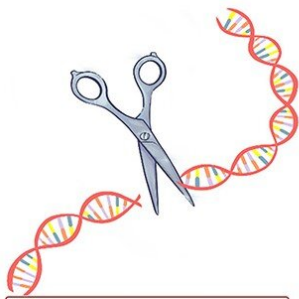


CRISPRInc: New lncRNA-specific SgRNA design method proposed

March 7 2024, by Zhang Nannan

A **CRISPRinc** website: <http://predict.crisprinc.cc/>



Submission Process
 step1: Selecting mechanism
 step2: Selecting reference genome
 step3: Selecting promoter distance
 step4: Input non-coding gene sequences or gene id

Reference Genome
 Homo sapiens: GRCh38
 Mus musculus: GRCm38
 Danio rerio: GRCz10
 Drosophila melanogaster: BDGP6.32
 Panpaniscus: panpan1.1
 Gorilla: gorGor4
 Macaque: Mmul_10
 Bos taurus: ARS-UCD1.2
 Capra hircus: ARS1

Result
 Target Candidates
 Information of sgRNA
 Validity prediction of sgRNA
 Region of sgRNA

Download
 Website Result
 Offline Version
 Reference Gene Sequences
 Predictive Model
 Prediction results for all reference genomes

B **Submission**

INTRODUCTION DESIGN SGRNA PERFORMANCE DOWNLOAD HELP CONTACT

Type of gene: non-coding genes

Homo sapiens : GRCh38

CRISPR inhibition

Please select promoter region length:

Please select enter sequence or gene ID: sequence gene ID

Paste your input sequence (>23bp) here, We support multiple sequences to be queried together. see [human example](#).

```
>ENST00000235032
GCACACAGCTTAGCACAAAGCAGGCCTCAGATGCACGCTGGACAAATGTGCTGTATCCTCTGATCCTTATGGC
CAGCATGATCCATCCAGAAACCCAGTGAAGTGGAGCCGAGCTGGATTCCAGCTCACAGAAACACCAAGAAC
TCTGTGGAAACATCAAGAACTCTGGGGGTCCGCCAGAAAAATCTGGGGGCACTGCAGAGCTTCTGACAGC
GCTCTGGGGGAAATCCACACGGATGGGCGAGCTGCCTGCATCTGGCACTGTGGAGTGGCGGGCAGCCATGG
AGGATGGGGAGACTCATCTTCTAGACTTCTCTGGGGACCGATTCTCCAGCCTCAGGTCAGACCAAAAT
AGAATGAGGTAATTCAGCCCTTCTCAGGACACTCAAGGAATAAACCAAGCACCAAAATACA
```

Please select whether you want off-target results. No off-target results required off-target results required

Please select filter the results or not: Unfiltering Filtering

C

sgRNA details:

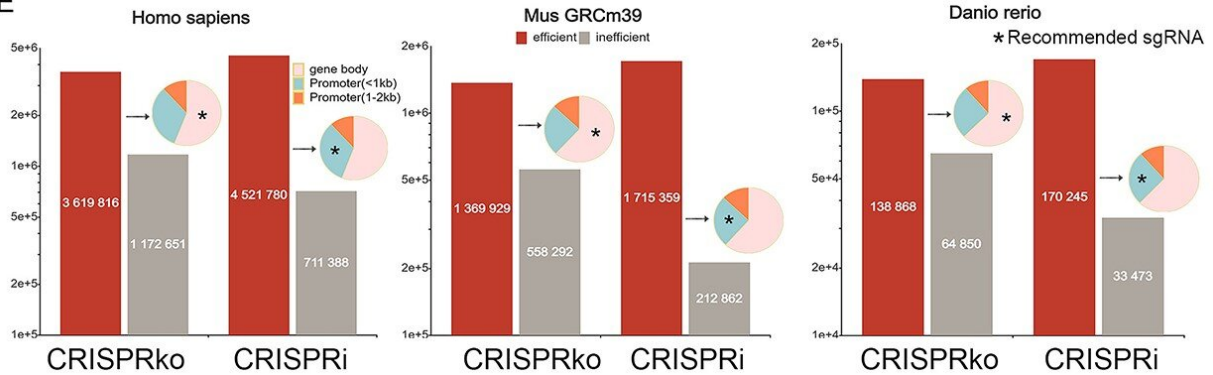
transcript	distance	gene region	ID	start	sequence	PAM	GC	position	genomic location	biotype	strand	cutting effectiveness	off-target risk	off-target detail	pair score
ENST00000445956	75bp	gene body	ENST00000445956-sgRNA6	+201	GCACTGCAGAGCTTCTGACA	CGG	0.55	chr20:57215631-57215653	ENS000000235032	exon	+	0.92	0.43	>	0.30
ENST00000445956		gene body	ENST00000445956-sgRNA9	+276	AGGTGGGGCGGCAGCCATGG	AGG	0.75	chr20:57215706-57215728	ENS000000235032	exon	+	0.37	0.67	>	

