The Amazing Travels of tRNA – Hopper Lab

Department of MOLECULAR GENETICS

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Listen to the Cells

What is a tRNA?

Transfer RNAs (tRNAs) are one of the most important molecules in biology

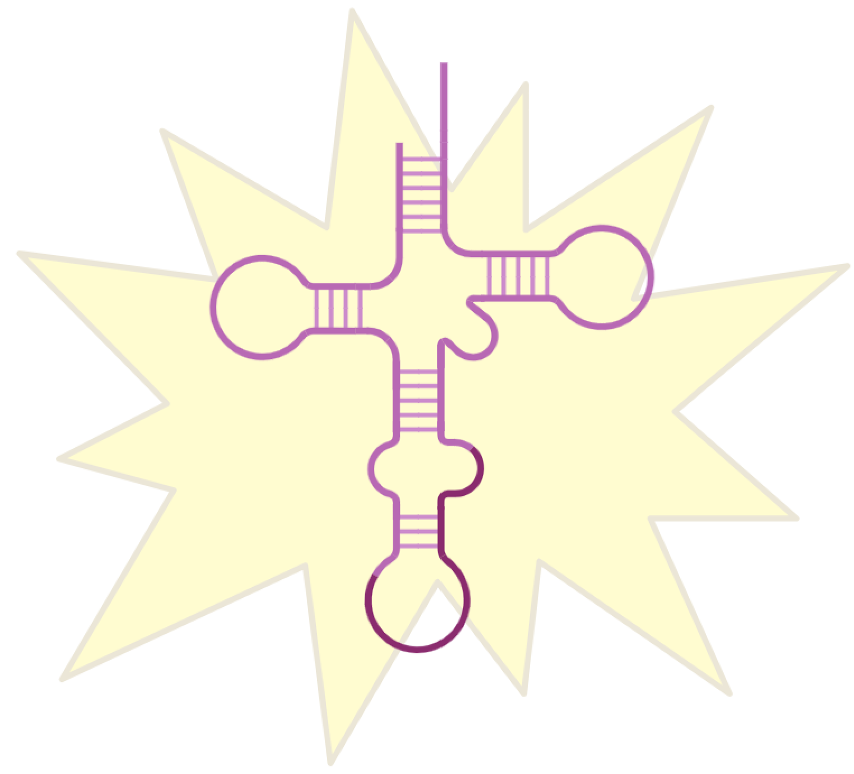
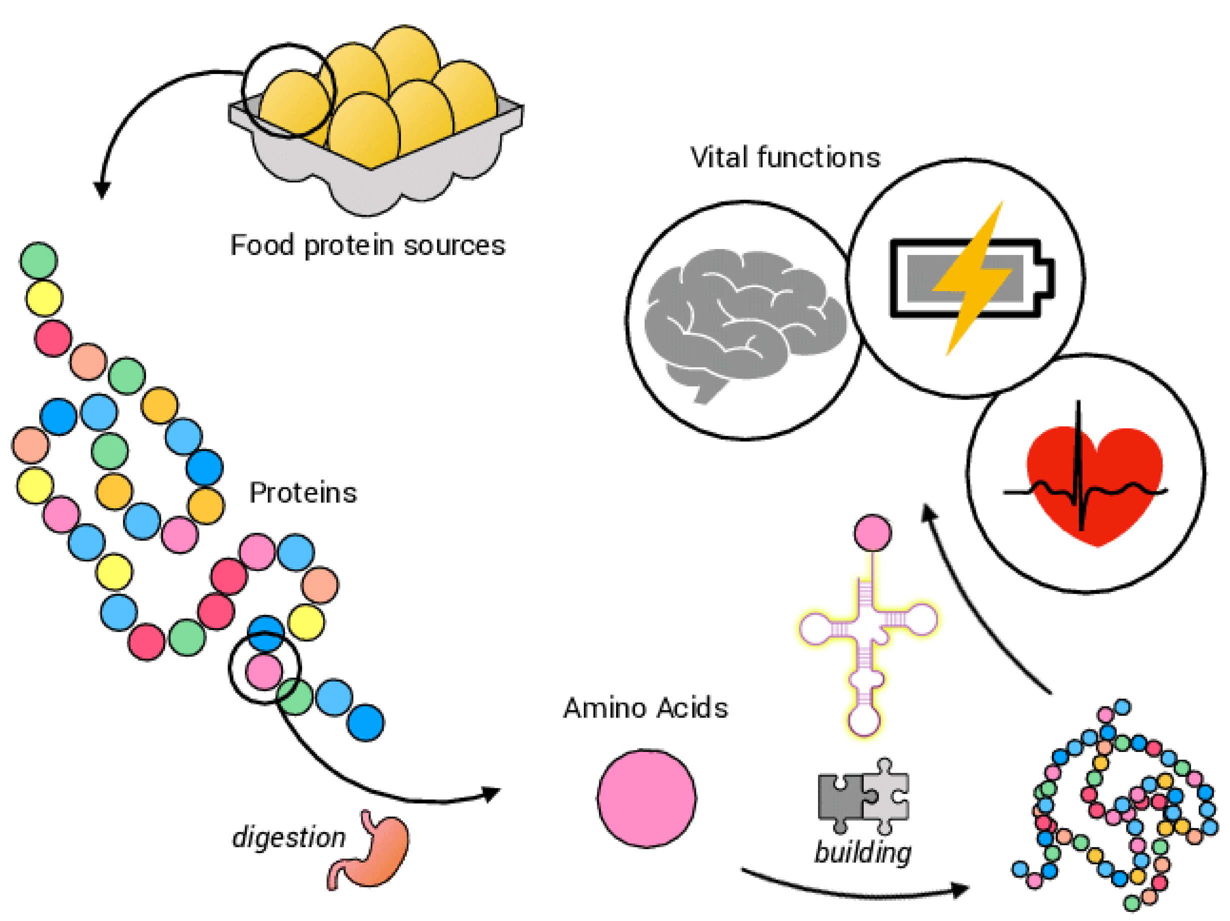


