Breakings Advances

4563  Highlights from Recent Cancer Literature

Review

4565  Acvr1 Mutations in DIPG: Lessons Learned from FOP
      Kathryn R. Taylor, Maria Vinci, Alex N. Bullock, and Chris Jones

Physics in Cancer Research

4572  Introduction to Physics in Cancer Research
      Herbert Levine

4574  Toward Decoding the Principles of Cancer Metastasis Circuits
      Mingyang Lu, Mohit Kumar Jolly, Jose’ Onuchic, and Eshel Ben-Jacob

4588  Modeling Contact Guidance and Invasion by Cancer Cells
      Leonard M. Sander

4597  Force Engages Vinculin and Promotes Tumor Progression by Enhancing PI3K Activation of Phosphatidylinositol (3,4,5)-Triphosphate
      Matthew G. Rubashkin, Luke Cassereau, Russell Bainer, Christopher C. DuFort, Yoshihiro Yui, Guanqing Ou, Matthew J. Paszek, Michael W. Davidson, Yunn-Yi Chen, and Valerie M. Weaver

4612  Using High-Throughput Transcriptomic Data for Prognosis: A Critical Overview and Perspectives
      Eytan Domany

4622  Advanced Magnetic Resonance Imaging of the Physical Processes in Human Glioblastoma
      Jayashree Kalpathy-Cramer, Elizabeth R. Gerstner, Kyrre E. Emblem, Ovidiu C. Andronesi, and Bruce Rosen

4638  Diffusion-Weighted Imaging in Cancer: Physical Foundations and Applications of Restriction Spectrum Imaging

4653  Therapies with Diverse Mechanisms of Action Kill Cells by a Similar Exponential Process in Advanced Cancers
      Krastan B. Blagoev, Julia Wilkerson, Wilfred D. Stein, James Yang, Susan E. Bates, and Tito Fojo

4663  Resistance to Chemotherapy: Patient Variability and Cellular Heterogeneity
      David A. Kessler, Robert H. Austin, and Herbert Levine

Meeting Report

4671  Mouse Models of Human Cancer
      Barbara C. Böck, Ulrike Stein, Clemens A. Schmitt, and Hellmut G. Augustin

Priority Report

4676  Kinase Domain Activation of FGFR2 Yields High-Grade Lung Adenocarcinoma Sensitive to a Pan-FGFR Inhibitor in a Mouse Model of NSCLC

Notes: In developing a unique mouse model of lung adenocarcinoma, this study may improve what have been limited opportunities for preclinical drug discovery and development in this setting.
INTEGRATED SYSTEMS AND TECHNOLOGIES

4685  Polarization-Sensitive Multimodal Imaging for Detecting Breast Cancer
Rakesh Patel, Ashraf Khan, Robert Quinlan, and Anna N. Yaroslavsky

Précis: This study describes a novel noninvasive imaging method that allows for rapid and accurate intraoperative detection of breast cancer margins.

4694  A Search for Novel Cancer/Testis Antigens in Lung Cancer Identifies Vcx/Y Genes, Expanding the Repertoire of Potential Immunotherapeutic Targets
Ayumu Taguchi, Allen D. Taylor, Jaime Rodriguez, Muğe Celiktaş, Hui Liu, Xiaotu Ma, Qing Zhang, Chee-Hong Wong, Alice Chin, Luc Girard, Carmen Behrens, Wan L. Lam, Stephen Lam, John D. Minna, Ignacio I. Wistuba, Adi F. Gazdar, and Samir M. Hanash

Précis: These results offer preclinical proof-of-concept for an Hsp70 regulatory complex as an appealing anticancer target for the generalized treatment of human malignancy.

MICROENVIRONMENT AND IMMUNOLOGY

4706  Osteopontin Shapes Immunosuppression in the Metastatic Niche
Sabina Sangaletti, Claudio Tripodo, Sara Sandri, Ilaria Torselli, Caterina Vitali, Chiara Ratti, Laura Botti, Alessia Burocchi, Rossana Porcasi, Andrea Tomirotti, Mario P. Colombo, and Claudia Chiodoni

Précis: Activities of a prometastatic molecule appear to differ to some extent when produced by tumor cells versus host immune cells however, from either source it helps establish local immunosuppression within metastatic sites.

