

Alimentación durante el tratamiento del cáncer: recomendaciones y falsos mitos

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Hospital 12 de Octubre

Límites de la oncología de precisión

Example of EGFR-mutant lung cancer

Easy-to-measure alteration (cheap, multiple source tissues, liquid biopsy)

Druggable alteration

Penetrant alteration

Third-generation drugs

“Clonal” behavior

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

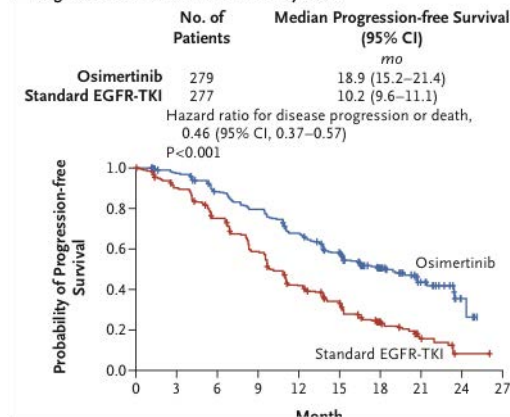
JANUARY 11, 2018

VOL. 378 NO. 2

Osimertinib in Untreated EGFR-Mutated Advanced Non-Small-Cell Lung Cancer

J.-C. Soria, Y. Ohe, J. Vansteenkiste, T. Reungwetwattana, B. Chewaskulyong, K.H. Lee, A. Dechaphunkul, F. Imamura, N. Nogami, T. Kurata, I. Okamoto, C. Zhou, B.C. Cho, Y. Cheng, E.K. Cho, P.J. Voon, D. Planchard, W.-C. Su, J.E. Gray, S.-M. Lee, R. Hodge, M. Marotti, Y. Rukazenzov, and S.S. Ramalingam, for the FLAURA Investigators*

A Progression-free Survival in Full Analysis Set



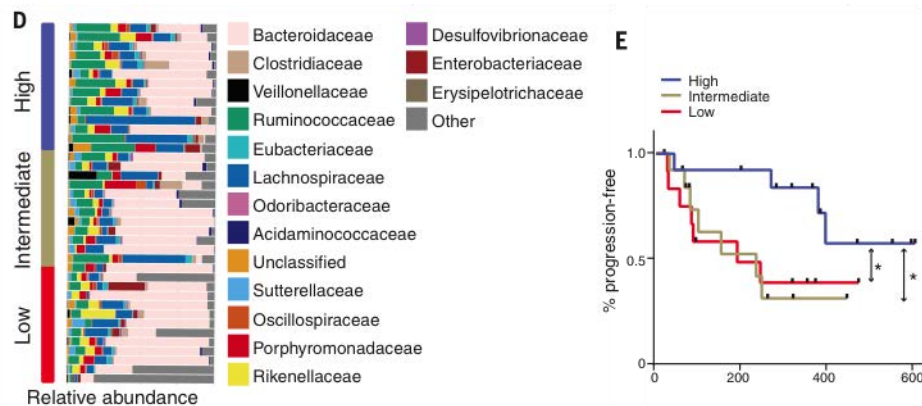
- Yet, 25% refractory

Qué otras cosas, además de la genómica, impactan en la eficacia del tratamiento?

CANCER IMMUNOTHERAPY

Gut microbiome modulates response to anti-PD-1 immunotherapy in melanoma patients

V. Gopalakrishnan,^{1,2*} C. N. Spencer,^{2,3*} L. Nezi,^{3*} A. Reuben,¹ M. C. Andrews,¹ T. V. Karpinets,³ P. A. Prieto,^{1†} D. Vicente,¹ K. Hoffman,⁴ S. C. Wei,⁵ A. P. Cogdill,^{1,5} L. Zhao,³ C. W. Hudgens,⁶ D. S. Hutchinson,⁷ T. Manzo,³ M. Petaccia de Macedo,^{6,‡} T. Catechini,⁸ T. Kumar,³ W. S. Chen,⁹ S. M. Reddy,¹⁰ B. Szezoniak-Sloane,¹



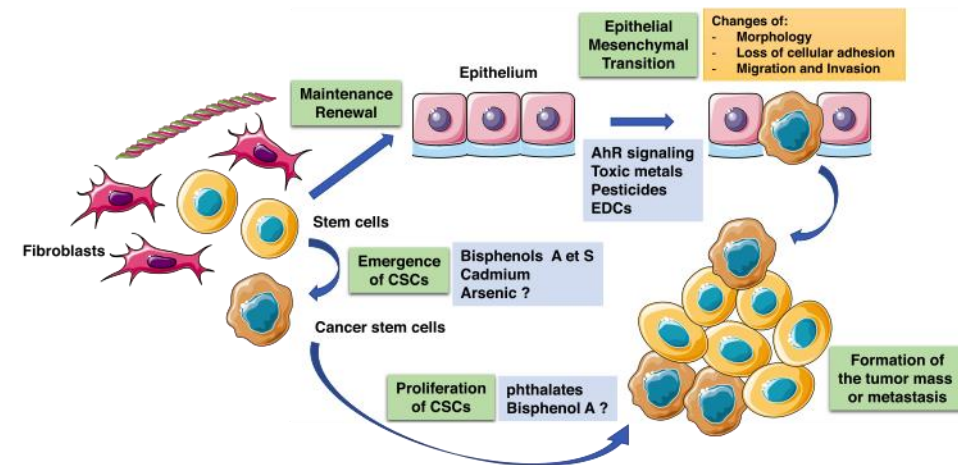
Microbiome

REVIEW

Open Access

Environmental chemicals, breast cancer progression and drug resistance

Meriem Koual^{1,2,3*}, Céline Tomkiewicz^{1,3}, German Cano-Sancho⁴, Jean-Philippe Antignac⁴, Anne-Sophie Bats^{2,3,5} and Xavier Coumoul^{1,3*}



Exposure - environment

Qué otras cosas, además de la genómica, impactan en la eficacia del tratamiento?

Mood, cognition

Diet

ARTICLES

<https://doi.org/10.1038/s41591-019-0566-4>

nature
medicine

Stress–glucocorticoid–TSC22D3 axis compromises therapy-induced antitumor immunity

Heng Yang^{1,2,22}, Lin Xia^{1,2,22}, Jian Chen^{3,22}, Shuqing Zhang^{1,2}, Vincent Martin⁴, Qingqing Li^{1,2}, Shangqing Lin^{1,2}, Jinfeng Chen^{1,2}, Joseph Calmette⁵, Min Lu⁶, Lingyi Fu⁷, Jie Yang⁷,

Article

Brain control of humoral immune responses amenable to behavioural modulation

<https://doi.org/10.1038/s41586-020-2235-7>

Received: 7 December 2018

Accepted: 20 March 2020

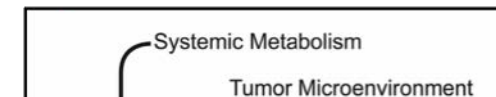
Xu Zhang^{1,2,3,4,16}, Bo Lei^{4,5,16}, Yuan Yuan^{6,16}, Li Zhang^{1,2,3,4,16}, Lu Hu⁷, Sen Jin⁸, Bilin Kang^{4,5}, Xuebin Liao⁷, Wenzhi Sun^{8,10}, Fuqiang Xu^{8,11,12}, Yi Zhong^{4,5,15}, Ji Hu^{6,13,15} & Hai Qi^{1,2,3,4,14,15,15}

