNA	Small nuclear RNA
SRF	serum response factor
sRNA	small RNA
ssRNAs	single-stranded RNAs
SuFu	suppressor of fused
Sur1	sulfonylurea receptor
T	Thymine
T1D	Type 1 diabetes
T2D	Type 2 diabetes
TBP	TATA binding protein
TFIID	Transcription Factor II D
TGF	Transforming growth factor
TLRs	toll like receptors
TNF	tumor necrosis factor
TNFα	tumor necrosis factor alpha
TRAF6	TNF receptor-associated factor 6
TRBP	transactivation-response element RNA-binding protein
TRNA	Transfer RNA
TS	Tourette's syndrome
TSP-1	thrombospondin-1
TUSC2	tumour suppressor candidate 2
U	Uracil
UTR	untranslated region
VCAM 1	vascular cell adhesion molecule 1
VEGF	vascular endothelial growth factor
VIG	Vasa intronic gene
VSMCs	vascular smooth muscle cells
XRN1	exoribonuclease 1
ZOP	Zonula occludens protein
3T3	3-day transfer, inoculum 3 x 105 cells
5-Aza-CdR	5-Azacytidine

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INTRODUCTION AND AIM OF WORK

Introduction

Human gene expression is the process by which DNA is transcribed into RNA to be translated into proteins which produce essential cellular function. This process is usually under strict regulation **(Wang, 2009).**

MicroRNAs (miRNA) are single-stranded RNA molecules of 21-23 nucleotides in length, which regulate gene expression. MiRNAs are encoded by genes from whose DNA they are transcribed but are not translated into protein **(Lee et al, 1993).**

A miRNA is complementary to a part of one or more messenger RNAs (mRNA). Animal miRNAs are usually complementary to a site in the three prime untranslated regions (3‘UTR) whereas plant miRNAs are usually complementary to coding regions of mRNAs **(Wang, 2009).**

The function of miRNAs appears to be in gene regulation. Perfect or near perfect base pairing with the target RNA promotes cleavage of the RNA. In animals, microRNAs more often only partially base pair and inhibit protein translation of the target mRNA. They can also speed up de-adenylation causing mRNAs to be degraded sooner. MicroRNAs occasionally also cause DNA methylation of promoter sites and therefore affecting the expression of targeted genes (**Williams, 2009**).

The elevated tissue-specific expression of some miRNA genes suggests that they might be involved in tissue differentiation and maintenance of cell-type identity; miRNAs would share such a role with tissue-specific transcriptional factors (**Kawasski et al, 2004**).