

*lncRNAs*

*long, non-coding RNAs*

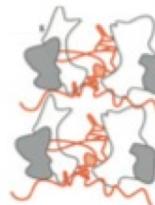
# Characteristics of lncRNAs

## *Long, non-coding RNAs (lncRNAs)*

- >200 nt RNAs
- costly poly-adenylated
- can contain introns
- act as primary or spliced transcripts

Mainly transcribed by  
RNA Pol II

Protein



*scaffold  
for  
protein  
complexes*



*miRNA  
sponge*



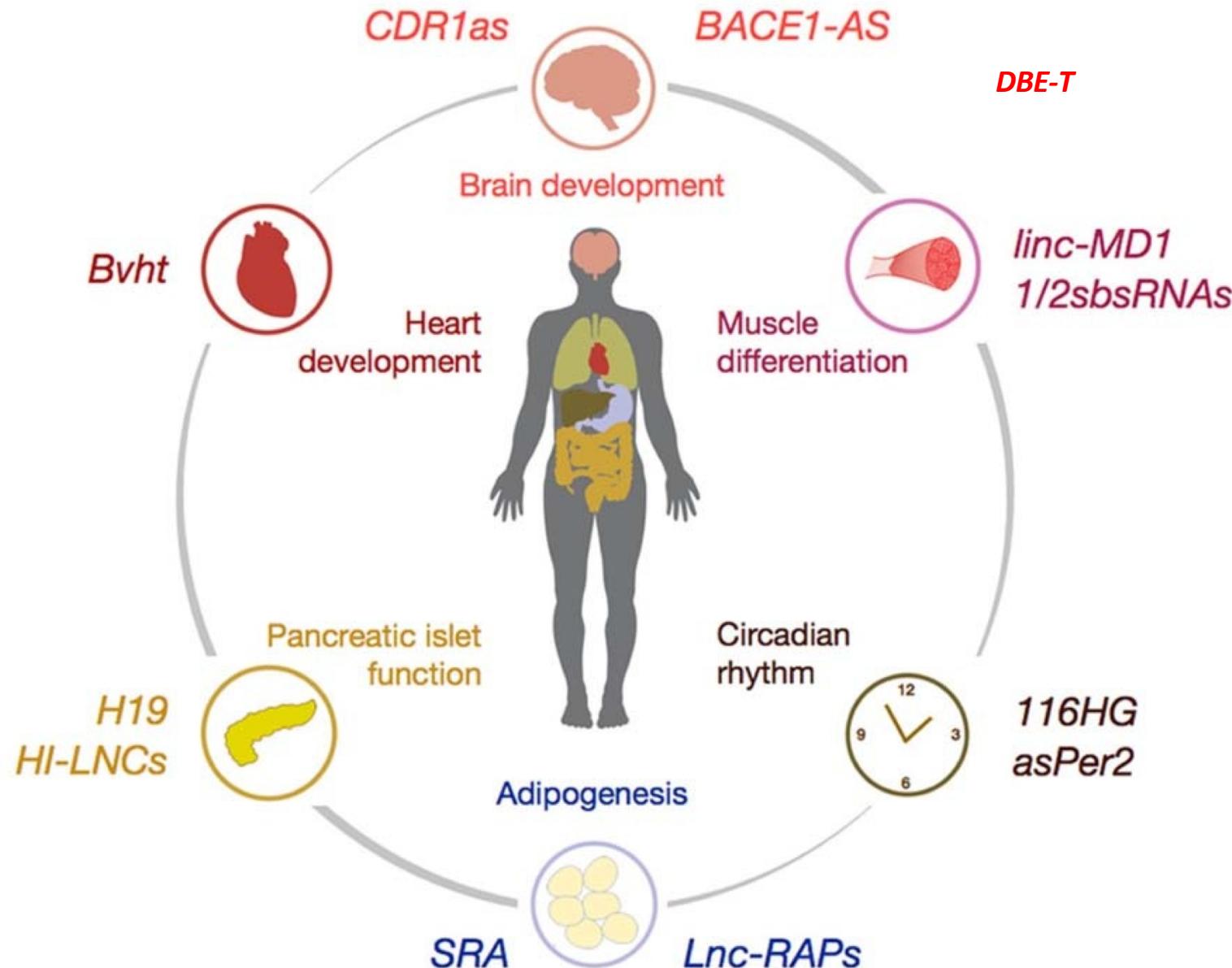
*Protein  
function*

DNA

*recruitment  
of chromatin  
modifying  
complexes*

Nuclear and/or  
cytoplasmatic  
localization

# lncRNAs in physiology



## Resource

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### The GENCODE v7 catalog of human long noncoding RNAs: Analysis of their gene structure, evolution, and expression

