## BREAKING ADVANCES

10017 Highlights from Recent Cancer Literature

## REVIEWS

10019 Imaging Cycling Tumor Hypoxia
Shingo Matsumoto, Hironobu Yasui, James B. Mitchell, and Murali C. Krishna

10024 Targeting γδ T Lymphocytes for Cancer Immunotherapy: From Novel Mechanistic Insight to Clinical Application
Anita Q. Gomes, Duarte S. Martins, and Bruno Silva-Santos

## PERSPECTIVE

10028 XMRV: A New Virus in Prostate Cancer?
Amanda L. Aloia, Karen S. Sfanos, William B. Isaacs, Qizhi Zheng, Frank Maldarelli, Angelo M. De Marzo, and Alan Rein

## MEETING REPORT

10034 Twenty-Second Annual Pezcoller Symposium: RNA Biology and Cancer
Rene Bernards, Witold Filipowicz, David M. Livingston, and Enrico Milich

## PRIORITY REPORTS

10038 The Neuroblastoma-Associated F1174L ALK Mutation Causes Resistance to an ALK Kinase Inhibitor in ALK-Translocated Cancers
Takaaki Sasaki, Katsuhiro Okuda, Wei Zheng, James Butrynski, Marzia Capelletti, Liping Wang, Nathanael S. Gray, Keith Wilner, James G. Christensen, George Demetri, Geoffrey I. Shapiro, Scott J. Rodig, Michael J. Eck, and Pasi A. Jänne

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### INTEGRATED SYSTEMS AND TECHNOLOGIES

10051 Mathematical and Experimental Approaches to Identify and Predict the Effects of Chemotherapy on Neuroglial Precursors
Olivier Hyrien, Jörg Dietrich, and Mark Noble

Précis: Chemotherapeutic drugs may alter precursor cell function in multiple ways, including cell cycle length, the time between division and differentiation, and the probability of self-renewal division, with potential clinical implications.

10060 Coexpression Network Analysis Identifies Transcriptional Modules Related to Proastrocytic Differentiation and Sprouty Signaling in Glioma
Alexander E. Ivliev, Peter A.C. ’t Hoen, and Marina G. Sergeeva

Précis: Study identifies a proastrocytic gene expression signature with prognostic utility in brain tumors and reveals that Sprouty family proteins which modify EGF signaling likely participate in brain cancer pathogenesis.

10071 Integrated Optical Coherence Tomography and Microscopy for Ex Vivo Multiscale Evaluation of Human Breast Tissues
Chao Zhou, David W. Cohen, Yihong Wang, Hsiang-Chieh Lee, Amy E. Mondelblatt, Tsung-Han Tsai, Aaron D. Aguirre, James G. Fujimoto, and James L. Connolly

Précis: Findings lay the foundation to improve optical evaluation of breast tissues with 3D imaging technologies that could improve surgical management of cancer.
Expression of Snail in Epidermal Keratinocytes Promotes Cutaneous Inflammation and Hyperplasia Conducive to Tumor Formation

Fei Du, Yoshikazu Nakamura, Tuan-Lin Tan, Pedro Lee, Robert Lee, Benjamin Yu, and Colin Jamora

Précis: Findings suggest that the chief contribution of a key EMT-inducing transcription factor to carcinoma progression is largely through the creation of a hyperproliferative and inflammatory niche in the tumor microenvironment.

HGF/c-Met Acts as an Alternative Angiogenic Pathway in Sunitinib-Resistant Tumors

Farbod Shojaei, Joseph H. Lee, Brett H. Simmons, Anthony Wong, Carlos O. Esparza, Pamela A. Plumlee, Junlii Peng, Albert E. Stewart, Dana D. Hu-Lowe, and James G. Christensen

Précis: Results indicate that inhibition of the c-Met pathway has an additive effect on inhibition of the VEGF pathway in tumors resistant to the VEGF inhibitor sunitinib.

