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New treatment target identified for aggressive breast cancer

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One of the first-known oncogenes has a protein partner that helps breast cancer proliferate and when it's blocked, so is the cancer, scientists report.

The gene ErbB2, commonly called HER2, is highly expressed in about 25 percent of breast cancers. Scientists have now found the protein Erbin, thought to be an anti-tumor factor, also is highly expressed in these cancers and essential to ErbB2's support of breast cancer.

When scientists interfere with the interaction between the two in mice, it inhibits tumor development and the usual spread to the lungs, according to an international team reporting in the journal *PNAS*. The team documented the overexpression of both in 171 cases of mostly aggressive human breast cancer as well.

The findings point toward a new therapeutic target for aggressive breast cancer and potentially an adjunct for women who become resistant to Herceptin, or trastuzumab, the drug commonly given to ErbB2-positive patients, said Dr. Lin Mei, corresponding author and Chairman of the Department of Neuroscience and Regenerative Medicine at the Medical College of Georgia at Georgia Regents University. Additionally, Erbin could be a diagnostic biomarker that physicians look for in breast tissue biopsies, Mei said.

Erbin, which is also expressed in healthy breast tissue, is critical to the stability and activity of aggressive, ErbB2-positive breast cancer, the

research shows.

When the scientists decreased Erbin levels, either by a gene therapy technique that reduced its production or a peptide that interfered with its interaction with ErbB2, breast cancer growth and spread was dramatically reduced or eliminated. "Erbin is an intracellular molecule that binds to ErbB2 and stabilizes it," Mei said. "If you take it out, ErbB2 becomes unstable."

ErbB2, on the other hand, typically extends both outside and inside breast cancer cells. Drugs such as Herceptin degrade excessive levels of the oncogene by targeting the portion that sticks out of the cell, which can be powerfully effective, moving patients from high-risk to a potential cure, Mei said.

"But the tumors are very smart," Mei said. In this case, breast cancer cells can mutate so they no longer have an external protrusion of ErbB2, leaving Herceptin without a place to bind. While getting inside the cells can be more difficult, the ability to target intracellular Erbin could one day make a difference for these patients.

"Erbin itself could be a novel target: you disrupt the interaction, and it will be therapeutic," Mei said. "Secondly, when a patient becomes Herceptin-resistant because the extracellular domain of ErbB2 is lost, this approach should still be effective because of the critical interaction of the two."

Next steps include refinement of the peptide they used for laboratory studies as well as high throughput screenings to look at other existing small molecules that might run important interference.

Mei and his colleague, Dr. Jean-Paul Borg, Director of the Cancer Research Center of Marseille, both came across Erbin in 2001.

Neuroscientist Mei was looking for proteins that regulate the protective covering around nerves and Borg was looking for cancer-relevant proteins. It turned out Erbin was involved in both. The current international team also includes scientists from China's Hangzhou Normal University and First Affiliated Hospital and Institute of Life Sciences of Nanchang University.

The Food and Drug Administration approved Herceptin for women with metastatic breast cancer who overexpress ErbB2, or HER2, in 1998 and, in 2006, as an adjuvant treatment in early stage HER2- positive breast cancer.

More information: www.pnas.org/cgi/doi/10.1073/pnas.1416074111

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