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# COMPARING mRNAs - lncRNAs

lncRNAs can be

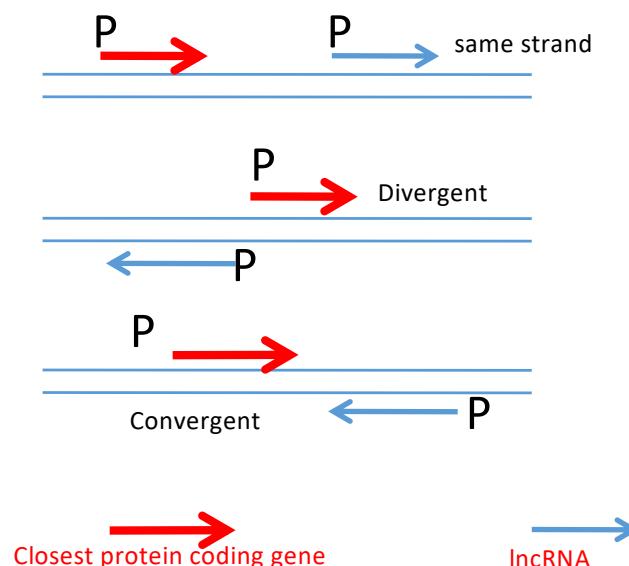
## 1. Intergenic lncRNAs (lincRNA):

Do not intersect with protein coding gene

## 2. Genic lncRNAs:

Intersect a protein coding gene

- Exonic
- Intronic
- overlapping



Intergenic lncRNA

LncRNA

Protein-coding

Genic lncRNA

Exonic

LncRNA

Protein-coding

Intronic

LncRNA

Protein-coding

Overlapping

LncRNA

Protein-coding

### Gencode lncRNAs transcripts (14,880)

Intergenic (9,518)			Genic (5,362)		
Same Strand	Convergent	Divergent	Exonic (2,411)	Intronic (2,784)	Overlapping (167)
4,165	1,937	3,416	S NA	AS 2,411	S 563
			AS 2,221	S 52	AS 115

Why?

Why?

Why?

