### Breaking Advances

#### Highlights from Recent Cancer Literature

1509

### Reviews

#### Ironing Out Cancer

1511
Suzy V. Torti and Frank M. Torti

#### p95HER2 and Breast Cancer

1515
Joaquín Arribas, José Baselga, Kim Pedersen, and Josep Lluís Parra-Palau

### Priority Reports

#### Anti-DLL4 Inhibits Growth and Reduces Tumor-Initiating Cell Frequency in Colorectal Tumors with Oncogenic KRAS Mutations

1520
Marcus Fischer, Wan-Ching Yen, Ann M. Kapoun, Min Wang, Gilbert O'Young, John Lewicki, Austin Gurney, and Timothy Hoey

**Précis:** Findings provide a preclinical rationale for clinical targeting of a Notch receptor ligand to improve treatment of colon cancers with oncogenic KRAS mutations, which are refractory to existing treatments.

#### Detection of Circulating Tumor Cells in Human Peripheral Blood Using Surface-Enhanced Raman Scattering Nanoparticles

1526
Xu Wang, Ximei Qian, Jonathan J. Beitler, Zhuo Georgia Chen, Fadlo R. Khuri, Melinda M. Lewis, Hyung Ju C. Shin, Shuming Nie, and Dong M. Shin

**Précis:** This study reports a rapid, simple, and inexpensive assay to detect cancer cells in blood, offering a potentially important tool for clinical management of cancer and cancer relapse.

### Microenvironment and Immunology

#### Increased Efficacy of Breast Cancer Chemotherapy in Thrombocytopenic Mice

1540
Mélanie Demers, Benoit Ho-Tin-Noé, Daphne Schatzberg, Janie J. Yang, and Denisa D. Wagner

**Précis:** Depleting platelets in tumor-bearing mice preferentially increases the leakiness of the tumor vasculature, leveraging the efficacy of administered chemotherapies without worsening toxic side effects.

#### Gap Junction–Mediated Import of MicroRNA from Bone Marrow Stromal Cells Can Elicit Cell Cycle Quiescence in Breast Cancer Cells

1550
Philip K. Lim, Sarah A. Bliss, Shyam A. Patel, Marcelo Taborga, Meneka A. Dave, Larissa A. Gregory, Steven J. Greco, Margarette Bryan, Prem S. Patel, and Pranela Rameshwar

**Précis:** Cellular exchange of microRNAs is emerging as a fascinating new mechanism by which tumor stromal cells can influence the tumor cell pathophysiology.

#### LOXL2-Mediated Matrix Remodeling in Metastasis and Mammary Gland Involution

1561
Holly E. Barker, Joan Chang, Thomas R. Cox, Georgina Lang, Demelza Bird, Monica Nicolau, Holly R. Evans, Alison Gartland, and Janine T. Erler

**Précis:** Findings offer preclinical evidence that breast cancer metastasis can be blocked by targeting an important oxidase in the tumor microenvironment.
Reduced VEGF Production, Angiogenesis, and Vascular Regrowth Contribute to the Antitumor Properties of Dual mTORC1/mTORC2 Inhibitors
Beverly L. Falcon, Sharon Barr, Prafulla C. Gokhale, Jeyling Chou, Jennifer Fogarty, Philippe Depeille, Mark Miglarese, David M. Epstein, and Donald M. McDonald

Précis: Small molecule inhibitors now in clinical development to block both mTORC kinases can leverage the antiangiogenic actions of VEGF inhibitors.

Stromal Deletion of the APC Tumor Suppressor in Mice Triggers Development of Endometrial Cancer
Pradeep S. Tanwar, LiHua Zhang, Drucilla J. Roberts, and Jose M. Teixeira

Précis: This interesting mouse model study suggests that tumor suppressor alterations in stromal tissue may be sufficient to drive progression of some types of cancer.

