

SITC 2019

Gaylord National Hotel
& Convention Center

Nov. 6-10

NATIONAL HARBOR, MARYLAND



Society for Immunotherapy of Cancer



There are no relevant disclosures to the presentation.



Spatial transcriptomics

Itai Yanai

Institute for Computational Medicine











NYU School of Medicine



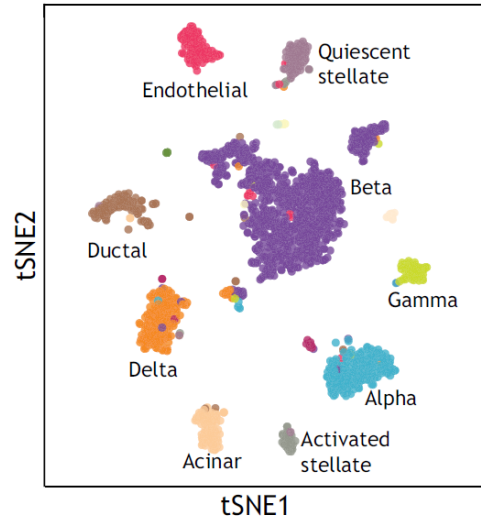
Society for Immunotherapy of Cancer

#SITC2019

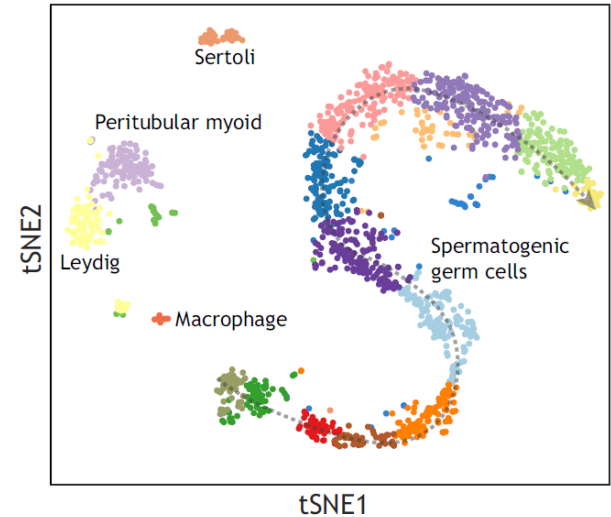
Historical and scRNA-Seq approaches to identifying cell types

Identification of cell types through:	
Morphology	Function
 Schwann cell	 Macrophage
 Purkinje cell	 β cell
 Sertoli cell	 Spermatozoon
 Astrocyte	 T cell
 Red blood cell	 Neural stem cell

CEL-Seq and CEL-Seq2
Hashimshony *et al.* (2012,2016)
used by the inDrop platform

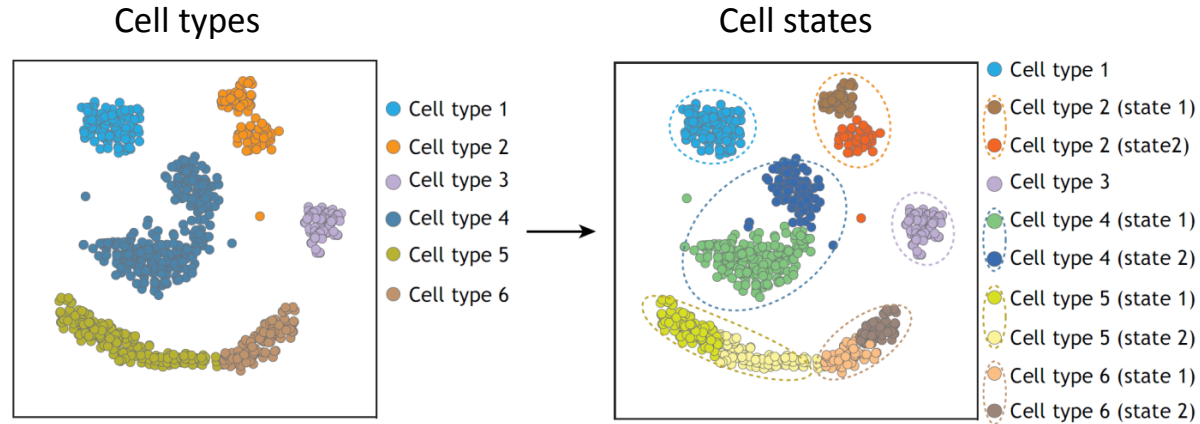


Pancreas
Baron et al. *Cell Systems* 2016

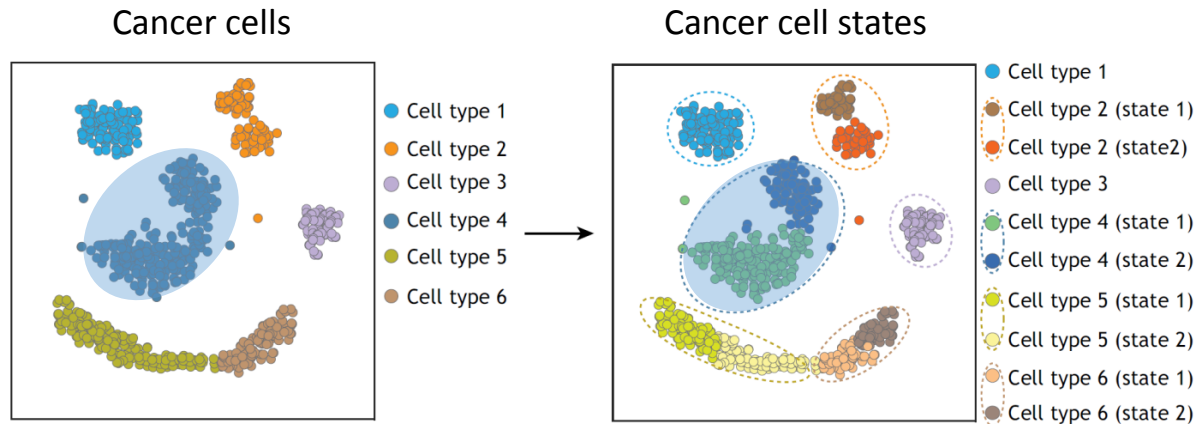


Spermatogenesis
Xia et al. *Cell* 2019 (in press)

