Taking aim at tumors: Novel way of studying cancer may inspire new treatments

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At the forefront of the war on cancer are Binghamton University researchers, Susannah Gal and Susan Bane, who are deploying a new tool in their study of an enzyme called tubulin tyrosine ligase, or TTL. Credit: Jonathan Cohen

Many of the newest weapons in the war on cancer come in the form of personalized therapies that can target specific changes in an individual's tumor. By disrupting molecular processes in tumor cells, these drugs can keep the tumor from growing and spreading. At the forefront of this work are Binghamton University researchers, Susan Bane, and Susannah Gal, who are deploying a new tool in their study of an enzyme called

tubulin tyrosine ligase, or TTL.

In developing these targeted therapies, scientists need to understand exactly what kind of activities within a tumor cell these drugs disturb. Bane, a professor of organic and biological chemistry, and Gal, an associate professor of biological sciences, are getting an insider's look at these cells and paying particular interest to the many cancer cells that contain less-than-normal levels of TTL.

Funded by the National Institute of General Medical Sciences, Bane and Gal's work focuses on microtubules, which are structures that provide part of the scaffolding that gives a cell its structure and also help chromosomes line up correctly during cell division.

These microtubules are made of proteins called tubulin and during the course of a cell's life, an enzyme called carboxypeptidase clips an amino acid called tyrosine off the end of some of these proteins. Later, TTL puts tyrosine back on the tubulin. No one knows the purpose of this cycle, but as Bane points out, "We do know that if you don't have that enzyme, you'll die."

In certain cancer cells, the cycle of removing and reattaching tyrosine has fallen out of balance: Too many tubulins lack tyrosine.

"Patients who have that characteristic in their tumor have a poor prognosis," Bane says. "And those tumors tend to grow more aggressively."

Hoping to learn more about the role of TTL in cancer, Bane and Gal are studying the removal and reattachment of tyrosine in live cells.

Bane has developed a way to mark tubulin with a fluorescent molecule using TTL, allowing the researchers to observe tubulin in action under a

fluorescent microscope. The new labeling technique, using a small molecule, provides an easier way to watch the behavior of microtubules as cells divide. Cancer cells are often undergoing cell division at a much faster rate than normal cells, making the process a major target of cancer research.

Although Bane and Gal aren't trying to develop a new cancer treatment, their efforts to learn the role of TTL in tumor growth could someday make it easier to choose a treatment for a specific case of the disease.

"Potentially, someone could send us their tumor sample, and we could put it in our labeling system and say, 'Yes, that has a problem with the TTL system, and therefore you should be more aggressive with it,'" Gal says. "Or we could say, 'That's probably OK, so you can treat it with normal chemotherapy.'"

Bane and Gal are very hopeful that this new approach will then allow clinicians to treat cancer far more effectively as therapies would be personalized to an individual's tumor.

Provided by Binghamton University