Natural Killer Cells Efficiently Reject Lymphoma Silenced for the Endoplasmic Reticulum Aminopeptidase Associated with Antigen Processing
Loredana Cifaldi, Elisa Lo Monaco, Matteo Forloni, Ezio Giorda, Silvia Lorenzi, Stefania Petrini, Elisa Tremante, Daniela Pende, Franco Locatelli, Patrizio Giacomini, and Doriana Fruci

Précis: Findings highlight a novel immunotherapeutic target that is tractable for small molecule inhibition and that could be broadly relevant to many types of human cancer.

TLR3 as a Biomarker for the Therapeutic Efficacy of Double-stranded RNA in Breast Cancer
Bruno Salaun, Laurence Zitvogel, Carine Asselin-Paturel, Yannis Morel, Karine Chemin, Clarisse Dubois, Catherine Massacrier, Rosa Conforti, Marie Pierre Chenard, Jean-Christophe Sabourin, Aicha Goubar, Serge Lebecque, Michel Pierres, Donata Rimoldi, Pedro Romero, and Fabrice Andre

Précis: Toll receptors that control innate immune response are not only expressed by immune cells but also by many human cancer cells, which might be targeted directly by Toll receptor agonists in certain disease settings.

Novel Role for STAT3 in Transcriptional Regulation of NK Immune Cell Targeting Receptor MICA on Cancer Cells
Romain Bedel, Antoine Thiery-Vuillemin, Camille Grandelment, Jeremy Ballard, Jean-Paul Remy-Martin, Bernadette Kantelip, Jean-Rene Pallandre, Xavier Pivot, Christophe Ferrand, Pierre Tiberghien, and Christophe Borg

Précis: Findings reveal a novel mechanism by which STAT3 modulates immunosurveillance by NK immune cells, by repressing the expression of a key NK cell recognition molecule on cancer cells.

Mast Cell 5-Lipoxygenase Activity Promotes Intestinal Polyposis in APC<sup>D468</sup> Mice
Eric C. Cheon, Khashayarsha Khazaie, Mohammad W. Khan, Matthew J. Strouch, Seth B. Krantz, Joseph Phillips, Nichole R. Blatner, Laura M. Hix, Ming Zhang, Kristen L. Dennis, Mohammd R. Salabat, Michael Heiferman, Paul J. Gripp, Hidayatullah G. Munshi, Elias Gounaris, and David J. Bentrem

Précis: Findings suggest that the established role of arachidonic acid biosynthesis in colon tumorigenesis may be driven to a large degree from mast cells that support myeloid-derived suppressor cells, an important component of the tumor microenvironment thought to drive immune escape.

Peroxiredoxin 1 Controls Prostate Cancer Growth through Toll-Like Receptor 4–Dependent Regulation of Tumor Vasculature
Jonah R. Riddell, Wiam Bshara, Michael T. Moser, Joseph A. Sperrnyak, Barbara A. Foster, and Sandra O. Gollnick

Précis: This study defines a tumor-derived inducer of inflammation that provides an important mechanistic link between chronic inflammation and prostate carcinogenesis.

The HIF-1–Inducible Lysyl Oxidase Activates HIF-1 via the Akt Pathway in a Positive Regulation Loop and Synergizes with HIF-1 in Promoting Tumor Cell Growth
Floriane Pez, Frédéric Dayan, Jérome Durivault, Bastien Kaniewski, Géraldine Aimon, Gabrielle S. Le Provost, Blainde Deux, Philippe Clézardin, Pascal Sommer, Jacques Pouysségur, and Caroline Reynaud

Précis: Findings reveal a regulatory cycle that can act synergistically to favor cancer cell proliferation in hypoxic tumor microenvironments.
The Role of Calcium in the Activation of Estrogen Receptor-Alpha
Shailaja D. Divekar, Geoffrey B. Storchman, Katherine Sperle, David J. Veselik, Earl Johnson, Sivanesan Dakshanamurthy, Yuse N. Lajiminmuhip, Rebecca E. Nakles, Li Huang, and Mary Beth Martin

Precis: Results shed light on potentially important mechanisms involved in estrogen mimicry at the estrogen receptor-alpha, with implications for understanding breast cancer risk and the development of novel therapeutics for treatment of endocrine independent breast cancer.

