BREAKING ADVANCES

905 Highlights from Recent Cancer Literature

REVIEWS

907 Heat Shock Factor 1 in Protein Homeostasis and Oncogenic Signal Integration
Trisha Home, Roy A. Jensen, and Rekha Rao

913 “(Not) All (Dead) Things Share the Same Breath”: Identification of Cell Death Mechanisms in Anticancer Therapy
Santiago Rello-Varona, David Herrero-Martín, Roser López-Alemany, Cristina Muñoz-Pinedo, and Oscar M. Tirado

PERSPECTIVE

918 Toward a Science of Tumor Forecasting for Clinical Oncology
Thomas E. Yankeelov, Vito Quaranta, Katherine J. Evans, and Erin C. Rericha

MEETING REPORT

924 Cancer Stem Cells: Targeting the Roots of Cancer, Seeds of Metastasis, and Sources of Therapy Resistance
Valery Adorno-Cruz, Golam Kibria, Xia Liu, Mary Doherty, Damien J. Junk, Dongxin Guan, Chris Hubert, Monica Venere, Erin Mulkearns-Hubert, Maksim Sinyuk, Alvaro Alvarado, Arnold I. Caplan, Jeremy Rich, Stanton L. Gerson, Justin Lathia, and Huiping Liu

INTEGRATED SYSTEMS AND TECHNOLOGIES

930 Emergence of Drug Tolerance in Cancer Cell Populations: An Evolutionary Outcome of Selection, Nongenetic Instability, and Stress-Induced Adaptation
Rebecca H. Chisholm, Tommaso Lorenzi, Alexander Lorz, Annette K. Larsen, Luís Neves de Almeida, Alexandre Escargueil, and Jean Clairambault

PRÉCIS: This study provides a new perspective on the inherent risks of interventional chemotherapy in cancer patients by showing how the adaption of unstable cell populations exposed to antiproliferative drugs can be acted upon by selective forces that drive the outgrowth of rapidly proliferative drug-resistant cell populations.

940 Cell Division Patterns in Acute Myeloid Leukemia Stem-like Cells Determine Clinical Course: A Model to Predict Patient Survival
Thomas Stiehl, Natalia Baran, Anthony D. Ho, and Anna Marciniak-Czochra

PRÉCIS: The dynamic behavior of stem-like cells in leukemia has a greater impact on clinical course than the behavior of non-stem-like cells, permitting the design of a mathematical model to stratify risks contributing to survival outcomes.

MICROENVIRONMENT AND IMMUNOLOGY

950 CSF1 Receptor Targeting in Prostate Cancer Reverses Macrophage-Mediated Resistance to Androgen Blockade Therapy
Jemima Escamilla, Shinuyeh Schokrpur, Connie Liu, Saul J. Priceman, Diana Moughon, Ziyue Jiang, Frederic Pouliot, Clara Magyar, James L. Sung, Jingying Xu, Gang Deng, Brian L. West, Gideon Bollag, Yves Fradet, Louis Lacombe, Michael E. Jung, Jiaoti Huang, and Lily Wu

PRÉCIS: Modulating the function of tumor-associated macrophages can leverage androgen blockade therapy in prostate cancer and may improve long-term treatment outcomes in patients.
Tumor-Derived Osteopontin Reprograms Normal Mammary Fibroblasts to Promote Inflammation and Tumor Growth in Breast Cancer
Yoray Sharon, Yael Raz, Noam Cohen, Amir Ben-Shmuel, Hila Schwartz, Tamar Geiger, and Neta Erez

Précis: These findings deepen the causative influence of a proinflammatory protein secreted by breast carcinoma cells in programming a supportive role for fibroblasts in the tumor microenvironment, with implications for understanding the etiology of advanced cancer and its therapeutic management by renormalization of the tissue microenvironment.

RAGE Mediates S100A7-Induced Breast Cancer Growth and Metastasis by Modulating the Tumor Microenvironment
Mohd W. Nasser, Nissar Ahmad Wani, Dinesh K. Ahirwar, Catherine A. Powell, Janani Ravi, Mohamad Elbaz, Helong Zhao, Laura Padilla, Xiaoli Zhang, Konstantin Shilo, Michael Ostrowski, Charles Shapiro, William E. Carson III, and Ramesh K. Ganju

Précis: A signaling axis that conditions the inflammatory microenvironment in breast cancer helps drive the aggressive growth of these tumors, including deadly triple-negative tumors that occur more commonly in premenopausal women.

