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From IgZ to IgT: A Call for a Common Nomenclature for Immunoglobulin Heavy Chain Genes of Ray-Finned Fish

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RAY-FINNED FISHES comprise more than half the ~60,000 known vertebrate species,¹ and are pivotal to the functionality of aquatic ecosystems and success of global multi-billion dollar industries. Understanding ray-finned fish immune systems is essential to predicting how species will respond to known or emergent pathogens as well as to the development of effective vaccines for aquaculture. However, the diversity of species, including in aquaculture, necessitates that immunology and translational medicine research groups investigating the immune system in one or a number of

species employ a common language for describing homologous immune components. Unfortunately for Immunoglobulin (Ig) genes that encode antibodies, this has not been the case.

Ig genes are restricted to jawed vertebrates (gnathostomes) with all lineages encoding common heavy chains IgM and IgD (aka IgW in cartilaginous fish, lungfish, and coelacanth).² Before 2005, it was believed that bony fish encoded only IgM and IgD. In 2005, Hansen et al. described a new Ig heavy chain encoded within the rainbow trout heavy chain locus and named it IgT for “teleost.”³ However, during the

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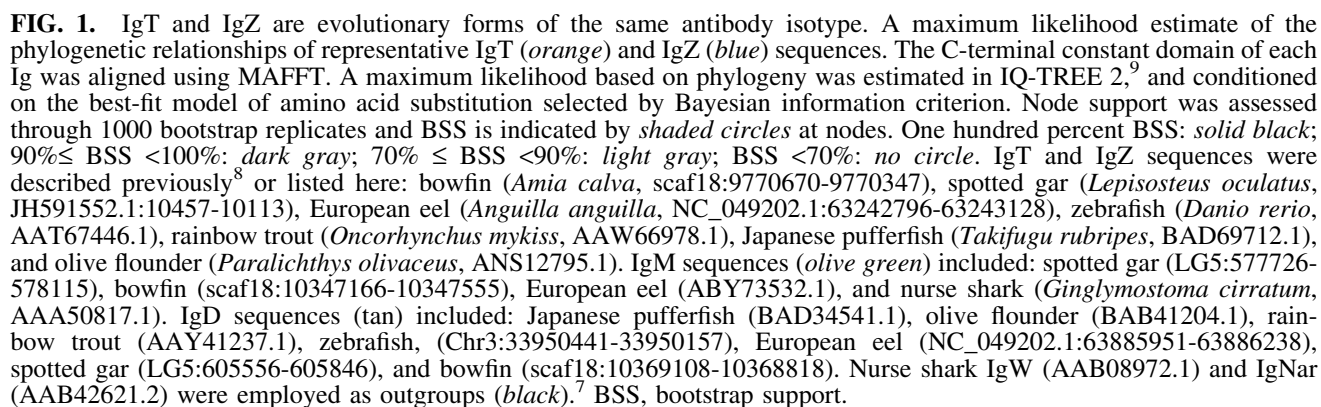
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To increase consistency in vertebrate immunogenetics, we propose a single nomenclature system is warranted for this heavy chain. IgZ continues to be used in zebrafish, a powerful model for human disease and the first fish with a reference genome. However, this convention is at odds with research that spans the remaining diversity of >30,000 additional species of ray-finned fishes. A simple PubMed search (<https://pubmed.ncbi.nlm.nih.gov/?term=IgZ>)

Therefore, discussions with the Zebrafish Nomenclature Committee have led to the changing of the official zebrafish gene symbol for the IgZ heavy chain (ZDB-GENE-040513-8)

from immunoglobulin heavy constant zeta (*ighz*) to immunoglobulin heavy constant tau (*ight*). We now encourage a shift from IgZ to IgT in all ray-finned fish species.

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References

1. Nelson JS, Grande TC, Wilson MVH. *Fishes of the World*. John Wiley & Sons, Hoboken, NJ, 2016.
2. Flajnik MF. A cold-blooded view of adaptive immunity. *Nat Rev Immunol* 2018;18:438.
3. Hansen JD, Landis ED, Phillips RB. Discovery of a unique Ig heavy-chain isotype (IgT) in rainbow trout: implications for a distinctive B cell developmental pathway in teleost fish. *Proc Natl Acad Sci U S A* 2005;102:6919.
4. Danilova N, Bussmann J, Jekosch K, Steiner LA. The immunoglobulin heavy-chain locus in zebrafish: identification and expression of a previously unknown isotype, immunoglobulin Z. *Nat Immunol* 2005;6:295.
5. Gambón-Deza F, Sánchez-Espinel C, Magadán-Mompó S. Presence of an unique IgT on the IGH locus in three-spined stickleback fish (*Gasterosteus aculeatus*) and the very recent generation of a repertoire of VH genes. *Dev Comp Immunol* 2010;34:114.
6. Zhang Y-A, Salinas I, Li J, *et al.* IgT, a primitive immunoglobulin class specialized in mucosal immunity. *Nat Immunol* 2010;11:827.
7. Thompson AW, Hawkins MB, Parey E, *et al.* The bowfin genome illuminates the developmental evolution of ray-finned fishes. *Nat Genet* 2021;53:1373.
8. Mirete-Bachiller S, Olivieri DN, Gambón-Deza F. Immunoglobulin T genes in Actinopterygii. *Fish Shellfish Immunol* 2021;108:86.
9. Minh BQ, Schmidt HA, Chernomor O, *et al.* IQ-TREE 2: new Models and Efficient Methods for Phylogenetic Inference in the Genomic Era. *Mol Biol Evol* 2020;37:1530.

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