HIF-2α Enhances β-Catenin/TCF-Driven Transcription by Interacting with β-Catenin

Hyunsung Choi, Yang-Sook Chun, Tae-You Kim, and Jong-Wan Park

Précis: Findings suggest that HIF-1α/HIF-2α balance determines cell growth when hypoxia and Wnt stimulation coexist, affecting understanding of tumor fate under hypoxic conditions that may help control hypoxic tumor cells.

IL-17 Enhances Tumor Development in Carcinogen-Induced Skin Cancer

Lin Wang, Tangsheng Yi, Wang Zhang, Drew M. Pardoll, and Hua Yu

Précis: Activation of a central proinflammatory pathway for adaptive immune cells contributes to cancer-associated inflammation in a classical model of carcinogenesis.

Delivery of NKG2D Ligand Using an Anti-HER2 Antibody-NKG2D Ligand Fusion Protein Results in an Enhanced Innate and Adaptive Antitumor Response


Précis: Preclinical study defines a novel antibody-based therapeutic strategy that can couple innate and adaptive immune responses against tumors to increase antitumor efficacy.

Conditional Deletion of the Focal Adhesion Kinase FAK Alters Remodeling of the Blood–Brain Barrier in Glioma

Jisook Lee, Alexandra K. Borboa, Hyun Bae Chun, Andrew Baird, and Brian P. Elieceiri

Précis: Findings suggest a way to stabilize the tumor vasculature as a strategy to treat brain tumors, including how blood-brain barriers might be restored in this setting.

Longitudinal, Noninvasive Imaging of T-Cell Effector Function and Proliferation in Living Subjects

Manishkumar R. Patel, Ya-Fang Chang, Ian Y. Chen, Michael H. Bachmann, Xinrui Yan, Christopher H. Contag, and Sanjiv S. Gambhir

Précis: This is the first study of its kind to noninvasively visualize T-cell receptor–dependent T-cell activation and differentiation in small animals in response to tumor antigens.

Active Immunotherapy Induces Antibody Responses That Target Tumor Angiogenesis


Précis: Cancer vaccines may stimulate in patients a humoral reaction that broadly targets tumor angiogenesis.

The Inflammasome Component Nlrp3 Impairs Antitumor Vaccine by Enhancing the Accumulation of Tumor-Associated Myeloid-Derived Suppressor Cells

Hendrik W. van Deventer, Joseph E. Burgents, Qing Ping Wu, Rita-Marie T. Woodford, W. June Briceky, Irving C. Allen, Erin McElvania-Tekippe, Jonathan S. Serody, and Jenny P.-Y. Ting

Précis: Results identify a core component of the inflammasome as an unexpected mediator of tumoral immune escape by myeloid-derived suppressor cells, also implicating it as a target to improve responses to dendritic cell vaccines of major interest in cancer immunotherapy.

CXCL12 Mediates Immunosuppression in the Lymphoma Microenvironment after Allogeneic Transplantation of Hematopoietic Cells

Christoph Dürr, Dietmar Pfeiffer, Rainer Claus, Annette Schmitt-Graeff, Ulrike V. Gerlach, Ralph Graeser, Sophie Krüger, Armin Gerbitz, Robert S. Negrin, Jürgen Finke, and Robert Zeiser

Précis: Findings suggest a mechanistic strategy to degrade immune suppression and improve efficacy in cancer patients who receive bone marrow transplant therapy.
**MOLECULAR AND CELLULAR PATHBIOLOGY**

**10182**
**Prognostic Value and Function of KLF4 in Prostate Cancer: RNAa and Vector-Mediated Overexpression Identify KLF4 as an Inhibitor of Tumor Cell Growth and Migration**

Ji Wang, Robert F. Place, Vera Huang, Xiaoling Wang, Emily J. Noonan, Clara E. Magyar, Jiaoti Huang, and Long-Cheng Li

**Précis:** A potential tumor and metastasis suppressor gene is identified in prostate cancer, in which its decreased expression predicts the development of metastasis.

**10192**
**Free Tubulin Modulates Mitochondrial Membrane Potential in Cancer Cells**

Eduardo N. Maldonado, Jyoti Patnaik, Matthew R. Mullins, and John J. Lemasters

**Précis:** Results suggest a mechanism to understand how mitochondrial metabolism is suppressed in cancer cells, a characteristic feature of the Warburg effect.

