Mutation in miRNA

FINAL REVIEW REPORT

Submitted by

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Prepared For

BIOLOGICAL DATABASE – BIT2002

PROJECT COMPONENT

Submitted To

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(Deemed to be University under section 3 of UGC Act, 1956)

Table of Contents

1. INTRODUCTION

MicroRNAs (miRNAs) are small, non-coding RNA molecules typically containing ~22 nucleotides found in human, animals, plants and some viruses which are playing an important regulatory role in the gene translation via silencing or degradation of target mRNAs.They are involved in many important biological processes and the dysfunction of microRNA has been associated with many diseases. MicroRNAs are transcribed by RNA polymerases II and III, generating precursors that undergo a series of cleavage events to form mature microRNA. The main aim of the project is to create a database and a website regarding the necessary information of mutations that occur in miRNA.

2. LITERATURE SURVEY

The databases referred in creating the database are :
  ➢ SomamiR : database of cancer somatic mutations in microRNAs.
  ➢ PolymiRTS : database of naturally occurring DNA variations in microRNA
  ➢ miRCancer : comprehensive collection of microRNA (miRNA) expression profiles in various human cancers

3. PROGRAMMING LANGUAGES

FRONT END :- HTML, CSS
BACK END :- MYSQL (XAMPP SERVER)
PHP – TO CONNECT FRONT END AND BACK END

4. DATABASE CREATION

1 - Classification based on where the mutation occurs : seed, mature, pre-miRNA

```
SELECT * FROM `region`
```

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+ Options

miRNA_name	chr_number	strand	allele	Sequence	region
hsa-miR-6777-3p	chr17	-	C/T	CCACU[C/T]U	Seed
hsa-miR-6814-5p	chr21	-	G/A	CCCAA[G/A]G	Seed
hsa-miR-662	chr16	+	G/A	CCCAC[G/A]U	Seed
hsa-miR-4301	chr11	-	C/A	[C/A]CCACUA	Seed
hsa-miR-6803-3p	chr19	-	C/T	CCCU[C/T]GC	Seed
hsa-miR-125a-5p	chr19	+	G/T	CCCUGA[G/T]	Seed
hsa-miR-671-3p	chr7	+	G/A	CC[G/A]GUUC	Seed
hsa-miR-6761-3p	chr12	+	C/T	[C/T]CUACGC	Seed
hsa-miR-6761-3p	chr12	+	C/T	CCUA[C/T]GC	Seed
hsa-miR-6767-5p	chr16	+	C/T	[C/T]GCAGAC	Seed
hsa-miR-1292-3p	chr20	+	C/T	[C/T]GCGCCC	Seed
hsa-miR-6499-5p	chr5	-	G/A	CGGGC[G/A]C	Seed

2) Classification based on type of mutation

```
SELECT * FROM `mutation`
```

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1 ⌄ > >> | Number of rows: 25 ⌄ Filter rows: Search this table

+ Options

TranscriptID	SNPID	mutation_type	Chrom	Allele1miR	Allele2miR
TransciptID	SNPID	mutation_type	Chrom	Allele1miR	Allele2miR
NM_015215	rs35695415	del	chr1	hsa-miR-129-5p|hsa-miR-19a-3p|hsa-miR-19b-3p|hsa-m...	
NM_005529	rs34870235	del	chr1	hsa-miR-1228-5p|hsa-miR-342-5p|hsa-miR-4651|hsa-mi...	hsa-miR-1908-5p|hsa-miR-663a|hsa-miR-6787-5p
NM_005529	rs36074868	del	chr1	hsa-miR-1228-5p|hsa-miR-4783-3p|hsa-miR-541-3p|hsa...	hsa-miR-1908-5p|hsa-miR-663a|hsa-miR-6787-5p
NM_016946	rs150640923	del	chr1	hsa-miR-4328	hsa-miR-145-5p|hsa-miR-3925-3p|hsa-miR-5195-3p
NM_022552	rs199673579	del	chr2	hsa-miR-29a-5p	
NM_058241	rs148699735	del	chr2	hsa-miR-519d-5p	hsa-miR-16-2-3p|hsa-miR-195-3p|hsa-miR-323b-3p

3) Cancer and miRNA

```
SELECT * FROM `cancer`
```

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1 ⌄ > >> | Number of rows: 25 ⌄ Filter rows: Search this table