# COMPARING mRNAs - lncRNAs

A. lncRNAs do not have coding potential:

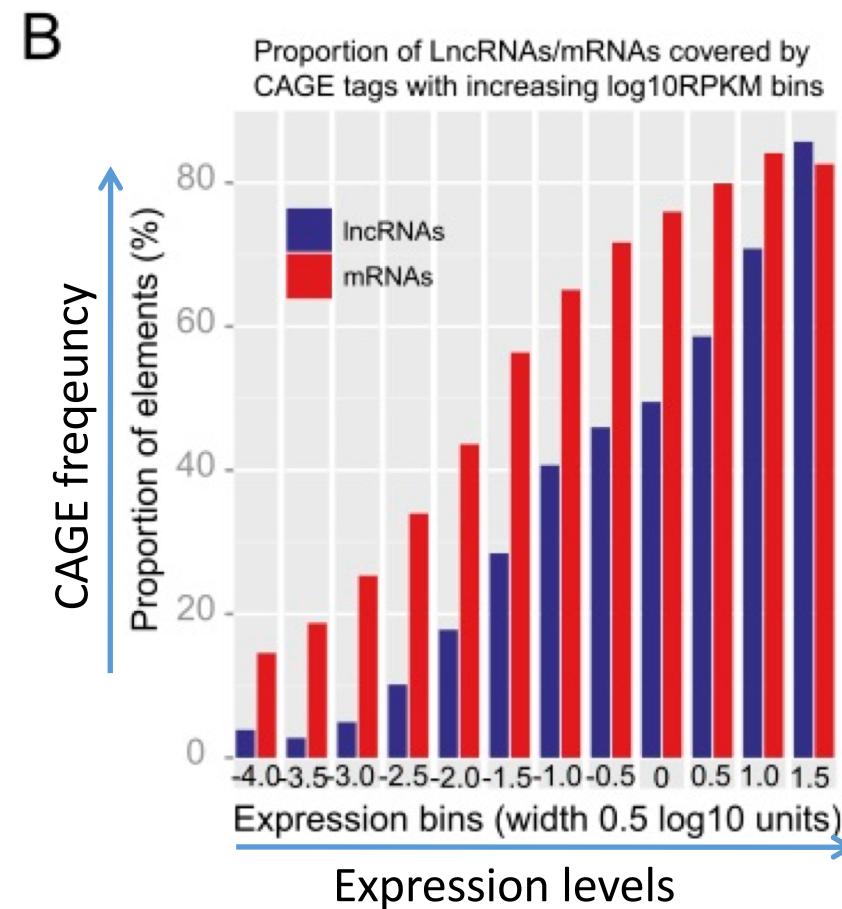
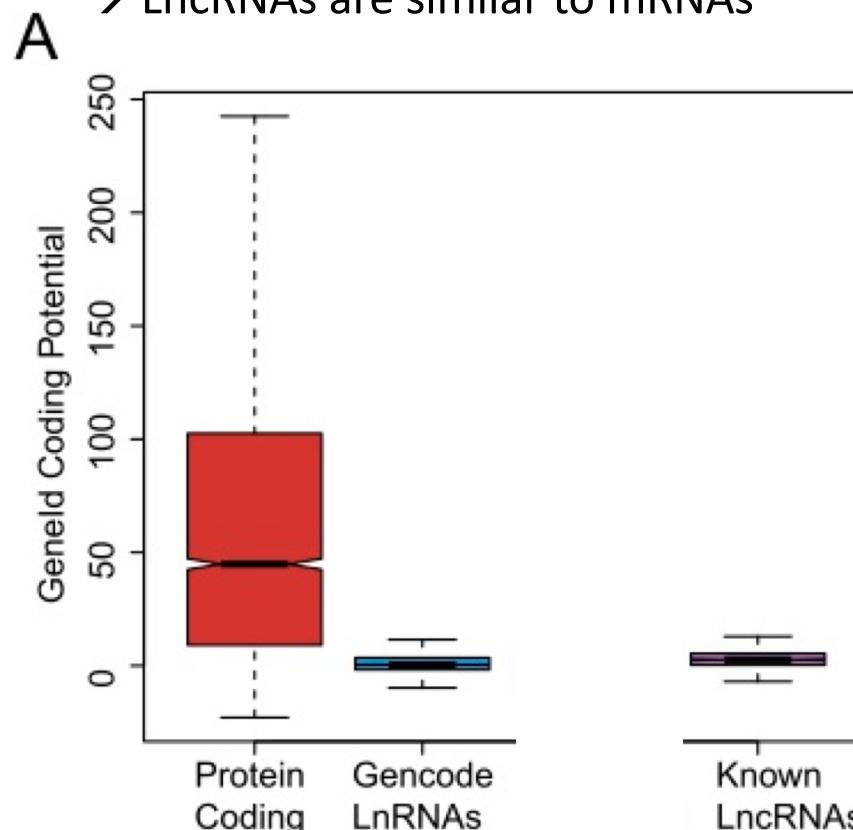
→ Longest possible ORF was searched in mRNA/lncRNAs