Cell

Article

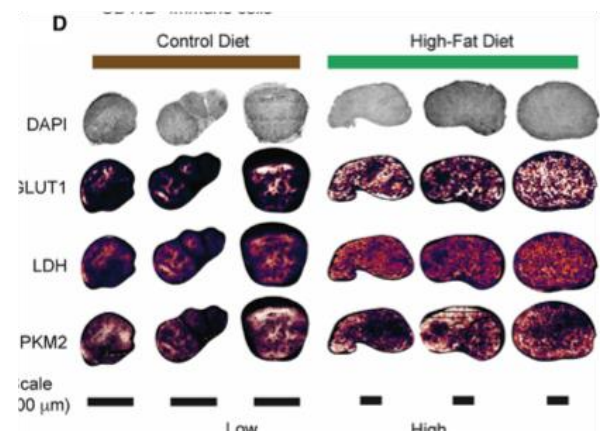
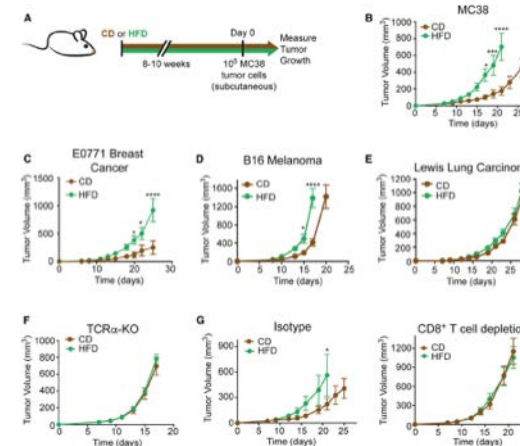
Obesity Shapes Metabolism in the Tumor Microenvironment to Suppress Anti-Tumor Immunity

Graphical Abstract



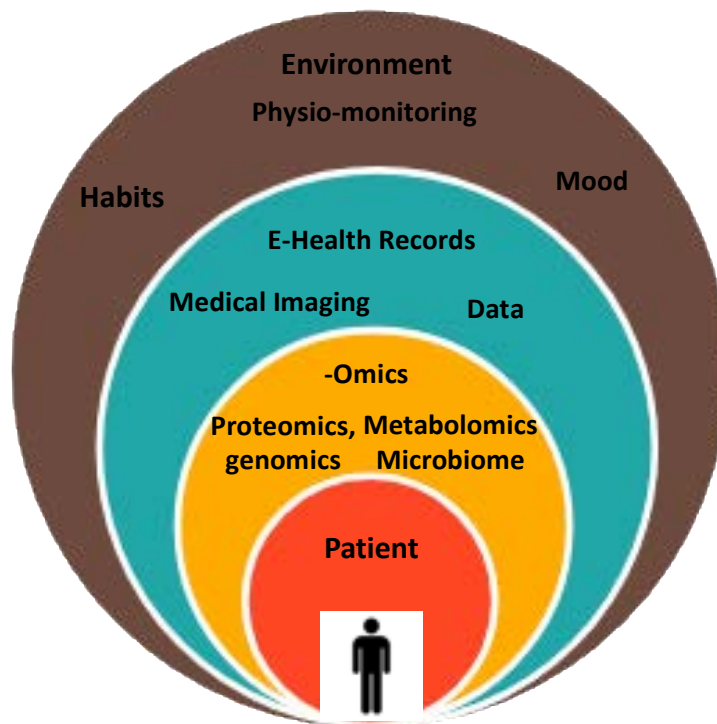
Authors

Alison E. Ringel, Jefte M. Drijvers, Gregory J. Baker, ..., Joshua D. Rabinowitz, Arlene H. Sharpe, Marcia C. Haigis



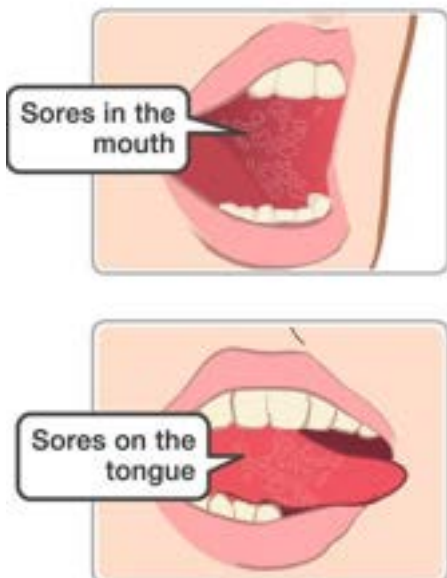
Qué otras cosas, además de la genómica, impactan en la eficacia del tratamiento?

Patient Data Universe (PDU)

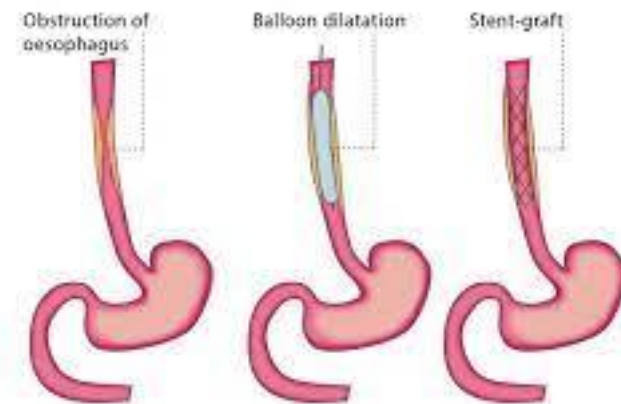


Hasta el 40% de la variabilidad inter-paciente puede ser explicada por factores ajenos al "core" de la oncología de precisión: alteración genómica y fármaco dirigido

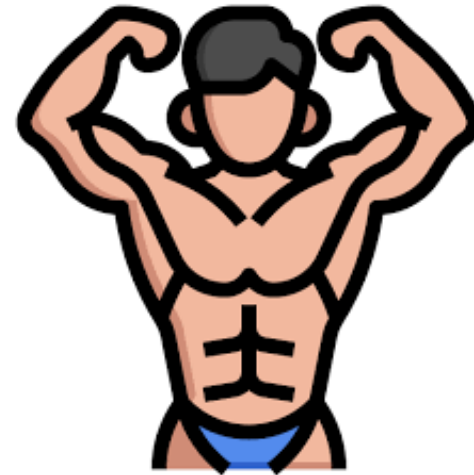
Nutrición pacientes oncológicos



Gastrointestinal and oesophageal stenting



Nutrición pacientes oncológicos



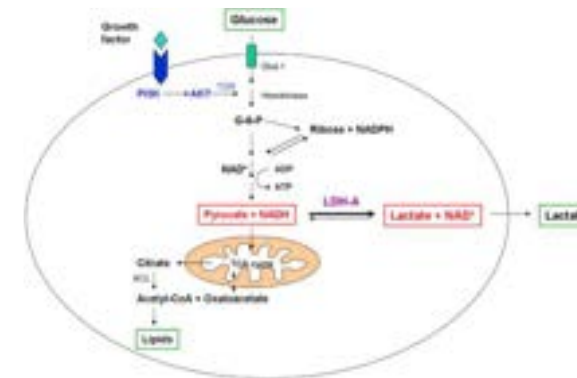
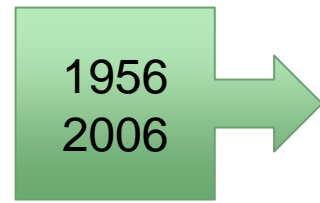
Es posible un cambio de paradigma?



PREVIEWS

Cancer's sweet tooth

Even in the presence of an adequate oxygen supply, many tumors metabolize the majority of the glucose they take up through glycolysis. It has been a long-held belief that this glycolytic phenotype is due to cancer-specific defects in mitochondrial oxidative phosphorylation. In this issue of *Cancer Cell*, Fantin et al. now report that most tumor cells have a substantial reserve



nature Vol 452|13 March 2008 |doi:10.1038/nature

LETTERS

The M2 splice isoform of pyruvate kinase is important for cancer metabolism and tumour growth

Heather R. Christofk¹, Matthew G. Vander Heiden^{1,2}, Marian H. Harris³, Arvind Ramanathan⁴, Robert E. Gerszten^{4,5,6}, Ru Wei⁴, Mark D. Fleming³, Stuart L. Schreiber^{4,7} & Lewis C. Cantley^{1,8}

1. Warburg O. Science, 1956 123(3191), 309–314.
2. Bui, T et al. Cancer cell, 2006; 9(6), 419–420.

Existen aberraciones metabólicas en las células tumorales

Es posible un cambio de paradigma?

Existen multiples
aberraciones?

Originan un margen
terapéutico?

Puede alcanzarse
mediante dieta?

