Spatial Multi-Omics: Mapping the Tumor Microenvironment for Next-Generation Oncology Target Validation

Literature Review

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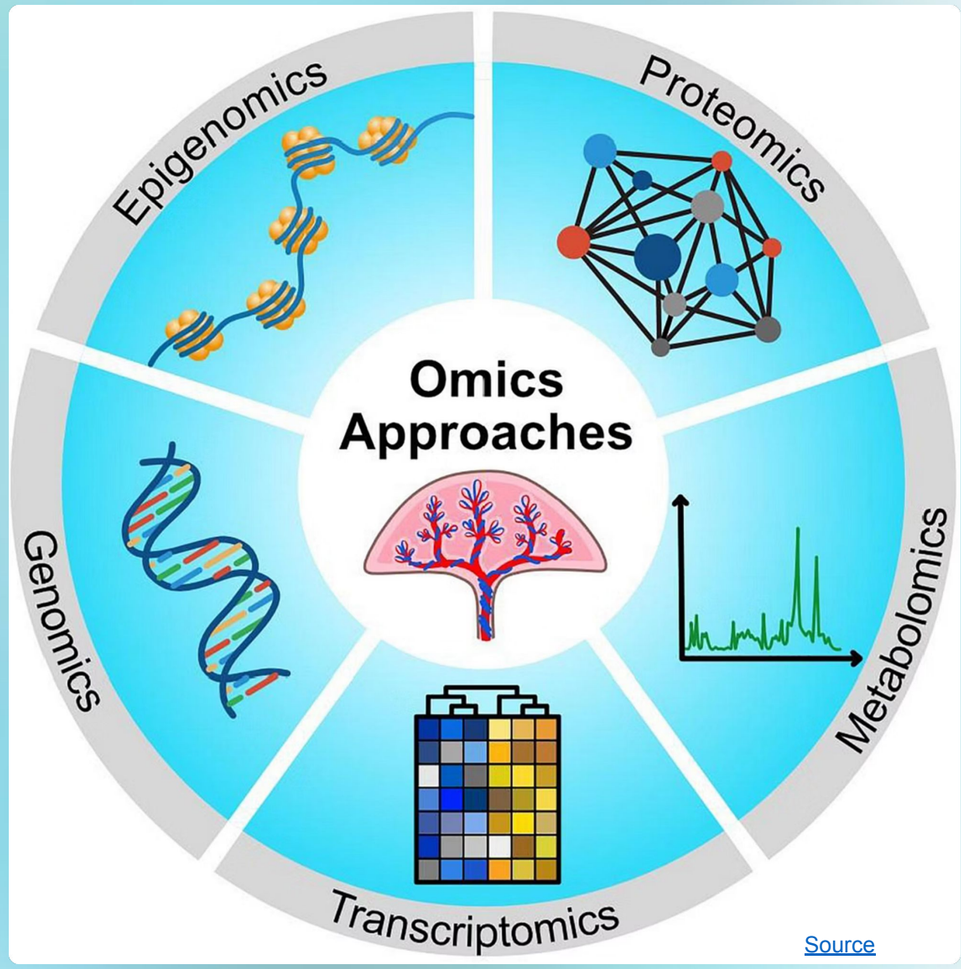
Understanding Spatial Multi-Omics (SMO)

Molecular Identity + Localization

Integrates omics data (transcriptomics, proteomics) within the preserved 3D tissue architecture.

