Cancer genomes to enter private practice

The hypothetical model of a cancerous tumor is as follows: your body's own cells contain or inherit a genetic mutation that then gets them growing at an out-of-control speed. This growth rate surpasses' the immune system stop's gaps designed to regulate renegade cell growth. A tumor forms. Then, sometimes, the cancer spreads further.

But what was long thought to be a mutation or two that kicked off this chain reaction is actually a lot more complex. New genetic testing techniques have proven that even within a single tumor, cancer mutations differ greatly, as Ed Yong reports at Nature:

> When Charles Swanton and his team at the Cancer Research UK London Research Institute sequenced DNA from a handful of kidney tumours, they expected to find a lot of different mutations, but the breadth of genetic diversity within even a single tumour shocked them. Cells from one end differed from those at the other and only one-third of the mutations were shared throughout the whole mass. Secondary tumours that had spread and taken root elsewhere in the patients' bodies were different again.

Tumor genetics are mostly different from each other, even within the same tumor. Traditional biopsies, where small tissue samples are taken from various parts of a tumor, miss the majority of tumor cells, and therefore miss the vast majority of useful genetic information about the cancer.

So instead of looking at tumors themselves, researchers are now looking at their genetic signatures, found in patients' blood streams. Circulating tumor DNA (ctDNA) has the advantage of catching DNA from dead tumor cells, which leave their DNA traces circulating in a patient's blood. These cells come from the entire tumor, and offer scientists the full genetic portrait of a cancer, rather than a peep here and there from a biopsy. The technique can also tell doctors when treatments are working and show if cancers have evolved mutations to make them resistant to specific drugs.

Initial results show that following ctDNA has proven effective for treatment decisions and followup care in several types of cancers, but the studies are still in early stages, Yong said. And, much more sensitive tests are needed for this kind of analysis because there is so little ctDNA in the blood stream at any time.

Although promising, it's likely these kinds of tests won't enter mainstream medical practice immediately. But, the technology is definitely coming. Last week Patrick Soon-Shiong, healthcare entrepreneur and surgeon, told Forbes he was purchasing a cluster of cutting-edge DNA sequencers to provide patients at Providence Health & Services with cancer genome testing. This is the first time that sequencing technology of this magnitude has been purchased specifically for clinical use:

> Soon-Shiong says that he is adding them to computation technologies he has developed that make it possible to analyze tumor genomes quickly and easily. He claims that his company can analyze the data from a tumor sample in 47 seconds and transport in 18 seconds, which

might someday make possible same day turnaround of genetic analysis.

Will this sequencing capability eliminate the need for biopsies for these patients? Ultimately, it's likely. And the technology adds impact in having near immediate results about the drug susceptibility and likely resistance of each patient's tumor. Moreover, following ctDNA's changes gives information about cancers throughout treatment. "The only thing constant about a cancer cell is its ability to change. And now we have the ability to monitor it in real time," Soon-Shiong said.

Additional Resources:

- It's time for a cancer genomics revolution, Genetic Literacy Project
- Epigenetics can drive cancer, may be target for new treatments, Genetic Literacy Project
- Researchers, startups hope one drop of blood could diagnose all types of cancer, Singluarity Hub