FUNCTIONAL ANALYSIS OF ZGC:162509 IN ZEBRAFISH EMBRYONIC DEVELOPMENT

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ABSTRACT

Understanding the molecular mechanisms that control early embryonic development and cellular reprogramming is important for advancing developmental biology and regenerative medicine. The poorly characterized gene ZGC:162509 may function as part of the maternal regulatory program that controls early zebrafish embryogenesis. This project investigates the effects of overexpression and knockout of ZGC:162509 in zebrafish embryos and examines the gene product's molecular function and cellular localization. Identifying previously unrecognized maternal regulators such as ZGC:162509 may improve our understanding of early developmental programs and help reveal missing components required for efficient cellular reprogramming. These results are preliminary, and ongoing experiments aim to clarify the biological role of ZGC:162509 further.

METHODS

- Zebrafish embryos will be used as the model organism to study the developmental effects of ZGC:162509 expression changes.
- Gene expression will be manipulated through overexpression and knockout experiments.
- Embryos will be observed across developmental stages to identify phenotypic and developmental differences.
- Molecular biology techniques and imaging will be used to examine gene activity and potential cellular localization.
- Genomic signal tracks and transcriptional data will be analyzed to assess gene activity across stages.
- Data from multiple trials will be collected and compared to identify consistent patterns and reproducible results.

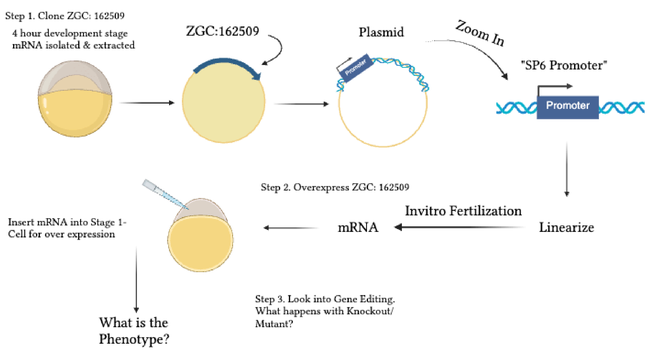

Figure 1: Flowchart of how ZGC: 162509 is overexpressed step-by-step. Figure created by BioRender.

REFRENCES

- Vejnar CE, et al. Genome-wide analysis of 3′ UTR sequence elements and proteins regulating mRNA stability during maternal-to-zygotic transition in zebrafish. Genome Research (2019). PMID: 31227602; PMCID: PMC6633259. Post-transcriptional mRNA regulation and cis-element identification during zebrafish early development.
- BioRender — graphical illustrations and schematics used in figures throughout this work (created with BioRender.com).

RESULTS (PRELIMINARY)

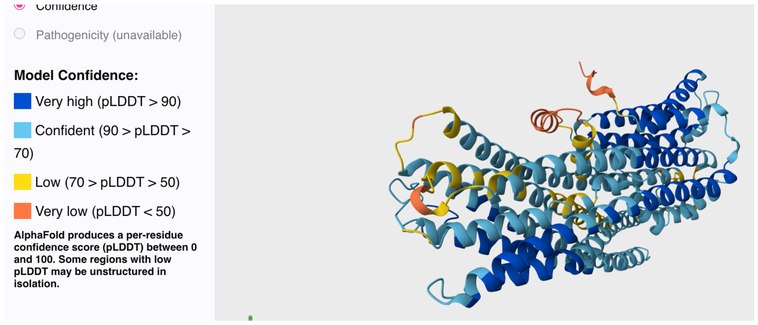

Figure 2: Predicted structure of the ZGC: 162509 protein.

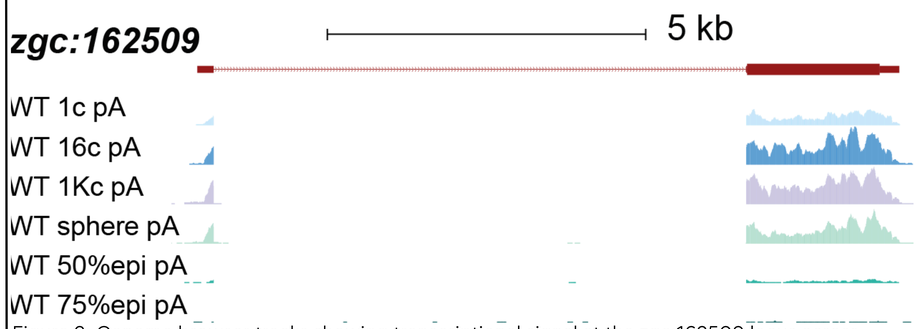

Figure 3: Genome browser tracks showing transcriptional signal at the zgc:162509 locus across multiple zebrafish developmental stages in wild-type embryos. The presence of signal during early stages suggests potential involvement of zgc:162509 in embryonic development.

