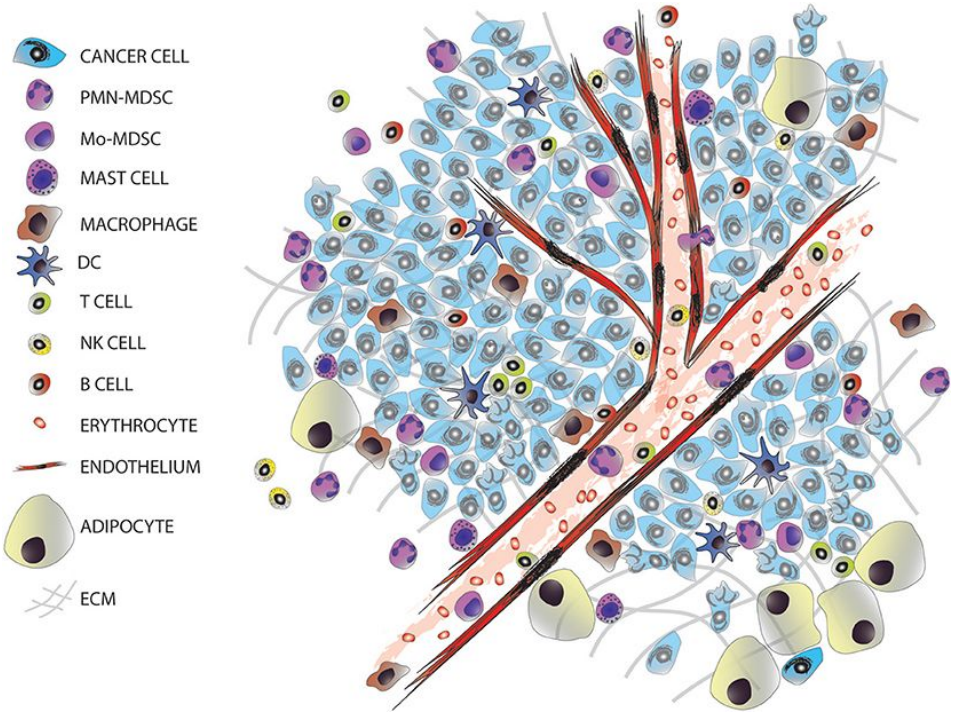
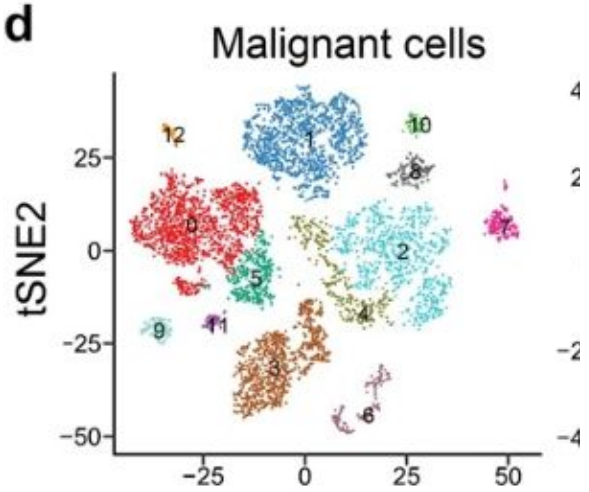
What do we know about intratumor competition

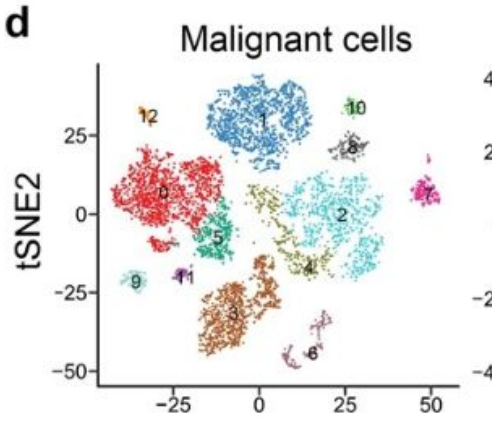
Who competes?



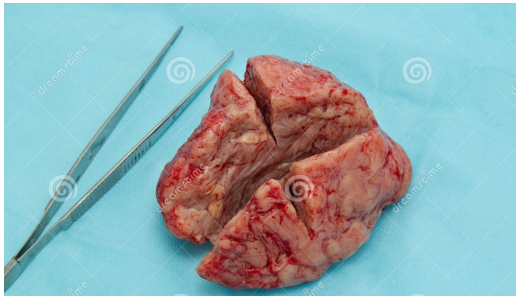
https://doi.org/10.3389/fimmu.2018.02582