+ Options

miRID	cancer	profile	article
mirId	Cancer	Profile	PubMed Article
hsa-let-7a	acute myeloid leukemia	up	Inducing Apoptosis and Decreasing Cell Proliferati...
hsa-let-7a	acute myeloid leukemia	up	Deregulation of miR-1, miR486, and let-7a in cytog...
hsa-let-7a	breast cancer	down	Plasma miR-21, miR-155, miR-10b, and Let-7a as the...
hsa-let-7a	breast cancer	down	Tumor suppressor let-7a inhibits breast cancer cel...
hsa-let-7a	breast cancer	down	Arsenic trioxide inhibits cell growth and motility...
hsa-let-7a	breast cancer	down	Let-7a mimic attenuates CCL18 induced breast cance...
hsa-let-7a	breast cancer	down	Let-7a inhibits growth and migration of breast can...
hsa-let-7a	breast cancer	down	MicroRNA let-7a suppresses breast cancer cell migr...
hsa-let-7a	breast cancer	down	The heterochronic microRNA let-7 inhibits cell mot...
hsa-let-7a	breast cancer	down	Lin28 induces epithelial-to-mesenchymal transition...
hsa-let-7a	chondrosarcoma	down	Analysis of microRNAs expressions in chondrosarcom...
	colon cancer	down	Let-7a inhibits tumor cell growth and metastasis b...

■ Console

4) Genes associated with cancer risk that contain miRNA related somatic mutations

```
SELECT * FROM `genes`
```

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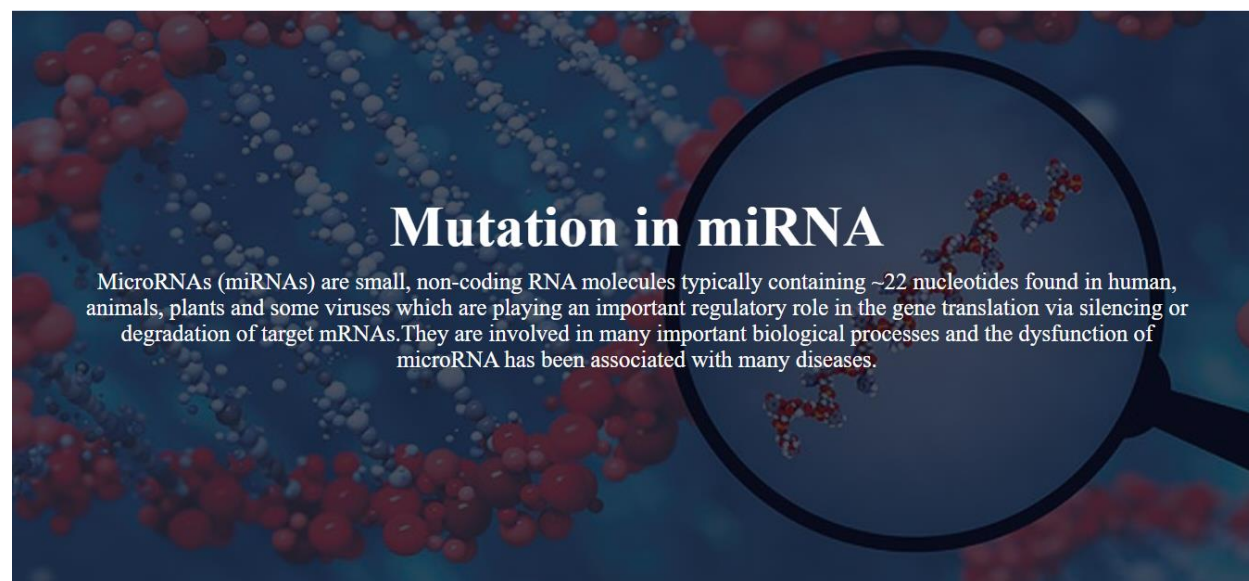| 1 ⌄ | > | >> | | Number of rows: | 25 ⌄ | Filter rows: | Search this table |

+ Options

gene_name	COL2	COL3	COL4	COL5
Gene Name	Marker	Study Type	Disease	PubMed ID
ARID5B	rs10821936	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
C12orf5	rs10849033	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
CCND2	rs10849033	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
CFHR1	rs6428370	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
CFHR4	rs6428370	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
DDC	rs11978267	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
IKZF1	rs11978267	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
KCNE4	rs12621643	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
KCNMB2	rs9290663	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
MAP1LC3B2	rs2089222	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
METTL4	rs1879352	GWAS	Acute lymphoblastic leukemia (childhood)	19684603
OR2C3	rs1881797	GWAS	Acute lymphoblastic leukemia (childhood)	19684603

5. WEBSITE OUTCOME

Mutation in miRNA

MicroRNAs (miRNAs) are small, non-coding RNA molecules typically containing ~22 nucleotides found in human, animals, plants and some viruses which are playing an important regulatory role in the gene translation via silencing or degradation of target mRNAs.They are involved in many important biological processes and the dysfunction of microRNA has been associated with many diseases.