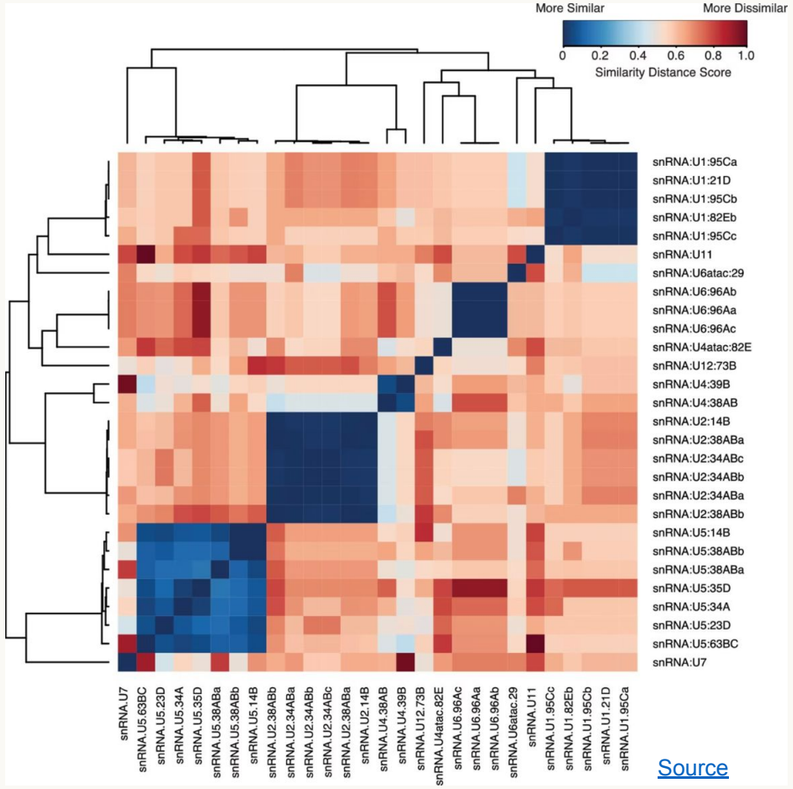
Combining 'what' changes with 'where' it happens.

Platforms include Visium HD, CosMx SMI, and GeoMx DSP.



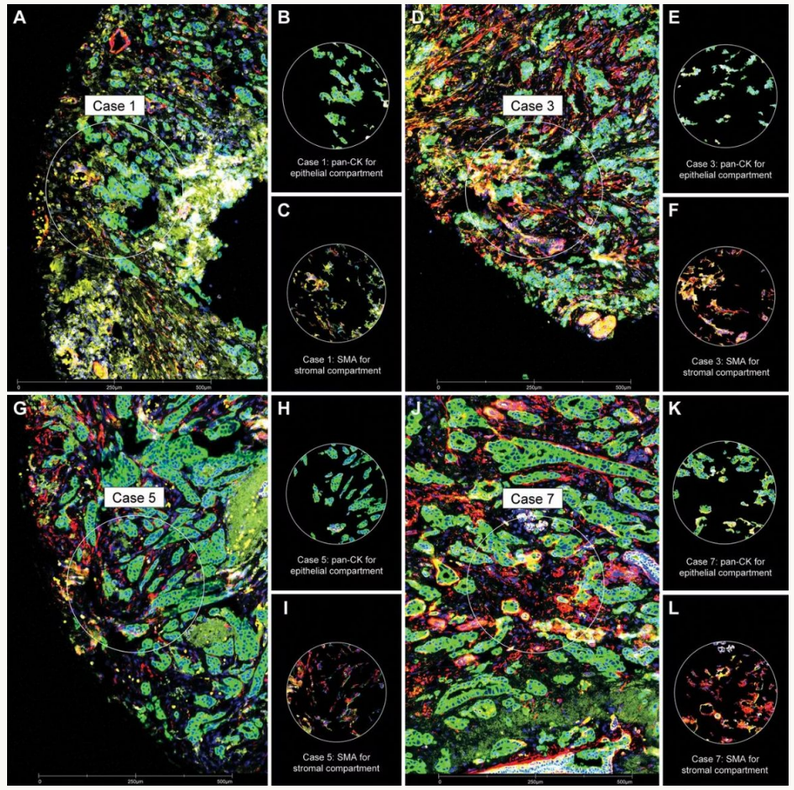
The Problem: Losing Spatial Context in Cancer Research

- Traditional omics techniques destroy the tissue structure, losing crucial positional data.
- Interactions between tumor cells, immune cells, and stromal cells go unseen.
- This limitation hinders understanding of therapeutic resistance and target relevance.



