

How can evolutionary biology explain why we get cancer?

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Over 500 billion cells in our bodies will be replaced daily, yet natural selection has enabled us to develop defenses against the cellular mutations which could cause cancer. It is this relationship between evolution and the body's fight against cancer which is explored in a new special issue of the Open Access journal *Evolutionary Applications*.

"Cancer is far from a single well-defined disease which we can identify and eradicate," said Dr Athena Aktipis, Director, Human and [Social Evolution](#), Center for Evolution and Cancer at the University of California, San Francisco. "It is highly diverse and evolutionary theory allows us to consider cancer as a highly complex and evolving ecosystem. This approach can improve the understanding, treatment and prevention of a number of different [cancer types](#)."

By applying the principles of [evolutionary biology](#) papers in the special issue ask: Why do we get cancer, despite the body's powerful cancer suppression mechanisms? How do evolutionary principles like natural selection, mutation, and [genetic drift](#), work in a cancer ecosystem? How can we use evolutionary theory to minimize the rate of cancers worldwide?

"Nowhere is the diversity of cancer better revealed than the many reasons why we remain vulnerable to it," said Dr Aktipis. "Evolutionary medicine allows us to see explanations for traits that leave organisms vulnerable to disease."

These evolutionary explanations include the role of environmental factors, such as the relationship between tobacco availability and lung cancer; co-evolution with fast evolving pathogens; constraints on what selection can do; trade-offs, such as the capacity for tissue repair vs. risk of cancer; [reproductive success](#) at the expense of health; defenses with costs as well as benefits, such as inflammation.

"An evolutionary approach can unite and explain the many avenues of [cancer research](#) by allowing us to see cancer as an ecosystem," concluded Dr Aktipis. "Just as a forest depends on the individual characteristics of trees as well as the interactions of each tree with its environment; similarly tumors can be comprised of genetically distinct cells, which depend on both cell-to-cell interactions within the tumor, as well as on the interactions of tumor itself with the body."

More information: Papers from the Evolution and Cancer Special Issue are all freely available on the Evolutionary Applications website: www.evolutionaryapplications.org

Papers in the Special Issue Include:

From forest and agro-ecosystems to the microecosystems of the human body: what can landscape ecology tell us about tumor growth, metastasis, and treatment options?

Simon P. Daoust, Lenore Fahrig, Amanda E. Martin and Frédéric Thomas, DOI: 10.1111/eva.12031

Cancer stem cells as 'units of selection'
Mel Greaves, DOI: 10.1111/eva.12017

The real war on cancer: the evolutionary dynamics of cancer suppression
Leonard Nunney, DOI: 10.1111/eva.12018

Cancer as a moving target: understanding the composition and rebound growth kinetics of recurrent tumors

Jasmine Foo, Kevin Leder and Shannon M. Mumenthaler, DOI:
10.1111/eva.12019

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