5.1 Classification based on the region where the mutation occurs

USER CHOOSES PRE-miRNA / SEED REGION / MATURE miRNA

They will be provided with

> ➢ miRNA name
> ➢ Chromosome number
> ➢ Strand
> ➢ Allele
> ➢ Sequence

Mutations

Classification based on the region where the mutation occurs
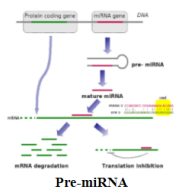
Pre-miRNA

Click on the image above to get to know about mutations in pre-miRNA region
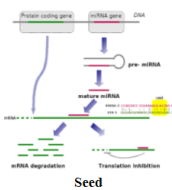
Seed

Click on the image above to get to know about mutations in seed region

Mature

Click on the image above to get to know about mutations in mature region

Pre-miRNA

Mutations in miRNA

Mutations that occur in the Pre-miRNA region of miRNA specifically

miRNA Name	Chromosome	Strand
hsa-mir-9-3	chr15	+
hsa-mir-192	chr11	-
hsa-mir-99a	chr21	+
hsa-mir-1208	chr8	+
hsa-mir-656	chr14	+
hsa-mir-134	chr14	+
hsa-mir-1307	chr10	-
hsa-mir-548f-1	chr10	-
hsa-mir-1324	chr3	+
hsa-mir-101-1	chr1	-

Seed :

Mutations in miRNA

Mutations that occur in the seed region of miRNA specifically

miRNA Name	Chromosome	Strand	Allele	Sequence
hsa-miR-6777-3p	chr17	-	C/T	CCACU[C/T]U
hsa-miR-6814-5p	chr21	-	G/A	CCCAA[G/A]G
hsa-miR-662	chr16	+	G/A	CCCAC[G/A]U
hsa-miR-4301	chr11	-	C/A	[C/A]CCACUA
hsa-miR-6803-3p	chr19	-	C/T	CCCU[C/T]GC
hsa-miR-125a-5p	chr19	+	G/T	CCCUGA[G/T]
hsa-miR-671-3p	chr7	+	G/A	CC[G/A]GUUC
hsa-miR-6761-3p	chr12	+	C/T	[C/T]CUACGC
hsa-miR-6761-3p	chr12	+	C/T	CCUA[C/T]GC
hsa-miR-6767-5p	chr16	+	C/T	[C/T]GCAGAC

Mature

Mutations in miRNA

Mutations that occur in the mature region of miRNA specifically

miRNA Name	Chromosome	Strand	Allele	Sequence
hsa-miR-134-3p	chr14	+	C/A	CCUGUGGGCCACCUAGU[C/A]ACCAA
hsa-miR-4533	chr20	+	C/U	UGGAAGGAGGUUGCCGGA[C/U]GCU
hsa-miR-663b	chr2	-	G/A	GGUGGCCC[G/A]GCCGUGCCUGAGG
hsa-miR-323a-5p	chr14	+	G/A	AGGUGGUCC[G/A]UGGCGCGUUCGC
hsa-miR-653-5p	chr7	-	A/C	GUGUUGAAAC[A/C]AUCUCUACUG
hsa-miR-627-5p	chr15	-	A/C	GUGAGUCUCUA[A/C]GAAAAGAGGA
hsa-miR-875-5p	chr8	-	C/G	UAUACCU[C/G]AGUUUUAUCAGGUG
hsa-miR-3939	chr6	-	U/C	UACGCGCAGACCACAGGA[U/C]GUC
hsa-miR-4280	chr5	-	G/A	GAGUGUAGUUCUGA[G/A]CAGAGC
hsa-miR-6775-5p	chr16	-	A/U	UCGGGGCAUGGGGG[A/U]GGGAGGCUGG

5.2 Classification based on the type of mutation

USER CHOOSES THE TYPE OF MUTATION – (INS, DEL, SNP)

They will be provided with

➢ miRNA name
➢ Chromosome number
➢ SNP-ID
➢ TRANSCRIPT-ID

Mutations

Classification based on the type of mutation
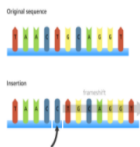
Insertion

Click on the image above to get to know about insertion type of mutation
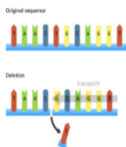
Deletion

Click on the image above to get to know about deletion type of mutation
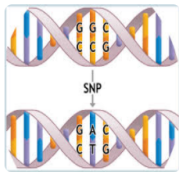
SNP

