**RESEARCH**

**Integration of Systems and Technologies**

**4697** Predicting the Response of Breast Cancer to Neoadjuvant Therapy Using a Mechanically Coupled Reaction–Diffusion Model

Jared A. Weiss, Michael I. Miga, Lori R. Arlinghaus, Xia Li, Vandana Abramson, A. Bapsi Chakravarthy, Praveen Pendyala, and Thomas E. Yankelev

**Précis:** Patient-specific imaging data were used to develop a biomechanical mathematical model that can predict clinical responses of breast cancer to neoadjuvant therapy, a type of care given before tumor resection, which appears to improve survival outcomes.

**4708** Kinetic Modeling and Constrained Reconstruction of Hyperpolarized [1-13C]-Pyruvate Offers Improved Metabolic Imaging of Tumors


**Précis:** A biophysical model was generated to help understand how hyperpolarized pyruvate can be used for metabolic MRI and how this tool can better measure the metabolic state of tumor tissue under baseline or perturbed conditions.

**4718** Early Prediction of Cancer Progression by Depth-Resolved Nanoscale Mapping of Nuclear Architecture from Unstained Tissue Specimens

Shikhar Uttam, Hoa V. Pham, Justin LaFace, Brian Leibowitz, Jian Yu, Randall E. Brand, Douglas J. Hartman, and Yang Liu

**Précis:** These results introduce a new tool to predict progression of early-stage cancers based on the density of nuclear architecture, addressing unmet clinical needs to more effectively manage the many patients at risk of developing invasive cancers.
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MICROENVIRONMENT AND IMMUNOLOGY

4728 Multivalent Forms of the Notch Ligand DLL-1 Enhance Antitumor T-cell Immunity in Lung Cancer and Improve Efficacy of EGFR-Targeted Therapy
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MOLECULAR AND CELLULAR PATHOBIOLOGY

4778 Merlin/NF2 Suppresses Pancreatic Tumor Growth and Metastasis by Attenuating the FOXM1-Mediated Wnt/β-Catenin Signaling
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4790 Radioprotection of IDH1-Mutated Cancer Cells by the IDH1-Mutant Inhibitor AGI-5198
Remco J. Molenaar, Dennis Botman, Myrthe A. Smits, Vashendriya V. Hira, Sanne A. van Lith, Jan Stap, Peter Henneman, Mohammed Khursheed, Krissie Lenting, Adri N. Mul, Dionysia Dimitrakopoulou, Cornelis M. van Druenen, Ron A. Hoebe, Tomas Radivoyevitch, Johanna W. Wilmink, Jaroslav P. Maciejewski, W. Peter Van Derport, William P. Leenders, Fornet E. Bleeker, and Cornelis J. van Noorden

Précis: These findings develop mechanistic insight and demonstrate the anticancer prowess in a preclinical model of lung cancer for multivalent forms of the Notch receptor ligand Delta-like-1 as a potential biologic for use in combination immunochemotherapy.

Précis: These striking findings show how blocking macrophage infiltration in late-stage epithelial ovarian cancers can normalize their dysfunctional vasculature, thereby reducing malignant ascites that are responsible for poor treatment outcomes.

Précis: These striking findings show how blocking macrophage infiltration in late-stage epithelial ovarian cancers can normalize their dysfunctional vasculature, thereby reducing malignant ascites that are responsible for poor treatment outcomes.

Précis: These findings strengthen the importance of the bone marrow microenvironment in the development of hematopoietic malignancies, such as primary myelofibrosis, and suggest that therapeutic strategies for this disease should aim to target malignant stromal cells in addition to hematopoietic cells.

Précis: These findings may explain the relatively longer survival of glioma patients with tumors harboring a common isocitrate dehydrogenase mutation, and they also imply that therapeutics to target this mutation should not be administered with radiotherapy, which is commonly used to treat glioma.
Histone Deacetylase HDAC8 Promotes Insulin Resistance and β-Catenin Activation in NAFLD-Associated Hepatocellular Carcinoma

This important study makes a molecular connection between obesity-associated fatty liver disease and the development of liver cancer, offering a therapeutic target to tackle the rising incidence of HCC in obese individuals.

Nrf2 Activation Promotes Keratinocyte Survival during Early Skin Carcinogenesis via Metabolic Alterations
Frank Rolfs, Marcel Huber, Andreas Kuehne, Stefan Kramer, Eric Haertel, Sukalp Muzumdar, Johanna Wagner, Yasmine Tannor, Friederike Böhm, Sigrun Smola, Nicola Zamboni, Johanna Wagner, Hans-Dietmar Beer, Daniel Hohl, Sabine Werner, and Matthias Schäfer

A key regulator of cellular redox that many studies have found to prevent cancer is reported here to have an unexpected protumorigenic activity in the skin, acting at early times to promote metabolic alterations that enhance the survival of premalignant keratinocytes.