Figure generated with BioRender

Our bodies break down proteins in the foods that we eat, and then tRNAs help stitch those pieces together to make new proteins that make us who we are!



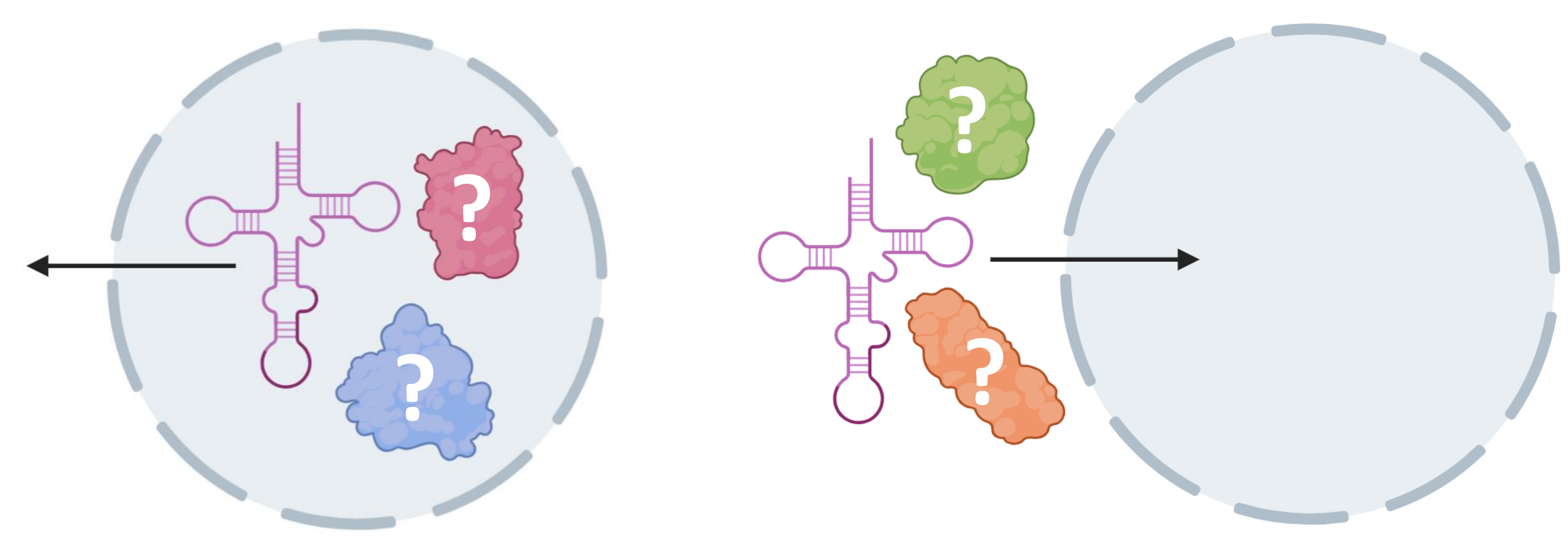
Modified from Marbach and Gaillac, 2021

To do their jobs properly, tRNAs must go to the…

What about tRNAs do we study?