Ulcereative Colitis–Associated Colorectal Cancer Arises in a Field of Short Telomeres, Senescence, and Inflammation
Rosa Ana Risques, Lisa A. Lai, Cigdem Himmetoglu, Anoosheh Ebaee, Lin Li, Ziding Feng, Mary P. Bronner, Bassel Al-Lahham, Kris V. Kowdley, Keith D. Lindor, Peter S. Rabinovitch, and Teresa A. Brentnall

Precis: In patients with ulcerative colitis, cell senescence acts as a tumor suppressor mechanism that is abrogated during the transition from low-grade to high-grade dysplasia.

MicroRNAs miR-199a-5p and -3p Target the Brm Subunit of SWI/SNF to Generate a Double-Negative Feedback Loop in a Variety of Human Cancers
Kouhei Sakurai, Chihiro Furukawa, Takeshi Haraguchi, Ken-ichi Inada, Kazuya Shiogama, Takanobu Tagawa, Shuji Fujita, Yoshihito Ueno, Aya Ogata, Mai Ito, Yutaka Tsutsumi, and Hideo Iba

Precis: Findings describe an microRNA-based mechanism constituting a double feedback loop for control of a pivotal chromatin remodeling factor in cancer cells.

Cyclin D1 Inhibits Mitochondrial Activity in B Cells
Guergana Tchakarska, Mikel Roussel, Xavier Troussard, and Brigitte Sola

Precis: Results identify a new function of cyclin D1 that could help explain its important pathophysiological roles in lymphomas and solid tumors.

Select Heterozygous Keap1 Mutations Have a Dominant-Negative Effect on Wild-Type Keap1 In Vivo
Takafumi Suzuki, Jonathan Maher, and Masayuki Yamamoto

Precis: A single-hit mutation in Keap1, a key regulator of the important cytoprotective gene Nrf2, is sufficient to generate a selective advantage in the cancer microenvironment.

Cancer Causes Cardiac Atrophy and Autophagy in a Sexually Dimorphic Manner
Pippa F. Cosper and Leslie A. Leinwand

Precis: Findings reveal the mechanisms of cancer-induced cardiac atrophy, which are distinct from skeletal muscle and exhibit sex differences.

Rho Kinase Phosphorylation Promotes Earrin-Mediated Metastasis in Hepatocellular Carcinoma
Yong Chen, Dongmei Wang, Zhen Guo, Jun Zhao, Bing Wu, Hui Deng, Ti Zhou, Hongjun Xiang, Fei Gao, Xue Yu, Jian Liao, Tarsha Ward, Peng Xia, Chibuzo Emenari, Xia Ding, Winston Thompson, Kelong Ma, Jingde Zhu, Felix Alkhionbare, Kefen Dou, Shi-Yuan Cheng, and Xuebiao Yao

Precis: This study reveals an important mechanistic linkage in metastasis of liver cancers, with potential therapeutic implications.

An EGFR–Src–Arg–Cortactin Pathway Mediates Functional Maturation of Invadopodia and Breast Cancer Cell Invasion
Christopher C. Mader, Matthew Oser, Marco A. O. Magalhaes, Jose Javier Bravo-Cordero, John Condeelis, Anthony J. Koleske, and Hava Gil-Henn

Precis: Findings define an Abl-related tyrosine kinase in a mechanism of breast cancer invasion that is mediated by invadopodia maturation and function.

Steroid Receptor Coactivator-1 Upregulates Integrin α5 Expression to Promote Breast Cancer Cell Adhesion and Migration
Li Qin, Xian Chen, Yelin Wu, Zhen Feng, Tao He, Li Wang, Lan Liao, and Jianming Xu

Precis: Findings suggest a mechanism through which a transcriptional coactivator can promote invasive progression in breast cancers, where it has been implicated as a marker of poor prognosis.