Chen, YP., Yin, JH., Li, WF. *et al.* Single-cell transcriptomics reveals regulators underlying immune cell diversity and immune subtypes associated with prognosis in nasopharyngeal carcinoma. *Cell Res* 30, 1024–1042 (2020). https://doi.org/10.1038/s41422-020-0374-x


d
Malignant cells
tSNE2
25
0
-25
-50
-25
0
25
50
4
2
-2
-4
12
1
10
8
7
2
6
5
4
9
11
3
6

vs




FEDERAL RESERVE NOTE
THE UNITED STATES OF AMERICA
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ONE DOLLAR

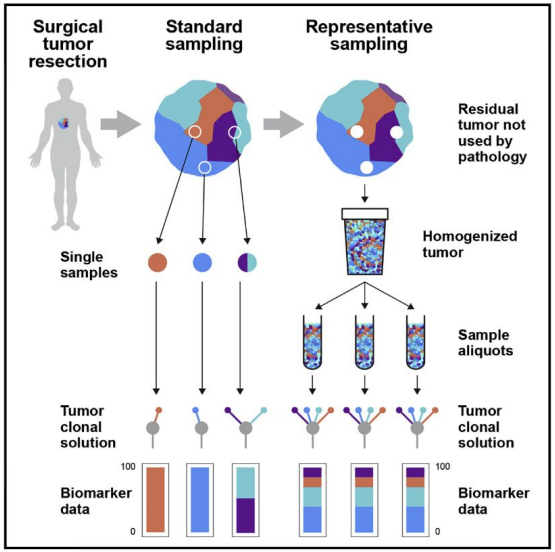
vs

Resource

Cell Reports

Representative Sequencing: Unbiased Sampling of Solid Tumor Tissue

Graphical Abstract



Authors

Kevin Litchfield, Stacey Stanislaw, Lavinia Spain, ..., Charles Swanton, Nelson R. Alexander, Samra Turajlic

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In Brief

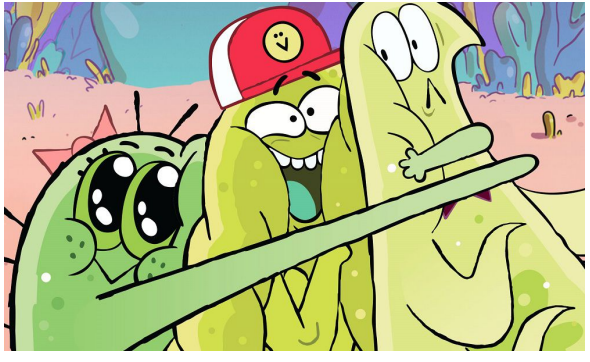
Solid tumors are under-sampled in the clinic, such that only 0.0005% of initial tumor volume is used as input for diagnostic testing. Litchfield et al. apply the principles of representative sampling to implement an unbiased tumor sampling approach that improves the reproducibility and accuracy of next-generation sequencing.

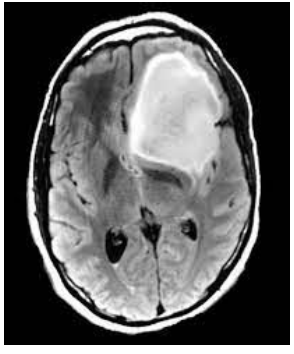
How do cells compete?

Nutrients

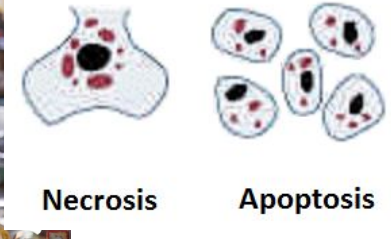
Signaling molecules

Space



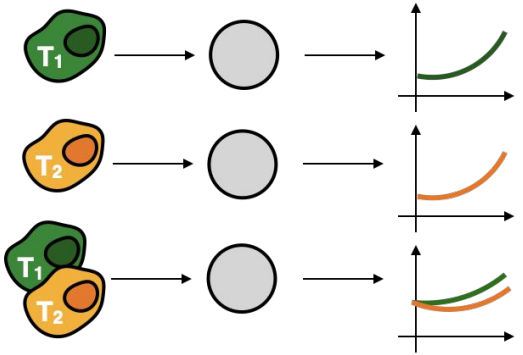


Waste products



How to measure cell competition?

