Cancer's Hearty Appetite

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Cancer cells require energy in the form of glucose (sugar) to grow. How do they meet that need? A new study shows that they rev up autophagy ("self-eating"), in which cell compartments called lysosomes digest worn-out proteins and other damaged cellular components. Dr. Cuervo and her colleagues detected unusually high levels of one type of autophagy, chaperone-mediated autophagy, in cells from more than 40 types of human cancers—but not in healthy tissue. When they blocked this autophagy in mice, the cancer cells stopped dividing, and most died because they were no longer able to use sugar as fuel; the researchers observed dramatic tumor shrinkage and nearly nonexistent metastasis. The findings were published in Science Translational Medicine in 2011. Dr. Cuervo is working to identify or develop drugs that block autophagy.

Genes at Work

Robert H. Singer, Ph.D.
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Dr. Singer and his colleagues recently watched, for the first time, the process of gene transcription, which occurs when a gene converts its DNA information into molecules of messenger RNA that then make the protein encoded by the gene. Proteins govern the body's structure and function, and underlie cancer and many other diseases when mutated or present in aberrant amounts. When the scientists inserted DNA sequences into a gene in live yeast cells, RNA made from these sequences bound a green fluorescent protein; expression of the entire gene resulted in messenger RNA molecules visible under fluorescent light. The study was published in a 2011 issue of Science.

Reversing Resistance

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How do cancers become resistant to anticancer drugs? One culprit may be the pregnane X receptor (PXR), a protein in the nucleus of cells that senses toxic substances and responds by mobilizing the cell's detoxification mechanisms. By grafting human colon cancer cells into immunodeficient mice, Dr. Mani and his colleagues found that activated PXR not only resulted in drug resistance but also spurred tumor cells to multiply, invade and metastasize. The researchers also found that activation of PXR required fibroblast growth factor 19. Insights gleaned from this study could lead to improved treatments for colon and other cancers. The study was published in a 2011 issue of the Journal of Clinical Investigation.

Welcome

Einstein recently recruited two experts on cancer stem cell biology. Wenjun Guo, Ph.D., from the Whitehead Institute for Biomedical Research, studies the molecular mechanisms that control whether stem cells in mammary tissues remain dormant, multiply or differentiate into other types of cells. Dr. Guo came to Einstein in 2011 as an assistant professor of cell biology. One focus of his research will be breast cancer stem cells. Keisuke Ito, M.D., Ph.D., from Harvard Medical School, arrived in 2012 as an assistant professor of cell biology and of medicine and serves as the director of scientific resources for the Ruth L. and David S. Gottesman Institute for Stem Cell and Regenerative Medicine Research. Dr. Ito’s academic interests include the critical regulatory mechanisms in the controlled equilibrium of healthy and leukemia stem cells. His research focuses on developing more-effective drugs for patients with hematological malignancies.