Epigenetic Silencing Mediated through Activated PI3K/AKT Signaling in Breast Cancer
Tao Zuo, Ta-Ming Liu, Xun Lan, Yu-I Weng, Rulong Shen, Fei Gu, Yi-Wen Huang, Sandy Liyanarachchi, Daniel E. Deatherage, Pei-Yin Hsu, Cenny Taslim, Bhuvaneswari Ramaswamy, Charles L. Shapiro, Huey-Jen L. Lin, Alfred S. L. Cheng, Victor X. Jin, and Tim H.-M. Huang

Precis: Combination therapy targeting PI3K/AKT signaling and DNA methylation can effectively reactivate epigenetically silenced genes and slow tumor progression.
**Prevention and Epidemiology**

1763

**Long-term Use of Cholesterol-Lowering Drugs and Cancer Incidence in a Large United States Cohort**
Eric J. Jacobs, Christina C. Newton, Michael J. Thun, and Susan M. Gapstur

**Précis:** In this large prospective study, long-term use of cholesterol-lowering drugs was associated with lower risk of melanoma, endometrial cancer, and non-Hodgkin lymphoma.

1816

**Discovery of DNA Repair Inhibitors by Combinatorial Library Profiling**
Benjamin J. Moeller, Richard L. Sidman, Renata Pasqualini, and Wadieh Arap

**Précis:** Combinatorial profiling of double-strand DNA break repair machinery yields peptides capable of modulating DNA repair phenotypes and sensitizing tumor cells to genotoxic therapy.

**Therapeutics, Targets, and Chemical Biology**

1772

**Using a Stem Cell–Based Signature to Guide Therapeutic Selection in Cancer**
Igor Shats, Michael L. Gatza, Jeffrey T. Chang, Seiichi Mori, Jialiang Wang, Jeremy Rich, and Joseph R. Nevins

**Précis:** Findings suggest strategies for therapeutic targeting of a stem-like phenotype in a relevant cohort of cancer patients.

1825

**CNT1 Expression Influences Proliferation and Chemosensitivity in Drug-Resistant Pancreatic Cancer Cells**
Yangzom D. Bhutia, Sau Wai Hung, Bhavi Patel, Dylan Lovin and Rajgopal Govindarajan

**Précis:** Findings suggest an effective strategy to defeat chemoresistance in human pancreatic cancers, which remains a primary clinical challenge.

1781

**Deoxycytidine Kinase Modulates the Impact of the ABC Transporter ABCG2 on Clofarabine Cytotoxicity**
Shinjirou Nagai, Kazumasa Takenaka, Deepa Nachagari, Charles Rose, Kali Domoney, Daxi Sun, Alex Sparreboom, and John D. Schuetz

**Précis:** Findings show how an cellular efflux transporter can circumvent a major pathway to activate therapeutic nucleoside mimetic drugs.

1836

**Parallel High-Throughput RNA Interference Screens Identify PINK1 as a Potential Therapeutic Target for the Treatment of DNA Mismatch Repair–Deficient Cancers**
Sarah A. Martin, Madeleine Hewish, David Sims, Christopher J. Lord, and Alan Ashworth

**Précis:** A kinase originally linked to Parkinson’s disease may offer a potential therapeutic target in treatment of cancers characterized by a specific deficiency in DNA repair.

1792

**Activation of TYRO3/AXL Tyrosine Kinase Receptors in Thyroid Cancer**
Elvira Avilla, Valentina Guarino, Carla Visciano, Federica Liotti, Maria Svelto, GnanaPrakasam Krishnamoorthy, Renato Franco, and Rosa Marina Melillo

**Précis:** Findings prompt clinical study of a tractable therapy for thyroid cancer based on disruption of a functionally critical cell surface receptor signaling complex.

1849

**Therapeutic Inhibition of MAP Kinase Interacting Kinase Blocks Eukaryotic Initiation Factor 4E Phosphorylation and Suppresses Outgrowth of Experimental Lung Metastases**

**Précis:** Findings offer initial preclinical proof-of-concept for small molecule blockade of a important translational regulator as a tractable cancer therapeutic approach.