**10202**
**A Unique Metastasis Gene Signature Enables Prediction of Tumor Relapse in Early-Stage Hepatocellular Carcinoma Patients**

Stephanie Roessler, Hu-Liang Jia, Amuradha Budhu, Marshonna Forgues, Qing-Hai Ye, Ju-Seog Lee, Snorri S. Thorgeirsson, Zhongtang Sun, Zhao-You Tang, Lun-Xiu Qin, and Xin Wei Wang

**Précis:** Results from two independent cohorts with mixed etiologies and ethnicity define a unique metastasis expression signature that can predict early recurrence of hepatocellular carcinoma.

**10213**
**Downregulation of c-MYC Protein Levels Contributes to Cancer Cell Survival under Dual Deficiency of Oxygen and Glucose**

Hiroaki Okuyama, Hiroko Endo, Tamaki Akashika, Kikuya Kato, and Masahiro Inoue

**Précis:** c-MYC downregulation may represent a universal survival strategy of cancer cells under ischemic conditions that select for development of aggressive phenotypes.

**THERAPEUTICS, TARGETS, AND CHEMICAL BIOLOGY**

**10224**
**Tip30 Deletion in MMTV-Neu Mice Leads to Enhanced EGFR Signaling and Development of Estrogen Receptor–Positive and Progesterone Receptor–Negative Mammary Tumors**

Chengliang Zhang, Mikito Mori, Shenglan Gao, Aimin Li, Isamu Hoshino, Mark D. Aupperlee, Sandra Z. Haslam, and Hua Xiao

**Précis:** Mechanistic study leads to development of a mouse model of ER+/PR– breast cancer, which while not as widely studied as other disease subtypes accounts for up to 25% of all breast cancers.

**10234**
**Histone H3 Lysine 79 Methyltransferase Dot1 Is Required for Immortalization by MLL Oncogenes**

Ming-Jin Chang, Hongyu Wu, Nicholas J. Achille, Mary Rose Reisenauer, Chau-Wen Chou, Nancy J. Zeleznik-Le, Charles S. Hemenway, and Wenzheng Zhang

**Précis:** Findings define a pivotal requirement for an important histone methyltransferase in a class of clinically aggressive leukemias, also implicating this enzyme as a therapeutic target for novel treatment strategies in these diseases.

**10243**
**Dual Functional Monoclonal Antibody PF-04605412 Targets Integrin α5β1 and Elicits Potent Antibody-Dependent Cellular Cytotoxicity**

Gang Li, Lianglin Zhang, Enhong Chen, Jiayiying Wang, Xin Jiang, Jeffrey H. Chen, Grant Wickman, Karin Amundson, Simon Bergqvist, James Zobel, Dana Buckman, Sangita M. Baxi, Steven L. Bender, Gerald F. Casperson, and Dana D. Hu-Lowe

**Précis:** Findings suggest that the efficacy of antibody-based therapy of solid tumors can be improved by engineering changes in the antibody constant region that enhance ADCC.
Targeting the Mitotic Checkpoint for Cancer Therapy with NMS-P715, an Inhibitor of MPS1 Kinase
Riccardo Colombo, Marina Caldarelli, Milena Mennecozzi, Maria Laura Giorgini, Francesco Sola, Paolo Cappella, Claudia Perrera, Stefania Re Depaolini, Luisa Rusconi, Ulisse Cucchi, Nilla Avanzi, Jay Aaron Bertrand, Roberto Tiberio Bossi, Enrico Pesenti, Arturo Galvani, Antonella Isacchi, Francesco Colotta, Daniele Donati, and Jürgen Moll

Précis: Proof-of-concept findings based on a small molecule that targets a key mitotic checkpoint suggest a promising new approach to selectively destroy cancer cells.

