Immunometabolism the CyTOF way
利用飞行时间流式细胞术(CyTOF)研究免疫代谢

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Preview

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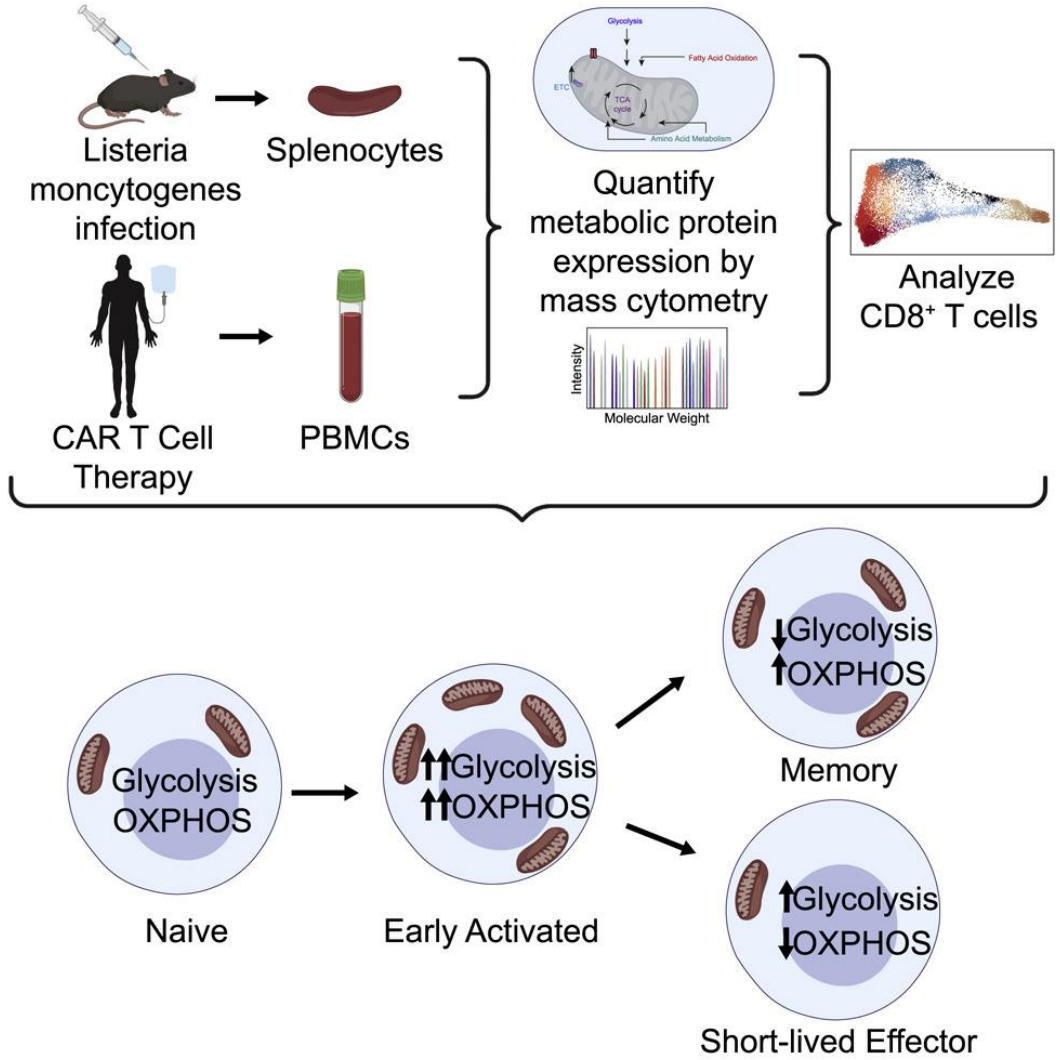
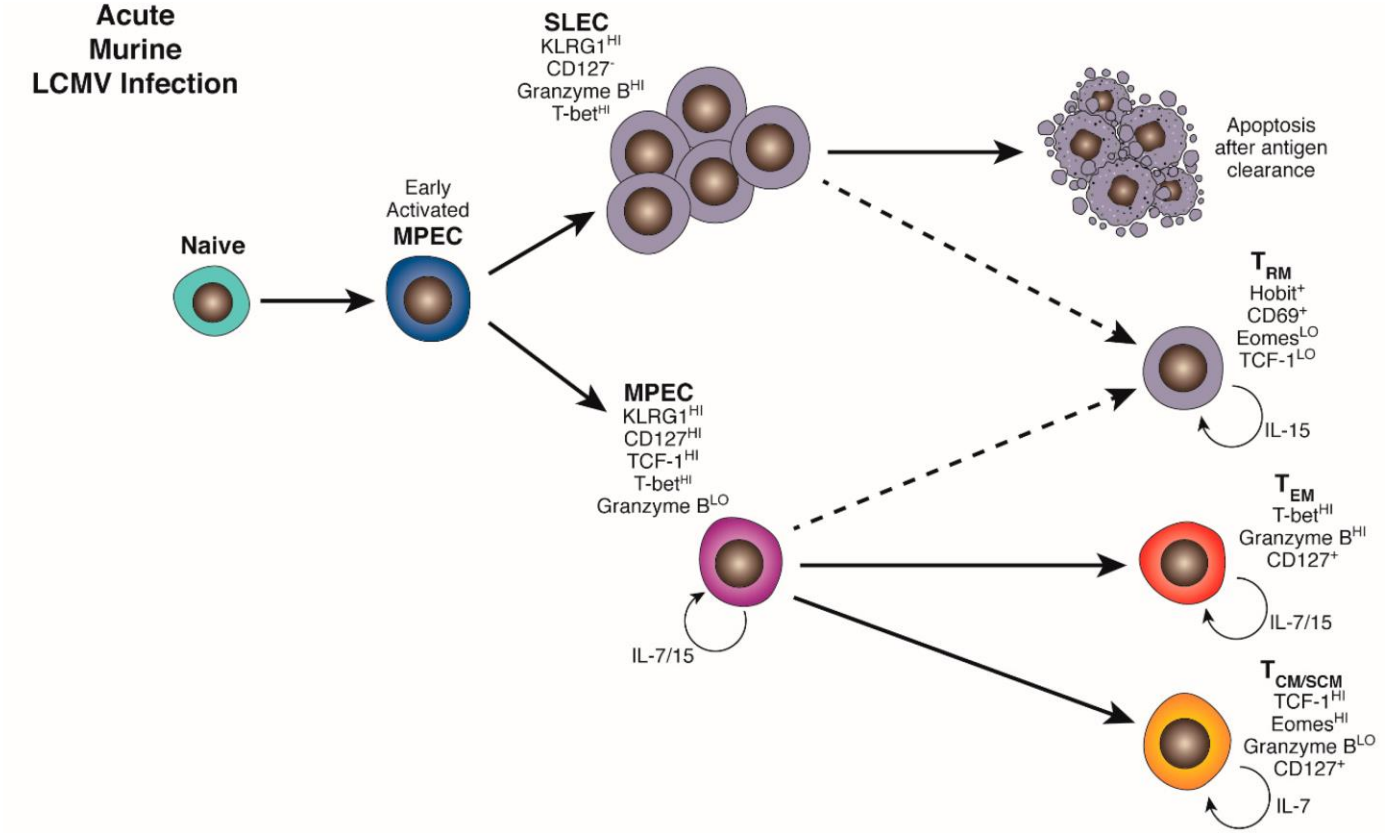
Resource