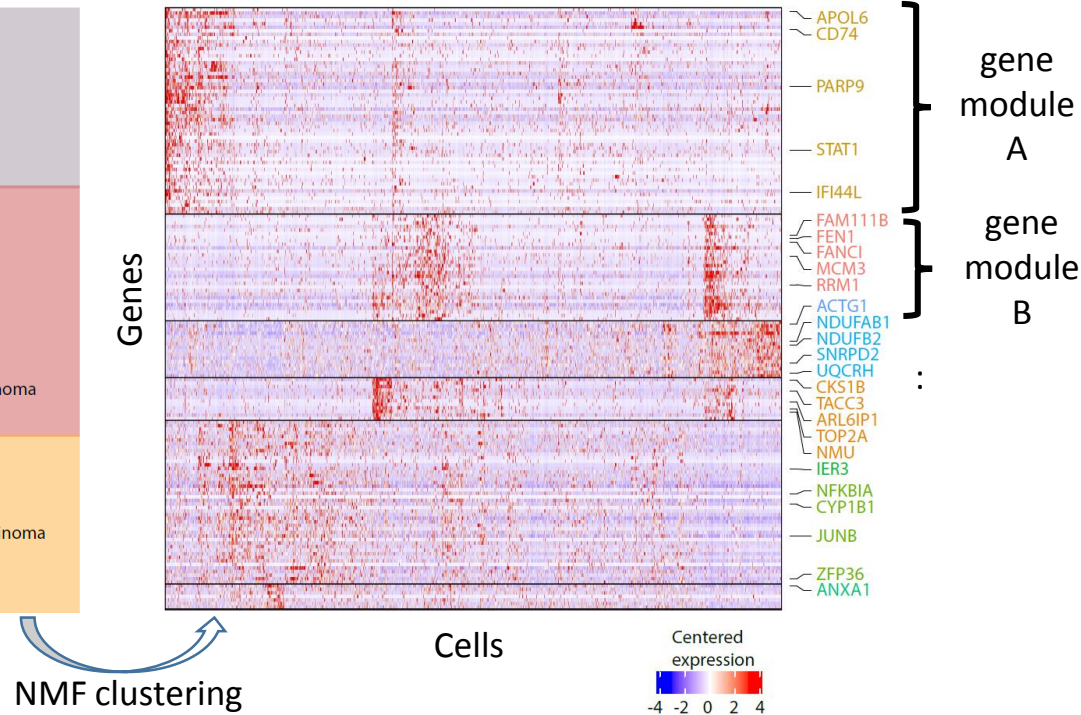
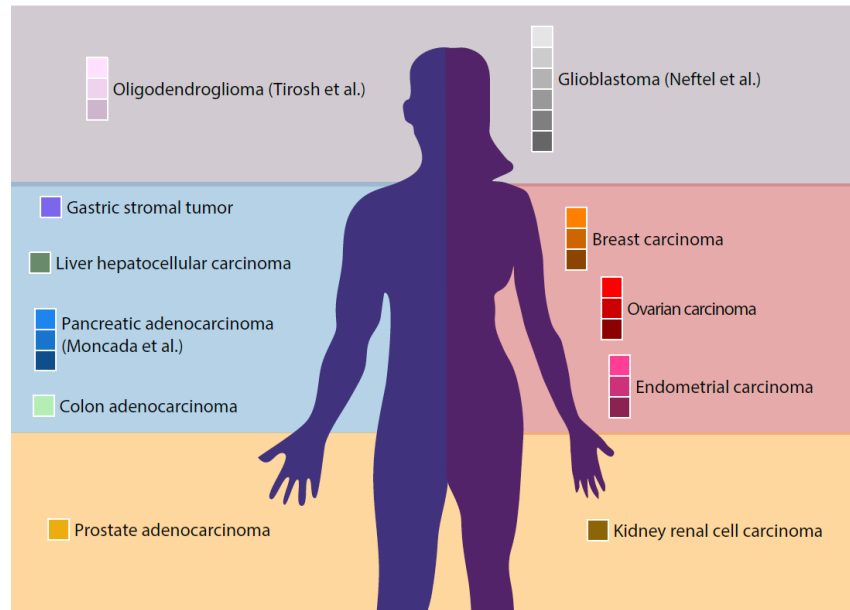
Distinguishing cell types and cell states



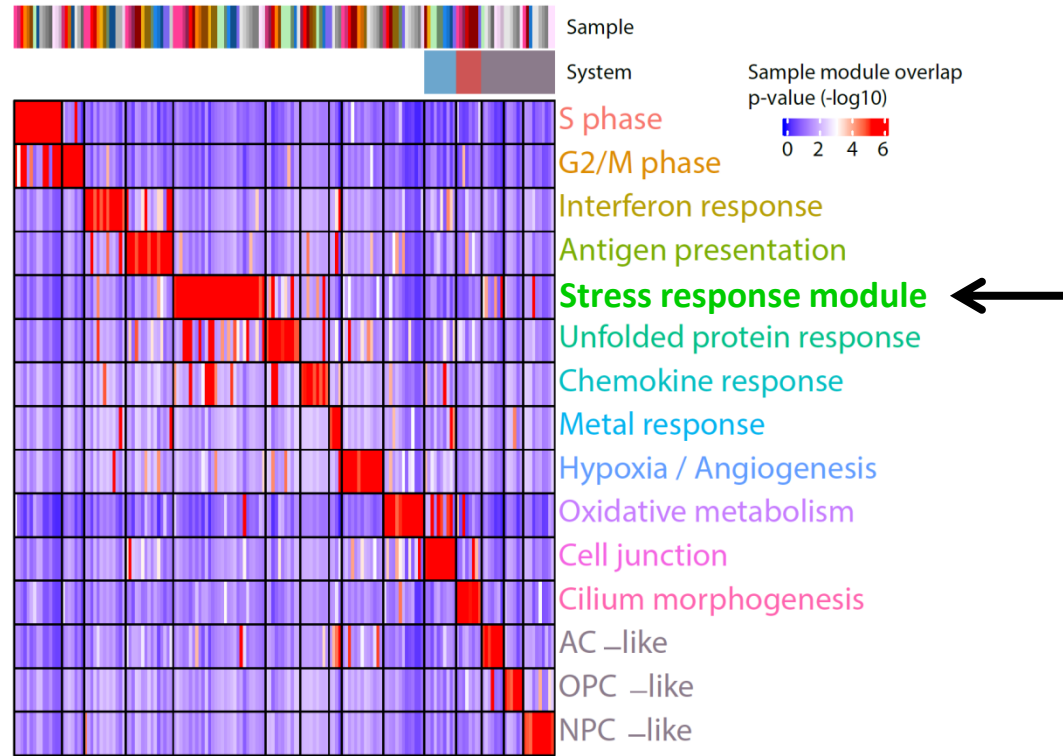
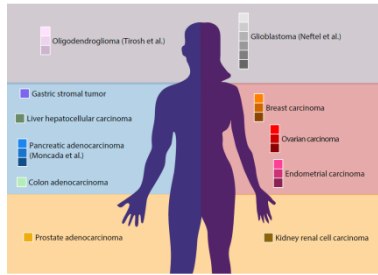
Distinguishing cancer cell states



