# Cancer Research

**December 1, 2013 • Volume 73 • Number 23**

## Contents

### BREAKING ADVANCES

6841  
**Highlights from Recent Cancer Literature**

### REVIEWS

6843  
**Tumor–Stroma Interaction: Revealing Fibroblast-Secreted Exosomes as Potent Regulators of Wnt-Planar Cell Polarity Signaling in Cancer Metastasis**  
Valbona Luga and Jeffrey L. Wrana

6848  
**The Role of Polo-like Kinase 1 in Carcinogenesis: Cause or Consequence?**  
Brian D. Chołeva, Xiaoshi Liu, and Nihal Ahmad

### PRIORITY REPORT

6856  
**D538G Mutation in Estrogen Receptor-α: A Novel Mechanism for Acquired Endocrine Resistance in Breast Cancer**  
Keren Merenbakh-Lamin, Noa Ben-Baruch, Adva Yeheskel, Addie Dvir, Lior Soussan-Gutman, Rinath Jeselsohn, Roman Yelensky, Myles Brown, Vincent A. Miller, David Sarid, Shulamith Rizel, Baruch Klein, Tami Rubinuk, and Ido Wolf

**Precis:** The identification of a novel mechanism of acquired endocrine resistance in metastatic breast cancer suggests a novel druggable target in this setting.

### INTEGRATED SYSTEMS AND TECHNOLOGIES

6865  
**Free Somatostatin Receptor Fraction Predicts the Antiproliferative Effect of Octreotide in a Neuroendocrine Tumor Model: Implications for Dose Optimization**  
Pedram Heidari, Eric Wehrenberg-Klee, Peiman Habibollahi, Daniel Yokell, Matthew Kulke, and Umar Mahmood

**Precis:** A novel noninvasive imaging method may be clinically useful to optimize the individualized dose of a drug used to treat neuroendocrine tumors, providing a basis for personalized, risk-tailored therapy.

### MICROENVIRONMENT AND IMMUNOLOGY

6868  
**Senescent Fibroblasts in Melanoma Initiation and Progression: An Integrated Theoretical, Experimental, and Clinical Approach**  
Eunjung Kim, Vito Rebecchi, Inna V. Fedorenko, Jane L. Messina, Rahel Mathew, Silvia S. Marta-Engles, David Basanta, Keiran S.M. Smalley, and Alexander R.A. Anderson

**Precis:** These findings developed by in silico modeling reinforce an alternative perspective on cancer, in which senescent fibroblasts create the core conditions required to license the ability of cancer cell mutations to promote malignancy, reinforcing a greater therapeutic focus on the tumor microenvironment as a cause of cancer.

6886  
**A Novel Model of Dormancy for Bone Metastatic Breast Cancer Cells**  
Rebecca Marlow, Gabriella Honeth, Sara Lombardi, Massimiliano Carìati, Sonya Hessey, Alkaterini Pipili, Veronica Mariotti, Bharath Buchupalli, Katie Foster, Dominique Bonnet, Agamemnon Grigoriadis, Pranela Rameshwar, Anand Purushotham, Andrew Tutt, and Gabriela Donu

**Precis:** This study presents novel experimental systems for investigating cancer cell dormancy, a phenomenon of high clinical relevance that is largely under-investigated due to lack of appropriate models.

6900  
**Therapeutic PD-1 Pathway Blockade Augments with Other Modalities of Immunotherapy T-Cell Function to Prevent Immune Decline in Ovarian Cancer**  
Jaikumar Duraiswamy, Gordon J. Freeman, and George Coukos

**Precis:** Immune escape, a core hallmark of advanced cancer, can be reversed by strategies that block a central pathway of T-cell exhaustion activated in the microenvironment of many solid tumors.
Low PIP4K2B Expression in Human Breast Tumors Correlates with Reduced Patient Survival: A Role for PIP4K2B in the Regulation of E-Cadherin Expression

Willem-Jan Keune, Andrew H. Sims, David R. Jones, Yvette Bultsma, James T. Lynch, Karin Jirström, Goran Landberg, and Nullin Divecha

Précis: An enzyme that regulates second messengers in lipid signaling impacts the survival of breast cancer patients by modifying a pivotal tumor suppressor function.

