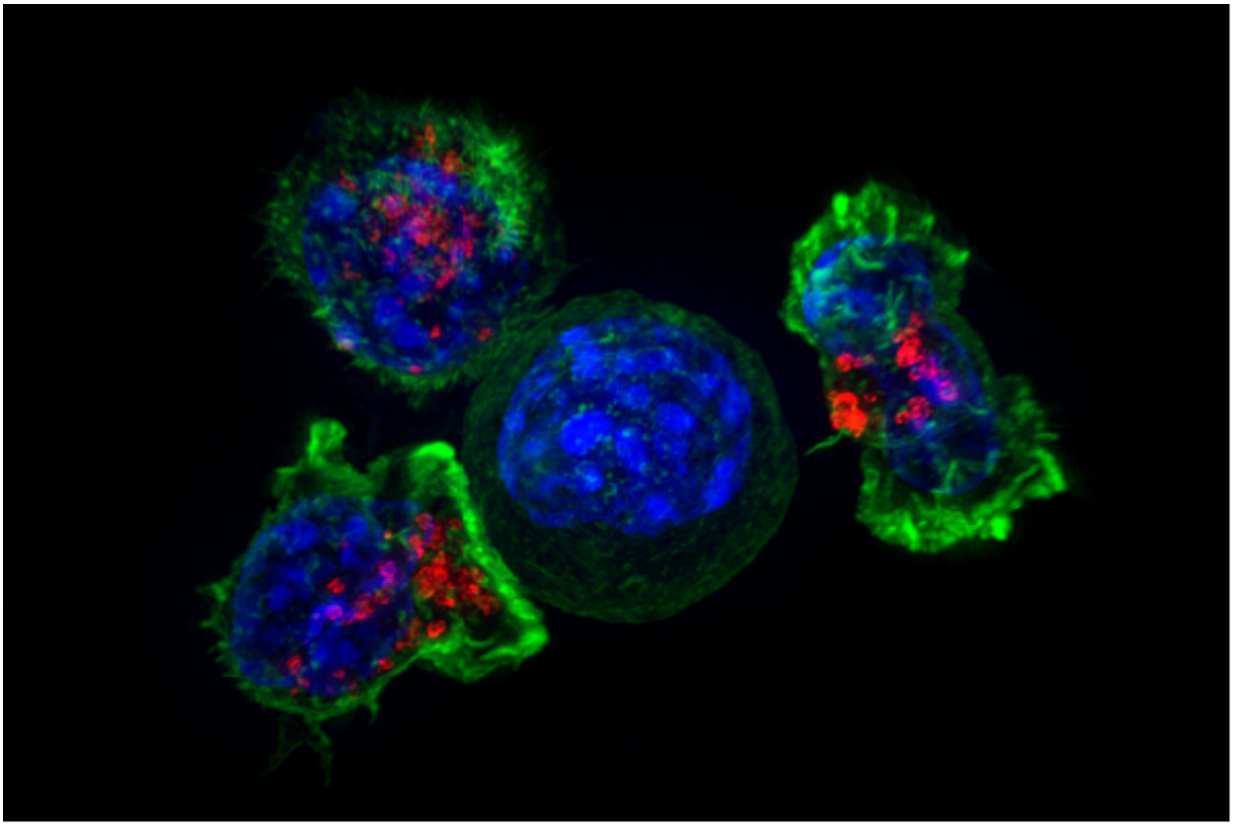
MedicalXpress

Scientists 'carbon date' cancer and unearth secrets about what could help make it deadly

May 10 2017



Killer T cells surround a cancer cell. Credit: NIH

Scientists have put precise timings on the history of a patient's cancer for the first time, effectively 'carbon dating' the different stages in the disease's progression.

Studying a single case of bowel cancer in great detail revealed that in some patients the disease can start to spread within only a year of cancerous cells first appearing, much more quickly than previously thought.

The research will help doctors understand exactly how long it takes for tumours to develop, first spread to another site in the body, and eventually become untreatable. It could help improve diagnosis, treatment and follow-up.

Scientists at The Institute of Cancer Research, London, and collaborators from Scotland, Italy and the US, analysed the whole genome of each tumour site in the patient.

The study is published in the journal *Annals of Oncology* today (Thursday). It was supported by a range of funders including The Institute of Cancer Research (ICR), Cancer Research UK, Wellcome, Chris Rokos, Geoffrey W Lewis Will Trust, the European Union and the NIHR Biomedical Research Centre at The Royal Marsden NHS Foundation Trust and The Institute of Cancer Research.

Researchers were able to time the different stages in the cancer's development so precisely because it was a particularly unusual case - a metastasis formed along a needle track when a biopsy of the tumour was taken.

Needle tract seeding is very rare, but well-documented, and the patient already had metastatic disease at the time of biopsy.

In this case, the initial bowel tumour formed and spread to the lungs and thyroid within just a year, but the patient was not diagnosed until at least five years after the cancer first started.

The research also provided important clues about what makes some cancers spread rapidly - and suggested that genetic instability, where either whole chromosomes or sections of chromosomes are duplicated or missing, could be more important than spread round the body for determining the prognosis and response to treatment.

The researchers used genetic analysis and mathematical models to map out how the cancer evolved from just a few cells at a single site, to tumours invading many different parts of the body.

This type of analysis is normally used in evolutionary biology to work out when new species of plants and animals arose throughout history by combining genetic data from current species with radiometric dating from the fossil record.

Because the researchers knew the exact time that the needle tract tumour first arose, they were able to use it as a timestamp to 'calibrate' their analysis and track the time of cancer progression.

The researchers found that although the patient's disease progressed rapidly in the first year, after metastasis its progression seemed to slow down.

The researchers therefore suggested that the degree of genetic instability might be a more important marker of how deadly a cancer was likely to be than whether it had spread to other sites in the body.

Study co-leader Dr Nicola Valeri, Leader of the Gastrointestinal Cancer Biology and Genomics Team at The Institute of Cancer Research, London, and a Consultant Medical Oncologist at The Royal Marsden NHS Foundation Trust, said:

"One of the questions patients often ask is how long a cancer has been

present before causing symptoms or spreading to other organs.

"Our study for the first time is able to answer those questions for an individual patient by effectively 'carbon dating' the cancer at different stages in its development.

"We found that in this case the patient's disease advanced much faster than we had expected - within a year of the original tumour forming. If we could provide this kind of information more routinely for patients, it would be extremely valuable in guiding decisions on treatment and follow-up."

Study co-leader Dr Andrea Sottoriva, Chris Rokos Fellow in Evolution and Cancer, and Team Leader in Evolutionary Genomics and Modelling at The Institute of Cancer Research, London, said:

"The mathematical techniques we borrowed for our study were originally developed to measure the time when new species of plants and animals arose during evolution. Our research was able not only to track the genetic evolution of the cancer, but also to put precise timings on each stage in a cancer's progression.

"Tracking, or even better predicting, a cancer's behaviour will be key to planning new treatment strategies that target tumours with drugs at exactly the right time for maximum effect."

Provided by Institute of Cancer Research