

Scientists discover mechanism that causes cancer cells to self-destruct

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Many cancer patients struggle with the adverse effects of chemotherapy, still the most prescribed cancer treatment. For patients with pancreatic cancer and other aggressive cancers, the forecast is more grim: there is no known effective therapy.

A new Tel Aviv University study published last month in *Oncotarget* discloses the role of three proteins in killing fast-duplicating [cancer cells](#) while they're dividing. The research, led by Prof. Malka Cohen-Armon of TAU's Sackler School of Medicine, finds that these proteins can be specifically modified during the division process—mitosis—to unleash an inherent "death [mechanism](#)" that self-eradicates duplicating [cancer cells](#).

"The discovery of an exclusive mechanism that kills cancer cells without impairing healthy cells, and the fact that this mechanism works on a variety of rapidly proliferating human cancer cells, is very exciting," Prof. Cohen-Armon said. "According to the mechanism we discovered, the faster cancer cells proliferate, the faster and more efficiently they will be eradicated. The mechanism unleashed during mitosis may be suitable for treating aggressive cancers that are unaffected by traditional chemotherapy.

"Our experiments in cell cultures tested a variety of incurable human cancer types—breast, lung, ovary, colon, pancreas, blood, brain," Prof. Cohen-Armon continued. "This discovery impacts existing [cancer research](#) by identifying a new specific target mechanism that exclusively and rapidly eradicates cancer cells without damaging normally proliferating human cells."

The research was conducted in collaboration with Prof. Shai Izraeli and Dr. Talia Golan of the Cancer Research Center at Sheba Medical Center, Tel Hashomer, and Prof. Tamar Peretz, head of the Sharett Institute of Oncology at Hadassah Medical Center, Ein Kerem.

A new target for cancer research

The newly-discovered mechanism involves the modification of specific proteins that affect the construction and stability of the spindle, the

microtubular structure that prepares duplicated chromosomes for segregation into "daughter" cells during cell division.

The researchers found that certain compounds called Phenanthridine derivatives were able to impair the activity of these proteins, which can distort the spindle structure and prevent the segregation of chromosomes. Once the proteins were modified, the cell was prevented from splitting, and this induced the cell's rapid self-destruction.

"The mechanism we identified during the mitosis of cancer cells is specifically targeted by the Phenanthridine derivatives we tested," Prof. Cohen-Armon said. "However, a variety of additional drugs that also modify these specific proteins may now be developed for cancer cell self-destruction during cell division. The faster the cancer cells proliferate, the more quickly they are expected to die."

Research was conducted using both cancer cell cultures and mice transplanted with human cancer cells. The scientists harnessed biochemical, molecular biology and imaging technologies to observe the mechanism in real time. In addition, mice transplanted with triple negative [breast cancer cells](#), currently resistant to available therapies, revealed the arrest of tumor growth.

"Identifying the mechanism and showing its relevance in treating developed tumors opens new avenues for the eradication of rapidly developing aggressive cancers without damaging healthy tissues," said Prof. Cohen-Armon.

The researchers are currently investigating the potential of one of the Phenanthridine derivatives to treat two aggressive cancers known to be unresponsive to current chemotherapy: pancreatic cancer and triple negative breast cancer.

More information: Leonid Visochek et al, Exclusive destruction of mitotic spindles in human cancer cells, *Oncotarget* (2017). [DOI: 10.18632/oncotarget.15343](https://doi.org/10.18632/oncotarget.15343)

Provided by Tel Aviv University

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