Amphiregulin Is a Critical Downstream Effector of Estrogen Signaling in ERα-Positive Breast Cancer

These findings implicate an EGFR receptor ligand as a critical mediator of the estrogen response in breast cancer, emphasizing the importance of EGFR receptor signaling in breast tumor pathogenesis and therapeutic responses.

Hypoxia-Induced WSB1 Promotes the Metastatic Potential of Osteosarcoma Cells
Ji Cao, Yijie Wang, Rong Dong, Guanyu Lin, Ning Zhang, Jing Wang, Nengming Lin, Yongchuan Gu, Ling Ding, Meidan Ying, Qiaoqian He, and Bo Yang

These findings define a new mechanistic linkage between hypoxic conditions in a tumor and its ability to develop metastatic prowess, also identifying a candidate therapeutic target that may help prevent aggressive disease.

Src Inhibition Blocks c-Myc Translation and Glucose Metabolism to Prevent the Development of Breast Cancer
Shalini Jain, Xiao Wang, Chia-Chi Chang, Catherine Ibarra-Drendall, Hai Wang, Qingleing Zhang, Samuel W. Brady, Ping Li, Hong Zhao, Jessica Dobbs, Matt Kyrysh, Tomase S. Tkaczky, Adrian Ambrose, Christopher Sistrunk, Banu K. Arun, Rebecca Richards-Kortum, Wei Jia, Victoria I. Seewaldt, and Dihua Yu

Src signaling linked to breast cancer has prompted investigation into the suitability of its targeting in that setting, here corroborated by key findings that suggest a rationale to treat premalignant breast lesions with Src kinase inhibitors.

Multiplex H. pylori Serology and Risk of Gastric Cardia and Noncardia Adenocarcinomas
Ramin Shakeri, Reza Malekzadeh, Dariush Nasrollahzadeh, Michael Pawilta, Gwen Murphy, Farhad Islami, Masoud Sotoudeh, Angelika Michel, Arash Etemad, Tim Waterboer, Hossein Poustchi, Paul Brennan, Paolo Boffetta, Sanford M. Dawsey, Farin Kamangar, and Christian C. Abnet

Risk of certain stomach cancers of high incidence in Asia are associated with changes in seropositivity to H. pylori bacterial antigens, with implications for population health management.
A Heritable Missense Polymorphism in CDKN2A Confers Strong Risk of Childhood Acute Lymphoblastic Leukemia and Is Preferentially Selected during Clonal Evolution
Kyle M. Walsh, Adam J. de Smith, Helen M. Hansen, Ivan V. Smirnov, Semrita Corneth, Alyson A. Endicott, Jianqiao Xiao, Terri Rice, Cecilia H. Fu, Lucie S. McCoy, Daniel H. Lachance, Jeanette E. Eckel-Passow, John K. Wiencke, Robert B. Jenkins, Margaret R. Wiensch, Xiaomei Ma, Catherine Metayer, and Joseph L. Wiemels

Précis: A newly identified heritable missense polymorphism in chromosome 9p21.3 that increases risk of childhood leukemia and is preferentially retained within the leukemic blast during tumor cell evolution sheds light on genomic events underlying the emergence of this disease.

Urokinase Receptor Promotes Skin Tumor Formation by Preventing Epithelial Cell Activation of Notch1
Roberta Mazzieri, Giovanni Pietrogrande, Laura Gerasi, Alessandro Gandelli, Piergiuseppe Colombo, Davide Moi, Chiara Brombin, Alessandro Ambrosi, Silvio Danese, Paolo Mignatti, Francesco Blasi, and Silvia D’Alessio

Précis: These findings provide a strong rationale to target a cell surface receptor implicated previously in malignant progression in skin carcinomas as a valid strategy to prevent this disease.

Heightening Energetic Stress Selectively Targets LKB1-Deficient Non–Small Cell Lung Cancers
Milica Momcilovic, Robert McMickle, Evan Abt, Atsuko Seki, Sarah A. Simko, Clara Magyar, David B. Stout, Michael C. Fishbein, Tonya C. Walser, Steven M. Dubinett, and David B. Shackelford

Précis: This biomarker-guided study offers preclinical proof of concept for a personalized and readily translatable clinical strategy to eradicate a common subset of lung adenocarcinomas and squamous cell carcinomas bearing LKB1 and KRAS mutations.

