

Editorial

Long Non-Coding RNAs: Hidden Regulators of Cancer

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HIGHLIGHTS

- Long non-coding RNAs play an important role in the development of a variety of diseases, including cancer.
- LncRNA polymorphisms can affect their structure, expression, and function by interfering with related target mRNAs.
- lncRNAs can be considered non-invasive diagnostic biomarkers.

ARTICLE INFO

Receive Date: 01 January 2023

Accept Date: 02 February 2023

Available online: 07 February 2023

DOI: [10.22034/TRU.2023.380556.1137](https://doi.org/10.22034/TRU.2023.380556.1137)

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ABSTRACT

Long non-coding RNAs (lncRNAs) are a group of noncoding RNAs longer than 200 nucleotides that don't provide instructions for making proteins. LncRNAs have attracted widespread attention recently as a potentially novel and vital layer of biological regulation. All long non-coding RNAs are involved in a wide range of developmental and biological processes, but their action mechanisms are still unclear. The aim of this study was to review cutting-edge data on lncRNAs and discuss their known biological function.

Keywords: pHLIP; Bladder Cancer; Fluorescent Imaging

Editorial: Long noncoding RNAs (lncRNAs) are a kind of RNA molecules longer than 200 nt that do not provide instructions for making proteins. Most lncRNAs are usually produced by RNA polymerase II. Due to the similarity of lncRNAs to mRNA, most of them contain poly-A tails and caps.

They have been widely found in different genomic regions, including gene deserts. Control of gene expression, regulation of transcription, translation, cell differentiation, formation of protein-protein or RNA-protein complexes, and RNA splicing are regulated by

complicated mechanisms in which lncRNAs are entailed (1).

The first cases of observing the regulatory roles of lncRNAs were detected in the early 1990s with the discovery of lncRNAs involved in epigenetics such as H19 and Xist (2).

In addition to mutation or misexpression of protein-coding genes, evidence suggests that mutations and misregulation of ncRNAs, particularly lncRNAs, play a remarkable role in the progression of a variety of diseases, including cancer. LncRNAs can exhibit both

Table 1. Examples of lncRNA involved in Urological Cancers

lncRNA	Cancer Type	Identified Functions	Function	Chromosomal Localization	References
MEG3	Prostate	Inhibits the progression of cancer by modulating the miR-9-5p/QKI-5 axis	Tumor Suppressor	14q32	(5)
	Bladder	Repression of MDM2			
	Kidney	Promotion of p53-dependent and p53-independent apoptosis			
MALAT1	Bladder	<ul style="list-style-type: none"> • Direct binding and activation of SUZ12 • Upregulation of ZEB1, ZEB2, and SNAI2 	Oncogene	11q13.1	(5)
	Kidney	Downregulation of multiple tumor suppressor genes through EZH2 binding			
	Prostate	Epigenetic reprogramming through EZH2			

oncogenic and tumor-suppressive functions (Table 1). Due to lncRNAs tissue-specific expression patterns and their roles in cell growth regulation, migration, metastasis, invasion, and acquired resistance to most chemotherapy as well as radiotherapy have allowed them to be considered as novel biomarkers and promising therapeutic targets in cancer (3, 4).

lncRNA polymorphisms can affect their structure, expression, and function by interfering with related target mRNAs. In conclusion, lncRNA polymorphisms may be related to the mechanism that predisposes cancer. Therefore, single nucleotide polymorphisms (SNP) in lncRNAs may be useful biomarkers for early detection and prognosis of cancers, as they influence the role of lncRNAs in tumorigenesis and cancer progression. Furthermore, the genetic inheritance of lncRNA SNPs influences individual therapeutic responses to drugs. For instance, Xu et al. found that lncRNA TINCR is related to the onset, growth, and susceptibility risk of bladder cancer (BC). Individuals who carried the G allele of rs2288947 were 2.32 times and T allele carriers of rs8113645 are 0.33 times increased risk to develop BC than the A and C allele carriers, respectively. Overall, lncRNA TINCR rs8113645 C>T and rs2288947 A>G are related to decreased and increased susceptibility risk of BC, respectively (5, 6).

Conclusions

The emerging world of ncRNA is fascinating and sheds light on a new level of complexity in nature. lncRNAs play a role in a vast range of biological processes and promote tumor onset, migration, and progression. Several studies have shown that lncRNAs are associated with cancer phenotypes of cancer patients. They are known as carcinogen inducers and tumor suppressors in any type of cancer. lncRNAs can be considered non-invasive diagnostic biomarkers because of the characteristics of

specific patterns of expression in cancers. Increasing knowledge about the molecular mechanisms by which lncRNAs exert their functions in normal and cancer cells will lead to an obvious perception of cancer mechanisms and can predict new therapeutic goals for the treatment of various cancers.

Authors' contributions

All authors contributed equally.

Acknowledgements

Thanks to the Department of Medical Genetics, Afzalipour Faculty of Medicine, Kerman University of Medical Sciences, Kerman, Iran.

Conflict of interest

The author declares that there is no conflict of interest.

Funding

There is no funding.

Ethics statement

Not Applicable.

Data availability

None.

Abbreviations

BC	Bladder cancer
lncRNAs	Long non-coding RNAs
SNP	Single nucleotide polymorphisms

References

1. Bhan A, Soleimani M, Mandal SS. Long Noncoding RNA and Cancer: A New Paradigm. *Cancer Res.* 2017;77(15):3965-81.
2. Kung JT, Colognori D, Lee JT. Long noncoding RNAs: past, present, and future. *Genetics.* 2013;193(3):651-69.
3. Peng WX, Koirala P, Mo YY. LncRNA-mediated regulation of cell signaling in cancer. *Oncogene.* 2017;36(41):5661-7.
4. Guzel E, Okyay TM, Yalcinkaya B, Karacaoglu S, Gocmen M, Akcakuyu MH. Tumor suppressor and oncogenic role of long non-coding RNAs in cancer. *Northern clinics of Istanbul.* 2020;7(1):81-6.
5. Azodian Ghajar H, Koochi Ortakand R. The Promising Role of MicroRNAs, Long Non-Coding RNAs and Circular RNAs in Urological Malignancies. *Translational Research in Urology.* 2022;4(1):9-23.
6. Gao P, Wei GH. Genomic Insight into the Role of lncRNA in Cancer Susceptibility. *International journal of molecular sciences.* 2017;18(6).

Author (s) biosketches

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How to cite this article

Nikoofar P, Azodian Ghajar H. Long Non-Coding RNAs: Hidden Regulators of Cancer.

Transl. res. urol., 2023 Feb 5(1): 1-3.

DOI: [10.22034/TRU.2023.380556.1137](https://doi.org/10.22034/TRU.2023.380556.1137)

URL: https://www.transresurology.com/article_166315.html

