Transfer RNAs (tRNAs) are essential molecules. They decode information from mRNA to deliver building blocks for protein assembly. To function well, tRNAs undergo intricate maturation, which includes chemical modifications. These processes enhance tRNA stability, optimize function, and expand decoding capacity. Mature tRNA undergoes the attachment of specific amino acids (charging). We do not know how tRNA modifications affect their charging in cancer.

Our research uses a cutting-edge method called **aa-tRNA-seq** to address this gap. This novel method uses nanopore RNA sequencing and advanced computational tools. It captures two key features of tRNAs at once: their chemical modifications and amino acid attachments. We will analyze both aspects at the single-molecule level. We aim to uncover how tRNA modifications and charging affect protein synthesis in cancer.

We will use breast cancer as a model. We will study how changes in tRNA modifications and charging affect protein production in these cells. This may contribute to cancer processes like tumor growth and metastasis. Our study will dissect these mechanisms. It will provide new insights into how tRNA biology affects cancer. This may lead to therapies that target tRNA-related processes.