TLR2 Limits Development of Hepatocellular Carcinoma by Reducing IL18-Mediated Immunosuppression
Shinan Li, Rui Sun, Yongyan Chen, Haiming Wei, and Zhigang Tian

Précis: These findings illuminate a mechanism of immunosuppression in liver carcinogenesis that may assist the design of effective immunotherapies to treat hepatocellular carcinoma.

Carbonic Anhydrase IX Promotes Myeloid-Derived Suppressor Cell Mobilization and Establishment of a Metastatic Niche by Stimulating G-CSF Production
Shawn C. Chafe, Yuanmei Lou, Jaclyn Scenery, Marylou Vallejo, Melissa J. Hamilton, Paul C. McDonald, Kevin L. Bennewith, Andreas Möller, and Shoukat Dedhar

Précis: Targeting the function of CAIX, an enzyme that is upregulated by hypoxia in the primary tumor, affects the mobilization of immunosuppressive myeloid cells that promote metastasis.

β-Arrestin-1 Mediates Nicotine-Induced Metastasis through E2F1 Target Genes That Modulate Epithelial–Mesenchymal Transition
Smitha Pillai, Jose Trevino, Bhupendra Rawal, Sandeep Singh, Michelle Kovacs, Xueli Li, Michael Schell, Eric Haura, Gerald Bepler, and Srikrumar Cheilappan

Précis: These important results show how nicotine promotes the metastatic progression of pulmonary lesions initiated by carcinogens found in cigarette smoke, deepening insights into how lung cancers are caused by smoking.

Coordinate Loss of MAP3K7 and CHD1 Promotes Aggressive Prostate Cancer

Précis: This study addresses the major gap in information concerning molecular subtypes of aggressive prostate cancer, where insights might help direct the development of more effective prognostic and therapeutic tools.

ERBB3-Independent Activation of the PI3K Pathway in EGFR-Mutant Lung Adenocarcinomas
Xiaoling Song, Pang-Dian Fan, Amlak Bantikasseg, Udayan Guha, David W. Threadgill, Harold Varmus, and Katerina Politi

Précis: Activation of the PI3K pathway in EGFR mutant lung cancer cells is maintained even in the absence of the EGFR heterodimerization partner ERBB3, challenging the current thinking that ERBB3 is the main activator of PI3K in this disease setting.

Interferon Regulatory Factor-1 Signaling Regulates the Switch between Autophagy and Apoptosis to Determine Breast Cancer Cell Fate

Précis: This study identifies a novel signaling axis that modulates responsiveness to antiestrogen drugs in human breast cancer, with implications for improving patient survival.
1056 Starvation Promotes REV1 SUMOylation and p53-Dependent Sensitization of Melanoma and Breast Cancer Cells
Hong Seok Shim, Min Wei, Sebastian Brandhorst, and Valter D. Longo
Précis: These findings suggest how dietary fasting may offer a nontoxic strategy to increase the efficacy of cytotoxic therapies that act in part by activating p53.

1068 Tumorigenic Activity of Merkel Cell Polyomavirus T Antigens Expressed in the Stratified Epithelium of Mice
Megan E. Spurgeon, Jingwei Cheng, Roderick T. Bronson, Paul F. Lambert, and James A. DeCaprio
Précis: Use of a new mouse model of Merkel cell polyomavirus-associated tumorigenesis provides deeper insights into how viral tumor antigens alter the cellular microenvironment in vivo, with potential relevance to various human cancers that involve virus infection.

1080 Targeting LUNX Inhibits Non–Small Cell Lung Cancer Growth and Metastasis
Xiaohu Zheng, Min Cheng, Binqing Fu, Xiaolei Fan, Qing Wang, Xiaqing Yu, Rui Sun, Zhigang Tian, and Haiming Wei
Précis: These results offer preclinical proof of concept for a candidate immunotherapy target in non–small cell lung cancers.

1091 Genetic Events That Limit the Efficacy of MEK and RTK Inhibitor Therapies in a Mouse Model of KRAS-Driven Pancreatic Cancer
Précis: Understanding the activation status of various oncogenic drivers as they exist in specific treatment contexts in vivo may be important to achieve beneficial outcomes, increasing the complexity in how to use targeted drugs that were designed only with cancer cells in mind.