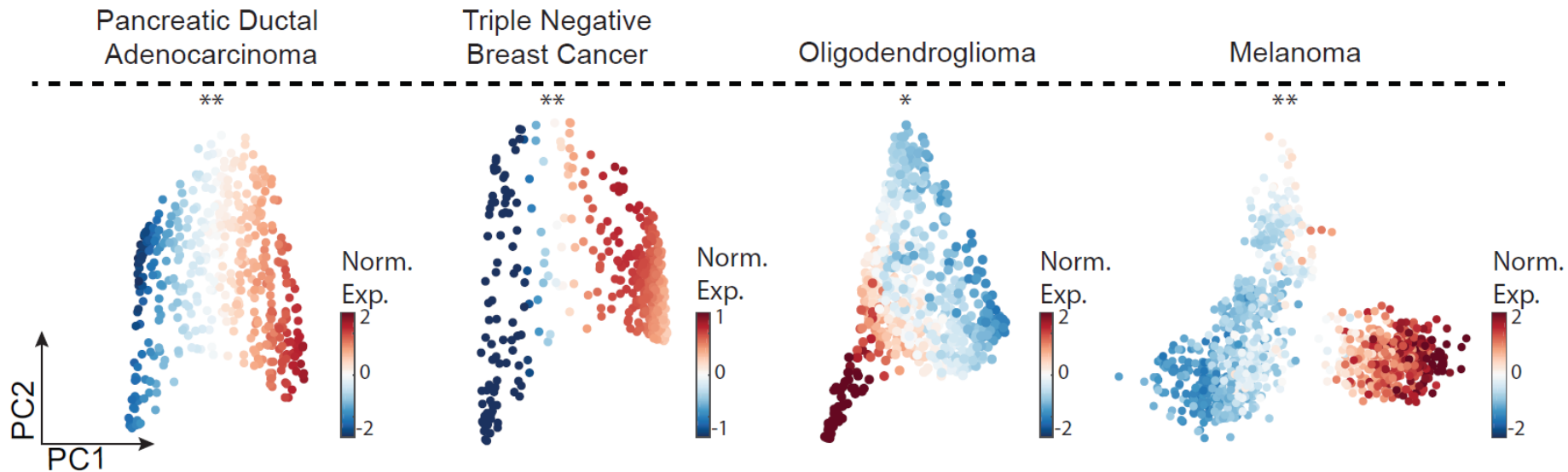
We studied 24 tumors of different cancer types and used scRNA-Seq to detect gene modules



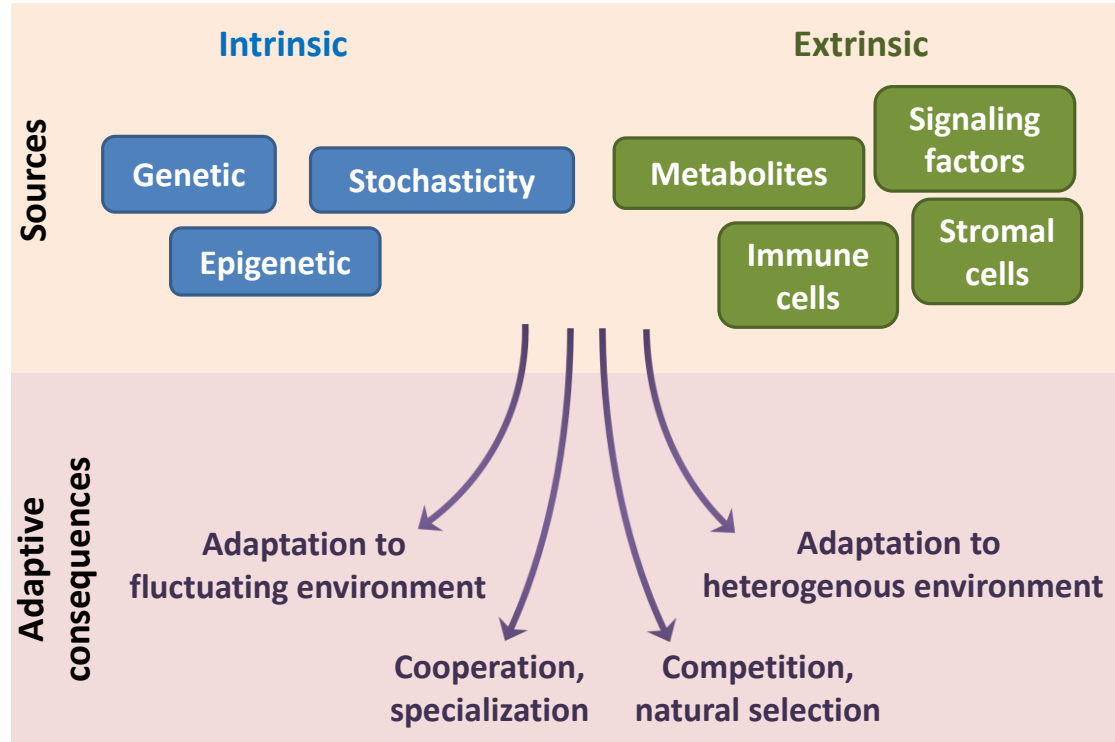
Universal and specific cancer gene modules



A state expressing the stress module across cancer types

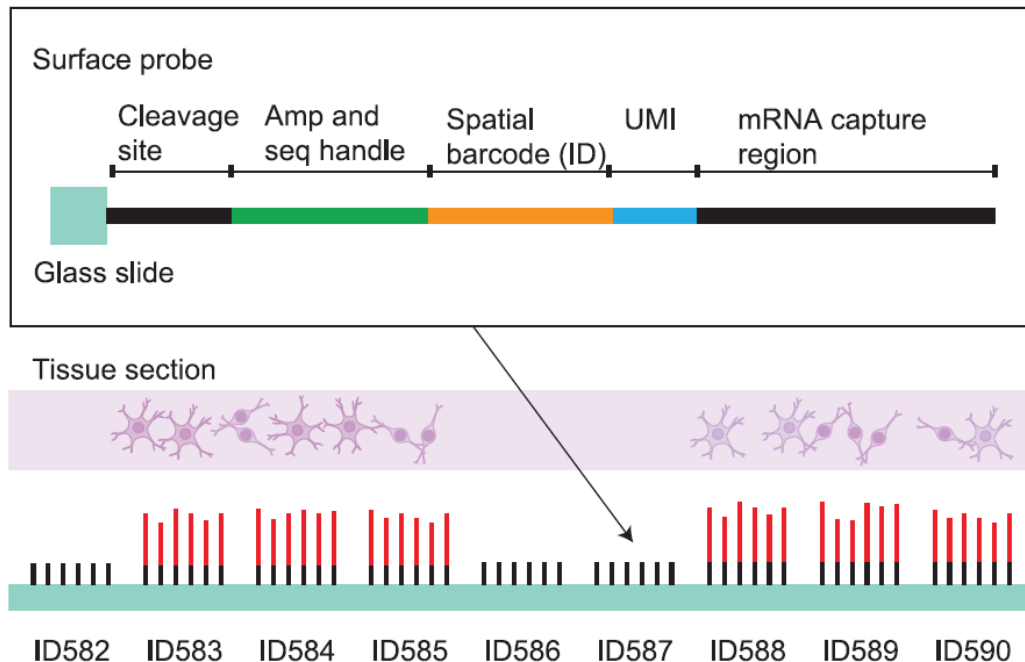


What are the roles of cancer cell states in tumorigenesis?