Source

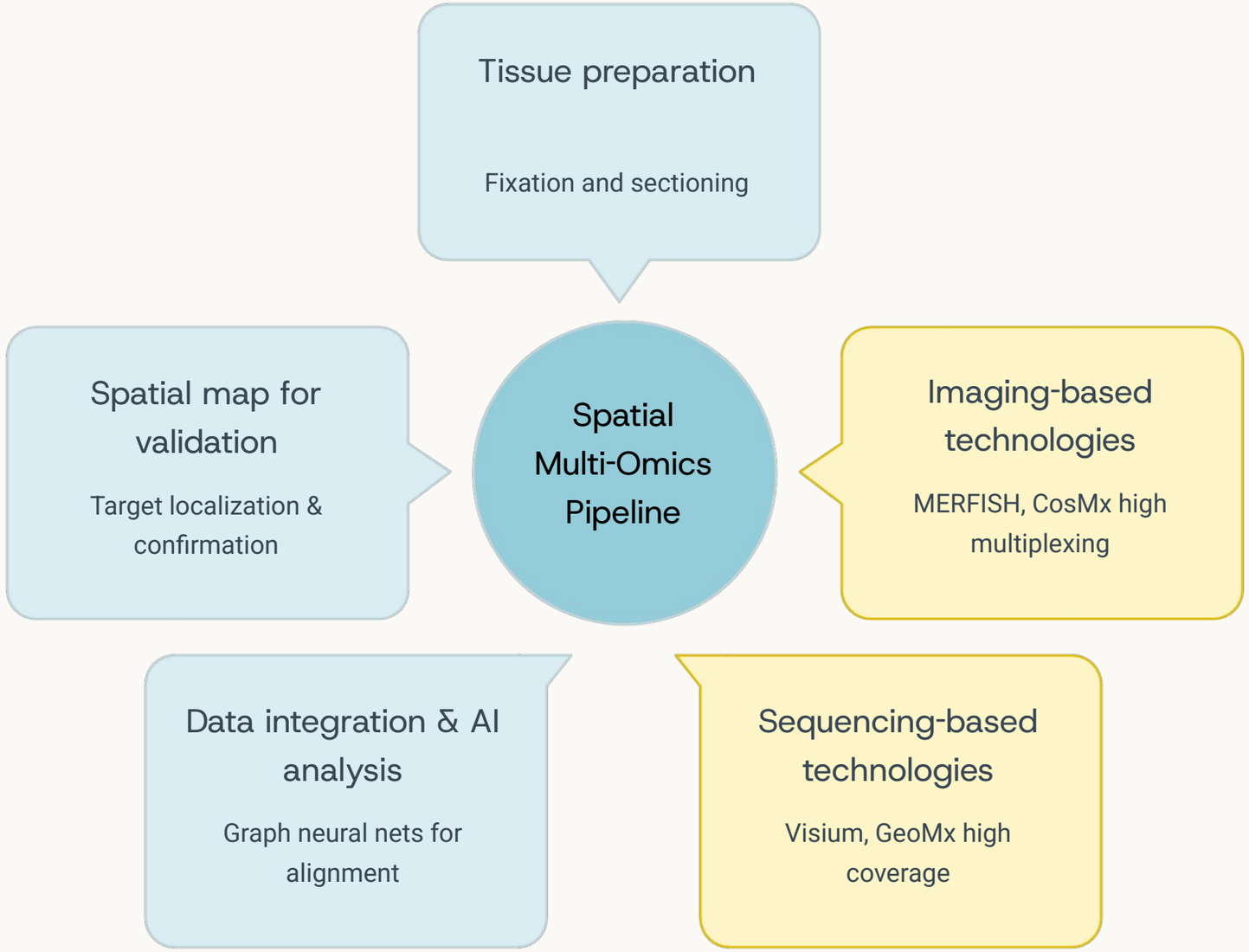
Bulk RNA-seq: Spatial context lost



Source

Spatial Transcriptomics: Preserving cellular neighborhoods

Technological Landscape



Commercial Landscape

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10x GENOMICS®

nanoString™

AKOYA BIOSCIENCES®

vizgen

Market Growth

Projected to exceed **$800 million by 2027**, fueled by pharma R&D investment.

Key Partnerships

Accelerating biomarker discovery and therapeutic target validation in oncology and immunology.

Challenges remain: standardization, proprietary data formats, and ensuring platform interoperability across the ecosystem.

Future Directions

3D & 4D Profiling

Moving beyond sections for volumetric and temporal analysis of disease progression.