1805

**Use of Macrophages to Target Therapeutic Adenovirus to Human Prostate Tumors**
Munitta Muthana, Athina Giannoudis, Simon D. Scott, Hsin-Yu Fang, Seth B. Coffelt, Fiona J. Morrow, Craig Murdoch, Julian Burton, Neil Cross, Bernard Burke, Rosina Mistry, Freddie Hamdy, Nicola J. Brown, Lindsay Georgopoulos, Peter Hoskin, Magnus Essand, Claire E. Lewis, and Norman J. Maitland

**Précis:** Findings describe the use of macrophages to target an oncolytic adenovirus to hypoxic areas of prostate tumors, to improve viral inhibition of primary and secondary tumor growth.

1858

**Chromosomal Instability Confers Intrinsic Multidrug Resistance**
Alvin J.X. Lee, David Endesfelder, Andrew J. Rowan, Axel Walther, Nicolai J. Birkbak, P. Andrew Futreal, Julian Downward, Zoltan Szallasi, Ian P.M. Tomlinson, Michael Howell, Maik Kschischo, and Charles Swanton

**Précis:** Determining the chromosome instability status of patient tumors may provide useful information on the clinical response to many cytotoxic agents and small molecules.
Trastuzumab Has Preferential Activity against Breast Cancers Driven by HER2 Homodimers

Précis: Findings suggest that the dimeric state of an oncogenic receptor in cancer cells may impact their therapeutic response to antireceptor antibodies.

Distinct TRAIL Resistance Mechanisms Can Be Overcome by Proteasome Inhibition but not Generally by Synergizing Agents
Christina Menke, Lianghua Bin, Jacqueline Thorburn, Kian Behbakht, Heide L. Ford, and Andrew Thorburn

Précis: This study rationalizes anticancer combinations that not only synergize but also overcome drug resistance, a primary challenge in cancer care.

Functional Activation of the Estrogen Receptor-α and Aromatase by the HDAC Inhibitor Entinostat Sensitizes ER-Negative Tumors to Letrozole
Gauri J. Sabnis, Olga Goloubeva, Saranya Chumsri, Nguyen Nguyen, Saraswati Sukumar, and Angela M.H. Brodie

Précis: This incisive and important preclinical study shows how using histone deacetylase inhibitors to restore ER expression in ER-negative tumors can be used to sensitize them to the therapeutic effects of aromatase inhibitors.

6-Thioguanine Reactivates Epigenetically Silenced Genes in Acute Lymphoblastic Leukemia Cells by Facilitating Proteasome-mediated Degradation of DNMT1
Bifeng Yuan, Jing Zhang, Hongxia Wang, Lei Xiong, Qian Cai, Tina Wang, Steven Jacobsen, Srirarsa Pradhan, and Yinsheng Wang

Précis: This study reveals a vital mechanistic connection between the widely employed cancer drug 6-thioguanine and its effects on DNA hypomethylation, with implications for understanding therapeutic efficacy.

The Epithelial-Mesenchymal Transition Mediator S100A4 Maintains Cancer-Initiating Cells in Head and Neck Cancers
Jeng-Fan Lo, Cheng-Chia Yu, Shih-Hua Chiuou, Chih-Yang Huang, Chia-Ing Jan, Shu-Chun Lin, Chung-Ji Liu, Wen-Yuan Hu, and Yau-Hua Yu

Précis: A calcium-binding molecule that is prognostic in several cancers is found to be critical to maintain stemness properties, with implications for new cancer targeting strategies.

Prediction and Genetic Demonstration of a Role for Activator E2Fs in Myc-Induced Tumors
Kenichiro Fujiwara, Inez Yuwanita, Daniel P. Hollern, and Eran R. Andrechek

Précis: This study establishes the root causal relationships between Myc and E2F, two key transcription factors involved in virtually all human cancers.

The ΔNp63 Proteins Are Key Allies of BRCA1 in the Prevention of Basal-Like Breast Cancer

Précis: Findings define an important transcriptional target of BRCA1 that may provide insight into the pathogenesis of basal-like breast cancers, an aggressive but poorly understood disease.