Barkley & Yanai. *Trends in Cancer* 2019

Spatial transcriptomics

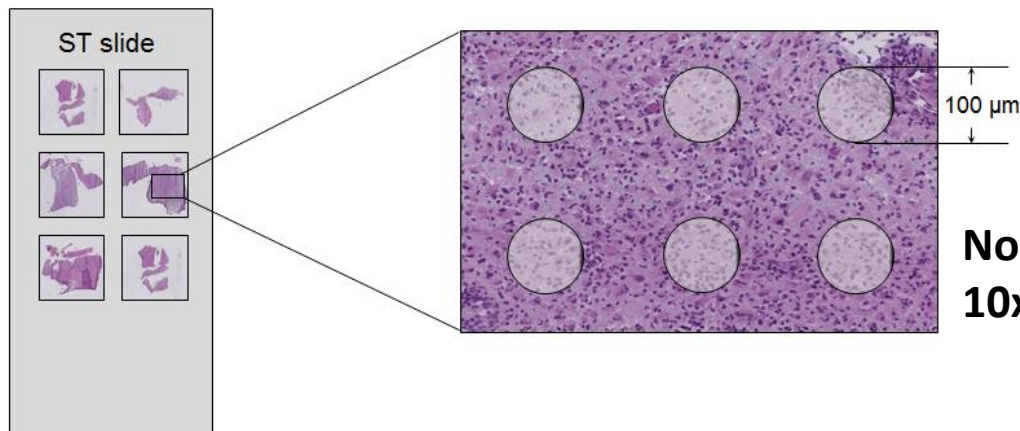
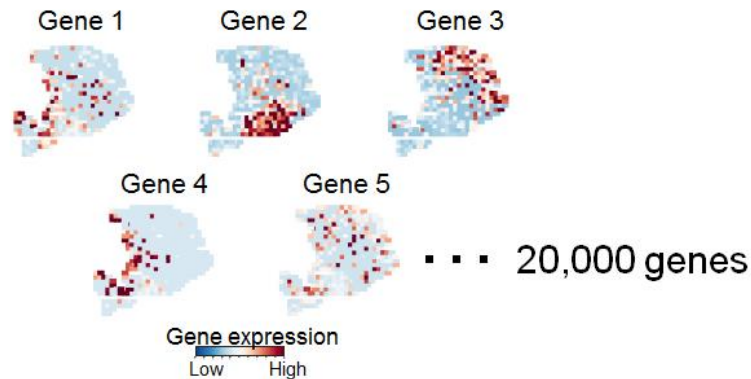
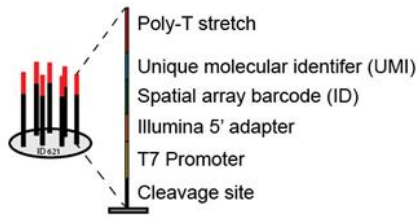
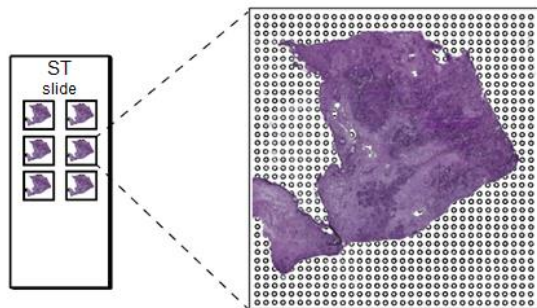


Visualization and analysis of gene expression in tissue sections by spatial transcriptomics

Patrik L. Ståhl,^{1,2*} Fredrik Salmén,^{2*} Sanja Vickovic,^{2,†} Anna Lundmark,^{2,3,†} José Fernández Navarro,^{1,2} Jens Magnusson,¹ Stefania Giacomello,² Michaela Asp,² Jakub O. Westholm,⁴ Mikael Huss,⁴ Annelie Mollbrink,² Sten Linnarsson,⁵ Simone Codeluppi,^{5,6} Åke Borg,⁷ Fredrik Pontén,⁸ Paul Igor Costea,² Pelin Sahlén,² Jan Mulder,⁹ Olaf Bergmann,¹ Joakim Lundeberg,^{2,†} Jonas Frisén¹

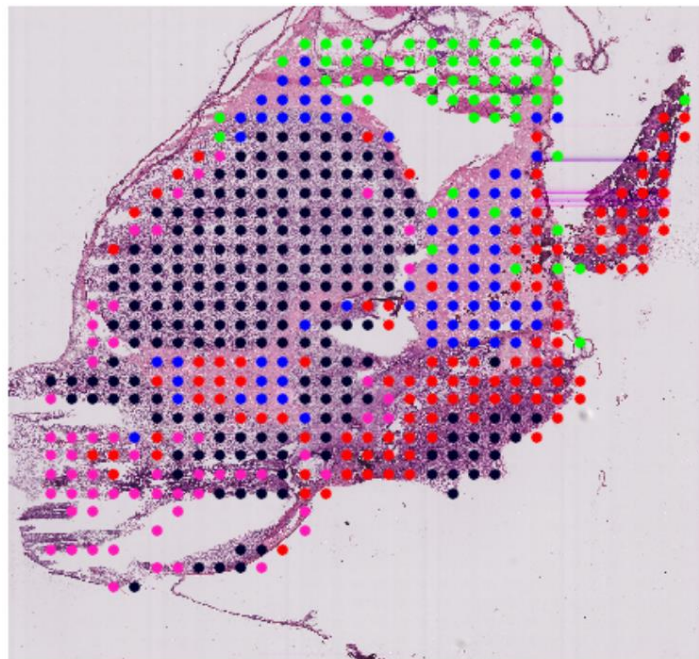
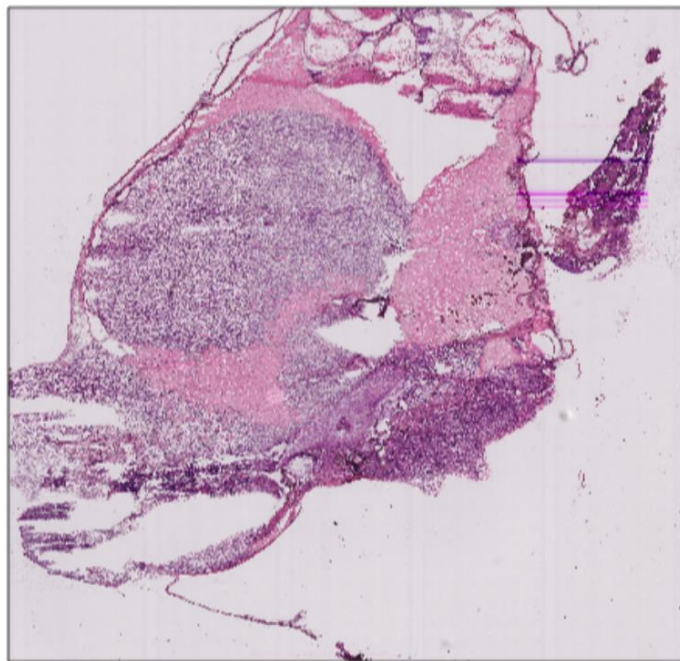
Stahl et al. *Science* 2016