AI and Digital Twins

Integration with machine learning for predictive modeling and treatment simulation.

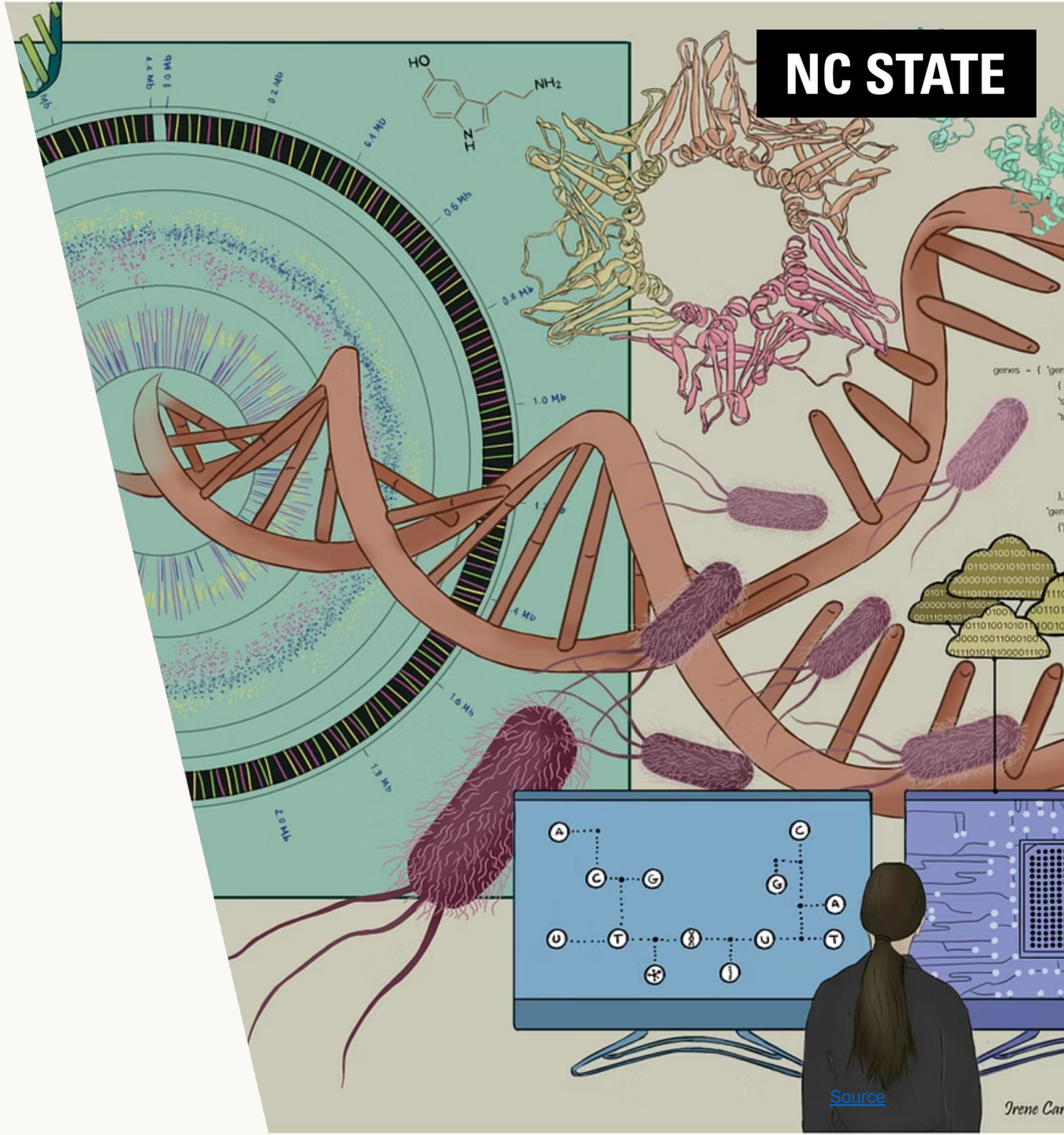
Clinical Translation

Establishing standardized, FAIR data principles for use in regulated clinical settings.

Source

Questions?

Slides made using Gamma



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