Right Place…

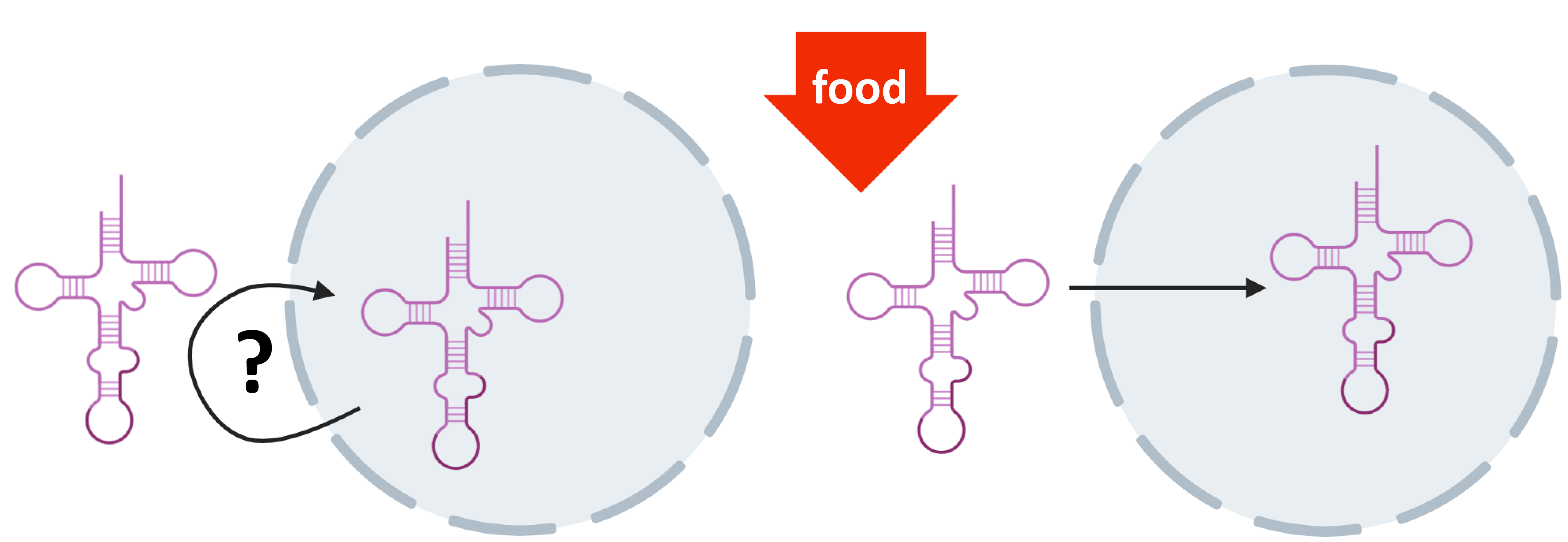
How does it leave the nucleus? **How does it get back in?**



Which mystery proteins help it move?

