

# Divergent adaptation in thyroid cancers

Thyroid cancer can be divided into several histological subtypes, the most common one being Papillary Thyroid Cancer (PTC). PTC has a good prognosis, whereas other subtypes such as Anaplastic Thyroid Cancer (ATC) have a dismal survival.

Some patients with ATC have a previous history of PTC and in rare cases two tumours with distinct histology can coexist at the same time. This led to the hypothesis that ATC is the result of progression from PTC, generally through the accumulation of additional malignant traits driven by clonal selection, hence linear evolution from PTC to ATC.

The hypothesis was sound and motivated by good histological data. However, as it happened with the advent of ancient genomics in archaeology [1], DNA data is often bound to shake previous assumptions.

The field of cancer genomics is often driven by big numbers and large cohorts, but it is the analysis of rare and unusual cases that is often key to grasp the underlying cancer biology. Many cancer genes have indeed been identified by studying rare germline predispositions to cancer, from APC [2] to NF1 [3].

In a study led by Ana Vivancos and Juan Seoane, from the Vall d'Hebron Institute of Oncology in Barcelona, Spain, Capdevila et al. [REF] analyse the genomic profiles of a cohort of ATC and PTC tumours. Interestingly, they also examine a small set of rare cases with concomitant ATC and PTC neoplasms.

The data is clear and indicates that ATC is unlikely to have linearly evolved from PTC. Instead, the two lesions seem to develop in parallel, and are characterised by early evolutionary divergence. Hence, divergent adaptation, rather than linear evolution, drives tumourigenesis in these thyroid cancers, with the two phenotypes co-existing side by side.

Although a larger study and additional data will be necessary to confirm this pattern, this study demonstrates how branched evolution is pervasive in cancer, supporting the idea that some tumours are *born to be bad*.

1. Callaway E. Divided by DNA: The uneasy relationship between archaeology and ancient genomics. *Nature* 2018; 555(7698):573–576.
2. Chasing down the APC bowel cancer gene - Cancer Research UK - Science blog. [<http://scienceblog.cancerresearchuk.org/2011/11/29/high-impact-science-chasing-down-the-apc-bowel-cancer-gene/>].
3. Yap Y-S, McPherson JR, Ong C-K et al. The NF1 gene revisited – from bench to bedside. *Oncotarget* 2014; 5(15):5873–5892.