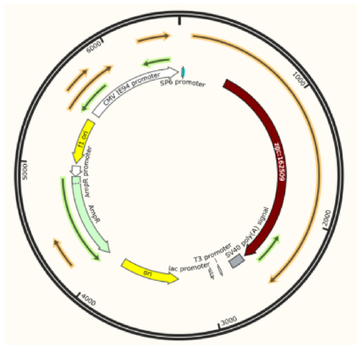

Figure 4: Plasmid map of the ZGC:162509 overexpression vector showing major regulatory elements and cloning features. Figure created by Liyun Miao.

REFERENCES (CONT.)

- Casper J, Speir ML, Raney BJ, Perez G, Nassar LR, Lee CM, Hinrichs AS, Gonzalez JN, Fischer C, Diekhans M, Clawson H, Benet-Pagès A, Barber GP, Vaske CJ, van Baren MJ, Wang K, Puga Rodriguez YJ, Jenkins-Kiefer J, Chalamala M, Haussler D, Kent WJ, Haeussler M. The UCSC Genome Browser database: 2026 update. Nucleic Acids Research. 2026;54(D1):D1331–D1335. PMID: 41251146; PMCID: PMC12807699. Updates and tools for genomic annotation and visualization.
- UniProt Consortium. UniProt: the Universal Protein Knowledgebase in 2025. Nucleic Acids Research. 2025;53(D1):D609–D617. A comprehensive resource of protein sequences and functional information.
- UniProt. Entry F1QY25. UniProtKB. Accessed via https://www.uniprot.org/uniprotkb/F1QY25/entry — summary protein information and annotations. (Accessed 2026). Note: direct metadata varies by entry.
- Ogasawara S. Double-Headed Zebrafish [Image]. EurekAlert! (AAAS) multimedia resource showing experimental images of double-headed zebrafish from light-controlled gene expression research. DOI: 10.1021/acschembio.6b00684. (Image accessed 2026).

DISCUSSION

- This project addresses the limited understanding of ZGC:162509 and its potential role in developmental biology.
- Preliminary observations suggest the gene may be active during key stages of zebrafish embryonic development.
- Manipulating gene expression may provide insight into its role in developmental and regulatory processes.
- Analysis of cellular localization may help determine whether the gene product functions in the nucleus or other cellular regions.
- Current limitations include the early stage of data collection and a limited dataset.
- Ongoing experiments will expand the dataset, confirm developmental effects, and investigate molecular interactions and localization.

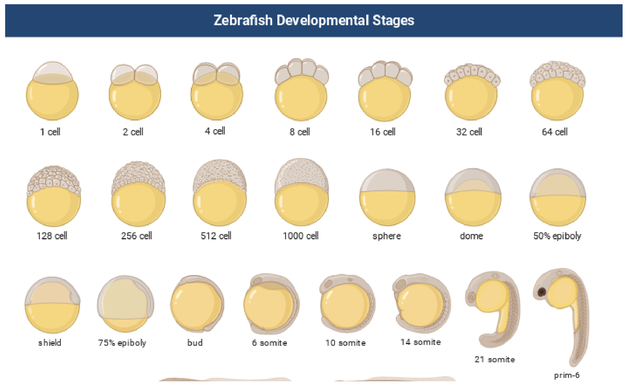

Figure 5: Normal Zebrafish Developmental Stages from 1 cell to protruding mouth.

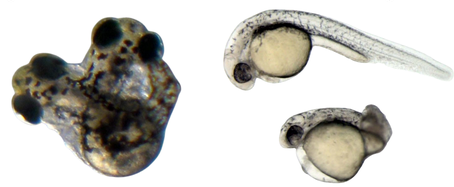

Figure 6: Abnormal Zebrafish Development.

CONCLUSION

- This study explores the function of ZGC:162509 by examining the effects of gene overexpression and knockout in zebrafish embryos.
- Preliminary findings indicate that the gene is maternally loaded and is imported to the nuclei during early embryonic development.
- The project is currently ongoing, and additional experiments will further clarify the gene's role in development and cellular processes.
- Continued research will help determine the molecular function, localization, and broader biological significance of ZGC:162509.

ACKNOWLEDGEMENTS

- I would like to thank Dr. Liyun Miao for mentorship, guidance, and support throughout this research project. I also thank Syed Mohammed for assistance with laboratory techniques and research support.
- Additionally, I would also like to thank UROP for giving me the ability to present our data with a panel of respected scholars and peers. It is an honor to be selected to be a part of this program.