Skin Tumorigenesis Stimulated by Raf Inhibitors Relies Upon Raf Functions That Are Dependent and Independent of ERK

Eszter Doma, Christian Rupp, Andrea Varga, Florian Kern, Bettina Riegler, and Manuela Baccarini

Précis: Provocative preclinical results suggest that B-Raf inhibitors being used currently in the clinic to treat melanoma may not only trigger development of cutaneous skin tumors, a known side effect, but also gastric tumors, which are far less manageable.

TRAF4 Is a Critical Molecule for Akt Activation in Lung Cancer

Wei Li, Cong Peng, Mee-Hyun Lee, DoYoung Lim, Feng Zhu, Yang Fu, Ge Yang, Yuqiao Sheng, Lanbo Xiao, Xin Dong, WeiYa Ma, Ann M. Bode, Ya Cao, and Zigang Dong

Précis: These findings reveal a pivotal role for a ubiquitylation enzyme in Akt control and lung cancer pathophysiology, suggesting its role as a candidate molecular target for lung cancer prevention and therapy.

SHON Is a Novel Estrogen-Regulated Oncogene in Mammary Carcinoma That Predicts Patient Response to Endocrine Therapy

Yewon Jung, Tarek M.A. Abdel-Fatah, Stephen Y.T. Chan, Christopher C. Nolan, Andrew R. Green, Ian O. Ellis, Lili Li, Baiqu Huang, Jun Lu, Bing Xu, Longxin Chen, Runlin Z. Ma, Min Zhang, Jingru Wang, ZhengSheng Wu, Hao Zhu, Jo K. Perry, Peter E. Lobie, and Dong-Xu Liu

Précis: These findings identify a human oncogene that may serve as a simple biomarker to predict the therapeutics efficay of antiestrogen therapy in ER+ breast tumors.

Androgen Glucuronidation: An Unexpected Target for Androgen Deprivation Therapy, with Prognosis and Diagnostic Implications

Laurent Grosse, Sophie Pâquet, Patrick Caron, Ladan Fazli, Paul S. Rennie, Alain Bélanger, and Olivier Barbier

Précis: These findings reveal a local pathway of androgen metabolism in prostate cells that can antagonize the effects of androgen deprivation therapy in prostate cancer.

miRNA-95 Mediates Radioresistance in Tumors by Targeting the Sphingolipid Phosphatase SGPP1

Xiaoyong Huang, Samira Taeb, Sahar Jahangiri, Urban Emmenegger, Elisa Tran, Jeff Bruce, Arzu Mesci, Elina Korpela, Danny Vesprini, C. Shun Wong, Robert G. Bristow, Fei-Fei Liu, and Stanley K. Liu

Précis: This seminal report identifies a little-studied microRNA as a major mediator of radiation resistance in tumors, also showing how resistance can be reversed with a clinically approved inhibitor of sphingosine-1-phosphate signaling.

Supramolecular Nanoparticles That Target Phosphoinositide-3-Kinase Overcome Insulin Resistance and Exert Pronounced Antitumor Efficacy


Précis: This study provides a preclinical foundation for the use of supramolecular nanochemistry to overcome current challenges associated with PI3K inhibitors and also offers a more general paradigm for the development of molecular targeted therapeutics for cancer treatment.

Contribution of Bcl-2 Phosphorylation to Bak Binding and Drug Resistance

Haiming Dai, Husheng Ding, X. Wei Meng, Sun-Hee Lee, Paula A. Schneider, and Scott H. Kaufmann

Précis: These findings offer a mechanistic basis to understand the enhanced antiapoptotic activity of phosphorylated Bcl-2, along with the ability of BH3 mimetics to enhance cancer cell sensitivity to taxanes.
Carbon Monoxide Expedites Metabolic Exhaustion to Inhibit Tumor Growth
Barbara Wegiel, David Gallo, Eva Csizmadia, Clair Harris, John Belcher, Gregory M. Vercellotti, Nuno Penacho, Pier Paolo Pandolfi, Leszek Helczynski, Anders Bjartell, Jenny Liao Persson, and Leo E. Otterbein

Precise: Clinical trials of carbon monoxide that are being conducted as a strategy for chemosensitization may benefit from mechanistic insights into CO-induced cancer cell death provided in this study.

