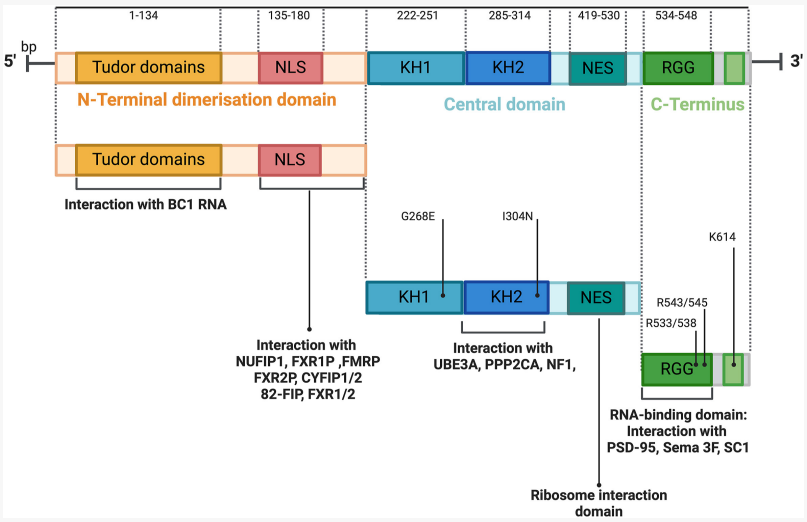
New Insights into Cancer Biology: The Dual Role of FMRP in Tumor Progression and Therapy Resistance

SHANNON, CLARE, IRELAND, April 20, 2025 /EINPresswire.com/ -- A recent review published in Genes & Diseases sheds light on the complex and multifaceted role of RNA-binding proteins (RBPs) in cancer progression, with a particular focus on the fragile X mental retardation protein (FMRP). Traditionally recognized for its critical functions in neural development, FMRP is now emerging as a key regulator in cancer biology, influencing tumor growth, metastasis, and therapy resistance. This growing body of knowledge presents a shift in understanding how RNA metabolism can drive oncogenic processes and potentially offer novel diagnostic and therapeutic strategies.



Multi-domain structure of FMRP. Tandem Tudor domains are located at the N-terminus of FMRP; these domains (depicted in yellow) enable specific recognition and binding to proteins with methylated lysine residues, crucial for epigenetic modulation and RNA p

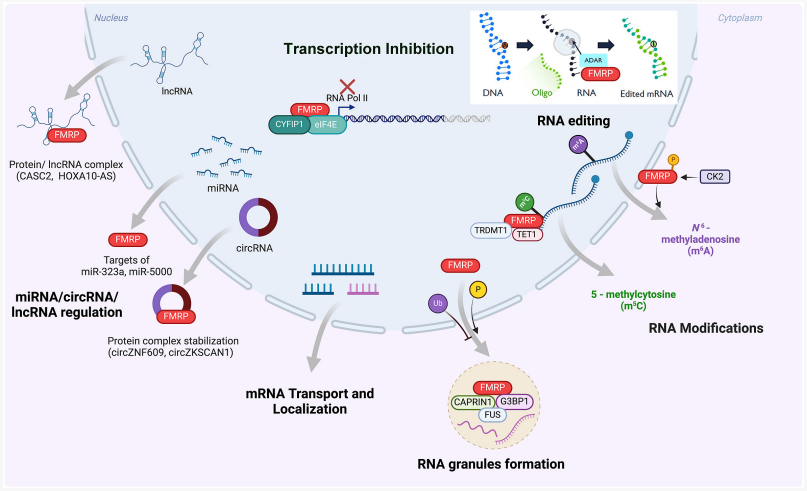
FMRP plays a dual role in cancer, acting both as a tumor suppressor and promoter, depending on the cellular context. Its ability to regulate mRNA stability, translation, and transport positions it as a crucial factor in the intricate network of gene expression that governs cancer progression. Studies indicate that low levels of FMRP are associated with decreased tumor development in some cases, whereas high expression is linked to aggressive cancers, including breast, colorectal, and hepatocellular carcinomas. The variability in FMRP's impact on different tumor types underscores the necessity for a nuanced approach when considering it as a therapeutic target.