Spatial transcriptomics

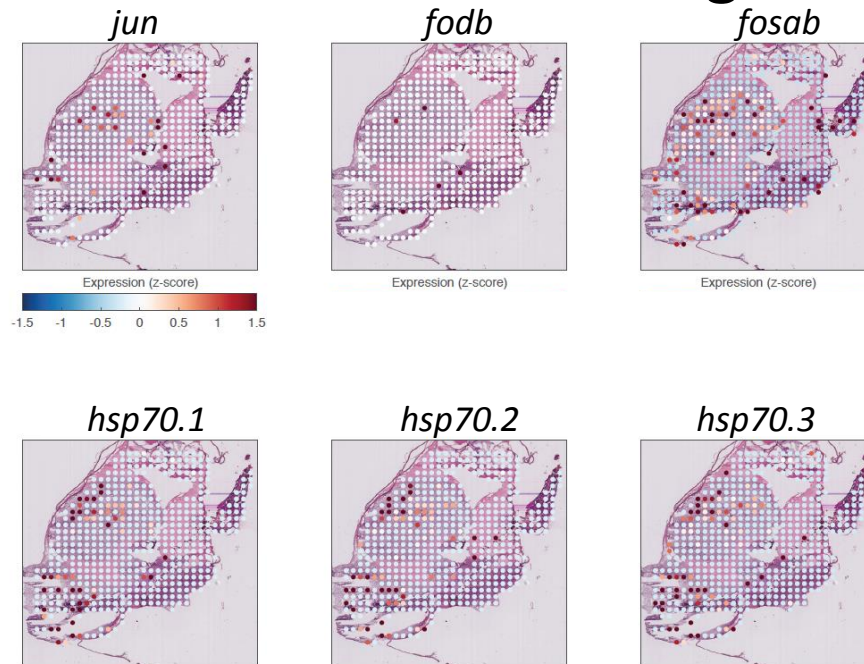
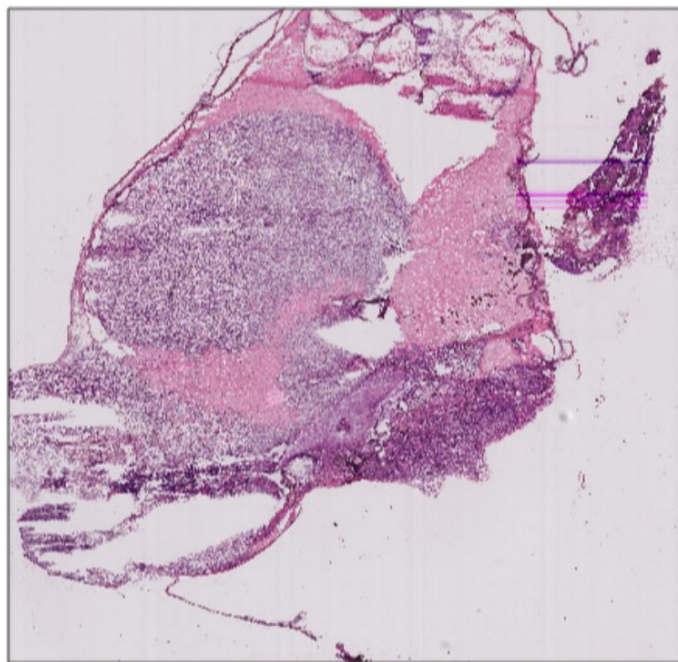


**Now distributed by
10x Genomics as Visium**

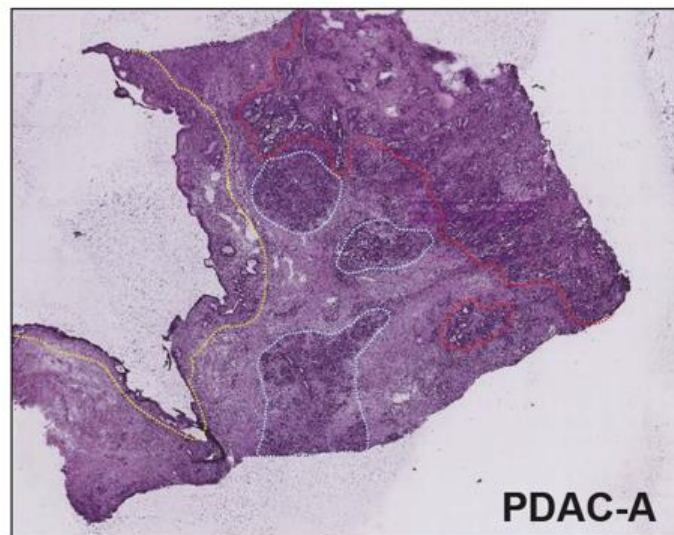
Spatial transcriptomics on a melanoma tumor



Spatial transcriptomics on a melanoma tumor reveals expression of the stress module in the cancer region



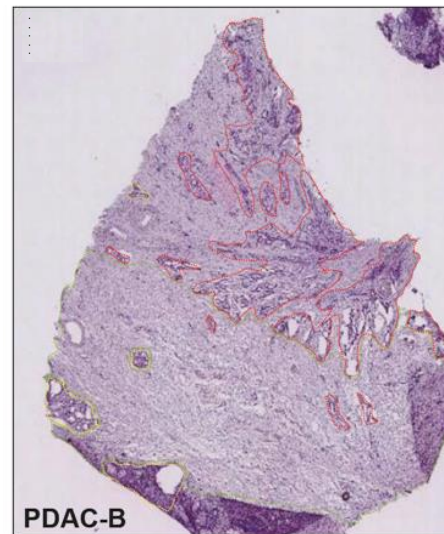
Spatial transcriptomics on pancreatic ductal adenocarcinoma (PDAC) tumor samples



— Cancer tubules and desmoplasia
— Duct epithelium
— Normal pancreatic tissue
— Interstitium