Click on the image above to get to know about Single Nucleotide Polymorphisms in MiRNA

Insertion :

Mutations in miRNA

Insertion type mutations occuring in miRNA specifically

TranscriptID	SNPID	Chromosome	Allele1miR	Allele2miR
NM_005563	rs35124746	chr1	hsa-miR-223-3p|hsa-miR-4277|hsa-miR-584-3p	hsa-miR-4328
NM_012411	rs34857282	chr1	hsa-miR-181a-5p|hsa-miR-181b-5p|hsa-miR-181c-5p|hsa-miR-181d-5p|hsa-miR-3671|hsa-miR-4262|hsa-miR-607	hsa-miR-518a-5p|hsa-miR-527|hsa-miR-548aw
NM_015215	rs34335657	chr1	hsa-miR-129-5p|hsa-miR-3680-3p|hsa-miR-450b-5p|hsa-miR-507|hsa-miR-557|hsa-miR-6516-5p	
NM_015215	rs60024044	chr1	hsa-miR-129-5p|hsa-miR-3680-3p|hsa-miR-450b-5p|hsa-miR-507|hsa-miR-557|hsa-miR-6516-5p	
NM_001197320	rs148777636	chr1	hsa-miR-29b-1-5p	hsa-miR-323a-5p|hsa-miR-876-3p
NM_001197320	rs34100999	chr1	hsa-miR-1273g-5p|hsa-miR-323a-5p|hsa-miR-876-3p	
NM_001197051	rs71741371	chr11	hsa-miR-129-5p|hsa-miR-2355-3p|hsa-miR-4646-3p|hsa-miR-676-3p	
NM_138973	rs201057843	chr11	hsa-miR-29a-5p	
NM_015055	rs6144205	chr11	hsa-miR-145-5p|hsa-miR-5195-3p	

Deletion :

Mutations in miRNA

Deletion type mutations occuring in miRNA specifically

TranscriptID	SNPID	Chromosome	Allele1miR	Allele2miR
NM_015215	rs35695415	chr1	hsa-miR-129-5p|hsa-miR-19a-3p|hsa-miR-19b-3p|hsa-miR-2113|hsa-miR-5010-3p	
NM_005529	rs34870235	chr1	hsa-miR-1228-5p|hsa-miR-342-5p|hsa-miR-4651|hsa-miR-4664-5p|hsa-miR-541-3p|hsa-miR-608|hsa-miR-654-5p|hsa-miR-6737-5p|hsa-miR-6747-5p|hsa-miR-6756-5p|hsa-miR-6766-5p|hsa-miR-6812-5p|hsa-miR-6819-5p	hsa-miR-1908-5p|hsa-miR-663a|hsa-miR-6787-5p
NM_005529	rs36074868	chr1	hsa-miR-1228-5p|hsa-miR-4783-3p|hsa-miR-541-3p|hsa-miR-654-5p|hsa-miR-6786-5p	hsa-miR-1908-5p|hsa-miR-663a|hsa-miR-6787-5p
NM_016946	rs150640923	chr1	hsa-miR-4328	hsa-miR-145-5p|hsa-miR-3925-3p|hsa-miR-5195-3p
NM_022552	rs199673579	chr2	hsa-miR-29a-5p	
NM_058241	rs148699735	chr2	hsa-miR-519d-5p	hsa-miR-16-2-3p|hsa-miR-195-3p|hsa-miR-323b-3p
NM_002207	rs111503233	chr3	hsa-miR-1227-5p|hsa-miR-128-1-5p|hsa-miR-128-2-5p|hsa-miR-1296-3p|hsa-miR-194-3p|hsa-miR-3151-5p|hsa-miR-5094|hsa-miR-5693|hsa-miR-6762-5p|hsa-miR-6845-5p	hsa-miR-4711-5p|hsa-miR-6798-5p
NM_021923	rs4647945	chr4	hsa-miR-210-3p|hsa-miR-6867-5p	
NM_021923	rs33966823	chr4	hsa-miR-210-3p|hsa-miR-6867-5p	

SNP :