B. CAGE tags can be found in lncRNAs → defined transcriptional start site

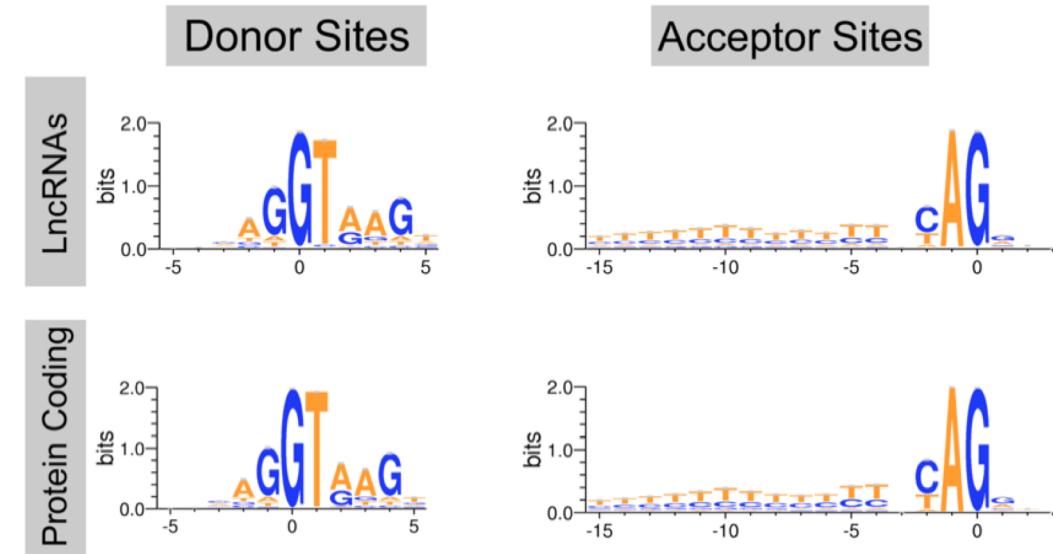
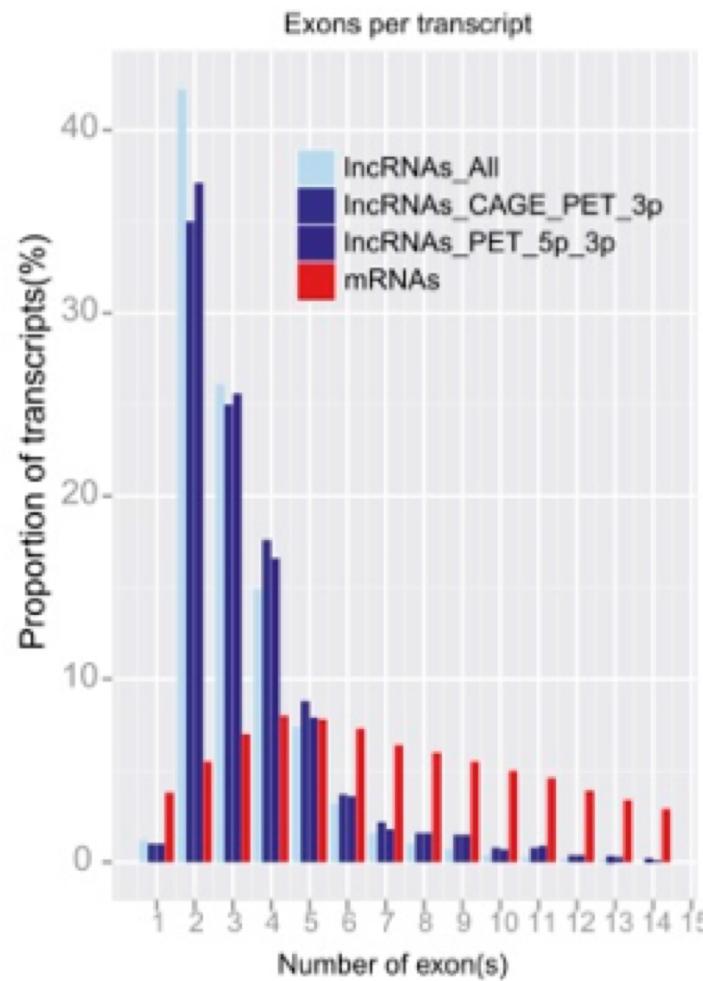
CAGE tag frequency increases with increased lncRNA expression levels.

