Tracking the Spread of Cancer

NEW YORK — In a groundbreaking development, scientists have created a revolutionary method to track the spread of cancer throughout the body, potentially paving the way for more effective treatments against this devastating disease. The new technology, developed by researchers at Cold Spring Harbor Laboratory and Weill Cornell Medicine in New York, uses genetic "barcodes" to monitor the movement of individual cancer cells, providing unprecedented insights into the process of metastasis.

Metastatic cancer, where the disease spreads from its original site to other parts of the body, is often a grim diagnosis for patients. Until now, the exact mechanisms of how cancer cells migrate have remained elusive. This new research, published in the journal *Cancer Discovery*, sheds light on this critical process, revealing that while most cancer cells remain within the primary tumor, a small number of aggressive cells are responsible for seeding cancer's rare but deadly migrations.

The study, which focused on prostate cancer, employed a novel mouse model called Evolution in Cancer Prostate (EvoCaP) along with an analysis pipeline known as Evolutionary Lineage Tracing in R (EvoTraceR). This innovative approach allows researchers to tag individual cancer cells with unique DNA sequences, effectively creating a cellular GPS system.

"This barcoding lets us read off the precise tracking information about how the cancer has spread from its origin to the tissues to which it's metastasized," explains CSHL Professor Adam Siepel, one of the lead researchers on the project, in a media release.

The results were surprising. While conventional wisdom might suggest that cancer spreads en masse, the study revealed that only a small subset of highly aggressive cells are responsible for establishing new tumor sites in organs such as bones, liver, lungs, and lymph nodes. This finding could have significant implications for how we approach cancer treatment in the future.

Bioluminescence imaging allowed for individual cancer cells to be isolated in the tibia.

Previous methods of tracking cancer spread relied on a combination of imaging techniques and whole-genome sequencing, which were not only time-consuming and expensive but also less precise. The new barcoding technology offers a more efficient and accurate way to map cancer's journey through the body.

For the average person, this breakthrough can be likened to installing tracking devices on individual cars to monitor traffic patterns instead of relying on aerial photographs of highways. This level of detail allows researchers to see exactly which "vehicles" (cancer cells) are causing the most problematic "traffic jams" (metastases) in the body.

"We've laid the fundamental molecular biology foundation for a whole lot of other questions to be answered. This is the beginning phase of a much larger project where our colleagues are expanding this work to other types of cancer, and we start looking at therapeutic interventions for metastasis," says CSHL postdoc Armin Scheben, another key contributor to the study.

The implications of this research extend far beyond prostate cancer. As the technology is applied to other forms of the disease, it could lead to the development of more targeted and effective treatments. By identifying the specific cells responsible for metastasis, researchers may be able to design therapies that prevent cancer from spreading in the first place.

While there is still a long road ahead before these findings translate into clinical treatments, the ability to map cancer's spread with such precision marks a significant milestone in cancer research. As our understanding of metastasis grows, so too does the hope that one day we may be able to stop cancer's deadly journey before it begins.