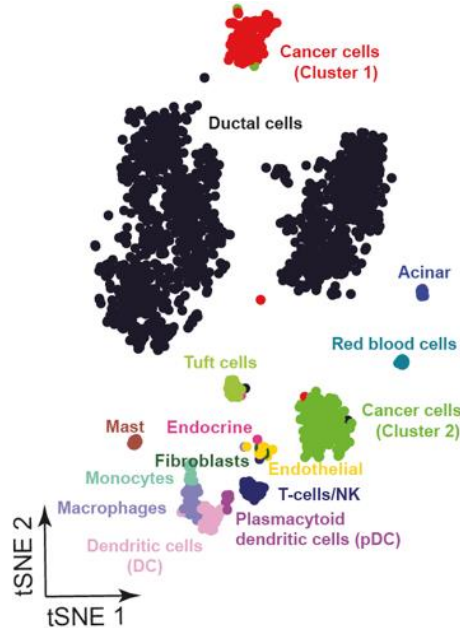
expression
-1 0 1



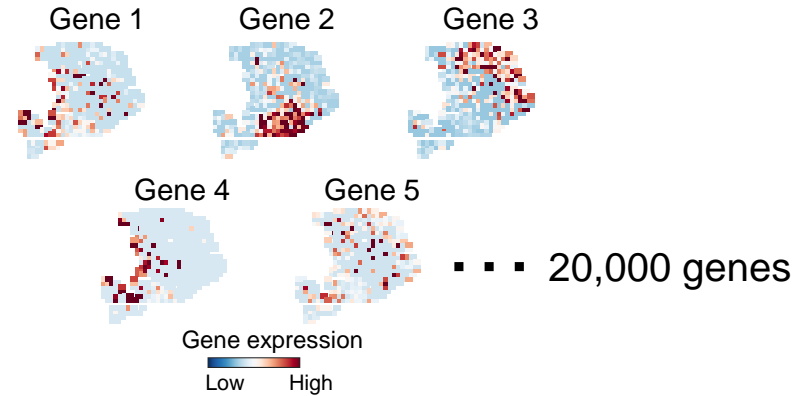
Diane M. Simeone and Cristina H. Hajdu

Integration of single-cell and spatial resolution

Single-cell resolution from scRNA-Seq

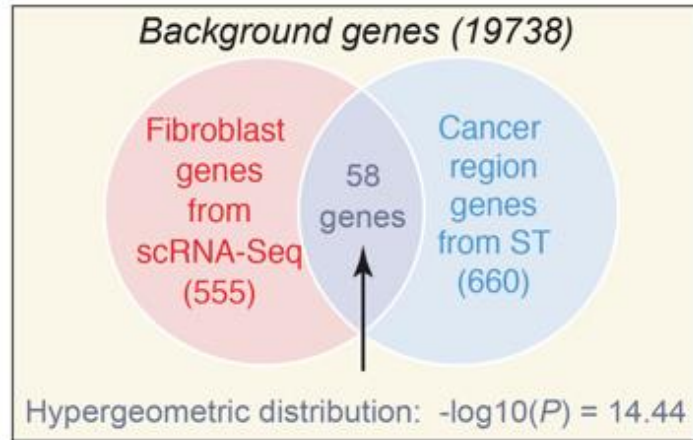


Gene expression with spatial resolution from ST

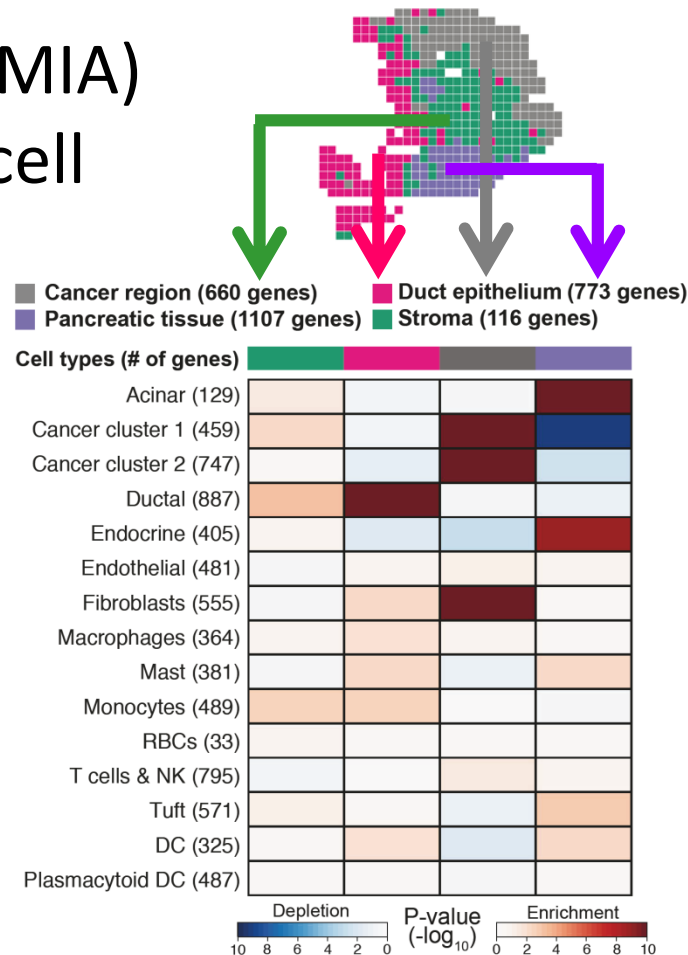
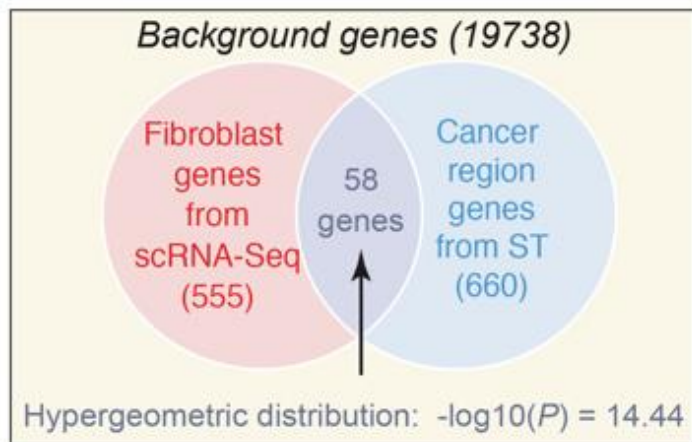


Spatial determinants of transcriptional states

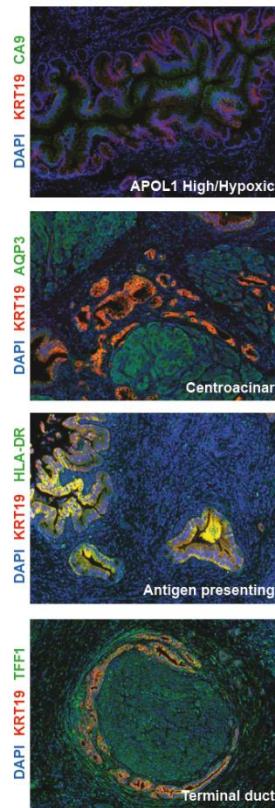
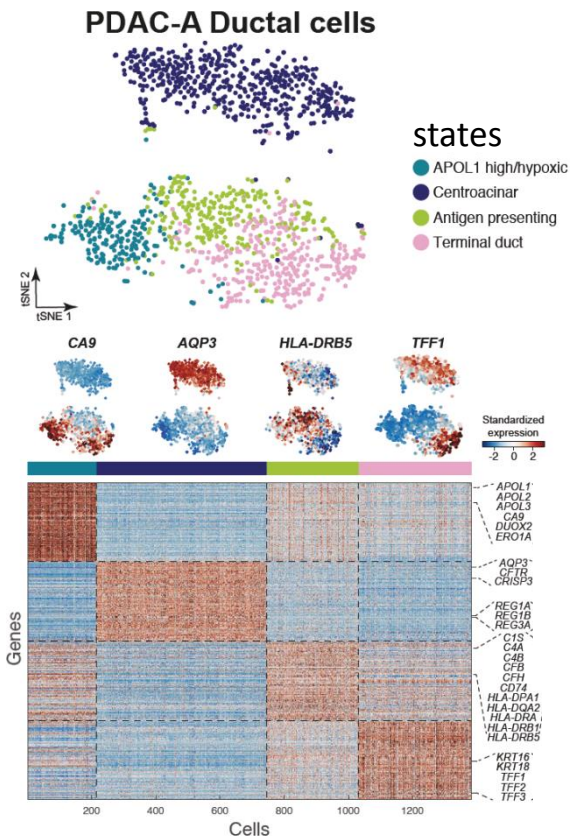
Multimodal Intersection Analysis (MIA) for the tissue-wide inference of cell type localization



