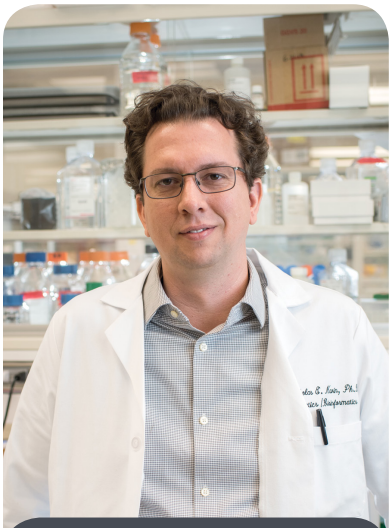
The Revolution of Single-Cell Sequencing



Dr. Navin has shown the value of sequencing single cancer cells to learn how they behave.

Cancer is smart. While oncologists have done a good job developing front-line therapies for most forms of the disease, cancer adapts to resist treatments that were previously effective. It instinctively spreads throughout the body to evade localized immune response. *So we have to be even smarter.*

Nicholas Navin, Ph.D., associate professor of Genetics and Bioinformatics at The University of Texas MD Anderson Cancer Center, has pioneered single-cell DNA sequencing (scDNA-seq) technology that gives researchers an unprecedented view of cancer progression. His laboratory has a particular interest in leveraging this insight for the improved treatment of breast cancer patients.

Common methods for analyzing tumor cells rely on bulk tissue and an output process that averages mutations together from multiple cell subpopulations. Unfortunately, this approach masks the presence of rare cells that play an important role in disease progression. As a graduate student, Dr. Navin became frustrated by an inability to look at data and know whether or not it reflected the profile of a single cell or a mix of many different genotypes. He spent the next year developing methodology to isolate a single cancer cell, amplify its genome and then sequence its DNA/RNA in a way that offers meaningful data.

Dr. Navin's team is now using scDNA-seq to gain a glimpse into the cancer life cycle. How does a single cell in a breast duct give rise to a premalignant lesion? And how do those expanded cells take hold in the form of invasive cancer? MD Anderson treats a large and diverse population of breast cancer patients, so our availability of cells for this line of study is an unmatched resource. Even rare and complex forms of the disease — like triple-negative breast cancer and metaplastic breast cancer — will yield their biological secrets to this technology. By understanding how cancer begins, we can translate that knowledge into clinical tools that improve early detection and non-invasive monitoring.

Once a tumor forms, prescribing one therapy over another therapy still involves conjecture. Why do certain patients respond to a therapy while others do not? Can oncologists predict response based on something reflected in the tumor cells or microenvironment? Dr. Navin thinks so. His team is looking at longitudinal cell samples — taken before, during and after treatment — to see how tumors adapt in the face of various chemotherapies and targeted therapies.

Finally, the research agenda is set to study if a single cell can trigger a metastatic cascade. Does the process occur early in the lifetime of the primary tumor or is it an event that happens later? Imagine learning a way to prevent cancer's spread. Survival rates would soar.

Additional funding is needed to offset laboratory staffing expenses and to further refine single-cell technologies. Your support of MD Anderson and Dr. Navin's revolutionary work will help provide new insight into the way we fundamentally view cancer cell behavior.