Loss of Metallothionein Predisposes Mice to Diethylnitrosamine-Induced Hepatocarcinogenesis by Activating NF-κB Target Genes
Sarmila Majumder, Satavisha Roy, Thomas Kaffenberger, Bo Wang, Stefan Costinean, Wendy Frankel, Anna Bratasz, Periannan Kuppusamy, Tsonvin Hai, Kalpana Ghoshal, and Samson T. Jacob

Précis: Results demonstrate the important protective role of metallothioneins as free radical scavengers during chemical carcinogen–induced liver cancer.

Transcriptional Control of the ERBB2 Amplicon by ERRα and PGC-1β Promotes Mammary Gland Tumorigenesis
Geneviève Deblois, Ghada Chahrour, Marie-Claude Perry, Guillaume Sylvain-Drolet, William J Muller, and Vincent Giguère

Précis: This study identifies two transcription factors that influence breast cancer etiology by coordinating the expression of genes located in the 17q12 region surrounding HER2.

CX-4945, an Orally Bioavailable Selective Inhibitor of Protein Kinase CK2, Inhibits Prosurvival and Angiogenic Signaling and Exhibits Antitumor Efficacy

Précis: Study offers preclinical validation of a first-in-class orally bioavailable inhibitor of the nononcogenic protein kinase CK2.

Zoledronic Acid Potentiates mTOR Inhibition and Abolishes the Resistance of Osteosarcoma Cells to RAD001 (Everolimus): Pivotal Role of the Prenylation Process
Gatien Moriceau, Benjamin Ory, Laura Mitrofan, Chiara Riganti, Frédéric Blanchard, Régis Brion, Céline Charrier, Séverine Battaglia, Paul Pilet, Marc G. Denis, Leonard D. Shultz, Jukka Mönkkönen, Françoise Rédimi, and Dominique Heymann

Précis: Combining inhibitors of the mTOR pathway with protein prenylation pathways such as zoledronate might markedly improve treatment of osteosarcoma, a highly aggressive disease.
**TUMOR AND STEM CELL BIOLOGY**

10340 Regulation of the Embryonic Morphogen Nodal by Notch4 Facilitates Manifestation of the Aggressive Melanoma Phenotype
Katharine M. Hardy, Dawn A. Kirschmann, Elisabeth A. Seftor, Naira V. Margaryan, Lynne-Marie Postovit, Luigi Strizzi, and Mary J.C. Hendrix

**Précis:** Findings define elements of a critical signaling pathway in development of metastastic melanoma that may be therapeutically tractable to disruption by Notch4 receptor antibodies.

10351 Combinatorial Regulation of Neuroblastoma Tumor Progression by N-Myc and Hypoxia Inducible Factor HIF-1α
Guoliang Qing, Nicolas Skuli, Patrick A. Mayes, Bruce Pawel, Daniel Martinez, John M. Maris, and M. Celeste Simon

**Précis:** Lactate dehydrogenase is defined as a metabolic weakness of N-Myc–amplified neuroblastoma, providing an attractive therapeutic target in this aggressive and poorly managed pediatric cancer.

10362 Mage-A Cancer/Testis Antigens Inhibit p53 Function by Blocking Its Interaction with Chromatin
Lynnette Marcar, Nicola J. MacLaine, Ted R. Hupp, and David W. Meek

**Précis:** Findings define a mechanism through which cells may gain metastastic capability by defeating p53 function, with implications for cancer immunotherapies that target MAGE antigens.

10371 Homeoprotein Six1 Increases TGF-β Type I Receptor and Converts TGF-β Signaling from Suppressive to Supportive for Tumor Growth
Douglas S. Micalizzi, Chu-An Wang, Susan M. Farabaugh, William P. Schiemann, and Heide L. Ford

**Précis:** A transcription factor that promotes epithelial-mesenchymal transition in breast cancer is shown to support metastastic properties by upregulating the type I receptor for TGF-β.

10381 p38 Kinase Is Crucial for Osteopontin-Induced Furin Expression That Supports Cervical Cancer Progression
Vinit Kumar, Reeti Behera, Kirti Lohite, Swapnil Karnik, and Gopal C Kundu

**Précis:** Mechanistic studies of the regulation of osteopontin, an important proinvasive cytokine in the tumor microenvironment, suggest novel approaches to combat cervical cancer.