4720  IL-1β-Mediated Repression of microRNA-101 Is Crucial for Inflammation-Promoted Lung Tumorigenesis
Lin Wang, Ling-Fei Zhang, Jing Wu, Shu-Jun Xu, Yang-Yang Xu, Dangsheng Li, Jia-Tao Lou, and Mo-Fang Liu

Précis: microRNA-101 provides a molecular connection between pathogenic inflammation and lung tumorigenesis by regulating Lin28B, an oncogenic RNA-binding protein with pleiotropic roles in cancer including stem-like cell function.

MOLECULAR AND CELLULAR PATHOBIOLOGY

4731  Hsp70–Bag3 Interactions Regulate Cancer-Related Signaling Networks

Précis: These studies confirm the suspicion that prospects for effective immunotherapy are far more likely to emerge from targeting multiple tumor antigens than single tumor antigens.

4741  NACK Is an Integral Component of the Notch Transcriptional Activation Complex and Is Critical for Development and Tumorigenesis
Kelly L. Weaver, Marie-Clotilde Alves-Guerra, Ke Jin, Zhiqiang Wang, Xiaojing Han, Prathibha Ranganathan, Xiaoxia Zhu, Thiago DaSilva, Wei Liu, Francesca Ratti, Renee M. Demarest, Cristos Tzimas, Meghan Rice, Rodrigo Vazquez-Del Carpio, Nadia Dahmane, David J. Robbins, and Anthony J. Capobianco

Précis: This study illuminates a novel critical part of the Notch receptor signaling pathway, which has emerged as an important driver of a variety of aggressive human cancers.

THERAPEUTICS, TARGETS, AND CHEMICAL BIOLOGY

4752  Antitumor Effects in Hepatocarcinoma of Isoform-Selective Inhibition of HDAC2
Yun-Han Lee, Daekwan Lee, Kunho-Yu Choi, Jesper B. Andersen, Min-Ah Won, Mitsuteru Kitade, Luis E. Gomez-Quiroz, Adam D. Judge, Jens U. Marquardt, Chiara Ratti, Elizabeth A. Conner, Ian MacLachlan, Valentina M. Factor, and Snorri S. Thorgeirsson

Précis: Systemic inactivation of a disease-specific HDAC isoform can achieve therapeutic efficacy, as shown by this preclinical proof-of-concept study for treatment of liver cancer.

4762  Combined SFK/mTOR Inhibition Prevents Rapamycin-Induced Feedback Activation of AKT and Elicits Efficient Tumor Regression
Jennifer L. Yori, Kristen L. Lozada, Darcie D. Seachrist, Jonathan D. Mosley, Fadi W. Abdul-Karim, Christine N. Booth, Chris A. Flask, and Ruth A. Keri

Précis: Results from this combination therapy study may help improve the mainly inefficacious effects of mTOR inhibitors in clinical trials, addressing the weaknesses of an erstwhile general approach to cancer cell eradication.
Immediate Utility of Two Approved Agents to Target Both the Metabolic Mevalonate Pathway and Its Restorative Feedback Loop
Aleksandra Pandya, Peter J. Mullen, Manpreet Kalkat, Rosemary Yu, Janice T. Pong, Zhihua Li, Suzanne Trudel, Karl S. Lang, Mark D. Minden, Aaron D. Schimmer, and Linda Z. Penn

**Précis**: This article provides an excellent illustration of polypharmacology discovery by tapping the existing armamentarium of approved drugs to identify immediately tractable new experimental therapies for clinical evaluation.

AMPK Reverses the Mesenchymal Phenotype of Cancer Cells by Targeting the Akt–MDM2–Foxo3a Signaling Axis
Chih-Chien Chou, Kuen-Haur Lee, I-Lu Lai, Dasheng Wang, Xiaokui Mo, Samuel K. Kulp, Charles L. Shapiro, and Ching-Shih Chen

**Précis**: This work illuminates a mechanism of EMT limitation in cancer cells, along with preclinical support for a tractable therapeutic strategy to reverse mesenchymal phenotypes associated with invasion and metastasis.

Neuronal Pentraxin 2 Supports Clear Cell Renal Cell Carcinoma by Activating the AMPA-Selective Glutamate Receptor-4
Christina A. von Roemeling, Derek C. Radisky, Laura A. Marlow, Simon J. Cooper, Stefan K. Grebe, Panagiotis Z. Anastasiadis, Han W. Tun, and John A. Copland

**Précis**: A secreted protein exclusively studied in the context of neuronal cell function appears to act through a calcium signaling pathway to support the pathogenicity of deadly kidney cancers, with immediate implications for a possible clinical treatment strategy.