Ayuno

RESEARCH ARTICLE

CANCER

Fasting Cycles Retard Growth of Tumors and Sensitize a Range of Cancer Cell Types to Chemotherapy

Changhan Lee,^{1*} Lizzia Raffaghello,^{2*} Sebastian Brandhorst,^{1,3} Fernando M. Safdie,¹ Giovanna Bianchi,² Alejandro Martin-Montalvo,⁴ Vito Pistoia,² Min Wei,¹ Saewon Hwang,¹ Annalisa Merlino,¹ Laura Emionite,⁵ Rafael de Cabo,⁴ Valter D. Longo^{1†}

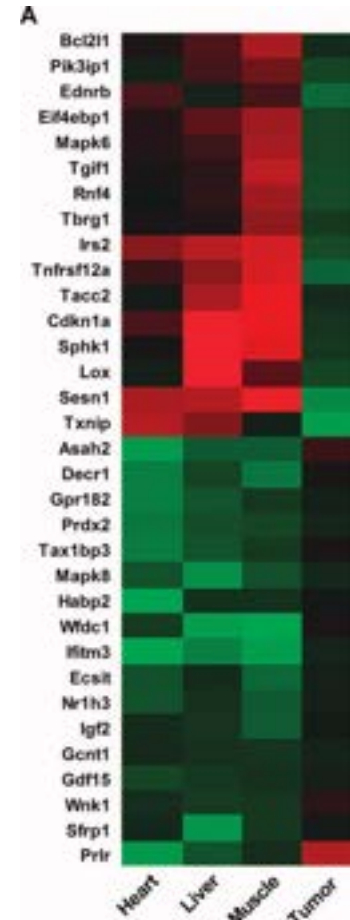
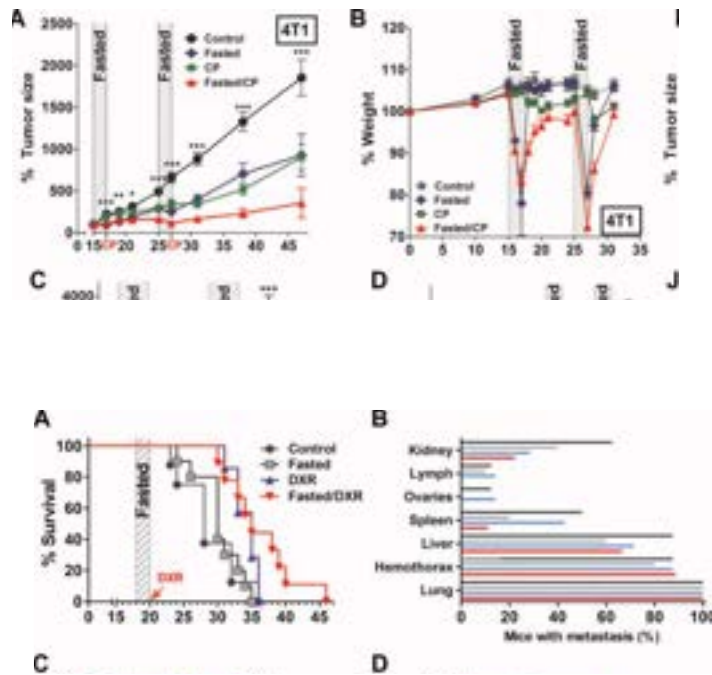
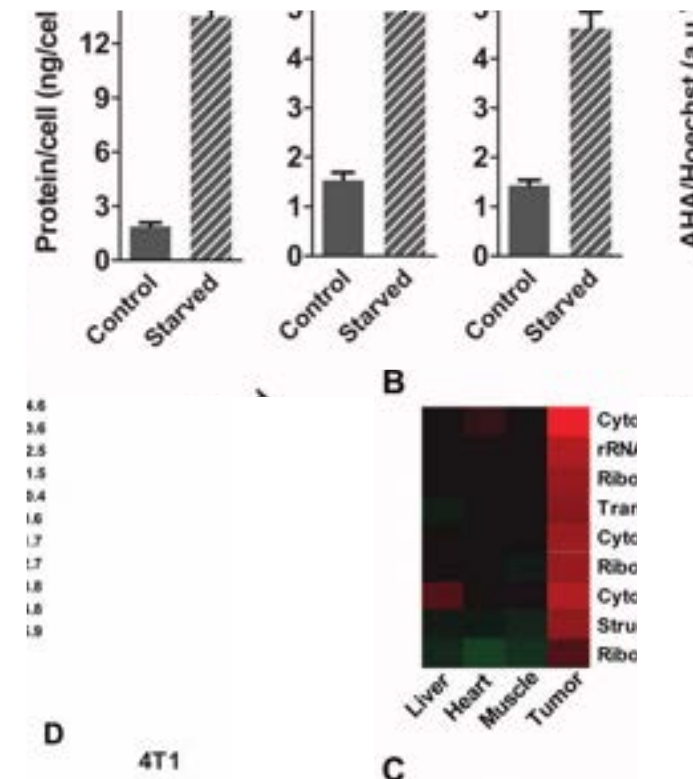


Fig. 1. Effect of fasting on cancer progression.

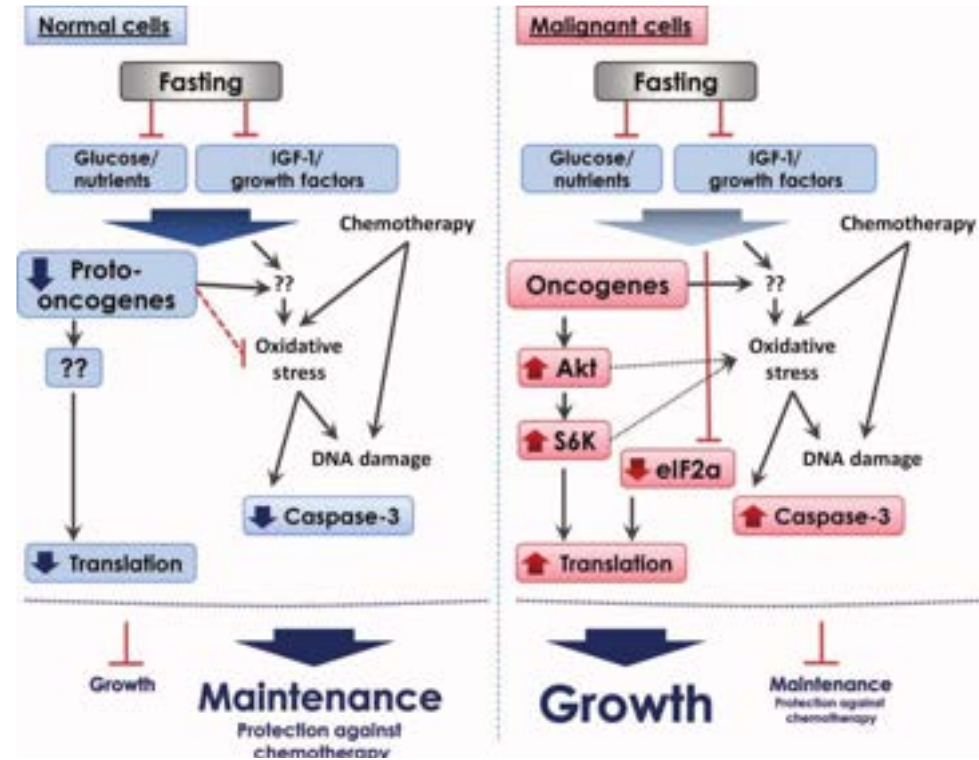
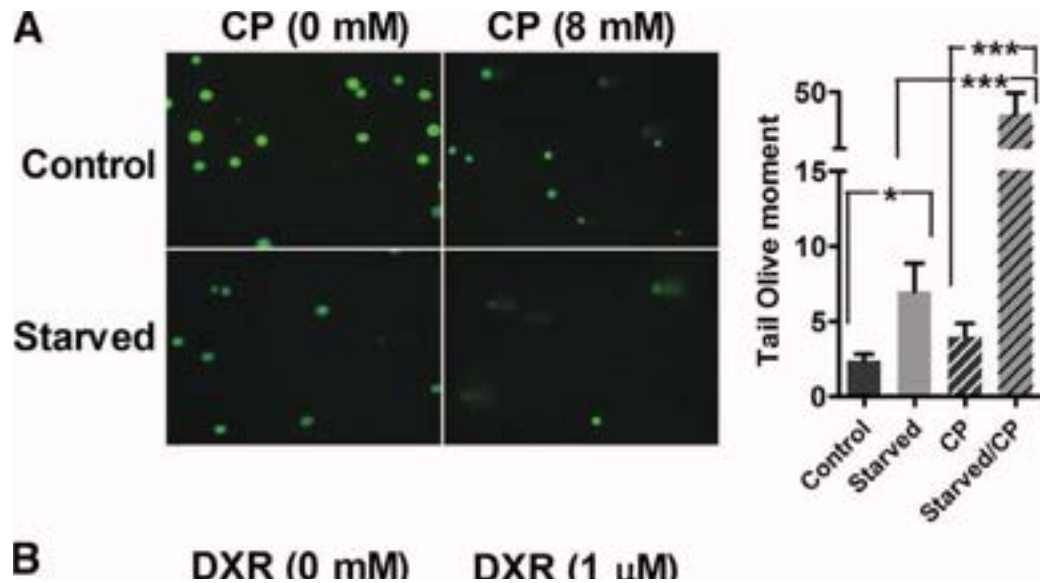