"Classical" Competition Experiment



ARTICLES
https://doi.org/10.1038/s41559-018-0768-z
nature ecology & evolution

Fibroblasts and alectinib switch the evolutionary games played by non-small cell lung cancer

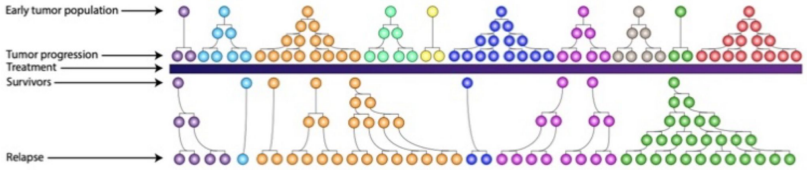
Artem Kaznatcheev[1,2*], Jeffrey Peacock[3], David Basanta[4], Andriy Marusyk[5*] and Jacob G. Scott[2,6*]

OPEN

Frequency-dependent interactions determine outcome of competition between two breast cancer cell lines

Audrey R. Freischel[1,2,3], Mehdi Damaghi[1,3], Jessica J. Cunningham[1,2], Arig Ibrahim-Hashim[1], Robert J. Gillies[1], Robert A. Gatenby[1,2] & Joel S. Brown[1,2]

Inference from Clonal Dynamics



TECHNICAL REPORT
https://doi.org/10.1038/s43018-021-00222-8
nature cancer

Multifunctional barcoding with ClonMapper enables high-resolution study of clonal dynamics during tumor evolution and treatment

Catherine Gutierrez[1,2,15], Aziz M. Al'Khafaji[3,4,5,15], Eric Brenner[3,4,15], Kaitlyn E. Johnson[4], Satyen H. Gohil[1,2,5,6,7], Ziao Lin[1,5,8], Binyamin A. Knisbacher[5], Russell E. Durrett[3,4], Shuqiang Li[2,5,9], Salma Parvin[2], Anat Biran[2,5], Wandi Zhang[2], Laura Rassenti[10], Thomas J. Kipps[10], Kenneth J. Livak[2,9], Donna Neuberg[11], Anthony Letai[1,2], Gad Getz[1,5,12,13], Catherine J. Wu[1,2,5,14] ✉ and Amy Brock[3,4] ✉

Others

- Measure resource consumption/use
- Induction and tracking of clones in vivo
- Contact inhibition and mechanical competition

nature genetics
ARTICLES
https://doi.org/10.1038/s41588-020-0624-3

Spatial competition shapes the dynamic mutational landscape of normal esophageal epithelium

Bartomeu Colom[1], Maria P. Alcolea[2,3,7], Gabriel Piedrafita[1,4,7], Michael W. J. Hall[1,5], Agnieszka Wabik[1], Stefan C. Dentro[1,6], Joanna C. Fowler[1], Albert Herms[1], Charlotte King[1], Swee Hoe Ong[1], Roshan K. Sood[1], Moritz Gerstung[6,*], Iñigo Martincorena[1], Benjamin A. Hall[4] ✉ and Philip H. Jones[1,5] ✉

Cell Competition: Mechanisms and Physiological Roles

Cristina Clavería and Miguel Torres

Cardiovascular Development Program, Centro Nacional de Investigaciones Cardiovasculares (CNIC), Madrid 28029, Spain; email: mtorres@cnic.es

How to model intra-tumor competition?

Stochastic model:

$b,\ X \to X + X$

$d,\ X \to 0$

b : Birth rate
d : death rate

Large population →

Differential equation

$$\frac{dN}{dt} = rN \to N(t) = e^{rt}$$

with $r = b - d$.

N : cell density

How add competition ?

- Add dependency in the rates
- Spatial structure
- Different types of cells

Implications for clinical practice?

Adaptive Therapy

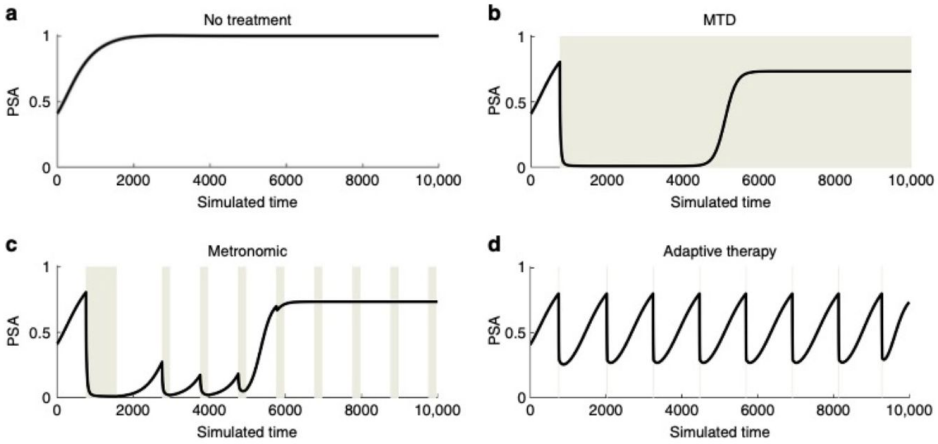


Figure taken from J. Zhang et al. Integrating evolutionary dynamics into treatment of metastatic castrate-resistant prostate cancer (Nat. Comm., 2017)

Progression of benign tumors?

nature genetics

ARTICLES

https://doi.org/10.1038/s41588-020-0624-3

Check for updates

Spatial competition shapes the dynamic mutational landscape of normal esophageal epithelium

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