How cancer cells rewire their metabolism to survive

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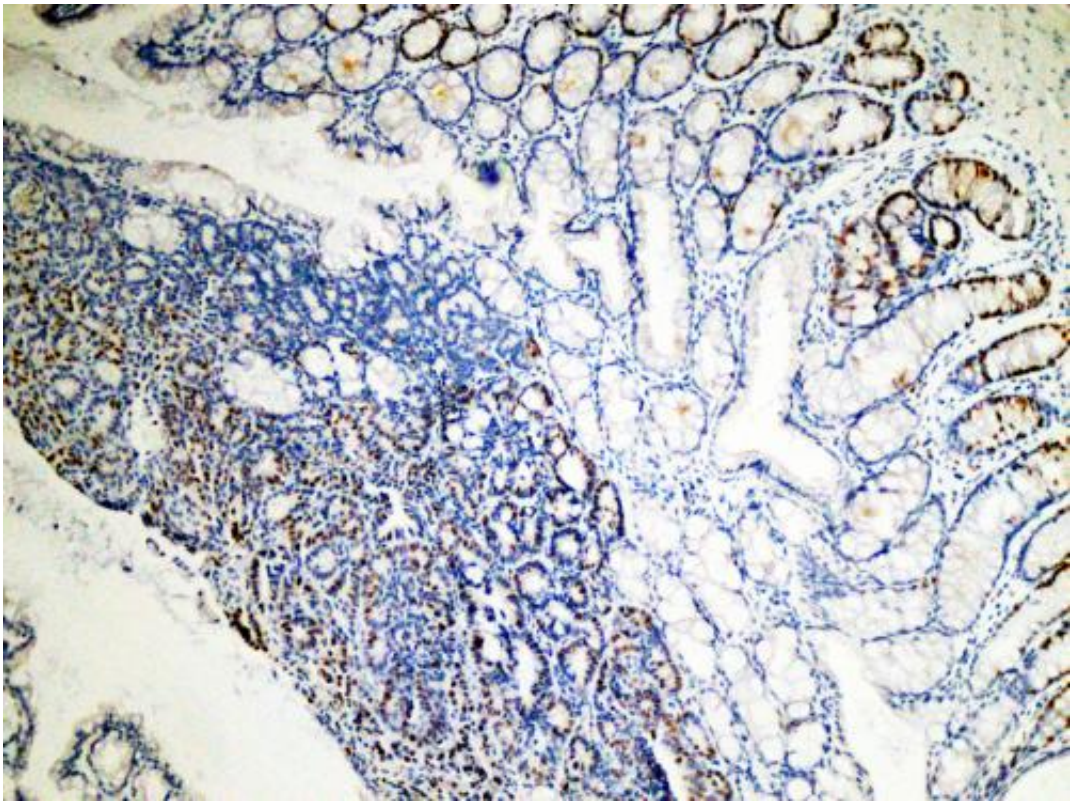

This shows cells proliferating in an intestinal tumor. Credit: Sanford-Burnham Medical Research Institute

Cancer cells need food to survive and grow. They're very good at getting it, too, even when nutrients are scarce. Many scientists have tried killing cancer cells by taking away their favorite food, a sugar called glucose. Unfortunately, this treatment approach not only fails to work, it

backfires—glucose-starved tumors actually get more aggressive. In a study published January 31 in the journal *Cell*, researchers at Sanford-Burnham Medical Research Institute discovered that a protein called PKCζ is responsible for this paradox. The research suggests that glucose depletion therapies might work against tumors as long as the cancer cells are producing PKCζ.

According to this study, when PKCζ is missing from cancer cells, tumors are able to use alternative nutrients. What's more, the lower the PKCζ levels, the more aggressive the tumor.

"We found an interesting correlation in colon cancers—if a patient's tumor doesn't produce PKCζ, he has a poorer prognosis than a similar patient with the protein. We looked specifically at colon cancer in this study, but it's likely also true for other tumor types," said Jorge Moscat, Ph.D., a professor in Sanford-Burnham's National Cancer Institute -designated Cancer Center. Moscat led the study in close collaboration with Sanford-Burnham colleague Maria Diaz-Meco, Ph.D.

PKCζ keeps tumors addicted to glucose, and under control

Although most cancer cells love glucose, tumors lacking PKCζ grow even better in the absence of this nutrient. Using human tumor samples and a mouse model of colon cancer, Moscat and his team determined this growth-without-glucose paradox is because PKCζ-deficient tumors are able to reprogram their metabolism to use glutamine, another nutrient, instead.

Without PKCζ around to keep them addicted to glucose, these tumors kick-start a new metabolic pathway. This altered metabolism helps PKCζ-deficient cancer cells survive in conditions that would otherwise

be lethal.

"If we can find an effective way to add PKCζ back to tumors that lack it, we'd make them less suited for survival and more sensitive to current therapies," Moscat said.

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