Tejido sano: stop traducción y replicación

Tumor: incremento traducción, replicación, síntesis de proteínas y señalización Pi3K-AKT

Fasting Cycles Retard Growth of Tumors and Sensitize a Range of Cancer Cell Types to Chemotherapy

Changhan Lee,^{1*} Lizzia Raffaghello,^{2*} Sebastian Brandhorst,^{1,3} Fernando M. Safdie,¹ Giovanna Bianchi,² Alejandro Martin-Montalvo,⁴ Vito Pistoia,² Min Wei,¹ Saewon Hwang,¹ Annalisa Merlino,¹ Laura Emionite,⁵ Rafael de Cabo,⁴ Valter D. Longo^{1†}



Evidencia no clínica

Article

Fasting-mimicking diet and hormone therapy induce breast cancer regression

<https://doi.org/10.1038/s41586-020-2502-7>

Received: 25 November 2018

Accepted: 30 April 2020

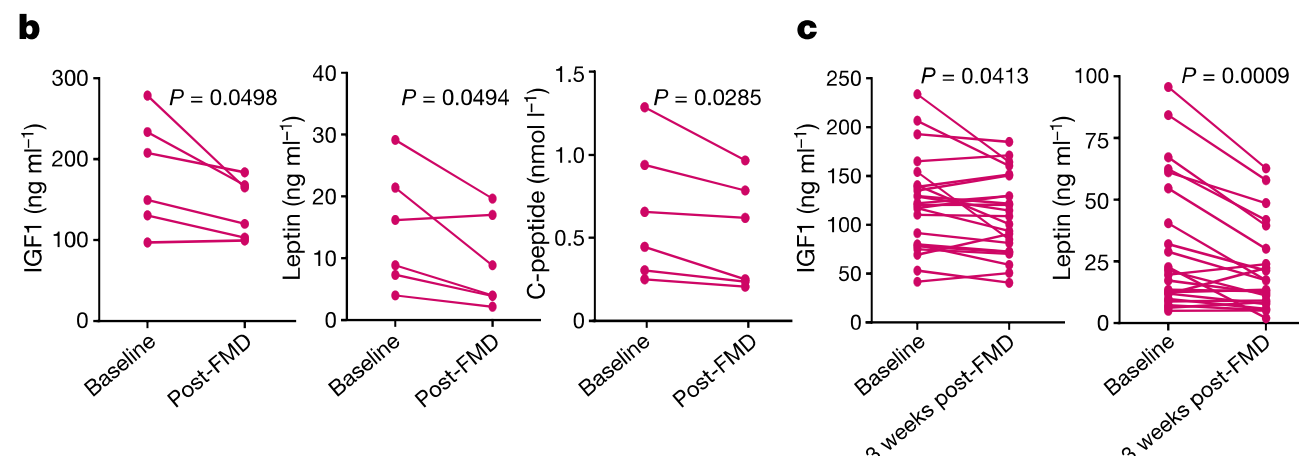
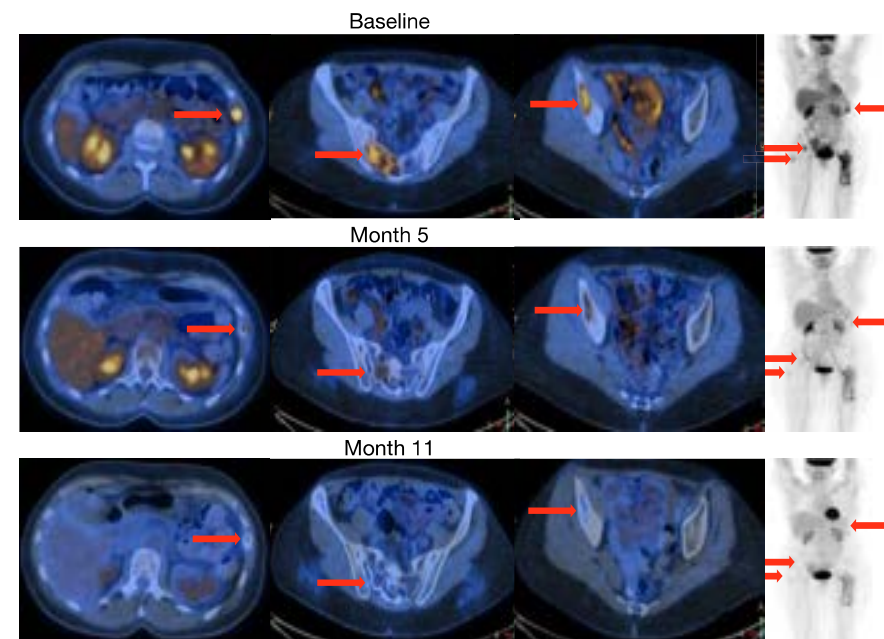
Published online: 15 July 2020

Check for updates

Irene Caffa^{1,4}, Vanessa Spagnolo^{2,3,14}, Claudio Vernieri^{3,4}, Francesca Valdemarin^{1,2}, Pamela Becherini^{1,5}, Min Wei⁶, Sebastian Brandhorst⁶, Chiara Zucal⁷, Else Driehuis^{8,9}, Lorenzo Ferrando¹, Francesco Piacente^{1,2}, Alberto Tagliafico¹⁰, Michele Cilli¹, Luca Mastracci^{1,11}, Valerio G. Vellone^{2,11}, Silvano Piazza⁷, Anna Laura Cremonini^{1,5}, Raffaella Gradaschi¹, Carolina Mantero¹, Mario Passalacqua¹², Alberto Ballestrero^{1,5}, Gabriele Zoppoli^{1,5}, Michele Cea^{1,5}, Annalisa Arrighi⁵, Patrizio Odetti^{1,5}, Fiammetta Monacelli^{1,5}, Giulia Salvadori^{2,3}, Salvatore Cortellino³, Hans Clevers^{8,9,13}, Filippo De Braud^{2,4}, Samir G. Sukkar¹, Alessandro Provenzani⁷, Valter D. Longo^{3,6,15,16} & Alessio Nencioni^{1,5,15,16}

We tested the combination of periodic FMD and ET in 36 patients with HR⁺ BC enrolled in one of two clinical trials, NCT03595540 (patients 1–24) and NCT03340935 (patients 25–36), designed to assess the safety and feasibility of periodic FMD in patients receiving active cancer treatment (Supplementary Table 1). In the NCT03595540 trial, patients received a five-day FMD (Xentigen)^{3,5} every four weeks. They completed an average of 6.8 FMD cycles, with some undergoing up to 14 cycles. Also in this clinical study, the FMD proved to be safe, leading to only grade 1–2 adverse events, most commonly headache (41%) and fatigue (21%) (Supplementary Tables 1, 2). Patients from the NCT03340935 study received a similar, albeit more calorie-restricted, five-day FMD regimen every three to four weeks and completed an average of 5.5 cycles with no severe adverse events. Patients from the NCT03595540 trial, who also received dietary recommendations²² and instructions for

a Patient no. 26 (second-line treatment for HR⁺/HER2⁻ mBC with FULV + PALB + FMD)