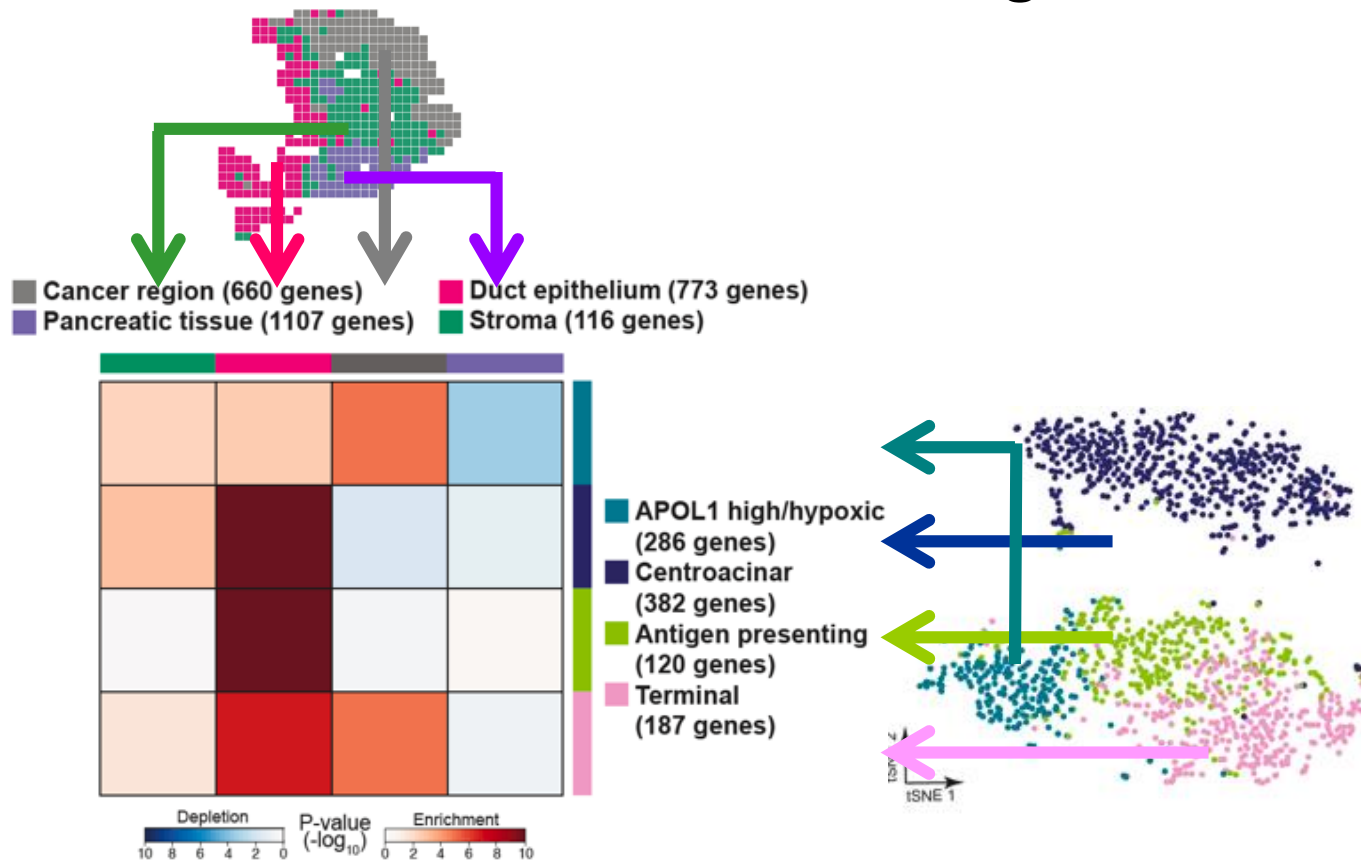
Multimodal Intersection Analysis (MIA) for the tissue-wide inference of cell type localization



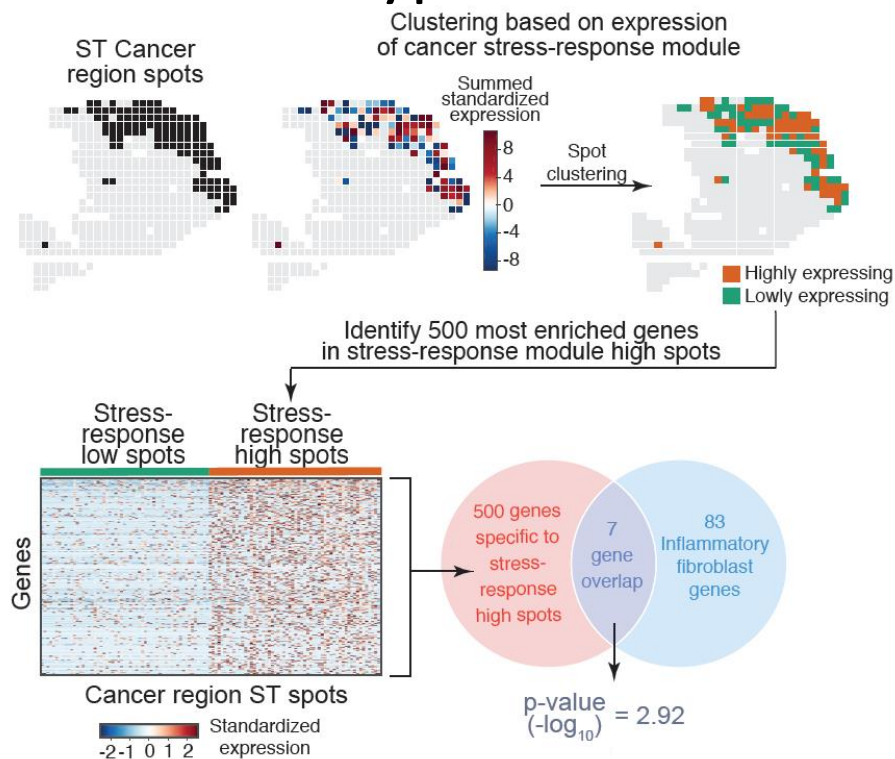
Identifying states among the ductal cells



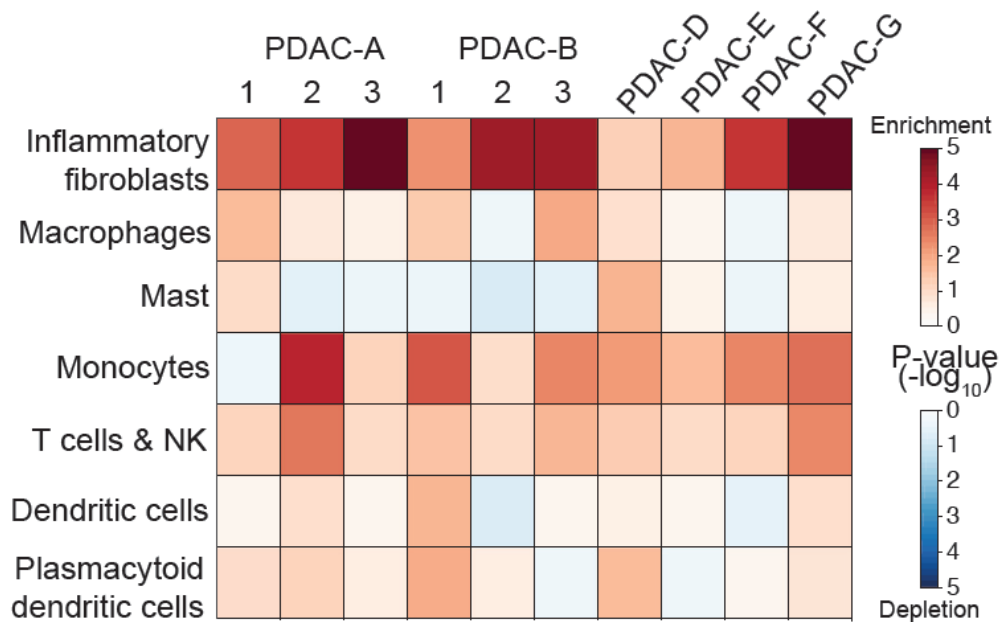
Ductal states across PDAC tissue regions



