Medical Xpress

Protecting the body in good times and bad

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The nasty side effects of radiation and chemotherapy are well known: fatigue, hair loss and nausea, to name a few. Cancer treatment can seem as harsh as the disease because it can't differentiate healthy cells from cancerous cells, killing both.

But what if there were a way to control or stop the growth of cancer cells without harming other cells?

Brandeis biologist Michael T. Marr is one step closer to understanding how cells promote and inhibit protein synthesis—an essential part of cellular reproduction—during times of stress. His new paper, co-authored by graduate students Calla Olson, Marissa Donovan and Michael Spellberg, is published in *eLife*, an open access digital publication for life science and biomedicine research.

Marr and his team discovered a mechanism, like an emergency backup system, that allows cells to synthesize certain proteins while shutting down the production of others. Building proteins requires a chain reaction with a dozen moving parts, each triggering the next step. These chain reactions are called signaling pathways.

The pathway that interests Marr and his team is called the insulin and insulin-like receptor (IIS) pathway. It is part of the body's emergency response system. When organisms are healthy and safe, the IIS pathway increases the activity of a protein complex called eIF4A, which helps in the synthesis of proteins.

But let's say you're not safe. You're starving. Your body is being deprived of nutrients, forcing you to conserve energy and resources. The IIS pathway, sensitive to this stress, realizes something isn't right, and sends a signal to stop eIF4A.

Protein synthesis screeches to a halt—for the most part.

Marr and his team discovered that the messages that build insulin receptor proteins have internal mechanisms allowing them to synthesize protein without the eIF4A kick-start. When the rest of the production line slows down, production of insulin receptors in the IIS ramps up. Why?

The hope is you're about to find food. The insulin receptors help the IIS pathway recognize when it's out of danger. The more receptors, the faster the IIS pathway can start ramping up protein production again. The same principle applies on the cellular level when cancerous cells overwhelm healthy cells, starving them of oxygen and nutrients—the healthy cells continue to produce insulin receptors.

"Even during times of stress, cells are stockpiling for good times," says Marr.

The mechanism that allows synthesis of insulin receptors during stress is the same from flies to mammals, pointing to a response conserved in evolution, Marr says.

Though this research is still early, the more deeply scientists understand mechanisms involved in growth and inhibition, the better they can decipher diseases that rely on uncontrolled cell growth, like cancer.

Provided by Brandeis University