Ayuno

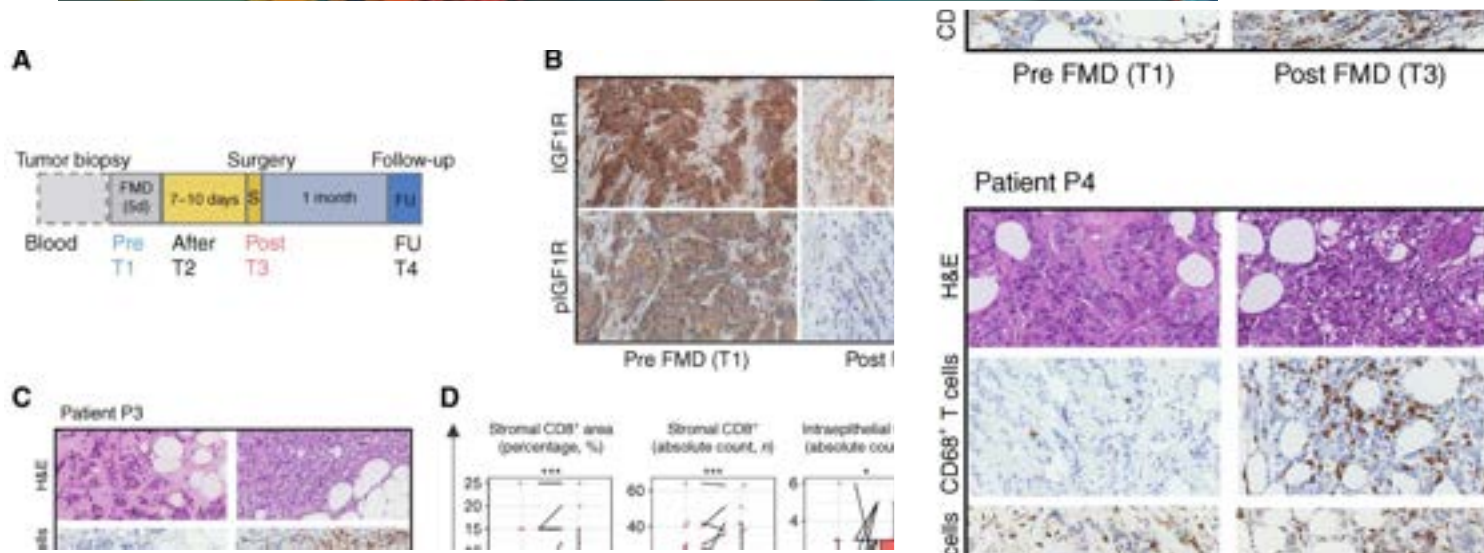
Improved immuno-environment, increased infiltration

RESEARCH ARTICLE

Fast ing-Mimicking Diet Is Safe and Reshapes Metabolism and Antitumor Immunity in Patients with Cancer

Claudio Vernieri^{1,2}, Giovanni Fucà¹, Francesca Ligorio¹, Veronica Huber³, Andrea Vingiani^{4,5}, Fabio Iannelli², Alessandra Raimondi¹, Darawan Rinchaj⁶, Gianmaria Frigè⁷, Antonino Belfiore⁵, Luca Lalli³, Claudia Chiodoni⁸, Valeria Cancila⁹, Federica Zanardi², Arta Ajazi², Salvatore Cortellino², Viviana Vallacchi³, Paola Squarcina⁹, Agata Cova³, Samantha Pesce³, Paola Frati³, Raghvendra Mall¹⁰, Paola Antonia Corsetto¹¹, Angela Maria Rizzo¹¹, Cristina Ferraris¹², Secondo Folli¹², Marina Chiara Garassino¹, Giuseppe Capri¹, Giulia Bianchi¹, Mario Paolo Colombo⁸, Saverio Minucci^{7,13}, Marco Foiani^{2,4}, Valter Daniel Longo^{2,14}, Giovanni Apolone¹⁵, Valter Torri¹⁶, Giancarlo Pruneri^{4,5}, Davide Bedognetti^{6,17,18}, Licia Rivoltini³, and Filippo de Braud^{1,4}

Baja toxicidad, y mitigación de algunos efectos secundarios esperados como hiperglucemias en inhibidores Pi3K



Evidencia clínica grado 2

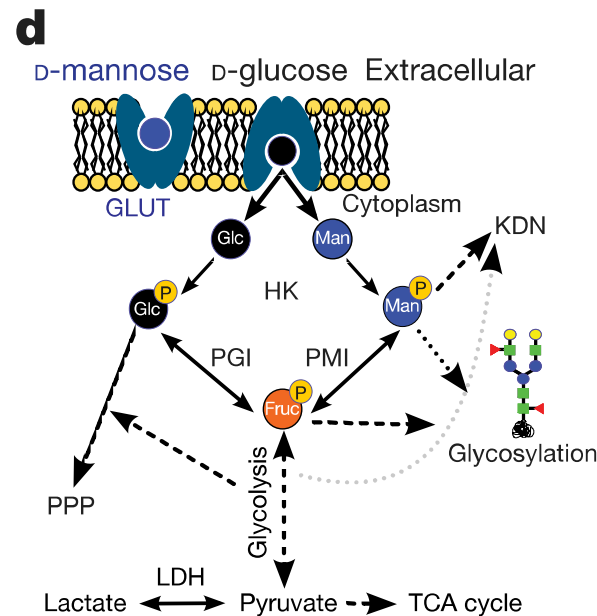
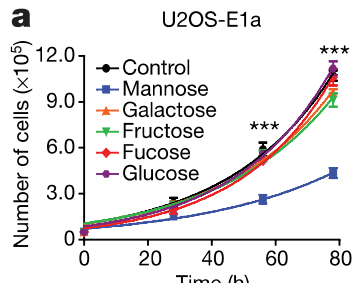
Manosa

LETTER

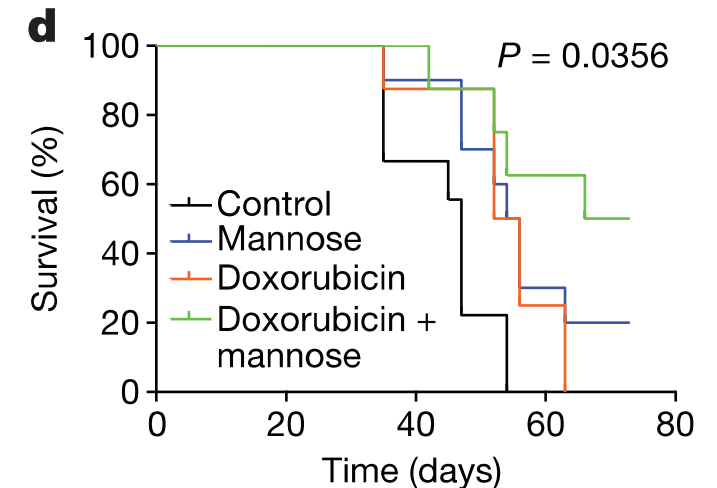
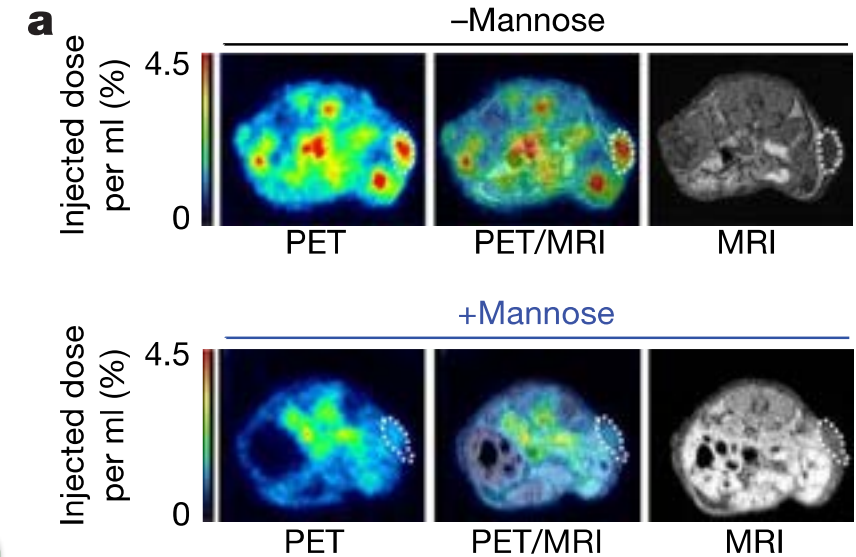
<https://doi.org/10.1038/s41586-018-0729-3>