The HSP90 Inhibitor Ganetespib Synergizes with the MET Kinase Inhibitor Crizotinib in both Crizotinib-Sensitive and -Resistant MET-Driven Tumor Models
Naoto Miyajima, Shinji Tsutsumi, Carole Sourbier, Kristin Beebe, Mehdi Mollapour, Candy Rivas, Soichiro Yoshida, Jane B. Trepel, Ying Huang, Manabu Tatokoro, Nobuo Shinohara, Katsuya Nonomura, and Len Neckers

Precise: Hsp90 inhibition synergizes with MET tyrosine kinase inhibition and restores sensitivity to drug-resistant MET mutants.

PTEN Loss Mitigates the Response of Medulloblastoma to Hedgehog Pathway Inhibition

Precise: This study offers new insights into the potential efficacy of Hedgehog pathway inhibitors being tested clinically against a common pediatric cancer.

Antitumor Activity of the Selective Pan-RAF Inhibitor TAK-632 in BRAF Inhibitor-Resistant Melanoma
Akito Nakamura, Takeo Arita, Shuntaro Tsujiya, Jill Donelan, Jouharah Chouitai, Elizabeth Carideo, Katherine Galvin, Masanori Okaniwa, Tomoyasu Ishikawa, and Sei Yoshida

Precise: This pan-RAF inhibitor may offer needed therapeutic options for patients with NRAS- or BRAF-driven melanomas that are refractory to BRAF inhibitor treatment.

A Novel EGFR Isoform Confers Increased Invasiveness to Cancer Cells
Min Zhou, Hai Wang, Keke Zhou, Xiaoying Luo, Xiaorong Pan, Bizhi Shi, Hua Jiang, Jiqin Zhang, Kesang Li, Hua-Mao Wang, Huiping Gao, Shun Lu, Ming Yao, Ying Mao, Hong-Yang Wang, Shengli Yang, Jianren Gu, Chuanyuan Li, and Zonghai Li

Precise: These findings reveal a novel mechanism through which dysregulated EGFR signaling drives cancer cell invasion and poor prognosis, in glioma and other cancers, with implications for new prognosis and treatment paradigms involving this core pathway in cancer.

Silencing of the mir-17–92 Cluster Family Inhibits Medulloblastoma Progression
Brian L. Murphy, Susanna Obad, Laure Bihannic, Olivier Ayrault, Frederique Zindy, Sakari Kauppinen, and Martine F. Roussel

Precise: This study highlights the therapeutic utility achieved by systemic delivery of a drug-like antisense molecule directed against microRNAs, termed tiny LNAs, to suppress tumor progression.

Glioblastoma Stem Cells Are Regulated by Interleukin-8 Signaling in a Tumoral Perivascular Niche
David W. Infanger, YouJin Cho, Brina S. Lopez, Sunish Mohanan, S. Chris Liu, Demirkan Gursel, John A. Boockvar, and Claudia Fischbach

Precise: This study demonstrates the impact that a 3D tumor environment exerts on chemokine-mediated signals needed to maintain cancer stem-like cells, with broader implications for illustrating the important role of 3D culture models in gaining a better understanding of cancer pathogenesis.