JX06 Selectively Inhibits Pyruvate Dehydrogenase Kinase PDK1 by a Covalent Cysteine Modification
Wenyi Sun, Zuoquan Xie, Yifu Liu, Dan Zhao, Zhixiang Wu, Dadong Zhang, Hao Lv, Shuai Tang, Nan Jin, Huialiang Jiang, Minjia Tan, Jian Ding, Cheng Luo, Jian Li, Min Huang, and Mei Yu Geng

Précis: These results report a small molecule that targets the enzyme responsible for switching glucose metabolism from mitochondrial oxidation to aerobic glycolysis in cancer cells, a general hallmark of neoplastic transformation termed the Warberg effect, with potentially broad implications for the general treatment of human malignancy.

Inhibition of Casein Kinase 1 Alpha Prevents Acquired Drug Resistance to Erlotinib in EGFR-Mutant Non–Small Cell Lung Cancer
Alexandra B. Lantermann, Dongshu Chen, Kaitlin McCatcheon, Greg Hoffman, Elizabeth Frias, David Ruddy, Daniel Rakic, Joshua Korn, Gregory McAllister, Frank Stegmeier, Matthew J. Meyer, and Sreenath V. Sharma

Précis: These findings suggest that acquired resistance to the EGF receptor kinase inhibitor erlotinib can be prevented by co-inhibiting CK1, a serine/threonine kinase that may be broadly involved in resistance mechanisms to EGF receptor inhibitors used in the clinic.

Identification of Bone-Derived Factors Conferring De Novo Therapeutic Resistance in Metastatic Prostate Cancer
Yu-Chen Lee, Song-Chang Lin, Guoyu Yu, Chien-Jui Cheng, Bin Liu, Hsuan-Chen Liu, David H. Hawke, Nila U. Parikh, Andreas Varkaris, Paul Corn, Christopher Logothetis, Robert J. Satchler, Li-Yuan Yu-Yu, Gary E. Gallick, and Sue-Hwa Lin

Précis: These findings deepen the evidence that the tumor stroma contributes significantly to the development of drug resistance in cancer, with specific clinical implications from this study for cancers that spread to bone.

Ras Signaling Is a Key Determinant for Metastatic Dissemination and Poor Survival of Luminal Breast Cancer Patients
Katherine L. Wright, Jessica R. Adams, Jeff C. Liu, Amanda J. Loch, Ruth G. Wong, Christine E. B. Jo, Lauren A. Beck, Divya R. Santhanam, Laura Weiss, Xue Mei, Timothy F. Lane, Sergei B. Koralov, Susan J. Done, James R. Woodgett, Eldad Zacksenhaus, Pingzhaohu, and Ean E. Egan

Précis: Breast cancers do not tend to involve Ras pathway mutations, but the findings of this study provide preclinical evidence that Ras-targeting therapeutics may offer a supplemental strategy for improving hormone therapy in the treatment of luminal subtypes of this disease.
Mitochondrial Superoxide Dismutase Has a Protumorigenic Role in Ovarian Clear Cell Carcinoma
L.P. Madhubhani, P. Hemachandra, Dong-Hui Shin, Unawadee Dier, James N. Iuliano, Sarah A. Engelberth, Larissa M. Uusitalo, Susan K. Murphy, and Nadine Hempel

Précis: This study identifies that enhanced expression of the antioxidant Sod2 is a distinguishing feature of ovarian clear cell carcinoma, which is imperative in maintaining high mitochondrial function and in shifting steady-state ROS balance to enhance tumor progression.

An Imbalance in TAZ and YAP Expression in Hepatocellular Carcinoma Confers Cancer Stem Cell–like Behaviors Contributing to Disease Progression
Hiromitsu Hayashi, Takaaki Higashi, Naomi Yokoyama, Takayoshi Kaida, Keita Sakamoto, Yukiko Fukushima, Takatsugu Ishimoto, Hideyuki Kuroki, Hitotoshi Nitta, Daisuke Hashimoto, Akira Chikamoto, Eiji Oki, Toru Beppu, and Hideo Baba

Précis: These findings describe a compensatory mechanism that allows Hippo signaling to continue to operate during HCC progression, highlighting the need for multitargeted therapies in this setting to achieve complete antitumor responses.

ABOUT THE COVER
Malignant ascites is a common and devastating complication of late stage epithelial ovarian cancer (EOC) that features dysregulated, leaky blood vasculature. Moughon and colleagues show that tumor-associated macrophages (TAM) contribute dominantly to the vascular pathology of EOC malignant ascites. Consequently, blocking TAMs’ functions by a selective CSF1R kinase inhibitor (GW2580) reversed the vascular leakage and improved vascular perfusion as indicated by the increased number of perfused, blood carrying (lectin, red) capillaries (CD31⁺, green). For details, see article by Moughon and colleagues on page 4742.
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