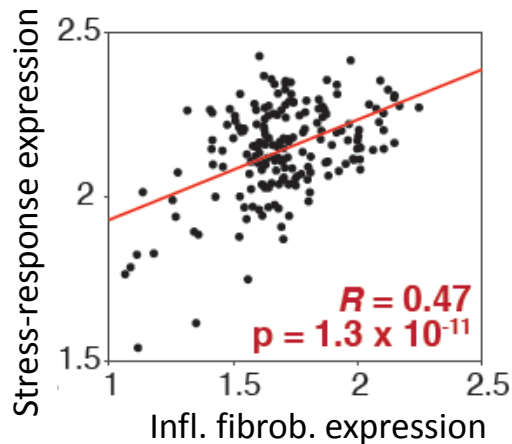
Querying for associations between cell states and cell types of the TME



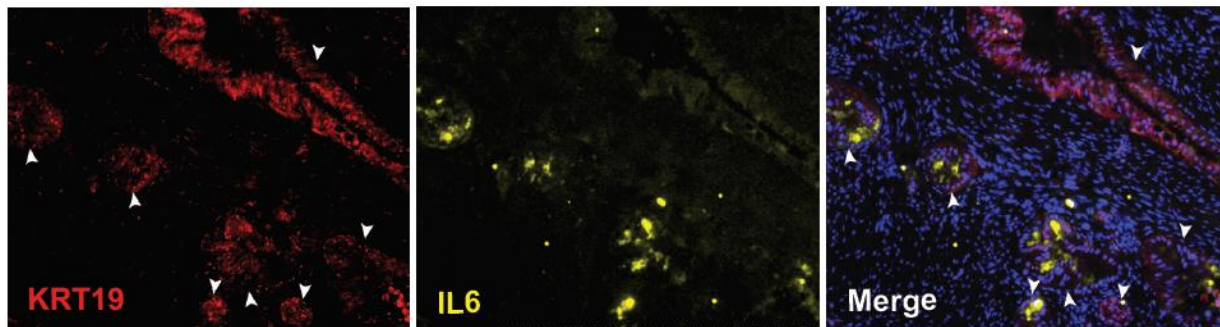
Inflammatory fibroblasts are consistently associated with cancer cells expressing the stress module



The stress module is correlated with inflammatory fibroblasts in the TCGA dataset and in IFs



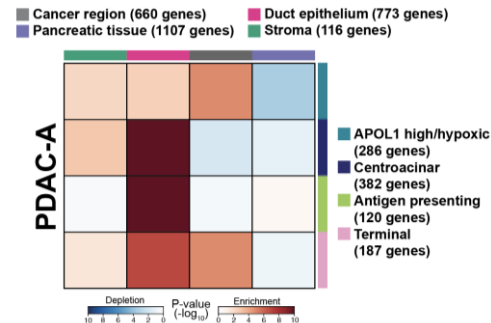
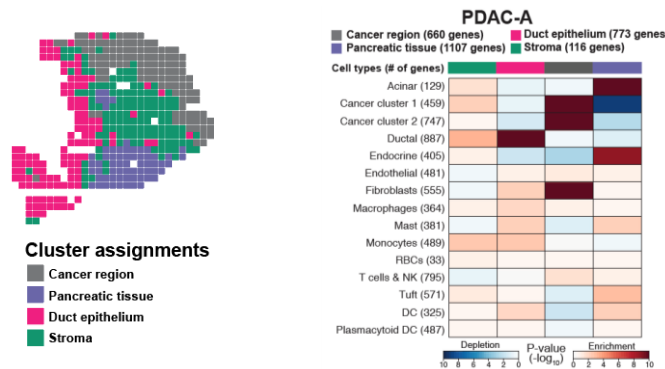
TCGA data



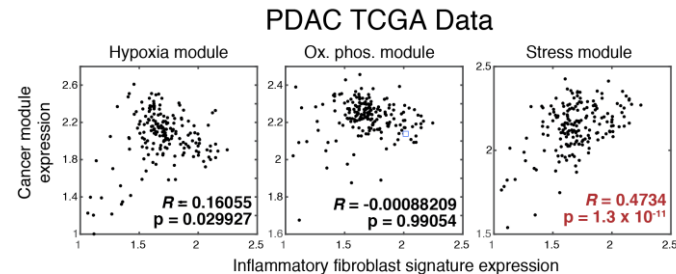
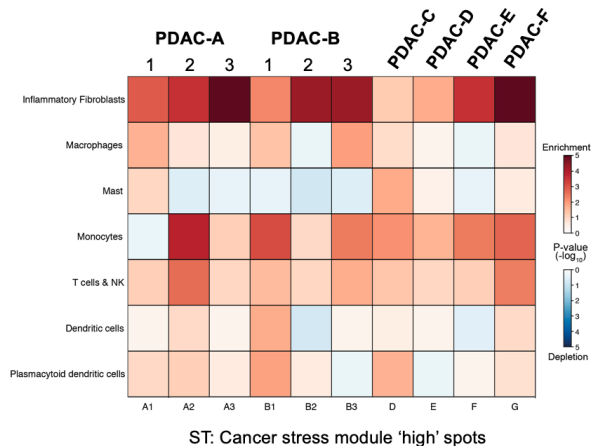
Immunofluorescence

Summary

Multimodal intersection analysis (MIA) maps scRNA-Seq states onto ST tissue regions



MIA highlights a potential functional relationship between inflammatory fibroblasts and a pan-cancer stress state in PDAC cancer cells



Acknowledging our wonderful lab and collaborators!

MSK



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Nate
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Mohita Malay
Tagore



Miranda
Hunter

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Dr. Michal Levin
Martin Feder
Leon Anavy
Sally Khair
Natalia Mostov
Naftalie Senderovich
Shay Ben-Elazar
David Silver
Avital Polsky



Dr. Cristina H.
Hajdu



Dr. Diane M.
Simeone



Dr. Maayan Pour



Dr. Gustavo Franca



Bo Xia



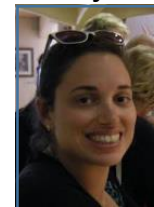
Dr. Florian Wagner



Dr. Maayan Baron



Dr. Anjali Rao



Dr. Gal Avital



Dalia Barkley



Reuben Moncada



Felicia Kuperwaser

Itai.Yanai@nyulangone.org

Institute for Computational Medicine

**We apply computational tools to solve
biomedical challenges.**