### BREAKING ADVANCES

#### Highlights from Recent Cancer Literature

### REVIEWS

#### Intratumor Heterogeneity: Evolution through Space and Time
Charles Swanton

#### Microenvironmental Regulation of Epithelial–Mesenchymal Transitions in Cancer
Dingcheng Gao, Linda T. Vahdat, Stephen Wong, Jenny C. Chang, and Vivek Mittal

#### The Growing Arsenal of ATP-Competitive and Allosteric Inhibitors of BCR–ABL
Oliver Hantschel, Florian Grebien, and Giulio Superti-Furga

### COMMENTARY

#### Biomarkers of HPV Infection in Oropharyngeal Carcinomas: Can We Find Simplicity in the Puzzle of Complexity?
Eduardo M. Mendez

### INTEGRATED SYSTEMS AND TECHNOLOGIES

#### Interstitial Fluid Pressure and Associated Lymph Node Metastasis Revealed in Tumors by Dynamic Contrast-Enhanced MRI
Tord Hompland, Christine Ellingsen, Kirsti Marie Øvrebo, and Einar K. Rofstad

**Précis:** Seminal findings describe a new noninvasive tool to image the internal fluid pressure in tumors, revealing a metric that might be used to predict the metastatic potential of any solid tumor.

### MICROENVIRONMENT AND IMMUNOLOGY

#### Roles for Endothelin Receptor B and BCL2A1 in Spontaneous CNS Metastasis of Melanoma
William Cruz-Muñoz, Maria L. Jaramillo, Shan Man, Ping Xu, Myriam Banville, Catherine Collins, Andre Nantel, Giulio Francia, Sherif S. Morgan, Lee D. Cranmer, Maureen D. O’Connor-McCourt, and Robert S. Kerbel

**Précis:** A model to evaluate genes relevant to brain metastasis by malignant melanoma provides important new insights into this little-understood process.

#### Rab27a Supports Exosome-Dependent and -Independent Mechanisms That Modify the Tumor Microenvironment and Can Promote Tumor Progression
Angélique Bobrie, Sophie Krumeich, Fabien Reyal, Chiara Recchi, Luis F. Moita, Miguel C. Seabra, Matias Ostrowski, and Clotilde Thiery

**Précis:** This important study offers what may be the first evidence of a role for *in vivo* secreted cancer cell-exosomes in primary tumor growth and metastasis.

#### Soluble CD200 Is Critical to Engraft Chronic Lymphocytic Leukemia Cells in Immunocompromised Mice
Karrie K. Wong, Fred Brenneman, Alden Chesney, David E. Spaner, and Reginald M. Gorczynski

**Précis:** This study characterizes a novel soluble isoform of the immunosuppressive molecule CD200, which, when overexpressed on cancer cells, may mediate immune escape.

### MOLECULAR AND CELLULAR PATHOBIOLOGY

#### Functional Genomics Identifies Drivers of Medulloblastoma Dissemination
Michael Mumert, Adrian Dubuc, Xiaochong Wu, Paul A. Northcott, Steven S. Chin, Carolyn A. Pedone, Michael D. Taylor, and Daniel W. Fults

**Précis:** An understanding of the genetic determinants of metastatic dissemination of medulloblastoma will make it possible to eliminate highly neurotoxic treatments, such as craniospinal radiation, which are currently indispensable for long-term survival.
PREVENTION AND EPIDEMIOLOGY

4993 Frequent PVT1 Rearrangement and Novel Chimeric Genes PVT1-NBEA and PVT1-WWOX Occur in Multiple Myeloma with 8q24 Abnormality


Precis: Not only MYC but also PVT1 has a pivotal role in the pathophysiology of multiple myeloma and possibly in other tumors with 8q24 abnormalities where Myc resides.

Viral RNA Patterns and High Viral Load Reliably Define Oropharynx Carcinomas with Active HPV16 Involvement

Dana Holzinger, Markus Schmitt, Gerhard Dyckhoff, Axel Benner, Michael Pawlita, and Franz X. Bosch

Precis: Identifying biomarkers that define the subset of oropharyngeal cancers driven by an increasing incidence of HPV16 infection could help improve treatment and clinical outcomes.

Biomarkers of HPV in Head and Neck Squamous Cell Carcinoma


Precis: Determining only the HPV16 DNA status or p16 immunostaining is not an effective prognostic biomarker for head and neck cancers on the rise, but combining these markers with E6/E7 antibody status has high predictive clinical value.

4994 FLT-PET Is Superior to FDG-PET for Very Early Response Prediction in NPM-ALK-Positive Lymphoma Treated with Targeted Therapy

Zhoulei Li, Nicolas Graf, Ken Herrmann, Alexandra Jünger, Michaela Aichler, Annette Feuchtinger, Anja Baumgart, Axel Walch, Christian Peschel, Markus Schwaiger, Andreas Buck, Ulrich Keller, and Tobias Dechow

Precis: A novel method of PET imaging can predict responses to treatment with a targeted inhibitor early enough in the course of treatment that it may be possible to generate faster predictions of treatment efficacy, thereby determining whether or not a patient should remain on the treatment.

THERAPEUTICS, TARGETS, AND CHEMICAL BIOLOGY

4996 RKI-1447 Is a Potent Inhibitor of the Rho-Associated ROCK Kinases with Anti-Invasive and Antitumor Activities in Breast Cancer

Ronil A. Patel, Kara D. Forinash, Roberta Pireddu, Ying Sun, Nan Sun, Mathew P. Martin, Ernst Schonbrunn, Nicholas J. Lawrence, and Said M. Sebti

Precis: ROCK kinases are intimately involved in tumor migration and invasion, and the discovery of a drug-like ROCK inhibitor offers significant potential as a novel anti-invasive and antitumor agent.