Generation of Prostate Tumor–Initiating Cells Is Associated with Elevation of Reactive Oxygen Species and IL-6/STAT3 Signaling
Yi Qu, Anne Margrete Oyan, Runhui Liu, Yaping Hua, Jigang Zhang, Randi Hovland, Mihaela Popa, Xiaojun Liu, Karl A. Brokstad, Ronald Simon, Anders Molven, Biaoyang Lin, Wei-dong Zhang, Emmet McCormack, Karl-Henning Kalland, and Xi-Song Ke

Precise: A novel stepwise-generated model of human prostate carcinogenesis reveals an intrinsic association of ROS and IL-6/STAT3 signaling, illuminating this relationship and defining therapeutic targets in this setting.
In Vivo MAPK Reporting Reveals the Heterogeneity in Tumoral Selection of Resistance to RAF Inhibitors

Kevin J. Basile, Ethan V. Abel, Neda Dadpey, Edward J. Hartsough, Paolo Fortina, and Andrew E. Aplin

Précis: This article describes a novel in vivo system for noninvasive evaluation of a kinase-mediated mechanism of acquired resistance to BRAF-targeting drugs, an area of present clinical challenge for treating metastatic melanoma.

Neuropilin-2 Is Upregulated in Lung Cancer Cells during TGF-β1–Induced Epithelial–Mesenchymal Transition

Patrick Nasarre, Robert M. Gemmill, Vincent A. Potiron, Joëlle Roche, Xian Lu, Anna E. Barón, Christopher Korch, Elizabeth Garrett-Mayer, Alessandro Lagana, Philip H. Howe, and Harry A. Drabkin

Précis: These findings provide insights into how TGF-β1 mediates invasion and tumorigenesis and identify a novel therapeutic target that may prevent or reverse EMT associated with metastatic progression.

BCCIP Suppresses Tumor Initiation but Is Required for Tumor Progression

Yi-Yuan Huang, Li Dai, Dakim Gaines, Roberto Droz-Rosario, Huimei Lu, Jingmei Liu, and Zhiyuan Shen

Précis: This study describes a paradoxical tumor suppressor that can also promote cancer progression, serving as a prototype for a class of suppressors that does not need to be permanently inactivated to trigger tumorigenesis.

Molecular Profiling of Tumor Cells in Cerebrospinal Fluid and Matched Primary Tumors from Metastatic Breast Cancer Patients with Leptomeningeal Carcinomatosis

Mark Jesus M. Magbanua, Michelle Melisko, Ritu Roy, Eduardo V. Sosa, Louai Hauranieh, Andrea Kablanian, Lauren E. Eisenbud, Artem Rayzantsev, Alfred Au, Janet H. Scott, and John W. Park

Précis: This study describes a method for molecular analysis of tumor cells isolated from cerebrospinal fluid, shedding light on their molecular characteristics and suggesting candidate biomarkers and therapeutic targets relevant to metastatic spread in the central nervous system.

Benefits of Vascular Normalization Are Dose and Time Dependent—Letter

Yuhui Huang, Triantafyllos Stylianopoulos, Dan G. Duda, Dai Fukumura, and Rakesh K. Jain

Bevacizumab-Induced Vessel Normalization Hampers Tumor Uptake of Antibodies—Response

Marlous Arjaans, Sjoukje F. Oosting, Carolina P. Schröder, and Elisabeth G.E. de Vries

ABOUT THE COVER

Carbon monoxide (CO) at therapeutic concentrations induces growth arrest of lung and prostate cancer cell lines and tumors. CO is generated endogenously as a bioactive signaling molecule by the cytoprotective gene heme oxygenase-1 (HO-1). In cancer cells, HO-1 activity, and thus endogenous CO levels, is decreased and can be rescued by delivery of exogenous CO. Astonishingly, CO sensitizes cancer cells to chemotherapeutic agents while simultaneously protecting normal cells from genotoxin-induced cell death. The mechanism of CO involves its propensity to bind to heme-containing oxidases in mitochondria. Shown here are prostate cancer cells (PC3) exposed to CO in the presence of the genotoxin doxorubicin, which resulted in a dramatic shift in mitochondrial membrane potential and metabolic collapse driven by an anti-Warburg effect. Using MitoTracker Red CMXRos staining (red), which fluoresces when a cell is actively respiring, Wegiel and colleagues observed that CO decreased respiration and mitochondrial membrane potential, indicative of mitochondrial failure. Nuclei were stained with Hoechst (blue). For details, see article by Wegiel and colleagues on page 7009.

AC icon indicates Author Choice

For more information please visit www.aacrjournals.org