10392 Paxillin Predicts Survival and Relapse in Non–Small Cell Lung Cancer by MicroRNA-218 Targeting
De-Wei Wu, Ya-Wen Cheng, John Wang, Chih-Yi Chen, and Huei Lee

**Précis:** Findings reveal how frequent misregulation of a miRNA-controlled cell adhesion pathway can contribute to poor clinical outcomes in lung cancer, with implications for new therapeutic targeting strategies.

10402 Role of Survivin in EGFR Inhibitor–Induced Apoptosis in Non–Small Cell Lung Cancers Positive for EGFR Mutations
Kunio Okamoto, Isamu Okamoto, Wataru Okamoto, Kaoru Tanaka, Ken Takezawa, Kyoko Kiyata, Haruka Yamaguchi, Kazuto Nishio, and Kazuhiro Nakagawa

**Précis:** Mechanistic findings define two critical pathways which are likely to sustain the survival of lung adenocarcinoma cells treated with EGFR kinase inhibitors, with implications for the design of combination drug therapies to be tested in clinic.

10411 CXCR4 Signaling Regulates Metastasis of Chemoresistant Melanoma Cells by a Lymphatic Metastatic Niche
Minah Kim, Young Jun Koh, Kyung Eun Kim, Bong Ilm Koh, Do-Hyun Nam, Kari Alitalo, Injune Kim, and Gou Young Koh

**Précis:** Lymphatic metastatic niches can support a distinct chemoresistant cell population in melanoma, suggesting new combinational drug strategies to improve melanoma therapy.

10422 p53 Dysfunction by Xeroderma Pigmentosum Group C Defects Enhance Lung Adenocarcinoma Metastasis via Increased Mmp1 Expression
Yi-Hui Wu, Tzu-Chin Wu, Jiunn-Wang Liao, Kun-Tu Yeh, Chih-Yi Chen, and Huei Lee

**Précis:** Findings define a mechanism of p53 dysfunction that can promote metastasis by directly altering expression of an extracellular matrix metalloprotease.
Coexpression of Oct4 and Nanog Enhances Malignancy in Lung Adenocarcinoma by Inducing Cancer Stem Cell–Like Properties and Epithelial–Mesenchymal Transdifferentiation
Shih-Hwa Chiou, Mong-Lien Wang, Yu-Ting Chou, Chi-Jen Chen, Chun-Fu Hong, Wang-Ju Hsieh, Hsin-Tzu Chang, Ying-Shan Chen, Tzu-Wei Lin, Han-Sui Hsu, and Cheng-Wen Wu

Précis: Findings establish roles for two central embryonic stemness factors in promoting lung cancer metastasis.

Cell Cycle Regulator ING4 Is a Suppressor of Melanoma Angiogenesis That Is Regulated by the Metastasis Suppressor BRMS1
Jun Li and Gang Li

Précis: Findings suggest that restoring the function of the ING4 tumor suppressor gene could not only block cell proliferation but also angiogenesis and metastasis of human melanoma.

Pierce1, a Novel p53 Target Gene Contributing to the Ultraviolet-Induced DNA Damage Response
Young Hoon Sung, Hye Jin Kim, Sushil Devkota, Jusik Roh, Jaeboom Lee, Kunsoo Rhee, Young Yil Bahk, and Han-Woong Lee


Retraction: Tripeptidyl-Peptidase II Controls DNA Damage Responses and In Vivo γ-Irradiation Resistance of Tumors
Rickard Glas, Alf Grandien, Steven Applequist, Brita Kunert, and Rajender Naredla

Acknowledgment to Reviewers

ABOUT THE COVER

Immunofluorescence analysis of Notch4 (red) and Nodal (green) in C8161 human metastatic melanoma cells reveals the expression of these proteins in a subpopulation of these aggressive cells in culture. An anti-pan-Cadherin antibody (pink) labels the cell membrane. Cell nuclei were counterstained with DAPI (blue). For details, see the article by Hardy and colleagues on page 10340 of this issue.
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