Mannose impairs tumour growth and enhances chemotherapy

Pablo Sierra Gonzalez¹, James O'Prey¹, Simone Cardaci^{1,2,6}, Valentin J. A. Barthet^{1,6}, Jun-ichi Sakamaki¹, Florian Beaumatin¹, Antonia Roseweir³, David M. Gay¹, Gillian Mackay¹, Gaurav Malviya¹, Elzbieta Kania¹, Shona Ritchie¹, Alice D. Baudot¹, Barbara Zunino¹, Agata Mrowinska¹, Colin Nixon¹, Darren Ennis^{3,5}, Aoisha Hoyle⁴, David Millan⁴, Iain A. McNeish^{3,5}, Owen J. Sansom^{1,3}, Joanne Edwards³ & Kevin M. Ryan^{1,3*}



↓ Glyco
↓ Krebs
↓ PPP
↓ Glycan
↑ BCL2



ARTICLES

nature
medicine

D-mannose induces regulatory T cells and suppresses immunopathology

Dunfang Zhang^{1,2}, Cheryl Chia¹, Xue Jiao^{1,3}, Wenwen Jin¹, Shimpei Kasagi¹, Ruiqing Wu^{1,2}, Joanne E Konkel¹, Hiroko Nakatsukasa¹, Peter Zanvit¹, Nathan Goldberg¹, Qianming Chen², Lingyun Sun⁴, Zi-Jiang Chen³ & WanJun Chen¹

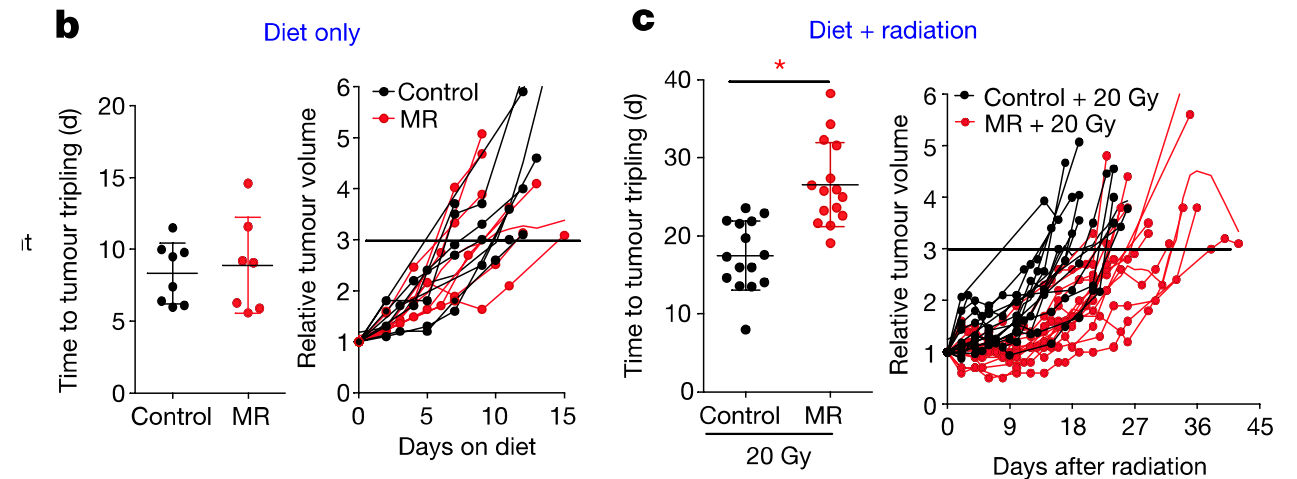
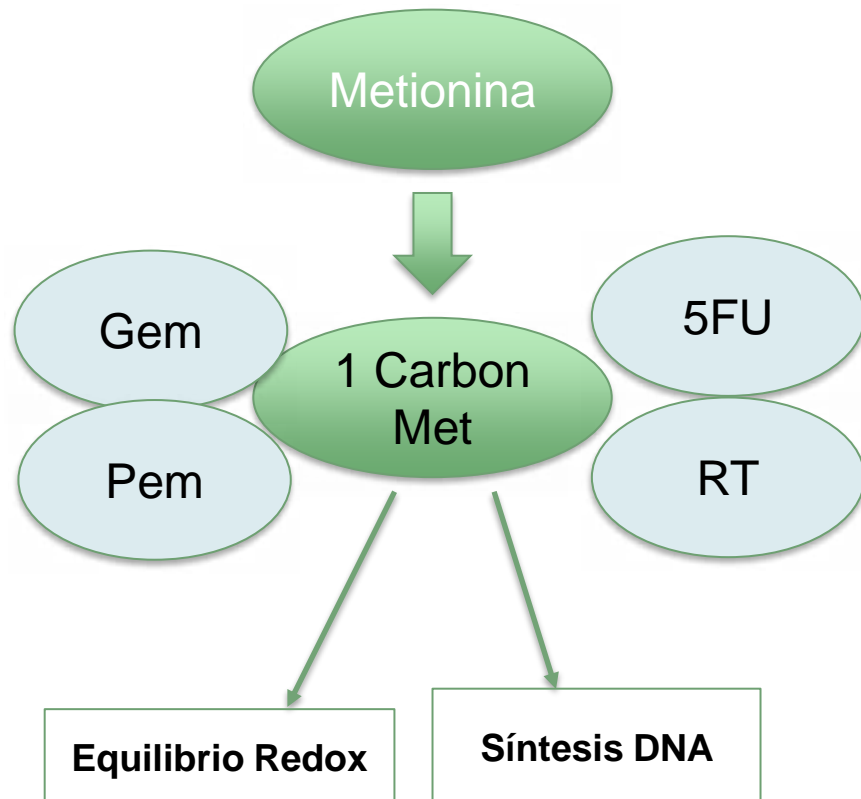
Metionina

LETTER

<https://doi.org/10.1038/s41586-019-1437-3>

Dietary methionine influences therapy in mouse cancer models and alters human metabolism

Xia Gao¹, Sydney M. Sanderson^{1,8}, Ziwei Dai^{1,8}, Michael A. Reid¹, Daniel E. Cooper², Min Lu^{3,4}, John P. Richie Jr⁵, Amy Ciccarella⁶, Ana Calcagnotto⁵, Peter G. Mikhalel¹, Samantha J. Mentch¹, Juan Liu¹, Gene Ables⁷, David G. Kirsch^{1,2}, David S. Hsu^{3,4}, Sailendra N. Nichenametla⁷ & Jason W. Locasale^{1*}



Metionina: es factible lograr los efectos mediante dieta en humanos

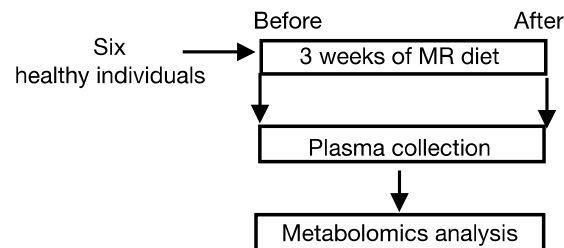
LETTER

<https://doi.org/10.1038/s41586-019-1437-3>

Dietary methionine influences therapy in mouse cancer models and alters human metabolism