Single-cell analysis by mass cytometry reveals metabolic states of early-activated CD8+ T cells during the primary immune response

Lauren S. Levine [1, 2, 3, 4, 5, 6, 9], Kamir J. Hiam-Galvez [1, 2, 3, 4, 5, 9], Diana M. Marquez [1, 2, 3, 4, 5], Iliana Tenvooren [1, 2, 3, 4, 5], Matthew Z. Madden [7], Diana C. Contreras [7], Debolanle O. Dahunsi [7], Jonathan M. Irish [7], Olalekan O. Oluwole [8], Jeffrey C. Rathmell [7], Matthew H. Spitzer [1, 2, 3, 4, 5, 10]



Background of cytotoxic CD8+ T cells



[1] Vladimir P.Badovinac , et al.. (2007). Immun 26(6), 827-841
[2] Daniel J. Verdon , et al. (2020). Int. J. Mol. Sci. 21(19), 7357

Immunometabolism

Effector T cell

Pathways used:	
Glycolysis	Supports proliferation and inflammatory cytokine production
Fatty acid synthesis	Promotes proliferation and regulates cytokine production
Amino acid metabolism	Promotes proliferation and effector cell differentiation

Regulatory T cell

Pathways used:	
TCA cycle	Associated with suppressive function
Fatty acid oxidation	Promotes generation of T_{reg} cells and linked to tolerogenic stimuli

Memory $CD8^+$ T cell

Pathways used:	
TCA cycle	Associated with memory cell phenotype
Fatty acid oxidation	Promotes memory cell generation and survival

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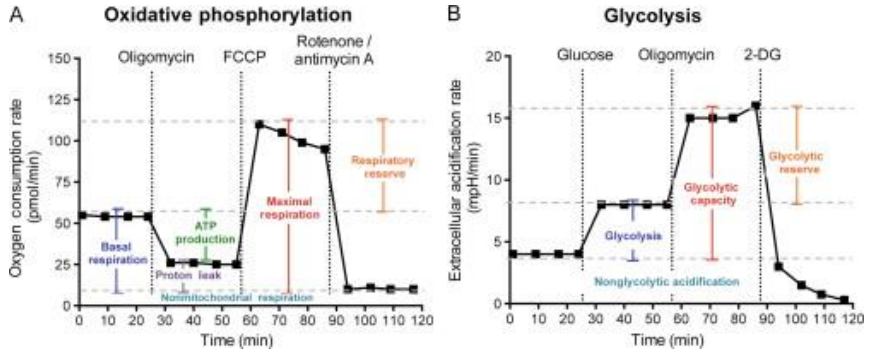
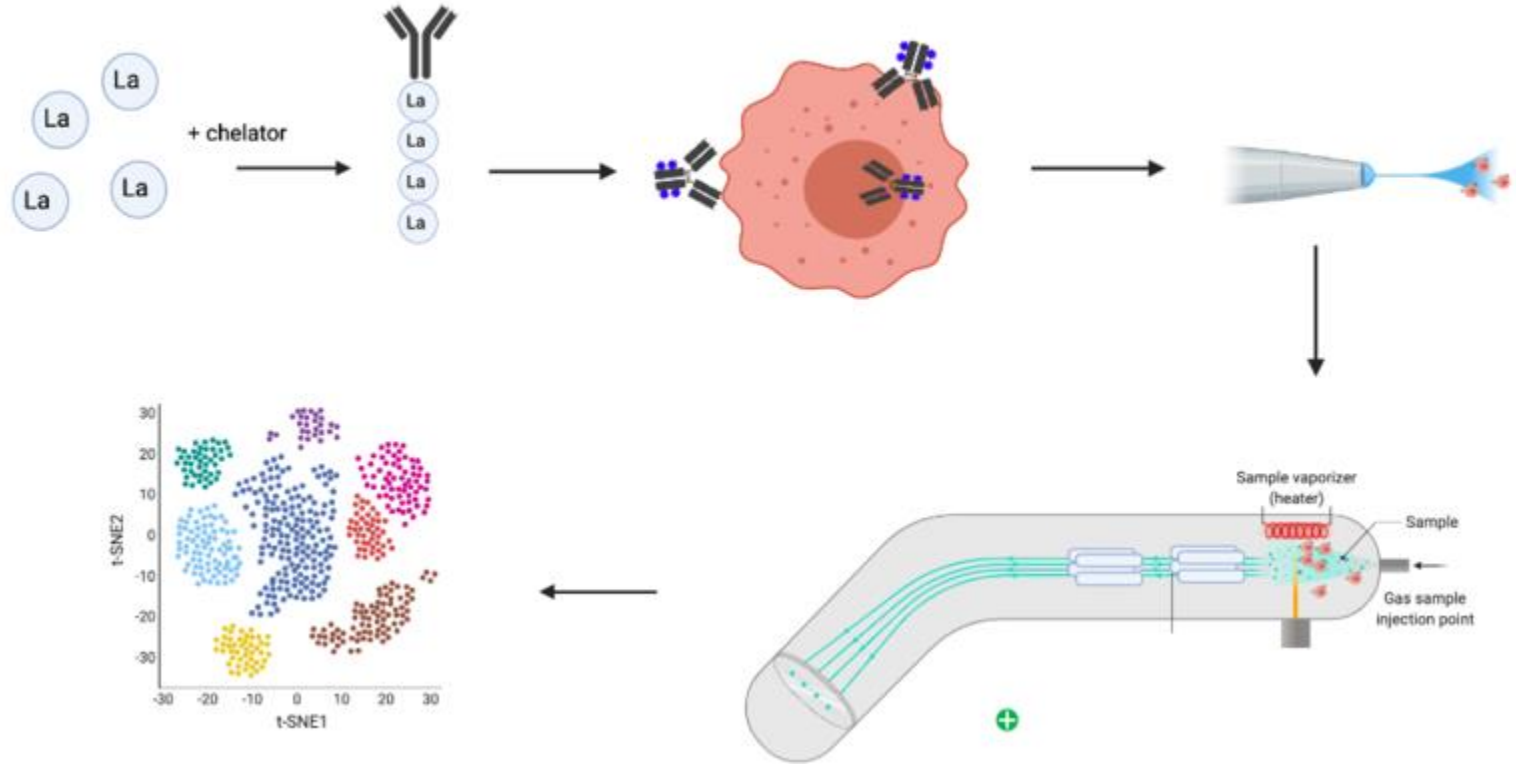
Bulk metabolic analysis techniques