1102 Genetic and Pharmacologic Inhibition of eIF4E Reduces Breast Cancer Cell Migration, Invasion, and Metastasis
Filippa Pettersson, Sonia V. del Rincon, Audrey Emond, Bonnie Huo, Elaine Ngan, Jonathan Ng, Monica C. Doboscan, Peter M. Siegel, and Wilson H. Miller Jr
Précis: These findings offer a powerful rationale to broaden the clinical evaluation of ribavirin, a small molecule inhibitor of the translation initiation factor eIF4E currently being tested in leukemia patients, as a strategy to treat advanced solid tumors such as metastatic breast cancer in which eIF4E is commonly overexpressed.

TUMOR AND STEM CELL BIOLOGY

1113 Constitutive Activation of Myosin-Dependent Contractility Sensitizes Glioma-Tumor-Initiating Cells to Mechanical Inputs and Reduces Tissue Invasion
Sophie Y. Wong, Theresa A. Ulrich, Loic P. Deleyrolle, Joanna L. MacKay, Jung-Ming G. Lin, Regina T. Martussello, Musa A. Jundi, Brent A. Reynolds, and Sanjay Kumar
Précis: Because recurrences of brain cancer are tied to local invasion of tumor cells, strategies to restrict the motility of stem-like cells by increasing their cellular contractility may help limit relapses and prolong survival.

1123 miR340 Suppresses the Stem-like Cell Function of Glioma-Initiating Cells by Targeting Tissue Plasminogen Activator
Daisuke Yamashita, Toru Kondo, Shiro Ohue, Hisaaki Takahashi, Madoka Ishikawa, Ryo Matoba, Satoshi Suehiro, Shohei Kohno, Hiroubu Harada, Junya Tanaka, and Takayori Ohnishi
Précis: A tumor suppressor gene that functions in glioma stem-like cells acts to inhibit their expression of tissue plasminogen activator, with the provocative implication that targeting this central coagulation factor may ablate cancer stem-like functions in the brain.

1134 Host Age Is a Systemic Regulator of Gene Expression Impacting Cancer Progression
Afshin Behesht, Sébastien Benzekery, J. Tyson McDonald, Lili Ma, Michael Peluso, Philip Hahnfeldt, and Lynn Hlatky
Précis: This study offers direct support for age dependence in determining the host tumor control dynamic and provides initial mechanism-based insights into how aging modulates tumor progression in ways that may be actionable for therapy or prevention.
p21 Ablation in Liver Enhances DNA Damage, Cholestasis, and Carcinogenesis
Haksier Ehedego, Mark V. Boekschoten, Wei Hu, Carina Doler, Johannes Haybaeck, Nikolaus Gaßler, Michael Müller, Christian Liedtke, and Christian Trautwein
Précis: These findings illuminate the ways in which loss of the NF-κB pathway regulator NEMO (also known as IKKγ) promotes liver inflammation and carcinogenesis by elevating p21, which acts in this setting to protect against the generation of DNA damage that contributes to chronic hepatitis and hepatocarcinoma formation in patients.

LETTERS TO THE EDITOR

Bufalin Is a Steroid Receptor Coactivator Inhibitor—Letter
José Manuel Calderón-Montaño, Estefanía Burgos-Morón, Manuel Luís Orta, Irene García-Domínguez, Dolores Maldonado-Navas, and Miguel López-Lázaro

Bufalin Is a Steroid Receptor Coactivator Inhibitor—Response
David M. Lonard, Jianming Xu, and Bert W. O’Malley

ABOUT THE COVER

miR340 is a tumor suppressor whose overexpression in human glioma-initiating cells (GIC) inhibits their proliferation, invasive, and migratory properties. Transplantation of miR340-overexpressed GICs in NOD/SCID mouse brains completely suppressed the tumor formation of malignant gliomas. Among factors related to antitumorigenesis, the transplanted GICs with miR340 overexpression showed a positive immunostain for an active form of caspase-3 in the early stage of transplantation, suggesting that antitumorigenic activity of miR340 in GICs may be due to tumor cell apoptosis. For details, see the article by Yamashita and colleagues on page 1123.
Cancer Research

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