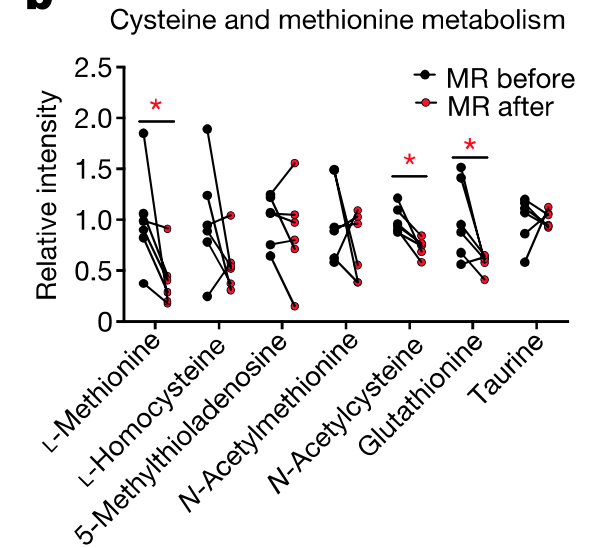
Xia Gao¹, Sydney M. Sanderson^{1,8}, Ziwei Dai^{1,8}, Michael A. Reid¹, Daniel E. Cooper², Min Lu^{3,4}, John P. Richie Jr⁵, Amy Ciccarella⁶, Ana Calcagnotto⁵, Peter G. Mikhael¹, Samantha J. Mentch¹, Juan Liu¹, Gene Ables⁷, David G. Kirsch^{1,2}, David S. Hsu^{3,4}, Sailendra N. Nichenametla⁷ & Jason W. Locasale^{1*}

a

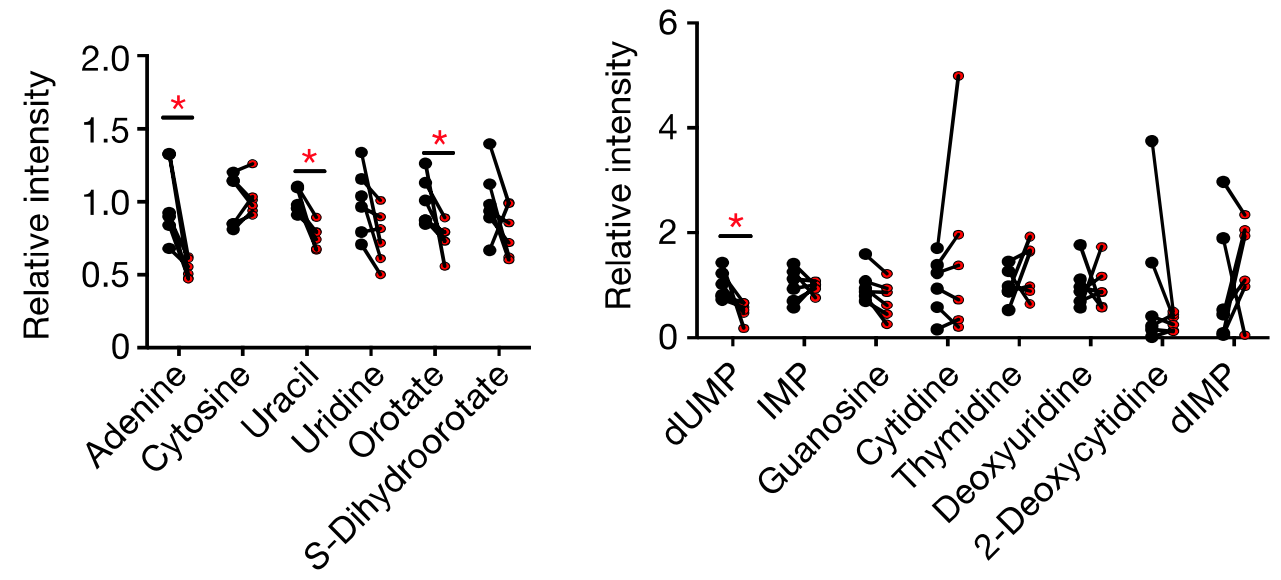


Individual no.	1	2	3	4	5	6
Gender	F	M	F	F	F	F
Age	50	52	51	49	53	58

b



Purine and pyrimidine metabolism



Suppression of insulin feedback enhances the efficacy of PI3K inhibitors

Benjamin D. Hopkins¹, Chantal Pauli^{2,3}, Xing Du⁴, Diana G. Wang^{1,5}, Xiang Li⁶, David Wu¹, Solomon C. Amadiume¹, Marcus D. Goncalves^{1,7}, Cindy Hodakoski¹, Mark R. Lundquist¹, Rohan Bareja^{1,3,8}, Yan Ma⁴, Emily M. Harris⁴, Andrea Sboner^{1,3,8,9}, Himisha Beltran^{1,3,10}, Mark A. Rubin^{3,11}, Siddhartha Mukherjee^{4*} & Lewis C. Cantley^{1*}



Dieta cetogénica
Diabéticos?

CellPress

Cell metabolism
Article



Restricción proteica en
inmunoterapia

Low-Protein Diet Induces IRE1 α -Dependent Anticancer Immunosurveillance

Camila Rubio-Patiño,^{1,9} Jozef P. Bossowski,^{1,9} Gian Marco De Donatis,¹ Laura Mondragón,¹ Elodie Villa,¹ Lazaro E. Aira,¹ Johanna Chiche,¹ Rana Mhaidly,¹ Cynthia Lebeaupin,¹ Sandrine Marchetti,¹ Konstantinos Voutetakis,^{2,3}

Serine, but Not Glycine, Supports One-Carbon Metabolism and Proliferation of Cancer Cells

Christiaan F. Labuschagne,¹ Niels J.F. van den Broek,¹ Gillian M. Mackay,¹ Karen H. Vousden,^{1,*} and Oliver D.K. Maddocks^{1,*}

¹Cancer Research UK Beatson Institute, Switchback Road, Glasgow G61 1BD, UK

*Correspondence: k.vousden@beatson.gla.ac.uk (K.H.V.), o.maddocks@beatson.gla.ac.uk (O.D.K.M.)

<http://dx.doi.org/10.1016/j.celrep.2014.04.045>

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Suppl. Glicina +
Restr. Metionina

Research Paper

Dietary Glycine Inhibits Angiogenesis During Wound Healing and Tumor Growth

Khalid Amin¹

Jie Li²

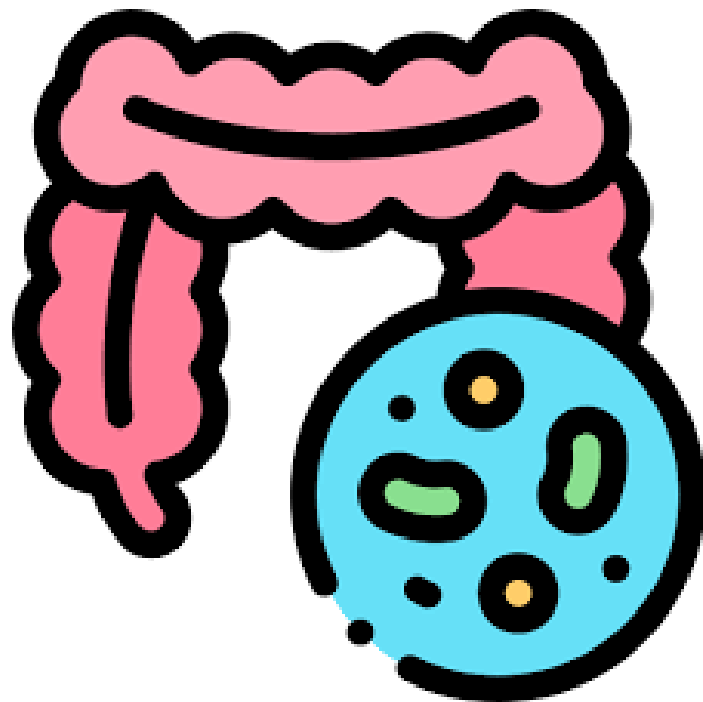
...