mRNAs are characterized by more CAGE tags

→ lncRNAs are similar to mRNAs



# COMPARING mRNAs - lncRNAs



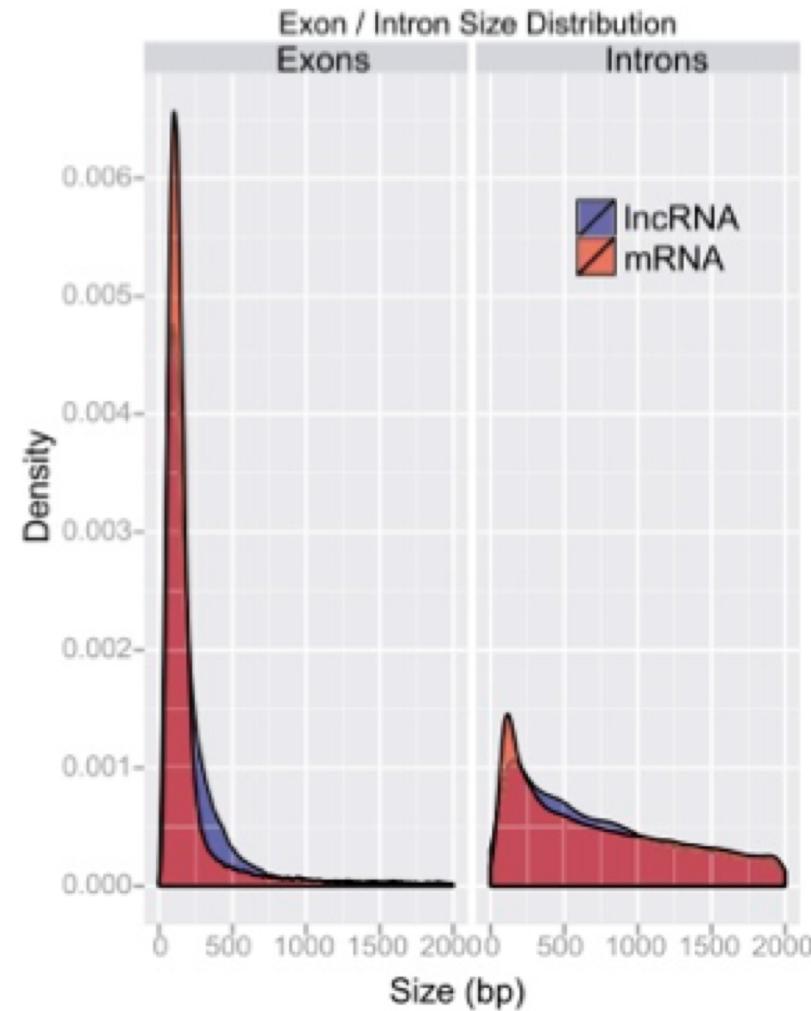
## SPLICING:

- 98% of lncRNAs are spliced,
- Relevant Splice-site prerequisites at splice donor/acceptor are conserved
- Remarkable tendency of lncRNAs to have only 2 exons (42%, mRNAs: 6%)

BUT: lncRNAs contain fewer INTRONS!! most lncRNA have only 1 intron!!!; mRNAs 3-6