Ron Kinase Transphosphorylation Sustains MET Oncogene Addiction
Silvia Benvenuti, Luca Lazzari, Addolorata Arnesano, Giulia Li Chiavi, Alessandra Gentile, and Paolo M. Comoglio

Précis: Insights into how oncogenic addiction is maintained to the MET kinase, which drives a powerful program of invasive growth in cancer cells, suggest strategies to strengthen cancer therapies based on MET inhibition.
Systematic Analysis of MicroRNAs Targeting the Androgen Receptor in Prostate Cancer Cells
Päivi Ostling, Suvi-Katri Leivonen, Anna Aakula, Pekka Kohonen, Rami Mäkelä, Zandra Hagman, Anders Edsjo, Sara Kangaspeska, Henrik Edgren, Daniel Nicorici, Anders Bjartell, Yvonne Ceder, Merja Perälä, and Olli Kallioniemi

Précis: A comprehensive survey defines a set of microRNAs that are important regulators of androgen receptor levels and prostate cancer cell proliferation.

Identification of N-Terminally Truncated Stable Nuclear Isoforms of CDC25B That Are Specifically Involved in G2/M Checkpoint Recovery
Denis Jullien, Beatrix Bugler, Christine Dozier, Martine Cazales, and Bernard Ducommun

Précis: Findings prompt a rethinking of CDC25B regulation and function and how its impaired expression in cancer may affect susceptibility and chemotherapeutic response.

Identification of a Clinically Relevant Androgen-Dependent Gene Signature in Prostate Cancer
Hannelore V. Heemers, Lucy J. Schmidt, Zhifu Sun, Kevin M. Regan, S. Keith Anderson, Kelly Duncan, Dan Wang, Song Liu, Karla V. Ballman, and Donald J. Tindall

Précis: Findings prompt new insights into how androgen signaling might be selectively blocked in prostate cancer cells while sparing normal androgen-dependent processes.

LPS-Induced TLR4 Signaling in Human Colorectal Cancer Cells Increases β1 Integrin-Mediated Cell Adhesion and Liver Metastasis
Rich Y.C. Hsu, Carlos H.F. Chan, Jonathan D. Spicer, Mathieu C. Rousseau, Betty Giannias, Simon Rousseau, and Lorenzo E. Ferri

Précis: Infectious complications during colon cancer surgery may contribute to liver metastasis, suggesting benefits to inhibiting these complications during the perioperative period.

High Basal Nuclear Levels of Nrf2 in Acute Myeloid Leukemia Reduces Sensitivity to Proteasome Inhibitors
Stuart A. Rushworth, Kristian M. Bowles, and David J. MacEwan

Précis: Findings suggest a strategy to render AML cells sensitive to proteasome inhibitory drugs, which are presently ineffective in this disease.

Negative Regulation of the Hippo Pathway by E3 Ubiquitin Ligase ITCH Is Sufficient to Promote Tumorigenicity
Zaidoun Salah, Gerry Melino, and Rami I. Aqeilan

Précis: A key regulator of the Hippo tumor suppressor pathway functions as a potent oncogene.

CORRECTIONS

Correction: Antitumoral Immune Response by Recruitment and Expansion of Dendritic Cells in Tumors Infected with Telomerase-Dependent Oncolytic Viruses

Correction: Serum microRNA Profiles Serve as Novel Biomarkers for HBV Infection and Diagnosis of HBV-Positive Hepatocarcinoma

Correction: TGF-βRI Kinase Inhibitor SD-208 Reduces the Development and Progression of Melanoma Bone Metastases

Correction: Physical Oncology: A Bench-to-Bedside Quantitative and Predictive Approach
ABOUT THE COVER

Photograph showing skinfold chambers with implanted mammary carcinoma in mice with normal (large image) and low (small image) platelet counts. Thrombocytopenia resulted in specific bleeding of the tumor. The lack of platelets induced breaches in the tumor vasculature that promoted extravasation of red blood cells and specifically increased the delivery of chemotherapeutic agents into the tumor. Thus, by favoring accumulation of the drug at the tumor site, low platelet count improved its effects and reduced tumor growth. For details, see the article by Demers and colleagues on page 1540 of this issue.
Cancer Research


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