Pyrvinium Attenuates Hedgehog Signaling Downstream of Smoothened
Bin Li, Dennis Liang Fei, Colin A. Flaveny, Nadia Dahmane, Valerie Baubet, Zhiqiang Wang, Feng Bai, Xin-Hai Pei, Jezabel Rodriguez-Blanco, Brian Hang, Darren Orton, Lu Han, Baolin Wang, Anthony J. Capobianco, Ethan Lee, and David J. Robbins

**Précis**: An FDA-approved pinworm drug with potent activity as a casein kinase-1α agonist is found to robustly inhibit Hedgehog signaling in tumors, including those resistant to existing Hedgehog pathway inhibitors, with immediate implications for clinical testing.

**TUMOR AND STEM CELL BIOLOGY**

Chromosomal Instability Selects Gene Copy-Number Variants Encoding Core Regulators of Proliferation in ER− Breast Cancer
David Endesfelder, Rebecca A. Burrell, Nnennaya Kanu, Nicholas McGranahan, Mike Howell, Peter J. Parker, Julian Downing, Charles Swanton, and Maik Kschischo

**Précis**: Chromosomal instability, a hallmark of cancer cells, permits a selection for gene copy number alternations in core regulators of proliferation that have prognostic value.
Epigenetic States of Cells of Origin and Tumor Evolution Drive Tumor-Initiating Cell Phenotype and Tumor Heterogeneity

Précis: This study probes the sources of tumor heterogeneity, a core research challenge that—despite its recognition by clinical pathologists for many years and its recent rediscovery by molecular geneticists—still represents the chief weakness of all cancer cell-targeted therapeutic strategies.

TRIM29 Suppresses TWIST1 and Invasive Breast Cancer Behavior

Précis: TRIM29 exerts complex roles in cancer, but in breast cancer it appears to function as a tumor suppressor by suppressing a core regulator of the epithelial–mesenchymal transition, a pivotal step in driving invasive and metastatic behavior.

TRIB1 Supports Prostate Tumorigenesis and Tumor-Propagating Cell Survival by Regulation of Endoplasmic Reticulum Chaperone Expression

Précis: Prostate cancer stem-like cells appear to be addicted to oncogenic signals from an endoplasmic reticulum-dependent stress response pathway, a finding with potential therapeutic implications.

IDH1 R132H Mutation Generates a Distinct Phospholipid Metabolite Profile in Glioma

Précis: This study reports novel noninvasive biomarkers of IDH-mutant gliomas that may help to guide treatments to target aberrant metabolism in these aggressive brain tumors.

IL15RA Drives Antagonistic Mechanisms of Cancer Development and Immune Control in Lymphocyte-Enriched Triple-Negative Breast Cancers

Précis: Expression of an immune memory-inducing receptor in some triple-negative breast cancers, usually only expressed by T cells, may offer a mechanistic explanation for the paradoxical association of some of these high-grade tumors with better survival outcomes.

Epigenetic Targeting of Ovarian Cancer Stem Cells

Précis: These results suggest that epigenome-targeting strategies can reprogram residual cancer stem-like cells to a differentiated state, thereby helping prevent the development of recurrent, chemoresistant disease.

Live-Cell Imaging of Invasion and Intravasation in an Artificial Microvessel Platform

Précis: An artificial microvessel platform can be used to obtain striking images and mechanistic insights into how cancer cells invade the local microenvironment and enter and exit vessels, providing a new tool to help unravel the complexities of metastasis and its prevention and treatment.

LETTERS TO THE EDITOR

A Synthetic Lethality-Based Strategy to Treat Cancers Harboring a Genetic Deficiency in the Chromatin Remodeling Factor BRG1—Letter

Proposal for a Synthetic Lethality Therapy Using the Paralog Dependence of Cancer Cells—Response
Correction: The TGFβ–miR200–Mig6 Pathway Orchestrates the EMT-Associated Kinase Switch That Induces Resistance to EGFR Inhibitors

Correction: Chk2 Phosphorylation of Survivin-ΔEx3 Contributes to a DNA Damage-Sensing Checkpoint in Cancer

ABOUT THE COVER

Confocal microscopy analysis for osteopontin performed on myeloid-derived suppressor cells (MDSC) shows osteopontin (red) localized under the cellular membrane but not colocalized with the ER marker concanavalin A (green) in MDSC. This picture is suggestive of the existence of an intracellular form, rather than a secreted form of osteopontin, in MDSC. For details, see article by S. Sangaletti and colleagues on page 4706.