Single-cell analysis of relevant biomolecules

- MS-based single-cell metabolomics
- Single-cell RNA-seq technologies
- Antibody-based single-cell protein analysis (CyTOF)

CyTOF


La
La
La
La
+ chelator
La
La
La
La
Sample vaporizer
(heater)
Sample
Gas sample
injection point
t-SNE2
t-SNE1
30
20
10
0
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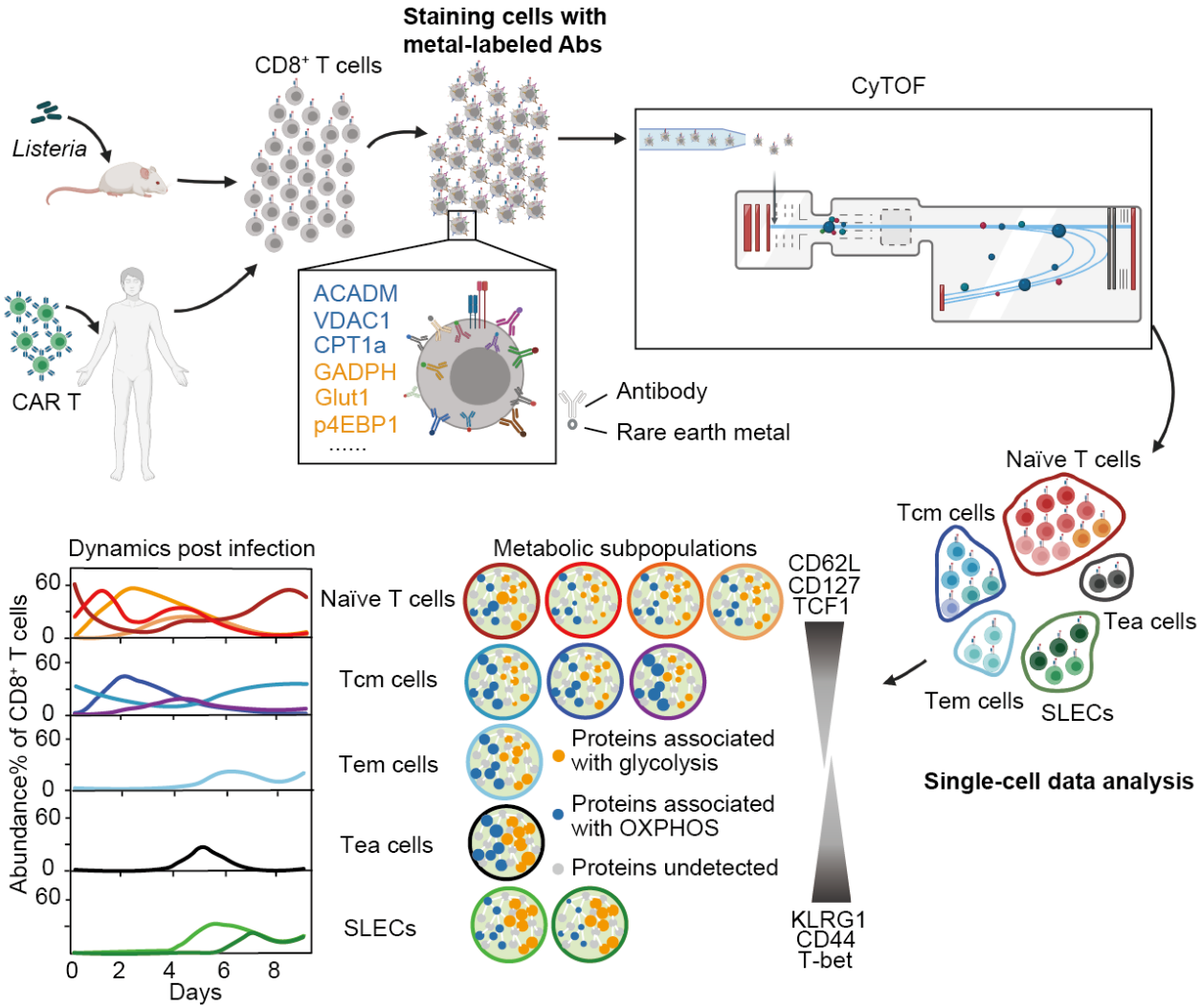
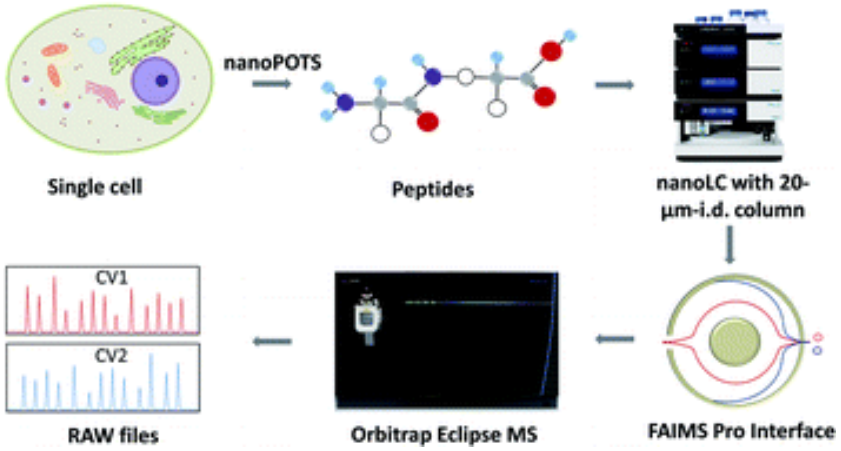
Objectives