4997 Cardiac Inflammation after Local Irradiation Is Influenced by the Kallikrein-Kinin System

Vijayalakshmi Sridharan, Preeti Tripathi, Sunil K. Sharma, Eduardo G. Moros, Peter M. Corry, Benjamin J. Lieblong, Elena Kaschina, Thomas Unger, Christa Thone-Reineke, Martin Hauer-Jensen, and Marjan Boerma

Precis: These results enhance understanding of the causes of radiation-induced heart disease, a severe side effect that can occur with certain forms of radiotherapy of chest tumors, with possible implications for its prevention or management.
## Inactivation of the HIF-1α/PDK3 Signaling Axis Drives Melanoma toward Mitochondrial Oxidative Metabolism and Potentiates the Therapeutic Activity of Pro-Oxidants

Jérôme Kluza, Paola Corazao-Rozas, Yasmine Touil, Manel Jendoubi, Cyril Maire, Pierre Guerrreschi, Aurélie Jeannieux, Caroline Ballot, Stéphane Balayssac, Samuel Valable, Aurélien Corroyer-Dulmont, Myrriam Bernaudin, Myrriam Malet-Martino, Elisabeth Martin de Lassalle, Patrice Mabsoudou, Pierre Formstecher, Renata Polakowska, Laurent Mortier, and Philippe Marchetti

**Précis:** These findings offer preclinical validation of a bioenergetic pathway that can be exploited immediately to improve therapeutic intervention in metastatic melanoma.

### Hedgehog Signaling Is a Novel Therapeutic Target in Tamoxifen-Resistant Breast Cancer Aberrantly Activated by PI3K/AKT Pathway

Bhuvaneswari Ramaswamy, Yuanzhi Lu, Kun-yu Teng, Gerard Nuovo, Xiaobai Li, Charles L. Shapiro, and Sarmila Majumder

**Précis:** Pharmacologic blockade of Hedgehog signaling may offer a general strategy to target breast cancer cells that have become resistant to hormone-ablative therapy.

### MEN1 Gene Replacement Therapy Reduces Proliferation Rates in a Mouse Model of Pituitary Adenomas

Gerard V. Walls, Manuel C. Lemos, Mahsa Javid, Miriam Bazan-Peregrino, Jeshmi Jeyabalanan, Anita A.C. Reed, Brian Harding, Damian J. Tyler, Daniel J. Stuckey, Sian Piret, Paul T. Christie, Olaf Ansorge, Kieran Clarke, Len Seymour, and Rajesh V. Thakker

**Précis:** These findings offer a preclinical proof-of-concept for gene replacement therapy of pituitary adenomas with a relevant tumor-suppressor gene that is often mutated in this setting.

### Intravesical Delivery of Small Activating RNA Formulated into Lipid Nanoparticles Inhibits Orthotopic Bladder Tumor Growth

Moo Rim Kang, Glen Yang, Robert F. Place, Klaus Charisse, Hila Epstein-Barash, Muthiah Manoharan, and Long-Cheng Li

**Précis:** This article offers a preclinical proof-of-concept for cancer treatment by RNA activation (RNAa), an RNA interference-related technology that uses small dsRNAs formulated into lipid nanoparticles to stimulate the expression of endogenous tumor-suppressor genes.
Adenylate Kinase-4 Is a Marker of Poor Clinical Outcomes That Promotes Metastasis of Lung Cancer by Downregulating the Transcription Factor ATF3

Yi-Hua Jan, Hong-Yuan Tsai, Chih-Jen Yang, Ming-Shyan Huang, Yi-Fang Yang, Tsung-Ching Lai, Chien-Hsin Lee, Yung-Ming Jeng, Chi-Ying Huang, Jen-Liang Su, Yung-Jen Chuang, and Michael Hsiao

Précis: These findings identify an adenylate kinase gene as a lung cancer progression marker that enhances the invasion ability of lung cancer and may represent a biomarker of metastasis.

Reciprocal Metabolic Reprogramming through Lactate Shuttle Coordinately Influences Tumor-Stroma Interplay

Tania Fiaschi, Alberto Marini, Elisa Giannoni, Maria Letizia Taddei, Paolo Gandellini, Alina De Donatis, Michele Lanciotti, Sergio Serni, Paolo Cirri, and Paola Chiarugi

Précis: This study furthers understanding of how cancer cells and cancer-associated fibroblasts support each other through coordinate control and exploitation of metabolic activity to survive nutrient-deprived conditions and license progress to more advanced stages of disease.

ABOUT THE COVER

Squamous cell carcinomas of the uterine cervix were subjected to dynamic contrast-enhanced magnetic resonance imaging by using gadolinium diethylene-triamine penta-acetic acid (Gd-DTPA) as contrast agent and an axial T1-weighted spoiled gradient recalled sequence for imaging. The T1-weighted images showed a high-signal intensity rim in the tumor periphery immediately after the contrast administration, and this rim moved outwards with time. The velocity of the rim movement at the tumor surface was associated with tumor interstitial fluid pressure and incidence of lymph node metastases, and may serve as a novel general biomarker of interstitial hypertension-induced tumor aggressiveness. For details, see article by Hompland and colleagues on page 4899.