ABSTRACT

In this study we investigated the effects of glycine on angiogenesis during embryoger wound healing and tumor growth. In chorioallantoic membrane (CAM) assay, al

SUMMARY

ents (uptake versus biosynthesis) and how they metabolize them



- Recuentos Akkermansia
- Recuentos F. Praunitzii
- Enterotipo
- Diversidad de Shannon
- Firmicutes/Bacteroidetes



Christian Frezza



Eran Elinav



Julio Saez



Luis Manso

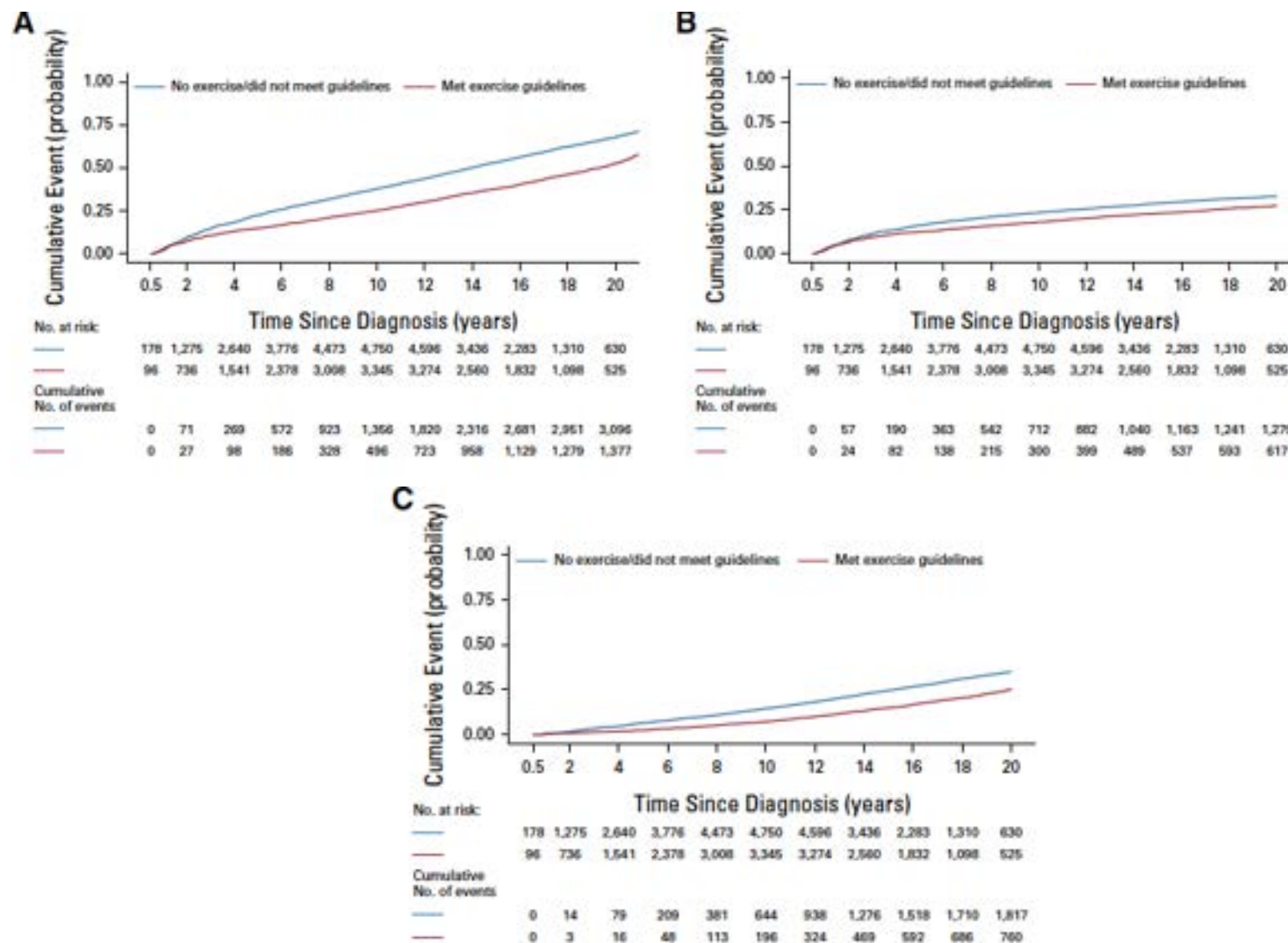


Miguel Quintela

Pan-Cancer Analysis of Postdiagnosis Exercise and Mortality

Jessica A. Lavery, MS¹ ; Paul C. Boutros, PhD^{2,3,4,5} ; Jessica M. Scott, PhD^{1,6} ; Tuomas Tammela, MD, PhD⁷ ;
Chaya S. Moskowitz, PhD¹ ; and Lee W. Jones, PhD^{1,6} 

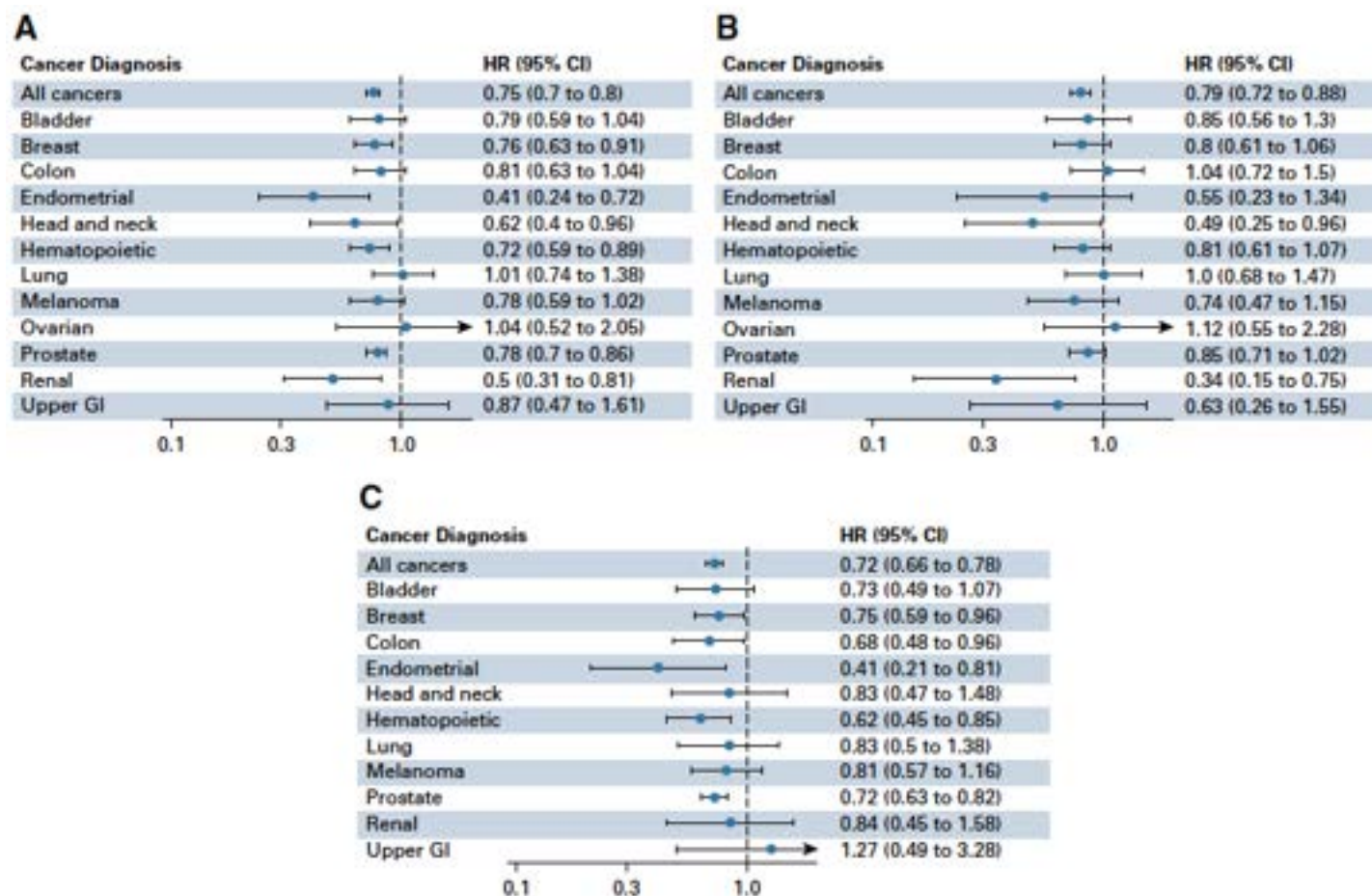
August 31, 2023



Pan-Cancer Analysis of Postdiagnosis Exercise and Mortality

Jessica A. Lavery, MS¹ ; Paul C. Boutros, PhD^{2,3,4,5} ; Jessica M. Scott, PhD^{1,6} ; Tuomas Tammela, MD, PhD⁷ ;
Chaya S. Moskowitz, PhD¹ ; and Lee W. Jones, PhD^{1,6} 

August 31, 2023



GRACIAS

Luis Manso Sánchez (MD, PhD)
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Instituto de Investigación
Hospital 12 de Octubre