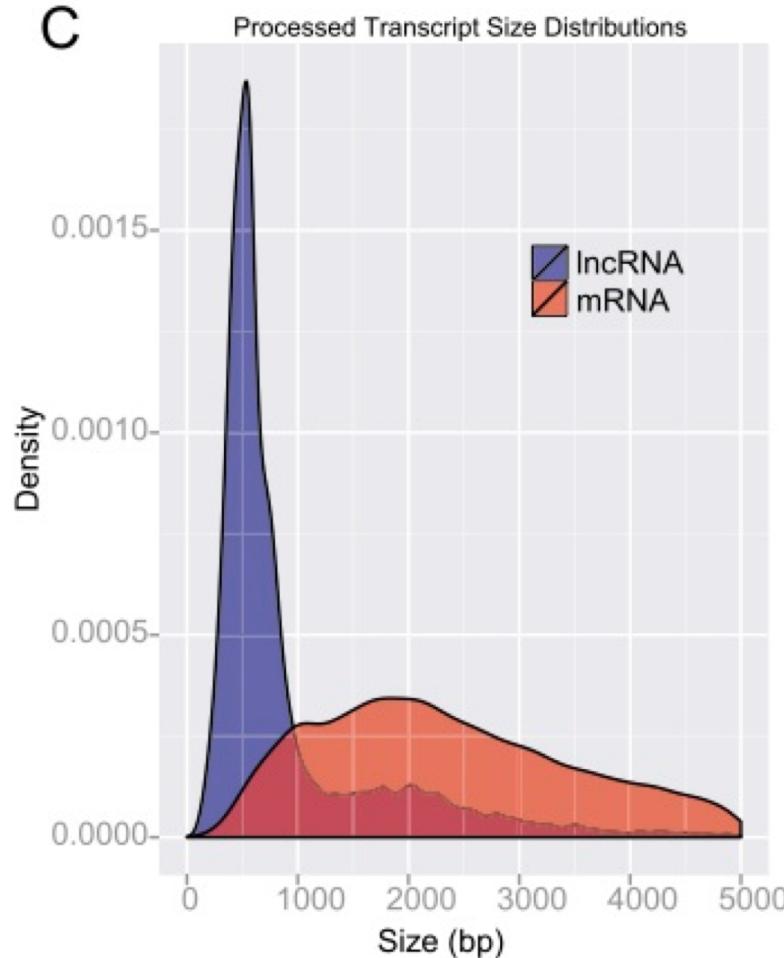
# COMPARING mRNAs - lncRNAs

Introns/Exons from lncRNAs are slightly longer



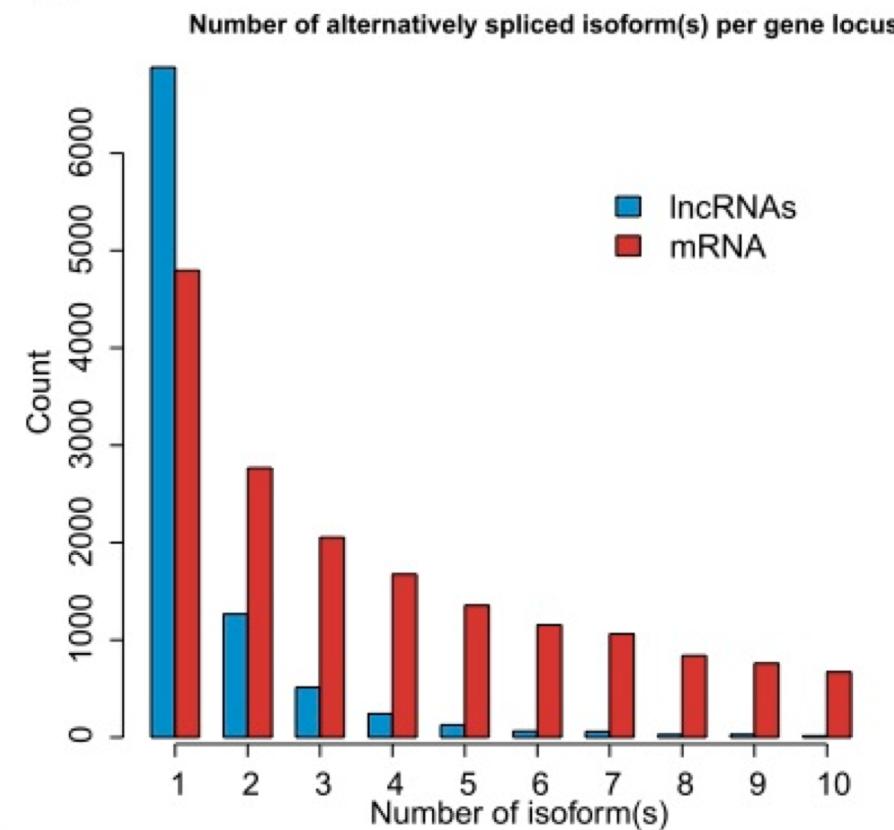
# COMPARING mRNAs - lncRNAs

C



- lncRNAs are on average much shorter:  
ca. 500nt
- mRNAs are longer and have wider size distribution

D



- lncRNAs are uniform → little alternative splicing
- mRNAs: large variety of alternative splicing

# COMPARING mRNAs - lncRNAs

## EXONS:

mRNA: high conservation

lncRNA: reduced conservation

**But:** conservation is higher than  
mRNA intron conservation

## INTRONS:

mRNA: higher conservation

than lncRNAs