D

sgRNA details:

transcript	gene region	ID	start	sequence	PAM	GC	position	genomic location	biotype	strand	cutting effectiveness	off-target risk	off-target detail	score
ENST00000445956	promoter	ENST00000445956-sgRNA23	-183	GTCCGACGTGGATGCACCAT	TAG	0.6	chr20:57214689-57214711	ENS000000101144	intron	-	0.98	0.24	>	0.74
ENST00000445956	promoter	ENST00000445956-sgRNA3	-145	GTCTCTCCCTGCGCCATC	TGG	0.7	chr20:57214727-57214749	ENS000000101144	intron	+	0.77	0.18	>	0.68
ENST00000445956	promoter	ENST00000445956-sgRNA21	-59	GGCTGGTCTTCTGTCACAAA	AAG	0.5	chr20:57214813-57214835	ENS000000101144	intron	-	0.98	0.40	>	0.67
ENST00000445956	gene body	ENST00000445956-sgRNA11	+227	TGGGGAAATCCACACGGA	TGG	0.6	chr20:57215657-57215679	ENS000000235032	exon	+	0.83	0.18	>	0.56
ENST00000445956	promoter	ENST00000445956-sgRNA2	-173	ATCCAGTCGGACAGCTCC	AAG	0.65	chr20:57214699-57214721	ENS000000101144	intron	+	0.6	0.30	>	0.55

E



Overview of CRISPRInc web version. (A) Services and downloads available on the website. (B) Examples of the website usage. (C) sgRNA design results based on CRISPRko mechanism. (D) sgRNA design results based on CRISPRi mechanism. (E) Statistics of sgRNA target results for lncRNA from Homo sapiens, Mus musculus and Danio rerio. Credit: *Briefings in Bioinformatics* (2024). DOI: 10.1093/bib/bbae066

Long non-coding RNAs (lncRNAs) are non-protein-coding transcripts. Currently, CRISPR/Cas9 is a promising RNA-guided genome editing technology consisting of a Cas9 nuclease and a single-guide RNA (sgRNA). Considering the significant differences between lncRNAs and protein-coding genes, it is necessary to investigate sgRNA design method optimized for lncRNAs.

Researchers from the Xishuangbanna Tropical Botanical Garden (XTBG) of the Chinese Academy of Sciences (CAS) studied the application of CRISPR/Cas9 technology in gene editing, especially for sgRNA design against long noncoding RNA (lncRNA).

They first evaluated the performance of a series of known sgRNA design tools on coding and noncoding [datasets](#) and analyzed the different performances in terms of sgRNA specificity to lncRNA, including nucleic acid sequence, genomic location, and editing mechanism preference. Results were [published](#) in *Briefings in Bioinformatics*.

The researchers also introduced a support vector machine-based machine learning algorithm, CRISPRInc, which aims to simulate the CRISPR knockout (CRISPRko) and CRISPR inhibition (CRISPRi) mechanisms to predict the targeting activity of the target. CRISPRInc combines paired sgRNA design and off-target analysis to achieve one-stop design of CRISPR/Cas9 sgRNA for noncoding genes.

By comparing the performance of CRISPRInc with several existing methods on multiple datasets, the researchers conclude that CRISPRInc performs much better than existing methods for lncRNA-specific sgRNA design for both CRISPRko and CRISPRi mechanisms.

"We have proposed a new machine learning method, CRISPRInc, for the design of lncRNA-specific sgRNA in the CRISPR/Cas9 system. The performance comparison shows that CRISPRInc is far superior to existing methods for lncRNA-specific sgRNA design in both CRISPRko and CRISPRi mechanisms," said Liu Changning of XTBG.

To facilitate the use of CRISPRInc, the researchers developed a [web server](#) and made it available for download on GitHub. For the convenience of users, they integrate services such as paired sgRNA design and off-target risk analysis into the implementation of the CRISPRInc tool, and provide a variety of information such as on-target validity, off-target risk and genomic location to help further select sgRNAs.

More information: Zitian Yang et al, CRISPRInc: a machine learning method for lncRNA-specific single-guide RNA design of CRISPR/Cas9 system, *Briefings in Bioinformatics* (2024). [DOI: 10.1093/bib/bbae066](https://doi.org/10.1093/bib/bbae066)

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