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Is sex primarily a strategy against transmissible cancer?

One of the greatest enigmas of evolutionary biology is that while sex is the dominant mode of reproduction among multicellular organisms, asexual reproduction appears much more efficient and less costly.

However, in a study published in the prestigious and open access journal PLOS Biology, researchers from France, Hungary and Australia - including University of Tasmania's devil facial tumour disease (DFDT) expert Dr Rodrigo Hamede - suggest that sexual reproduction is favoured by selection because, unlike asexual reproduction, it not only provides important evolutionary advantages in constantly changing environments, but also prevents the invasion of transmissible cancer, or 'cheater' cells.

A key point in the evolution of multicellular organisms was the ability to prevent cheater cells from overexploiting the cooperative system - this evolutionary constraint favoured the emergence of the many known mechanisms that suppress cancer, notably the immune system.

Whatever the efficiency of these mechanisms, a prerequisite of all these defences is the ability to recognise cheater cells from normal ones.

So the first multicellular organisms had to evolve mechanisms to fight their cheater cells as well as resist being colonised by foreign malignant cells.

Because asexual reproduction leads to identical or 'clonal' organisms, this mode of reproduction is risky due to the possibility of being invaded by clonal infectious cell lineages, or transmissible cancers.

Conversely, sexual reproduction decreases the compatibility of contagious cancer cells with their hosts and generates the genetic variation that facilitates the detection of foreign cells, the first and critical step of immune protection.

Although relatively rare, transmissible cancers do exist (e.g. two in Tasmanian devils, one in domestic dogs and five in marine bivalves), and increasing evidence suggests that most, if not all, malignant cells are potentially transmissible provided a suitable transmission route is offered.

Given the ubiquity of cancer in multicellular organisms, in combination with the plethora of potential transmission routes, sexual reproduction may have been favoured as a less risky, more profitable option to produce viable offspring despite its associated costs.

Dr Hamede said that Tasmanian devils and devil facial tumour disease provide a unique opportunity to study the biology and evolution of cancer in natural populations.

Dr Hamede is part of a world-leading program (International Associated Laboratory) established by France's National Centre for Scientific Research, Deakin University and the University of Tasmania to study the roles of cancer in ecology and evolution.

"Our aim is to integrate oncology and other biological sciences to understand how oncogenic processes have shaped the ecology and evolutionary history of multicellular organisms."

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