One of the most significant findings discussed in the review is FMRP's role in therapy resistance. By interacting with key oncogenic pathways, FMRP contributes to cancer cells' ability to withstand chemotherapy, radiation, and immunotherapy. In colorectal cancer, FMRP stabilizes epidermal growth factor receptor (EGFR) mRNA, enhancing tumor proliferation. Additionally, its involvement in epithelial-mesenchymal transition (EMT) suggests a critical function in tumor

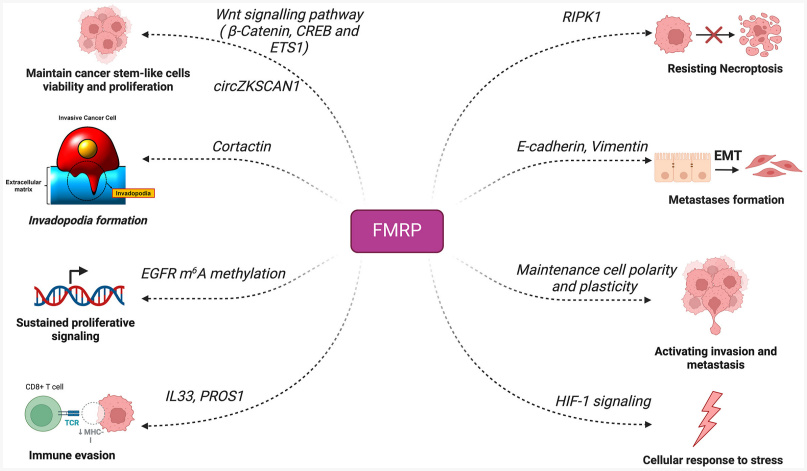
metastasis. Furthermore, its association with immune evasion mechanisms highlights its potential influence on the tumor microenvironment and response to immune checkpoint inhibitors.

The potential of targeting FMRP in cancer treatment is an area of growing interest. By interfering with its ability to regulate oncogenic mRNAs, researchers aim to develop precision medicine strategies that can either inhibit its tumor-promoting functions or harness its tumor-suppressive capabilities. Exploring the post-translational modifications (PTMs) of FMRP and its interplay with other RNA-binding proteins could pave the way for highly specific therapeutic interventions that mitigate its oncogenic effects while preserving essential cellular functions.

This evolving understanding of FMRP's role in cancer underscores the complexity of RNA metabolism in tumorigenesis. As scientists continue to investigate the intricate balance between FMRP's tumor-suppressive and oncogenic functions, its potential as both a biomarker and therapeutic target is becoming increasingly evident.



Biological functions of FMRP in RNA biology. The illustrations depict the functional mechanisms of FMRP (depicted in the center) in RNA biology, such as miRNA/cirRNA/lncRNA-mediated regulation, mRNA transport and localization, RNA modification (m5C/5-meth



The pivotal role of FMRP in cancer development and progression. High FMRP levels are associated with enhanced invasiveness, metastasis, and drug resistance as well as contributing to the cancer's ability to evade immune surveillance and promote angiogenes

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Scopus CiteScore: 7.3
Impact Factor: 6.9

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Print ISSN: 2352-4820
eISSN: 2352-3042
CN: 50-1221/R
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Reference
Yunlu Jia, Ruyin Jia, Yongxia Chen, Xuanyi Lin, Nadire Aishan, Han li, Linbo Wang, Xiaochen Zhang, Jian Ruan, The role of RNA binding proteins in cancer biology: A focus on FMRP, Genes & Diseases,
2025, 101493, https://doi.org/10.1016/j.gendis.2024.101493

Funding Information:
National Natural Science Foundation of China 82000212
Natural Science Foundation of Zhejiang Province, China LQ21H160022
Medical Health Science and Technology Project of Zhejiang Provincial Health Commission (China) 2024KY989

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