Mutations in miRNA

Single Nucleotide Polymorphism type mutations occuring in miRNA specifically

TranscriptID	SNPID	Chromosome	Allele1miR	Allele2miR
NM_015215	rs201601214	chr1	hsa-miR-129-5p|hsa-miR-3680-3p|hsa-miR-450b-5p|hsa-miR-507|hsa-miR-557|hsa-miR-6516-5p	hsa-miR-30a-3p|hsa-miR-30d-3p|hsa-miR-30e-3p|hsa-miR-335-3p|hsa-miR-4328
NM_020248	rs112637865	chr1	hsa-miR-192-5p|hsa-miR-215-5p	hsa-miR-3646|hsa-miR-4637|hsa-miR-7158-3p
NM_020248	rs180922155	chr1	hsa-miR-29a-3p|hsa-miR-29b-3p|hsa-miR-29c-3p|hsa-miR-4422|hsa-miR-6835-3p	hsa-miR-4509|hsa-miR-6816-3p
NM_006474	rs1061615	chr1	hsa-miR-219b-3p|hsa-miR-25-3p|hsa-miR-32-5p|hsa-miR-363-3p|hsa-miR-367-3p|hsa-miR-92a-3p|hsa-miR-92b-3p	
NM_005529	rs200353436	chr1	hsa-miR-1908-5p|hsa-miR-4706|hsa-miR-4749-5p|hsa-miR-542-5p|hsa-miR-663a|hsa-miR-6787-5p	hsa-miR-25-5p|hsa-miR-4730
NM_005529	rs3767135	chr1	hsa-miR-1228-5p|hsa-miR-1908-5p|hsa-miR-541-3p|hsa-miR-654-5p|hsa-miR-663a|hsa-miR-6787-5p|hsa-miR-744-5p	hsa-miR-1227-5p|hsa-miR-128-1-5p|hsa-miR-128-2-5p|hsa-miR-1293|hsa-miR-3151-5p|hsa-miR-363-5p|hsa-miR-4483|hsa-miR-6745|hsa-miR-6748-5p|hsa-miR-6756-5p|hsa-miR-6762-5p|hsa-miR-6766-5p|hsa-miR-6769a-5p|hsa-miR-6769b-5p|hsa-miR-6845-5p|hsa-miR-92a-2-5p
NM_005529	rs116354301	chr1	hsa-miR-1228-5p|hsa-miR-1908-5p|hsa-miR-663a|hsa-miR-6787-5p|hsa-miR-744-5p	hsa-miR-1207-5p|hsa-miR-3918|hsa-miR-4763-3p|hsa-miR-6132|hsa-miR-6721-5p|hsa-miR-6836-5p|hsa-miR-7160-3p

5.3 Cancer and miRNA

The user will be provided with the cancer types. Based on the selection of a particular type of cancer, They'll be provided with

- ➢ miRNA name
- ➢ profile
- ➢ Research article related to the cancer

By searching for a particular gene ID, the user will get to know whether that gene is associated with cancer risk, contains any miRNA related somatic mutations.

Mutations and cancer
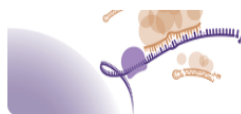
Cancer

Click on the image above to get to know about the various miRNA mutations associated with cancer
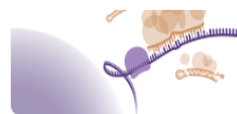
Genes

Click on the image above to get to browse genes associated with cancer risk that contain miRNA related somatic mutations

5.3.1 miRNA mutations associated with cancer

5.3.2 genes associated with cancer risk that contain miRNA related somatic mutations

Mutations in miRNA

Browse genes associated with cancer risk that contain miRNA related somatic mutations

Enter Gene : [_____]

[Select]

Enter Gene : [_____]

[Select]

GeneName	Marker	Study type	Disease	Pubmed ID
KRAS	rs10505975	GWAS	Neuroblastoma	NA
KRAS	NR	CGAS	Colorectal Cancer	20580219
KRAS	NR	CGAS	Lung Cancer	20022659

(Clear Response)

6. REFERENCES

1. Bhattacharya A, Cui Y. SomamiR 2.0: a database of cancer somatic mutations altering microRNA–ceRNA interactions. Nucleic Acids Res. 2016; 44(D1): D1005-D1010. PMID: 26578591
2. Bhattacharya A, Ziebarth JD, Cui Y. SomamiR: a database for somatic mutations impacting microRNA function in cancer. Nucleic Acids Res. 2013; 41(D1):D977-D982. PMID: 23180788.
3. Bhattacharya A, Ziebarth JD, Cui Y. PolymiRTS Database 3.0: linking polymorphisms in microRNAs and their target sites with human diseases and biological pathways. Nucleic Acids Res. 2014; 42(D1):D86-D91.
4. Ziebarth JD, Bhattacharya A, Chen A, Cui Y.PolymiRTS Database 2.0: linking polymorphisms in microRNA target sites with human diseases and complex traits. Nucleic Acids Res. 2012; 40(D1):D216-221. PMID: 22080514.
5. Boya Xie; Qin Ding; Hongjin Han; Di Wu, Bioinformatics, Vol. 29, Issue 5, pp.638-644, 2013