…Under the Right Conditions

How often does it go back and forth? **Which stress conditions make it move?**



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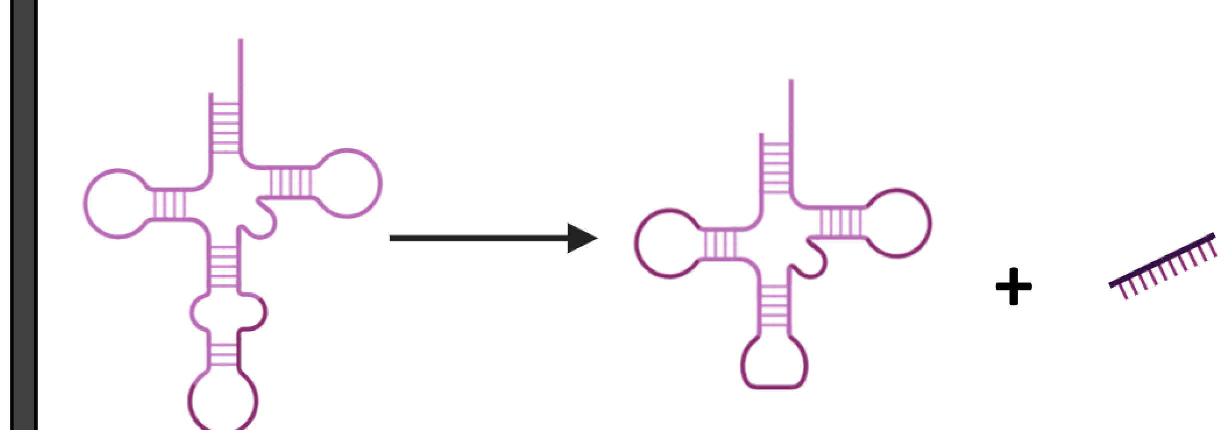
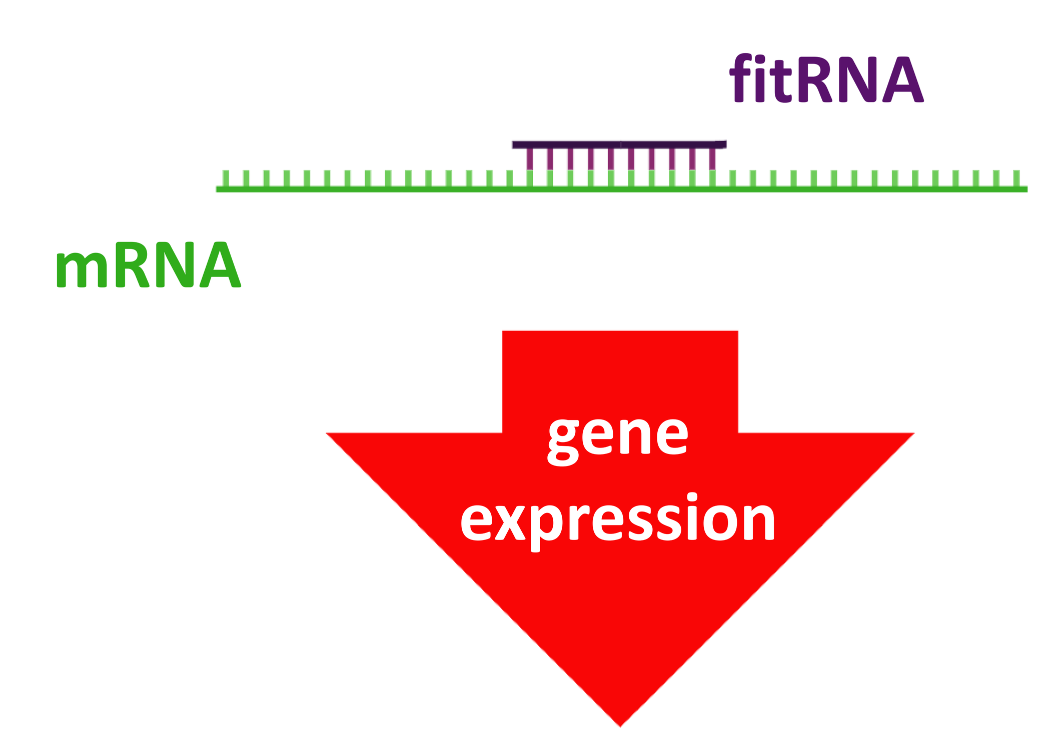
Sometimes, tRNAs surprise us

Some tRNAs have extra segments – known as introns – that are removed from the tRNA



Our lab discovered that these free introns of tRNAs (fitRNAs) have their own jobs altering gene expression, like microRNAs!



Figures generated with BioRender

References: Nostramo RT, Hopper AK. A novel assay provides insight into tRNAPhe retrograde nuclear import and re-export in S. cerevisiae. Nucleic Acids Res. 2020 Nov 18;48(20):11577-11588. doi: 10.1093/nar/gkaa879. PMID: 33074312; Hopper AK, Huang HY. Quality Control Pathways for Nucleus-Encoded Eukaryotic tRNA Biosynthesis and Subcellular Trafficking. Mol Cell Biol. 2015 Jun;35(12):2052-8. doi: 10.1128/MCB.00131-15. Epub 2015 Apr 6. PMID: 25848089; Takano A, Kajita T, Mochizuki M, Endo T, Yoshihisa T. Cytosolic Hsp70 and co-chaperones constitute a novel system for tRNA import into the nucleus. Elife. 2015 Apr 8;4:e04659. doi: 10.7554/eLife.04659. PMID: 25853343; Nostramo RT, Sinopoli PL, Bao A, Metcalf S, Peltier LM, Hopper AK. Free introns of tRNAs as complementarity-dependent regulators of gene expression. Mol Cell. 2025 Feb 20;85(4):726-741.e6. doi: 10.1016/j.molcel.2025.01.019. Epub 2025 Feb 11. PMID: 39938518

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