Topological analysis links local expression dynamics with spatial heterogeneity using the GeoMx[®] DSP Platform

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Exploration of biological structure within spatial 'Omics data

- The NanoString GeoMx[®] Digital Spatial Profiler enables exploration of protein & RNA expression in biologically relevant compartments within a tissue
- In this analysis we explore the application of landscape ecology tools to characterize the tumor and stromal compartments profiled using the GeoMx Whole Transcriptome Atlas (WTA) in a colorectal cancer sample
- Together, these methods link the spatial structure identified in the tissue images to the transcriptome-wide expression which can shed light on the role of spatial heterogeneity in cancer biology

GeoMx workflow directly leverages tissue morphology

GeoMx captures tissue morphology GeoMx hardware and workflow are both intimately linked to profile tissue structures and morphological compartments

Expanding the GeoMx toolkit with landscape ecology metrics



Methods used to assess and quantify landscape¹ metrics have natural analogs in the morphological organization of tissue in both normal and diseased tissues

Table 1 Three landscape metrics used in this study defined in Hesselbarth et al.².

Metric	Definition	Behavior
Core Area % of Landscape (CAPL)	% of core area of class in relation to the total area.	Increases as patches beco larger with simple shape
argest patch index [LPI)	% of the landscape covered by the largest patch within a class	0 = largest patch is very s 100 = a single large patch
COHESION	The connectedness of individual patches belonging to each class	Goes to 0 as patches beco isolated







Spatial Information Dramatically Changes Interpretation

Each ROI GeoMx was segmented into tumor and stroma based on PanCK+ staining. A) a single ROI showing classifications of patches and spatial structure. B) Identical composition of in terms of area but without spatial context

Landscape Metrics scored across GeoMx ROIs

For the three metrics defined above and highlighted on the right panel (CAPL, LPI, COHESION), the bubble plots below show the relative proportion of a given landscape metric on the FFPE slide LPI in Tumor Masks **CAPL in Stroma Masks**



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