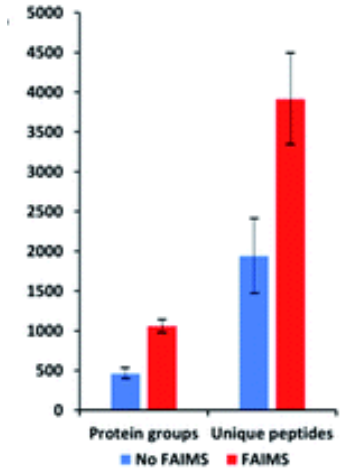
- To gain insight into the metabolic states of the heterogenous and dynamic CD8+ T cell response in vivo

The dynamic trajectory of metabolic CD8+ T cell subpopulations in vivo



Outlook: single-cell proteome





- 1056 protein groups detected in single cells
- covering most of the metabolic proteins analyzed by mass cytometry and Met-Flow

Yongzheng Cong, et al.. (2021). Chem.Sci. 12, 1001-1006

Comments

In this issue of *Immunity*, Levine et al. report a CyTOF-based approach for the analyses of $CD8^+$ T cells metabolic changes at the single-cell level. This approach identified a transition state early in T cell activation that is characterized by high glycolytic and oxidative activity, providing new insight into the metabolic changes that underlie the transition to effector and memory T cell fates.

We foresee that the granularity of immune system will be further improved by emerging high-throughput single-cell analysis techniques in the coming years.

Publication

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Preview

Immunometabolism the CyTOF way

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Acknowledgements

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UOMICS
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THANK YOU

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